ASPECTS OF GROWTH EMPIRICS IN SOUTH AFRICA

by

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SUMMARY

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Economic growth is the single most important factor in the economic success of nations. Growth can be robust in trying circumstances over the short term, but usually requires the basic tenets of peace, safety and security, the rule of law, price and exchange rate stability and a market friendly ambience to be sustainable over decades.

Achieving this is a formidable task, but does not guarantee success, because other factors, such as pessimism or uncertainty in the business community, rumours and corruption, can impede progress.

Government policy plays a vital role in economic growth, but measures of it are scarce and problematic. Similarly, economic data focus on outcomes, rather than on causes, for example, numbers employed rather than labour market policies.

Growth analysts generally use indirect measures to analyse growth causes and effects. There are more of these, but many are also volatile over the long term.

Economists devised empirical tools to compensate for these obstacles, and such tools were used in this study to investigate South Africa's growth record, in order to determine what worked and what did not.

This study shows that measures of openness of the economy to trade are indicative of growth. A robust and export-oriented manufacturing sector

contributes to growth and perpetuates itself. This implies that barriers to trade, such as tariffs and quotas must be minimised and manufactured exports promoted, rather than primary products such as iron ore and coal.

Nonproductive government spending reduces the growth rate and should be minimised, and the largest expenditures should be on safety and security (because crime incidence reduces growth), housing for the poor, and education, while most other services such as electricity, transport and communication should be privatised.

While investment is important, its link to growth is bi-directional. However, productivity is a significant contributor to growth. Unused capacity of human resources and machines is productivity's main detractor. Policies to enhance rival competition in the private sector, with full utilisation of capacity, increase productivity growth and can have sizeable spin-offs for economic growth and living standards.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
AGOA	African growth and opportunity act
AIC	Akaike information criterion
DF	Dickey Fuller
EDP	Economic development programme
EG	Engle-Granger
FDI	Foreign direct investment
GDE	Gross domestic expenditure
GDP	Gross domestic product
GEAR	Growth, employment and redistribution – A macro economic strategy
GNP	Gross national product
HDI	Human development index
HPAE's	High performance Asian economies: Japan, Hong Kong, Korea, Singapore, Taiwan, Indonesia, Malaysia and Thailand
HSRC	Human Sciences Research Council
IBM	International Businness Machines
IMD	International Institute for Management Development
NEM	Normative Economic Model
OECD	Organisation for Economic Cooperation and Development
R&D	Research and development
SARB	South African Reserve Bank
s.d.	standard deviation
SDIs	Spatial development initiatives
s.e.	standard error
STATS SA	Statistics South Africa
TBVC	Transkei, Bophuthatswana, Venda & Ciskei
TIMMS	Trends in International Mathematics and Science Study
VAR model	Vector autoregressive model
WCY	World Competitiveness Yearbook

Refer to table 6.1 on page 131 for the list of acronyms used for variables in chapter 6.

CHAPTER 1

INTRODUCTION

[The] consequences … of economic growth … for human welfare ... are simply staggering. Once one starts to think about them, it is hard to think of anything else.

Robert Lucas (The Economist 1996:23)

1.1 INTRODUCTION AND BACKGROUND

This chapter provides various definitions of economic growth used in the literature. It outlines the rationale for the different definitions of economic growth and discusses the merits of the various concepts. It also deals with the criticisms leveled at some of the definitions. It outlines population data limitations in South Africa and on the basis thereof, demarcates the definition of growth for this study. The next section briefly summarises the history of growth theory. The chapter concludes with an outline of the rest of the study.

1.2 DEFINITIONS OF ECONOMIC GROWTH

Economic growth is both the most prominent and a vast field of study. Samuelson and Nordhaus (2001:568), for example, write in their best-selling textbook: “Economic growth is the single most important factor in the economic success of nations in the long term.” Its genesis may be associated with the classical school, which in fact produced two fundamentally different approaches - Smith's growth optimism and Malthus and Ricardo's growth pessimism. With modifications, both theoretical strands are still encountered today.

A distinction is usually made between economic growth and economic development. Economic growth refers to the sustained increase in per capita or total income, while the term “economic development” implies sustained

structural changes, including all the complex effects of economic growth. The two processes are usually intimately linked but the terms are not synonyms. Sir John Hicks made it clear that "growth economics" has nothing to do with the problem of developing the underdeveloped. According to Hicks (1965: 3-4), "underdevelopment economics is a vastly important subject, but it is not a formal or theoretical subject". He cast doubt on the connection between growth theory and economic development by observing "the appearance of a branch of theory called Growth Theory, at a time when the economics of underdevelopment has been a major preoccupation of economists, has made it look as if there must be a real connection". Hahn and Mathews (1964:804) agree with this approach and write "Growth theory is applicable only to the advanced sector whereas the problem of the backward sector must be regarded as part of the theory of development rather than the theory of growth". Choi (1983:8) observed that "if the linguistic usage is to be precise, Walter Rostow's well-known *The Stages of Economic Growth* certainly ought to be titled *The Stages of Economic Development*".

There are many definitions of economic growth. They differ mainly because of shifts in emphasis or the inclusion or exclusion of certain aspects of the process. The core ingredient of most definitions is the annual rate of increase in gross domestic product in constant values from one year to the next, or over a number of years.

Gross domestic product (GDP) gives the total market value of final goods and services produced in the economy in any one year. The purpose of the measure is to determine the increasing ability of a nation to satisfy the material wants of its people by measuring the rate at which the volume of real goods and services expands over a period of time.

The main limitations of GDP as a measure of growth are that it

- does not include imports which are a large source of economic growth and therefore do not include capital importation which can be used to produce larger quantities of goods and services;
- does not include non-monetary incomes, because GDP only measures the value of goods and services traded in markets;

- includes depreciation on capital equipment although a net addition of production capacity would give a more realistic account;
- ignores population changes with the result that if the population increases more rapidly than production, living standards may fall, while GDP may be increase;
- does not account for income distribution which means that no redistribution changes can be accounted for (even real GDP per capita cannot measure which part of the population benefits from higher living standards);
- does not take into account the composition of output and thus gives no indication of the division between capital and consumer goods;
- gives no indication of changes in productivity, nor of the working conditions under which GDP increases;
- does not consider the costs of growth because it cannot measure satisfaction in the community, or lost or gained leisure time;
- it registers only household incomes received to contribute to production and not transfer payments;
- is unable to capture the informal economy which accounts for a significant part of the economy in less developed countries - cash transactions in particular may go unrecorded; (in the 1990s, Statistics South Africa and the South African Reserve Bank started to estimate the contribution of the informal sector and added it to the GDP figures. According to these estimates, the informal sector contributes about 7 per cent to GDP);
- omits nonmonetary factors like political freedom, the environment and cultural achievement;
- is measured in current values which means that it must be adjusted for inflation.

It is clear that a mere increase in the gross domestic product at current prices need not constitute growth because inflation could be high and/or the population growth rate could be higher than the growth rate, resulting in a decrease in the average living standards of the inhabitants of a country. A better measure is the annual rate of increase in the real gross domestic product per capita of a country. This measure provides an indication of the value of real goods and services available to each member of the population on average.

The advantages of real GDP per capita are that it

- accounts for population growth;
- eliminates inflation rises;
- allows for comparisons between countries.

Real GDP per capita figures are the most widely used measure of a nation's general level of material well-being or standard of living. Many analysts of cross-country studies use GDP per capita as their dependent variable. While real GDP per capita appears flawed as an indicator of growth, it is one of the most readily available measures.

The following are alternative indicators that are sometimes used:

- real GNP per capita;
- labour productivity growth showing relative changes in the volume of goods and services produced per person in the labour force;
- real per capita consumption expenditure which is sometimes used to obtain a proxy for the quantity of consumer goods and services purchased by households;
- economic welfare measures focusing on externalities such as leisure, pollution and environmental damage or conservation;
- human development indices which combine measures such as GDP, life expectancy and education.

As implied, economic growth also involves expansion of national productive capacity. The other growth factors involved include:

- whether all resources are fully employed and effectively applied;
- whether supplies of production factors are fixed, pliable or easily transferable;
- whether technology is constant or improving.

Simon Kuznets (1973:247) pointed out that the level of production capacity is significant. He defined the economic growth of a country as "a long-term rise in capacity to supply increasingly diverse economic goods to its population, this growing capacity based on advancing technology and the institutional and ideological adjustments that it demands". This view implies that growth which is measured as increases in real gross domestic product without taking cognisance

of levels of utilisation of existing production capacity might not in a certain sense, constitute growth, but rather the catching up of lost production. He stressed that nations can only derive abundance by using best available technology and not by “selling fortuitous gifts of nature to others”.

This therefore brings in the notion of production potential rather than actual performance. Robert Solow (1970:295) is emphatic that attention should rather be focused on the “growth of capacity to produce rather than the growth of demand, which is important but a separate problem. The foundation of any broad view must evaluate the major determinants of potential output and productivity in an economy, the chances of influencing them and the effectiveness of changes in the determinants on capacity output itself”.

It is a problem obtaining production potential, especially if one is interested in the growth of many economies. To obviate this problem, Solow (1957:314) proposed relative utilisation of labour and capital functions using the unemployment rate. This method uses the same measure to adjust both inputs simultaneously, which in turn introduces its own inaccuracies.

Some adjustment to take account of capacity levels is necessary especially if one is to determine the contribution of productivity to economic growth, since the utilisation of production capacity is one of the factors influencing productivity growth. The approach proposed by Donovan and Norwood (1983:9) and Jorgenson (1995:5) is perhaps the most practical one to minimise this problem. They calculate average annual growth rates from upper turning point to upper turning point of the economic cycle. This would largely reduce the production capacity utilisation distortions. This procedure does not eliminate the problem since the rates of utilisation of the capital stock and of employment need not be the same at each peak. However, it does reduce the problem substantially. Another problem is encountered with international comparisons because business cycle movements and therefore upper turning points may not coincide. This method seems to provide a satisfactory solution for national comparisons and analysis and is the approach adopted in the analyses of growth in South Africa for successive periods between 1946 and 2000 (mainly in chapter 4).

GDP per capita is accepted as the measure of increase in welfare or standard of living of a country, but confusing as it may seem, can be regarded as a passive outcome of an economically determined rate of increase of aggregate real product and an exogenously determined rate of population increase. There are also controversies about the direction of causality between economic growth and population growth. Furthermore, changes in population growth are patently long-term phenomena, whereas total real income can fluctuate dramatically in the short term. Many growth theories and international growth measures therefore focus on total real income or product, because this is an object of interest in its own right, and according to Choi (1983:7), should not be further complicated by demographic phenomena. The total real income is thus the part of the ratio that could change welfare dramatically in the short to medium term. This does not imply that the standard of living or welfare considerations are less important.

Many researchers use GDP per capita as their growth variable, while some also use productivity increases defined as output per employee as their economic growth series. In South Africa it is problematic obtaining reliable population figures, let alone worker or employee series that date as far back as 1946. This problem was compounded by the Transkei, Bophuthatswana, Venda and Ciskei independence and their subsequent reincorporation into South Africa. To circumvent these problems and because time series were used in this study, it was decided to use real GDP growth as the dependent variable in this research project.

1.3 GROWTH THEORY

According to Pearce (1992:179) and Bannock, Baxter and Davies (1998:127), growth theory covers the study of growth in economies with a view to constructing models, which use changes in variables such as

- the capital stock;
- the growth in the size of the population, which impacts on the numbers and age distribution of the labour force;
- the training of workers; and also
- advances in technology

to explain economic progress. The interaction between these and other variables is important, because if they have direct and sizeable effects on the rate of economic growth, they could make a significant contribution to raising living standards through the improved material welfare of the population.

Long-run international growth rate analysis by Barro and Sala-i-Martin (1995:2-4) has shown that a modest rise in the growth rate of a nation could vastly improve living standards over the long term. A permanent increase in economic growth is indispensable for every nation, and even more so for developing countries which need to grow faster than developed countries to catch up. This means that their growth rates must exceed those of developed countries by a considerable margin if gaps in income are to be reduced or levelled over the long term.

A wide variety of growth theories exist and they are almost as old as economics. The classical growth period extends from Adam Smith and his *Wealth of nations* (1776) to JS Mill's *Principles of political economy* of 1848 (Bannock, Baxter and Davis 1998:59). The classical growth theory focuses on growth and development and sets out to investigate the nature and causes of the wealth of nations and the distribution of national product (income) among the factors of production. This is set within a framework of a growing population with finite resources using free competition in a private enterprise economy (Pearce 1992:61).

The Keynesian and neo–Keynesian growth theory considers the capitalist economy to be inherently unstable or extremely delicate to balance. It considers the conditions necessary for equilibrium to be so restrictive that it is extremely unlikely that they will be met. The neo–Keynesian models focus on the problems of instability and unemployment and may be seen as an extension of Keynesian theory in a continuously changing context. The theory focuses on the role of investment and saving as a component of total demand and as an expansion of the capital stock.

The neo-classical growth theory considers the economy to be inherently stable and tending towards full employment. These models assume factor prices of labour and capital to vary over the long term. Changes in the cost of labour and capital lead to the substitution of capital for labour, or vice versa. This in turn

leads to changes in input proportions actually utilised in the aggregate production function. Changing input proportions result in changes in the capital-output ratio. The assumption of perfect competition leads to the outcome that on the equilibrium growth path the real rate of interest equals the marginal product of capital and the real wage equals the marginal product of labour (Pearce 1992:179). Unlike the vintage growth models, which assume that new technology can only be incorporated into new machines, the neoclassical models assume that technological progress is exogenous and falls like "manna from heaven" and that technical advances can be incorporated into existing and new machines. According to neoclassical theory, growth originates from population growth and disembodied technical progress. Abramovitz (1993:218) termed the latter "some sort of measure of our ignorance", and defined it as the difference between the growth of output and the growth of all factor inputs combined.

According to Romer (1994:3): "Endogenous growth embraces a diverse body of theoretical and empirical work. The empirical work does not settle for measuring a growth accounting residual that grows at different rates in different countries. It tries instead to uncover the private and public sector choices that cause the rate of growth of the residual to vary across countries."

Modern growth theory is often considered to be of more interest for its mathematical content than for its insights into the actual working of the economic system. In this study an attempt is made to explain and investigate economic growth with descriptive text rather than mathematics. Factors contributing towards economic growth in South Africa are, however, examined using econometric tools.

It is also important to note that high growth rates can easily dissipate and be quite difficult to regain, something South Africa was painfully aware of in the 1990s and still is in the new millennium. Other countries that experienced similar declines in growth are Japan (1993-98) and Mexico (1982-88), and decades ago, Argentina (1972-76 and again 1987-90). Rostow (1971:38) classified Argentina as a developed industrialised country and states the following: "In one sense the Argentine economy began its take-off during the First World War. But by and large, down to the pit of the post-1929 depression, the growth of its modern sector, tended to slacken; and like a good part of the

Western World, the Argentine sought during the 1920s to return to a pre-1914 normalcy. It was not until the mid-1930s that a sustained take-off was inaugurated, which by and large can now be judged to have been successful despite the structural vicissitudes of that economy." The World Bank (2000:229) confirms this view as it classified Argentina as an upper middle-income country.

Denison (1967:5) observed that "there are many sources of growth and these vary greatly in importance from time to time and from place to place". Simon Kuznets (1973:247) is more specific on the same subject and states the following "The source of technological progress, the particular production sectors that it affected most, and the pace at which it and economic growth advanced, differ over centuries and among the regions of the world; and so did the institutional and ideological adjustments in their interplay with the technological changes … ."

1.4 CONCLUSION

Economic growth is the most important outcome in the field of economic studies because it affects the material well-being of every human being. The growth in GDP per capita is the most widely used measure to determine the standard of living of the citizens of a country and for international comparisons.

The percentage increase in gross domestic product from one year to the next is used as the dependent variable of growth when econometric tools are used in this study to test for factors determining economic growth in South Africa.

1.5 OUTLINE OF THE STUDY

The second chapter examines the origins of economic growth, with a study of the growth theories of the classical economists, followed by a brief look at the neoclassical growth theories and the empirically untestable theory of Marx. A cursory study of the difference between growth and development follows. The initial growth hiatus of the late classical and early neoclassical period is then discussed, focusing on the important microeconomic tools designed by Marshall.

Two growth proponents of the neoclassical period, namely Schumpeter and Kuznets are then discussed, before looking into the seminal work of Robert Solow. Chapter 3 focuses on the exogenous growth theory proposed by Solow followed by the endogenous growth theory propounded by Romer and Lucas. Chapter 4 examines the growth performance of South Africa and evaluates the efforts towards sustained growth and development since 1960 through the decades and ends with the new political dispensation that followed the general elections in 1994. In chapter 5 the concept of growth empiricism is examined, with particular emphasis on the work of cross-country growth theorists and the factors they isolated as important contributors to economic growth.

As there does not seem to be a single or common growth recipe that is suitable for all countries, it is important to find out which growth-inducing factors might lift South Africa's growth performance and as such make a meaningful contribution to higher living standards. The proposed approach for this study is to use the growth factors identified in cross-country literature and test their contributions to growth in South Africa. This methodology can identify the most promising growth determinants and the results can then be used to induce a higher growth rate for South Africa in the future.

In chapter 6, South African time series are used to determine the contributions to growth of the factors that were found to be robust contributors to economic growth in the cross-country analyses discussed in chapter 5. Instead of using the indicated growth-inducing factors in a similar fashion to those of cross-country analysts in explaining growth, thus heeding the advice of Barro, stationary time series are used in conjunction with Granger causality tests. If these tests are significant, the instruments of vector autoregression and spectrum analyses are applied to cast more light on the influence of some of the factors discussed in chapter 5, on growth in South Africa. The thesis concludes with an empirical analysis of growth determinants in South Africa from 1946 to 2000.

CHAPTER 2

SOME SEMINAL CONTRIBUTIONS TO ECONOMIC GROWTH

In the case of economics there are no important propositions that cannot, in fact, be stated in plain language.
(Galbraith 1979:293)

2.1 INTRODUCTION

This chapter commences with economic growth and its classical roots from the optimistic viewpoint of Adam Smith (1723-1790) to the pessimism of Malthus (1766-1834) and Ricardo (1772-1823). The classical phase ends with the work of John Stuart Mill (1806-1873). The next section lingers briefly on the socialism of Marx and then fast-forwards to the neoclassical hiatus, focusing on Marshall (1842-1924). The chapter ends with a discussion of Schumpeter (1833-1950) and Kuznets (1901-1985), whose work has important links with our modern growth theory.

2.2 CLASSICAL FOUNDATIONS OF ECONOMIC GROWTH

Economic growth is a vast but critically important subject that somehow impacts on all nations. For example, Samuelson and Nordhaus (2001:568) write in their best-selling textbook: “Economic growth is the most important factor in the success of nations in the long run.” The origins of economic growth are found in the Classical School, where two apposing poles emerged, namely the growth optimism of Adam Smith and the growth pessimism of Malthus and Ricardo. Strands of these broad philosophies are still discernible in modern economics. The basic tenets of these opposing views are examined in the next section. The classical economists tended to analyse economic phenomena from a long-term perspective – often without time limitations.

Professor Andrew Skinner (Smith 1986:73–82) focused attention on the optimistic and pessimistic schools in his introduction to a contemporary edition of the *Wealth of nations*: "Smith's predominant concern was with economic growth" which, once started, "may be seen as self-generating", thus reflecting his basic optimism in contrast to the theme of "growth and decay", which was not only typical of other 18th century writers but came to assume apocalyptic dimensions in the subsequent works of Malthus and Ricardo.

2.3 THE CLASSICAL SCHOOL: THE OPTIMISTS

Adam Smith (1723–1790) emphasised capital accumulation, the division of labour and technical progress as the main causes of economic growth. There are two sections in the Wealth of nations (1981) where the growth process is at least slightly related to the relationship between input and output in the form of the law of returns. The first section appears in the beginning of the first volume, where Smith relates his famous pin-making example: One worker, alone, can probably produce one pin in a day, whereas 10 specialised workers could reach a total estimated daily output of 48 000 pins (Smith 1981:14-15). The per capita output thus rises from one pin per worker per day in small-scale manufacturing to 4 800 pins per worker per day by a specialised team in large-scale manufacturing. The outcome of this enormous increase in productivity vastly reduces the cost per pin and is undoubtedly followed by a significant decrease in the price per pin. Would such a vast increase in output, made possible by the division of labour, be economically viable? Smith's answer to this question is that it depends on the "extent of the market" (Smith 1981:31). With this response, Smith closes the circle of causation by showing that economic growth is the joint outcome of supply (division of labour) and demand (extent of the market). It is therefore a logical progression to state that the outcomes of large-scale production will be a lower unit cost of output and economic growth.

In his extended chapter on rent, Smith (1981:260) refers for a second time to variable returns within the ambit of economic growth: " … it is the natural effect of improvement … to diminish gradually the price of almost all manufactures … In consequence of better machinery, of greater dexterity, and of a more proper division and distribution of work, all of which are the natural effects of

improvement, a much smaller quantity of labour becomes requisite for executing any particular piece of work."

In contemporary language this may be interpreted as follows: Where economic growth is accomplished by technical progress, the desired quantity of output could be produced by reduced factor inputs, which result in a lower unit cost of production. Economic growth at the macroeconomic level is accomplished by increasing returns at the microeconomic level, with the proviso that demand ("the extent of the market") is sufficient to absorb the increased output volume.

Smith's pioneering work did not have the supportive peer evaluation infrastructure of modern economics, which often gave rise to technical imprecision. Schumpeter (1986:259) makes the following critical comment on the above reference: "Observe that this statement mixes up two entirely different things:

- 'better' machinery seems to point to an effect of the widening of knowledge – the Technological Horizon – that occurs in the course of economic development;
- improved division of labour, on the other hand, is one of the consequences of mere increases in output and may occur within an unchanging technological horizon or an unchanging state of the industrial arts."

Schumpeter's criticism is legitimate, but technical progress need not preclude or conflict with improved division of labour. More fundamental still is the fact that Smith was working with an unlimited time span during which (quantitative) factor inputs and (qualitative) factor productivities could both change. This implies that the time span is not just the long term, but includes the *very* long-term period in production theory. Smith (1981:160; 161; 192; 374; 395) conceded that the total land area that can be used for productive purposes is fixed and that its marginal productivity diminishes, but showed with convincing examples how this can be more than counteracted by technological progress embodied in increased investment.

2.3.1 The law of variable returns

Two options of the law of variable returns were mentioned in the section above, depending on whether the analysis deals with the short-term or the long-term production time span. The effect of time periods in economic analyses – and variable returns in particular – was only developed deep into the 20th century. Hence Smith did not use these modern tools but they do facilitate the understanding of Smith's analyses and are used in the next section.

The two versions of variable returns that were subsequently formulated in economic analysis and used in this section are as follows:

(1) The short-term version of the law is conceptualised in a production environment in which changes occur in both fixed and variable factors. Additional units of the variable factor are used in combination with the fixed factor. If production techniques remain the same, the resulting incremental output at first rises and eventually falls. The short-term period is defined as leading to a production bottleneck (the fixed factor), so that the incremental output eventually diminishes as more units of the variable factor are employed. This process is generally known as the "law of diminishing returns", and is sometimes referred to as the "law of variable proportions".

(2) All input can be changed in the long term, and production bottlenecks can be eliminated. The law of variable returns then applies to the rate at which production increases simultaneously with all inputs. The resulting long-term incremental input/output relationship is then referred to as the principle of "returns to scale".

In a theoretical conceptualisation, the principle requires that all inputs increase in the same proportions while production technology remains the same. When all inputs are doubled and the resulting output also doubles, *constant* returns to scale are said to prevail. Similarly, when output more than doubles, there are *increasing* returns to scale, and when output less than doubles itself, returns to scale *decline*. Adam Smith went beyond the strict definition of the conceptual long-term period when he related capital formation, division of labour and

(especially) technical progress to economic growth. The extended time scale in terms of which Smith operated, was called the "secular" period by Marshall (1956:314-316) (see below), and is today described as the "very" long term in economics textbooks. This time scale is extensive enough to allow for the development of a process in which "technological possibilities ... are subject to change, leading to new and improved products and new methods of production" Lipsey (1983:648).

A problem arises in finding a common physical measure for such heterogeneous input units when the technological properties of production factors change as the scale of production expands, or when the production period is extended. Relating physical output to its cost of production solves this problem. Money is the common measure of value of all factor inputs, no matter how different they may be. The concept of an incremental input/output relationship as conceived by Adam Smith in time came to be referred to as "economies of scale". The broad definition describes the phenomenon in which the average cost of production declines in relation to the expansion of the scale of production (i.e. the size of a plant or firm).

2.4 THE CLASSICAL SCHOOL: THE PESSIMISTS

Thomas Robert Malthus (1766-1834) and David Ricardo (1772-1823) were two exceptional personalities. They belonged to the pessimistic faction of the so-called "Classical School". Diminishing returns feature prominently in the Malthusian population principle in terms of which the population grows at a geometric rate and food production only increases at an arithmetic rate. The per capita production of food would therefore diminish in time and the ultimate result would be a population catastrophe or explosion – unless it is prevented by three interventions, namely vice, misery and moral restraint. Malthus considers only the last-mentioned check to be ethically acceptable in principle, but even he had major reservations about its practical efficacy. Despite these misgivings, nothing could persuade him to redirect his definitive vision of economic stagnation.

It has been said that Ricardo approached the economy as if it were one gigantic farm. Against the background of finite resources and the Malthusian population

principle, together with his own laws of income distribution, he argued that economic growth would eventually come to an end. Blaug (1985:88) concluded: "At the heart of the Ricardian system is the notion that economic growth must sooner or later peter out owing to scarcity of natural sources."

The actual process leading to an ultimate stationary state of the economy is common knowledge, and it is only necessary to note the role that diminishing returns are expected to play within these confines. The Ricardian system presupposes that as increasingly more joint "doses" of capital-and-labour (used in a fixed ratio) are applied to a given quantity of land, the resultant overall production will increase at a diminishing rate. Population growth will simultaneously raise the demand and the concomitant prices of food, thus raising the income share accruing to farm owners from rent.

Since the relative share of wages remains constant, at a long-term subsistence level, the net profit available to investors (capitalists) would of necessity decline and ultimately fall away. Neutralising the inducement for capitalists to invest would cause economic growth to grind to a halt – bringing about a stationary state. Ricardo (1951:120) conceded that "improvements in machinery" and "discoveries in the science of agriculture" could serve to retard the "natural tendency" of profits to fall. This, he believed, would only bring about temporary reprieve from ultimate gloom.

Malthus and Ricardo's doom and gloom never materialised, despite their correct premises regarding the scarcity of land. Economic growth continued. Their predictions were proven wrong because they applied short-term reasoning (diminishing returns) to a long-term situation (economic growth). Another flaw in their reasoning was that, even in the short term, persistent diminishing returns could only be maintained indefinitely in a two-factor economy, where one factor was fixed (e.g. land) and the other remained variable (e.g. labour).

Blaug (1985:79) comments: "Once a third factor is admitted, capital may increase relative to labour sufficiently to offset the effects of an increasing ratio of labour to land even in the absence of technical change: the fact that the supply of land is fixed proves nothing about the law of diminishing returns."

(Note that Ricardo's fixed "doses" of capital-and-labour effectively amount to only *one* factor of production.)

Malthus's and Ricardo's gloomy future prospects may be deemed to be an exaggerated version of the "growth and decay" hypothesis that was widespread during the 18th century. Malthus's and Ricardo's methods were in direct in opposition to the optimism of Adam Smith, the founder of classical economics.

The following insightful statement by Malthus (1989:413) is significant: "We have seen that the powers of production, to whatever extent they may exist, are not alone sufficient to secure the creation of a proportionate degree of wealth. Something else seems necessary in order to call these powers fully into action. This is an effectual and unchecked demand for all that is produced." This notion strongly resembles Adams Smith's belief that the division of labour is limited by the extent (size) of the market. What is more, Malthus seems to reach into the future to foreshadow the Keynesian thesis that insufficient aggregate demand may cause employment and production to fall below capacity levels. Malthus also emphasises that economic growth is the joint outcome of supply and demand.

2.5 THE CONCLUSION OF THE CLASSICAL SCHOOL

2.5.1 John Stuart Mill (1806-1873)

Adams Smith's *Wealth of nations* (1776) is widely accepted as representing the opening stages of the classical era in economics. Few economists would disagree that John Stuart Mill's *Principles of political economy* (1848), on its own merits, represents a commendable closure to the classical era. The laws of variable returns are set out in book I on *Production: economies of scale* in chapter IX and diminishing returns in chapter XII. Similar to the work of Smith, Mill's analysis is strong in its broad insights rather than rigorous minutiae. His analysis and reasoning were in tandem with those of Ricardo. Mill also foresaw an ultimate growthless economy and society as the stationary state.

On the subject of diminishing returns, Mill held that this principle governs conditions of production, mainly in agriculture or where land and natural

resources are the primary input. His reasoning followed the known pattern of more labour applied to fixed land, but Mill added the potential importance of reproducible capital as an autonomous production factor.

In the light of the opportunity cost of capital, agriculture was unlikely to secure sufficient capital to counteract diminishing returns, especially in the realm of more profitable investment opportunities – and in the manufacturing sector in particular. Diminishing returns, according to Mill, would occur even in a three-factor economy, in the ambit of changing factor proportionality. He believed that improved technology could reduce the adverse effects of diminishing returns. He gave several examples and concluded: "There is, thus, no possible improvement in the arts of production which does not in one or another mode exercise an antagonistic influence to the law of diminishing returns to agricultural labour" (Mill 1921:186).

In describing the interaction between diminishing returns and technical progress, Mill focused on the virtually unsolvable problem that the concept of diminishing returns is short term and technical progress is a (very) long-term period phenomenon in production theory. He was quite philosophical about the eventual outcome of the inevitable law of diminishing returns. He surmised that it could only be "suspended, or temporarily controlled, by whatever adds to the general power of mankind over nature" (Mill 1921:188). Mill was quite emphatic about the ultimate significance of the law. He stated quite clearly: "This general law of agriculture (diminishing returns) is the most important proposition in political economy" (Mill 1921:77).

In the context of long-term analyses, Mill generally conformed to increasing returns to scale. His increasing returns are the result of a growing division of labour, and the flushing out of hidden unemployment in small-scale business operations (Mill 1921:133): "If the business doubled itself, it would probably be necessary to increase, but certainly not to double, the number either of accountants, or of buying and selling agents. Every increase of business would enable the whole to be carried on with a proportionately smaller amount of labour."
Mill also mentioned productivity-related sources of increasing returns to scale, for example the generally better utilisation of business overheads, employing

"expensive machinery" and mobilising capital by joint stock companies. He did not believe that small-scale production would be completely usurped by large companies, and to this end he devised a test for comparative productivity (Mill 1921:134): "Whenever there are large and small establishments in the same business, the one of the two which in existing circumstances carries on the production at the greatest advantage will be able to undersell the other."

As mentioned above, one of the effects of large-scale production is declining average costs. The question could then rightfully be posed as to how average cost in small-scale production could be lower than in large-scale production. One instance could be when returns to scale decrease, and another when diseconomies of scale emerge. Mill thought that this would probably happen in agriculture, leading him to formulate the rule that production units should be "small" in primary and "large" in secondary and tertiary sectors.

A consequence of large-scale production is reduced competition because some smaller firms grow bigger and others are eliminated from the industry. These burgeoning firms could create so-called "natural monopolies", and Mill expressed the opinion that the government would run these firms better than private enterprises. These policy proposals departed radically from the *laissez-faire* tradition of the Classical School.

2.6 THE UNTESTABLES

2.6.1 Karl Marx (1818-1883)

Karl Marx discarded two cornerstones of the Classical School: firstly, that economics (political economy) was an autonomous scientific subject, and secondly, that the market mechanism provided an intrinsic clearing system. Marx formulated his own conclusions, but used most of the analytical tools introduced by the classical economists, in particular their inclination to contemplate the eventual demise or survival of humankind. Blaug (1980:73) labelled Marx the greatest proponent of "the apocalyptic fallacy", or the habit pioneered by Malthus and Ricardo "of making predictions with open-ended time horizons".

In the context of a broad social and historical background, the laws of variable returns constitute a small but essential part in the demise of capitalism and the market economy as predicted by Marx. Analyses of economies of scale make up a large section of the first volume of *Capital* (1979). Marx relates the saving in costs of building bigger facilities to accommodate 20 weavers at 20 looms in one room to building 10 rooms to accommodate two weavers each. Marx (1979:442) concludes: "The value of the means of production concentrated for use in common on a large scale does not increase in direct proportion to their extent and useful effect." Marx (1979:588-589) submits that economic growth results from the continuous establishment of bigger but the survival of fewer business firms. This tendency induces both the division of labour and capital formation, leading to increasing returns to scale, particularly in the manufacturing industry. The outcome is mass production of comparatively cheap goods in shrinking markets with deficient aggregate demand.

These "laws of motion" of the capitalist system were destined to bring about its demise. Marx referred to Adam Smith's example of 10 specialised pin makers producing 48 000 pins daily. He (1979:588-589) stated that one machine had the capacity to produce at least 145 000 needles [*sic*] in a working day, and added: "One woman or one girl superintends four such machines, and so produces nearly 600 000 needles in a day, and over 3 000 000 in a week."

This multiplicative capacity of mechanisation relegates an increasing number of workers as well as large numbers of small producers to a growing "reserve army" of the unemployed. Marx writes that the capitalist demise is convoluted, but that capitalism faces a catch-22 situation because competition and the profit motive entice producers to introduce increasingly more capital-intensive techniques. The outcome is a *reduced* rate of profit in the long term, based on his deduction that the only source of profit is the "surplus value" obtained from employing labour and not capital.

With a dwindling number of labourers, capitalists cannot gain enough surplus value to keep up the necessary capital formation. He states, correctly, that the rate of profit, investment and economic growth in a capitalist system will fluctuate over time. However, Marx also theorised that cyclical amplitudes would increase and lead to an economic collapse and, in the words of the *Communist*

Manifesto, "the forcible overthrow of all social conditions" (Marx and Engels 1983:120).

Most Marxist economies, notably the USSR and its satellite states, recorded initial high growth rates. However, their performance dwindled largely because of the absence of inducements to increase productivity and to continuously innovate production methods, products and services.

The ensuing classless (socialist or communist) society envisaged by Marx therefore remained an empty set. Although Marx has been called an important growth theorist (Krelle 1971:133), his conclusions (predictions) cannot be empirically tested. Marxian economics therefore does not form part of scientific knowledge in the normal sense of the term.

Krelle (1971:127) attempted to construct a mathematical explanation of Marx's theory. Some of the variables were invented by Krelle and were therefore not part of Marx's original theory. Others were defined by Marx but were not observable or had no empirical content because they were imperceptible and below the surface – for example, his assumption that the population increases faster than employment and small business is always less efficient than big business and the "law" of the declining rate of profit.

Marxian law on the tendency of the rate of profit to decline is said to be subject to certain "counteracting or disturbing causes". Although these are spelled out, "they are held to be set in motion by the very fall in the rate of profit, which they counteract. We therefore have one negative rate of change, enshrined in the basic law, and several positive counteracting rates of change. The joint outcome of all these forces could clearly be either negative or positive" (Blaug 1992: 60).

According to Blaug (1992:61), it is evident that "Marx's 'law' of the declining rate of profit suggests that the 'disturbing' or 'counteracting' causes of the basic tendency are themselves induced by the tendency, so that the relationship can be observed under no conceivable circumstances."

Krelle (1971:125) interprets Marx's labour theory of value as "what Marx states is the proposition that there is an unobservable intrinsic value of each

commodity behind the screen of its really observable price. The intrinsic value is equal to the real price without any profit mark-up." These unobservable variables at the core of Marx's theories mean that his growth theory cannot be empirically tested.

2.7 NEOCLASSICAL HIATUS

The neoclassical economists chose to study the functioning of the market system and its role as an allocator of resources. The motivation for rethinking economic theory could partly be ascribed to changes in the economic structure after the classicists. *Firstly*, there has been a notable tendency towards the concentration of industry. Fewer units with greater production capacities wielded almost monopolistic economic power. *Secondly*, the trade unions emerged and although still in their infancy, already started to lay claim to a role in wage determination. The free-market approach subsequently showed increasing strain in allowing "natural" and "market" prices to converge. *Thirdly*, intellectual debates on economic matters became more customary, and the environment in which neoclassical economics operated encouraged a new approach. Of particular importance was the neoclassical economists' claim that certain "imperfections" in the market could be remedied by policy interventions. A tinge of optimism was infused into the economic debate, especially as suggestions seemed aimed at resolving social tensions.

2.7.1 The Neoclassical School

This section refers to the early neoclassical school and in the work of Alfred Marshall in particular. It points out this school's benign neglect of the broad approach to economic growth and can therefore be regarded as a period of standstill or hiatus in macro growth theory. The next two sections refer to the work of Schumpeter and Kuznets who contributed significantly to growth theory with their work on business cycles and empirical data respectively, which are important building blocks in growth theory. The work of Solow, which also falls under the neoclassical school, is largely a bridge between the classical school and modern growth theory and is discussed in section 3.5 entitled "exogenous growth".

During the neoclassical period, economic theory began to focus on micro-aspects of the economy, and in particular on decision-making units consisting of households, firms and industries. This approach was contrary to the classical approach in which the emphasis was on aggregate income and its basic components of wages, profit and rent. One consequence of the emphasis on micro-decision-making units was that the behaviour of the market system and understanding the factors that determine the prices of both output and input became focal points.

The neoclassical economists invented elaborate mechanisms to analyse market price formation, and these opened up a wide new field for economic theory. This shift in emphasis caused neglect of some of the themes of the classicists – long-term growth and the distribution of income in particular. Robinson quipped that the important classical questions of growth and distribution were displaced by little ones, for example: “Why does an egg cost more than a cup of tea?” (Barber 1967:165). These moves were deliberate and aimed at refuting the market failures predicted by Marx.

2.7.2 Alfred Marshall (1842-1924)

Alfred Marshall introduced a number of useful analytical tools for economic analysis in his book, *Principles of economics* (1890). These tools were one of the outcomes of his general philosophy that “ [e]conomics ... is not a body of concrete truth, but an engine for the discovery of the concrete truth” (Barber 1967:169). Modern economists still use Marshall’s analytical innovations which include the delimitation of time in economic analyses, related to economic events, the distinction between internal and external economies and the laws of returns, including the relationship between increasing returns and external economies.

The logical distinctions between moments of economic time opened the door to a new and interesting set of theoretical possibilities. After all, it was quite conceivable that in the long run – when the scale of plant could be altered and utilisation of all production factors varied – several outcomes relating to cost

levels might follow. Changes in scale might, for example, be associated with rising, declining or constant unit costs.

The most interesting case was the one in which average costs declined with the enlargement in the scale of plant. This situation was described as “increasing returns to scale”. On the whole, the classical economists had anticipated that “constant returns to scale” would normally prevail; in other words, that the size of the individual production unit had no effect on average costs. They had, of course, given much attention to the gains in productivity arising from growth in the size of the economy (and the associated progressive subdivision of labour), but the scale effect was quite different from the neoclassical concern with individual enterprises. Mill and Marx had undoubtedly caught glimpses of the cost-reducing effects of large industrial concentrations, although they had not fully worked out the implications.

Marshall saw that increasing returns were associated with a growing economy, when producers used opportunities to extend their scale of operations. This facilitated the reduction of average costs and consequently the selling price of products. Marshall described this process in terms of manufacturing activities in which entrepreneurs invoked better organisational models that lowered unit costs through internal and external economies of scale.

Internal economies result from the large-scale operations of the individual firm regardless of the size of the industry in which it operates. The large firm produces more products and is able to realise a lower cost per unit of fixed input. The bigger firm can also invoke greater specialisation in terms of labour and machines. Non-technical factors also contribute because large companies can negotiate discounts from their suppliers when they place large orders.

External economies result from the development of an industry, leading to the development of ancillary services which benefit all organisations: a labour force whose skills become available to the specific industry, a component industry that supplies the exact specified parts, infrastructure facilities that meet the needs of the industry and commercial and promotional facilities that can be utilised by all (Bannock, Baxter and Davis 1998:123).

For Marshall and other neoclassical economists, analysis of the functioning of a market system began with the behaviour of consumers and producers who acted rationally in pursuit of their own advantage. Consumers sought maximum satisfaction, and producers of goods and services looked for maximum rewards. The neoclassicists formalised these interactions with their principles of diminishing marginal utility (each additional unit consumed gives less satisfaction). These neoclassicists emphasised that their study was restricted to the economic aspects of human action rather than the entire set of human aspirations (Barber 1967:170).

For Marshall, the concept of demand referred to the relationship between quantities demanded and prices. He contended that buyers would be prepared to purchase more of a particular commodity at a lower price than at a higher price. A whole range of combinations of prices and quantities was therefore feasible and could be depicted in a curve that presented price on the vertical axis and quantity on the horizontal axis. This of course also has a bearing on economic growth, departing from the classicist who focused mainly on the supply side of growth (Barber 1967:170).

Similar to the pricing of products, distribution was also analysed in terms of the pricing of productive services. This had the effect that both input and output were determined by the interaction between supply and demand.

Marshall used the basic classification of production factors – land, labour and capital – and assigned a unique distributive share to each factor. He suggested a fourth production factor, namely the organisational skills of managers. Salaries for professional managers and an imputed wage to management in owner-operated establishments fell within the neoclassicist wage classification. Interest accrued to the owners of capital as their reward for “waiting”, and rents were assigned to the productive services supplied by land. The neoclassicist view diverged from the preoccupation of the classicists with agricultural land and highlighted the site value of urban land (Barber 1967:177).

The neoclassicists focused on investigating market determinants (embodied in the behaviour of individual firms and consumers). The decisions these producers and consumers reached in market situations and the consequences of these

decisions captured the attention of the neoclassicists. The properties of these behaviours in allocating resources optimally to given wants were formalised in their principles of diminishing marginal utility (each additional unit consumed giving less satisfaction) and comparative static equilibrium analyses (time is not taken into account to arrive at an equilibrium) (Pearce 1992:301).

At best, Marshall believed that economic growth would take care of itself, with the *proviso* that the state ensured an environment that is conducive to growth (including minimum state controls) and an appropriate sociopolitical environment, and provided and enforced the basic rules of free competition. However, although Marshall believed that economic growth would continue, he failed to provide an explicit link between the growth process and the economies of large-scale production. Blaug (1985:701) consequently points out that "neither Marshall nor the other neoclassical economists established a coherent theory of economic growth".

Marshall, who may be classified as a growth optimist, concluded the classical era by instituting the *hiatus*. He contended that growth would take care of itself if free competition were allowed to take its course. This view somehow stultified the progression of growth theory. This *hiatus* was unfortunate in that it assumed that growth-inducing factors flow only from free competition and neglected institutional growth impediments or stimulants. Moreover, these impediments or stimulants would not disappear or appear by themselves unless growth empiricists could prove that they were detrimental to growth or, in the case of stimuli, growth inducing.

Two exceptions to the neoclassical growth hiatus were the theories of Schumpeter and Kuznets, who are discussed below.

2.8 THE EXCEPTIONS

2.8.1 Joseph Alois Schumpeter (1883-1950)

Schumpeter had many interests besides economics. He was, for example, also involved in business and politics at various stages of his life. Although not successful in all his endeavours, his contribution to economics was outstanding,

first in Austria and later in the USA. Although it is not feasible to assign him to a particular school of economic thought, his principal work highlighted the relation between entrepreneurship and economic growth, with major implications for business cycles.

In essence, the entrepreneur's central role was to apply new combinations of factor inputs and bring about the production of new economic output. In other words, the entrepreneur was first and foremost an innovator, and profits were the reward for innovation. Or, alternatively, as long as an entrepreneur enjoyed a production monopoly, he or she would derive a monopoly profit, which would disappear when competitors followed the leader. Continuous innovation thus became the source of continuous profit and economic growth.

Technical progress played a pivotal role in Schumpeter's theory. In particular, the obsolescence of intermediate inputs and their replacement by technically superior inputs, sent waves of "creative destruction" through the economy. Economic progress therefore represented both a quantitative and a qualitative process, and in his *Theory of economic development*, Schumpeter (1951:63) writes: "... the mere growth of the economy, as shown by the growth of population and wealth, [is not] designated here as a process of development. For it calls forth no qualitatively new phenomena, but only processes of adaptation of the same kind as the changes in the natural data."

Schumpeter used the basic economic concepts of the classical school in his theory of the business cycle, but in a different manner. He also used the neoclassicist concepts relating to the firm, but only to explain technical progress – something the early neoclassicists neglected. He used Marxian socialist concepts and to some extent thought that capitalism would evolve into socialism – owing to different pressures, however.

He starts his analysis with a particular version of a static equilibrium system "in a state of circular flow" (Rostow 1990:234). Schumpeter introduces a simplified assumption "of a commercially organized state, one in which private property, division of labor, and free competition prevail". He maintains this assumption in his later works and therefore limits his range as a growth economist by excluding growth in underdeveloped countries.

In his *Business cycles*, Schumpeter (1939) enhanced his theory of entrepreneurship, integrating it into a business cycle theory, and in his popular *Capitalism, socialism and democracy* (1943:156-163), he propounded a theory of socioeconomic evolution in which he famously predicted the downfall of capitalism in the hands of intellectuals. He described entrepreneurs as daring individualists who create technical and financial innovations in the face of competition and declining profits. They have vision and use their own and investors' money to develop and introduce new products. Innovative entrepreneurs are the movers of economic growth because they take risks and introduce new technologies to stimulate economic activity, replacing old technologies by a process of "creative destruction" (Schumpeter 1943:83).

Schumpeter (1951:64) distinguished between the way an economy would operate as a "circular flow" if technology were static, and the way it would operate in the real world of "economic development" where "technique and productive organisation" were changing. He stated that in a capitalist economy, "economic life changes its own data by fits and starts", and the system "so displaces its equilibrium point that the new one cannot be reached from the old one by infinitesimal steps. Add successively as many mail coaches as you please, you will never get a railway thereby."

Schumpeter emphasised the central role of the entrepreneur in economic growth, and not disembodied technical progress represented by growth in capital stock. He wrote that "capital is nothing but the lever by which the entrepreneur subjects to his control the concrete goods which he needs, nothing but a means of diverting the factors of production to new uses, or of dictating a new direction to production." He made a definite distinction between the entrepreneurial role of innovation and that of owning or managing assets. He believed that only the entrepreneur created profit, which is quite distinct from "interest" which is the return on the management of assets. Interest comes in a varying but continuous stream, whereas profits are "transitory and ever-changing." The entrepreneur is able to capture the benefits of innovation only temporarily. Demonstration of the viability of the innovation leads to high profitability and attracts copiers and imitators. This erodes its value as an innovation and, having lost its uniqueness, it will revert to the domain of the circular flow (Maddison 1982:19-20).

An environment that is conducive to entrepreneurial activity must display continual creative destruction. Start-up companies therefore prosper and enhance the economy, in part by taking over the markets of established competitors. Modern-day examples are cellular phones, encroaching on the market of conventional wire telephones as well as two-way radios (Eatwell, Millgate and Newman 1987:264-265).

The efforts of entrepreneurs create spurts of activity; others join in with imitations or improvements and thus create a wave of economic growth or a boom. This period of growth is always followed by a consolidation phase to adapt to changes brought about by the boom. Ups and downs in economic development can be explained by the fact that new combinations or innovations appear. Innovation should be distinguished from invention. Entrepreneurs can apply new combinations, but invention as such need not lead to innovation and need not have economic consequences (Eatwell, *et al.* 1987:264).

Schumpeter's (1951:66) description of economic development as the "carrying out of new combinations" coincides with the concept of "new recipes" which Romer (1994:13; 1996:204) frequently uses in his endogenous growth model. Innovation need not be new products. It can also be new ways of doing things or creating new markets, access to a new supplier of raw materials, or new organisational methods in an industry. Only the first two coincide with what is conventionally regarded as technical progress. Maddison (1982:20) describes it as a provocative approach that represents "a major break with the tradition in economics."

Schumpeter used somewhat ambivalent terminology to explain the development of economic progress. Saving, for example, is not considered to be a factor that leads to economic development in the sense of entrepreneurial innovation. Capital formation and a population increase determine the growth rate in a stationary economy (Eatwell, *et al.* 1987:264).

Schumpeter (1943:162) stated that capitalism would eventually be replaced by socialism. He predicted that capitalist economies would become increasingly prosperous and eventually lose their innovative spark. This would be brought

about by a process in which innovative entrepreneurs would be replaced by bureaucratic managements in big, slow-growing companies. These lethargic giant companies would dominate the economy, place less emphasis on price competition and resist new technologies that are perceived as threatening. These companies would be divorced from their owners who would have no interest in ownership. In a climate of growing hostility to capitalism, governments would be pressured to take over the big companies and become active in economic affairs - thus promoting socialism. Capitalism would therefore evolve into socialism.

According to Marx's theory, the transition would take place because of the weaknesses of capitalism, whereas Schumpeter (1943:134) theorised that it would happen because of the strengths of capitalism. The preoccupation of these two authors with the collapse of the capitalist system was perhaps one of the reasons for the absence of policy discussions in their analyses.

Schumpeter (1943:88) made scant reference to the role of patents in research, development and invention, all three of which are important issues that precede entrepreneurial action. Schumpeter only referred to patents in a footnote (1943:88, footnote 3). All these concepts are nevertheless important stepping-stones in Romer's (1994:17-21) endogenous growth theory.

Schumpeter (1951:63) was possibly the first economist to speak of "growth of the economy" with its present-day meaning. His focus on economic growth was a major deviation from economic thinking in his time. His contemporaries had not paid much attention to problems or theories of economic growth for decades. In placing technical change in a central position and in postulating the entrepreneur as its main change agent, he broke new ground and even portended major developments in economic growth that materialised only in the mid-1980s. With his insight into the temporary nature of innovation profit, he addressed the non-appropriability of knowledge. This vexing feature of knowledge complicated its inclusion in the production function.

One problematic argument in Schumpeter's theory is the dearth of entrepreneurs as a factor of production. He later expanded his theory to include the idea that innovation could be institutionalised in big companies – an argument which some

analysts considered a contradiction and others a solution to the argument about entrepreneurs (Maddison 1982:21).

Schumpeter and Marx, unlike Adam Smith, did not pay much attention to policies that could promote growth but made their analyses in more general terms. An explanation for their omission may be found in the notion that capitalism is only a halfway station to socialism, albeit for different reasons. Schumpeter's idea of "creative destruction" (1943:83) has impressed many subsequent economists, three of whom are mentioned below.

Myint (1971:86) wrote: "One of the most interesting developments in the long-run theory of economic development is Professor Schumpeter's well-known argument that the growth of monopoly, which from a static view would result in a maldistribution of resources, might actually favour technical innovation and economic development." Moreover, as the states of Central and Eastern Europe embarked on the transition from socialism to capitalism in 1989, the resulting process was also widely seen as an example of Schumpeter's creative destruction – although Schumpeter believed that capitalism would be gradually replaced by socialism. The real world therefore simultaneously confirmed one and falsified the other of his two predictions.

Aghion and Howitt (1998:53-83) classify Schumpeter under endogenous growth. They (1998:1) acknowledge that "the approaches put forward in this book are based on Joseph Schumpeter's notion of creative destruction, the competitive process by which entrepreneurs are constantly looking for new ideas that will render their rivals' ideas obsolete. By focusing explicitly on innovation as a distinct economic activity with distinct economic causes and effects, this approach opens the door to a deeper understanding of how organisations, institutions, etc. affect (and are affected by) long-run growth through their effects on economic agent's incentives to engage in innovative (or more generally knowledge-producing) activities."

Schumpeter's ideas on economic growth are still relevant and can pass the rigorous tests of modern empirical analysis. With his incisive insight into how microeconomics interacts with macroeconomics, Schumpeter may be regarded

as a 20th century incarnation of Smith. Modern economist Romer (1998c:1) aptly refers to endogenous growth as “neo-Schumpeterian” growth theory.

2.8.2 Simon Kuznets (1901-1985): growth empiricist *par excellence*

Kuznets took the creed of Wesley Mitchel, his mentor at Columbia, to heart, namely “that the painstaking collection of empirical data was a priority.” One of the main problems of early analysts of capitalist development was that they had to work without the benefit of the modern statistics and national accounts. Simon Kuznets developed the analytical framework of the national accounts, and encouraged scholars in other countries to produce historical estimates of the major magnitudes. We are therefore much better placed to see when the critical changes in the magnitude of economic growth took place than earlier analysts who had to rely on partial indicators such as industrial production or prices, or simply on imaginative hypotheses or metaphors (Maddison 1982:21).

Kuznets worked at the time when econometrics and Keynesian economics emerged, but, like Mitchel, because he worked methodologically, he was an institutionalist (Eatwell *et al.* 1987, vol 3:71). Kuznets’s definition of economic growth (1973:1) emphasises technology and institutional adjustment as necessary conditions for growth. Efficient use of technology depends on institutional and ideological adjustments to affect the proper use of innovations generated by advancing human knowledge. Kuznets received the Nobel Prize in 1971 for an empirically founded comparative analysis of the economic growth of nations, which eventually gave rise to development economics.

Kuznets used a series of empirical observations to explain a process of sectoral retardation. He referred to existing theory and new theory that enabled him, like Schumpeter, to assert that changes in technology are a decisive factor in growth (Rostow 1990:243). In the opinion of Rostow (1990:243), Kuznets believed that, of the numerous factors discussed by economic historians in connection with the history of an industry, the following factors stand out as dynamic forces:

- population growth;
- changes in demand; and

- technical change, including mechanical or engineering progress and improved business organization, as interpreted).

While these forces are seen as interdependent in the work of Kuznets, according to Rostow (1990:244), changes in technology most certainly "conditioned the movements in both population and demand, while the dependence of technical progress upon population and demand is less clear and immediate. In the interconnection of the three, technology seems to be most prominent." Kuznets therefore also focused on innovation as a prime cause of growth, but his conceptual frameworks differed rather markedly from those of Schumpeter. He devised the so-called "inverted U-shaped curve" measuring inequality over time and addressed issues like causes of growth, the negative affects of growth and growth in less-developed countries.

2.8.2.1 *The inverted U-shaped curve*

Kuznets observed that some nations seemed to have led the world at one time, others at another. Some industries developed at the beginning of the century, others at the end. Various industries in a given national system led the way in developing shifts from one branch to another. However, this fast-growing industry does not continue to grow indefinitely. The pace slackens after a while, and the industry in question is overtaken by industries whose periods of rapid development come later.

This leads to the question why a slowdown occurs in the growth of old industries as the inventive and organising capacities of the nation flow evenly into different channels of economic activity. Which inducements concentrate the forces of growth and development in one or two branches of production at a given time, only to shift from one field to another as time passes? Kuznets answered these questions by studying the historical records of industrial growth and by focusing on the processes that underpin economic development.

This "modern economic analysis" gave rise to the celebrated "inverted U-shaped" curve – also called the Kuznets hypothesis – which states that income inequality at first increases and later diminishes in the process of economic development (Lecaillon, Paukert, Morrison and Germidis 1984:4). Subsequent empirical

research widely supported the Kuznets hypothesis (Lecaillon *et al.* 1984:14), but Kuznets admitted that his "pessimistic" (initial) conclusion regarding to developing countries had been based on meager empirical evidence.

Aghion and Williamson (1998:9) interpret the Kuznets hypothesis to mean that the lowest and highest levels of GNP per head are associated with a low level of inequality, and that the middle levels are associated with a high level of inequality. The relation between income inequality (measured by the Gini coefficient) and GNP per head, although cross-sectional, suggests a pattern of inequality during development. The conjecture was that inequality would necessarily increase during the early stages of development (owing to urbanisation and industrialisation), but decrease later as industries attracted a large fraction of the rural labour force. They confirm this finding by stating that in the USA, the share of total wealth owned by 10 per cent of the richest households rose from 50 per cent around 1770, to between 70 and 80 per cent around 1870, only to recede to 50 per cent in 1970.

The basic mechanism responsible for the inverted U-shaped curve is the economic diversification that represents the initial development. Cheng-Chung (1988:177) provides the following explanation: The agricultural sector shrinks in size relative to the manufacturing sector because of greater profit (income) opportunities in the manufacturing sector. The percentage income difference between the agriculture sector and the manufacturing sector increases. However, as increasingly more people move from the agricultural sector to the manufacturing sector (and later to more profitable opportunities in the services sector), their average income rises (economic development) and income differentials decline.

The greater availability of statistics has confirmed the long-term predictions of the Kuznets hypothesis (that the per capita real income rises as the economy becomes more developed). However, the pessimistic short-term implication of the inverted U-curve has been called into question. Technological change may be the answer (Aghion and Williamson 1998:9-11).
Using data from the USA and most of the OECD countries, Kuznets's predictions seemed to be validated up to the 1970s, but the declining inequality measured in these economies during the 20th century turned around sharply because the data

for 1980 to 1989 show a significant increase in wage inequality, both between and within groups of workers with different levels of education (Aghion and Williamson 1998:9 and 34). The increased inequality shows that, as industrialisation progresses, it is not necessarily true that income (wage) distribution becomes more equal. This in turn suggests that the evolving inequality may be governed by factors other than the GNP per capita (Aghion and Williamson 1998 9). Technological change has been identified as the most important factor in rising inequality (Aghion and Williamson 1998:11).

Recent empirical studies have pointed to a substantial increase in wage and income inequality in several OECD countries during the past 20 years – which contradicts the Kuznets hypothesis. This is true of Australia, Austria, Belgium and Japan, and the biggest increases occurred in the UK and North America (Aghion and Williamson 1998:34).

Aghion and Williamson (1998:38) contend, "there appears to be widespread agreement on the fact that there has been a shift in demand away from unskilled labour in favour of skilled workers". Structural changes in the relative demand for skilled labour may be explained by:

- vertical and structural change in organizations;
- technological change that is biased against the unskilled;
- trade with the rapidly growing East Asian economies, reducing demand for unskilled labour; and
- weakening of labour market institutions, with an upsurge of wage inequality (Aghion and Williamson 1998:38).

2.8.2.2 *The causes of growth*

Kuznets (1973:248) listed the following causes of economic growth:

- high rates of growth in the per capita product and the population in developed countries;
- accelerated productivity growth (output per unit of all input);
- the rate of structural change, from agriculture to manufacturing and then to services;
- urbanisation;
- technological progress, particularly in transport and communication; and

- increasing economic growth internationally.

Kuznets (1973:250) stated that the underlying source of growth "is the emergence of modern science as the basis of advancing technology." Modern economic growth feeds on this new knowledge through the mass application of technological innovations (many based on recent scientific discoveries) and incorporates the new technology into new products. In turn, this mass application encourages more research and development, producing new research tools which then produce more advanced science. In this manner a mechanism is provided for self-sustaining technological advances and economic growth.

Kuznets (1973:257) observed that the quantitative basis and interest in economic growth have widened greatly during the past three to four decades, and that the accumulated results of past studies of economic history and economic analyses could be combined with a richer stock of quantitative data to advance empirical studies of the growth process. He also referred to the important external economies of foreign enterprises in developing countries. These economies are not confined to the supply of capital and foreign exchange. They also bring new ideas, new knowledge and technical skills to developing economies. These skills and knowledge, which are embodied in a profitable enterprise, are adapted to local economic conditions and are much more efficient and successful than technical aid programmes administered by a foot-loose group of foreign experts on short-term contracts.

2.8.2.3 *The negative effects of growth*

Kuznets (1973:258) identified some of the hidden but clearly important costs of growth, including capital investment in education, urbanisation, pollution and other negative results of mass production. The costs of lifestyle changes caused by "urbanisation" are not accounted for in economic measurement, and many may never be susceptible to measurement. Internal and international migration represents substantial costs in pulling up roots and adjusting to anonymity and a higher cost of living. "Deskilling" new urbanites by nullifying their rural knowledge and enabling them to acquire new skills cannot be but a costly process – to both the individuals and society (Kuznets 1973:251).

Other aspects of structural change are the intrashifts in relative shares of the economy and of specific population groups attached to particular production sectors. Shifts in the shares of a specific sector, with its distinctive characteristics and even mode of life, would affect the population group engaged in it. Economic growth perforce brings about changes in the relative position of one group *vis-à-vis* another (e.g. of farmers and small-scale producers, street vendors and shopkeepers). Such changes are not easily accepted and are frequently resisted – even when they are associated with rises in absolute income or a product common to all the groups (Kuznets 1973:251-252).

Technological (and social) innovations are fraught with uncertainties. The diffusion of a major innovation is also a long and complicated process that defies accurate forecasts, especially since the initial economic effect may generate responses in other processes or social sectors (Kuznets 1973:253). Most Schumpeterian entrepreneurs fail to foresee the full range and significance of their innovations. Many users can point to the unexpected negative effects of some technological or social invention that first appeared to be an unlimited blessing (Kuznets 1973:253). The passenger car as a mass means of transport is a case in point. It promoted suburban growth, the more affluent moving from the city centers, and the agglomeration of lower-income groups and unemployed migrants in urban slums. All of these caused acute urban, financial and other problems as well as a trend towards metropolitan consolidation. These problems were not foreseen in the 1920s when the mass production of passenger cars began in the USA (Kuznets 1973:253).

2.8.2.4 *Less-developed countries and growth effects*

There are two enabling factors or groups of factors that curtailed the spread of modern economic growth to less developed countries:

(1) The lack of an enabling environment for growth in these countries, in the form of stable but flexible political and social frameworks that are capable of accommodating rapid structural change and resolving the conflicts that are generated, while encouraging growth–promoting groups in society. (These frameworks are not easily or rapidly constructed, as evidenced by

long struggles in the past – even in some of the developed countries of the 19th and early 20th centuries.) [Kuznets 1973:254].

(2) The growth environments of contemporary developing countries are significantly different from those of the developed countries prior to their take-off into modern economic growth. The developing countries of the late 20th century are at much lower per capita product levels and have higher populations than the developed countries were before industrialisation. The latter were more advanced than the rest of the world, and not at the lower end of GDP per capita (Kuznets 1973:255).

Kuznets (1973:256) contended that economic advances in the developing countries might require technological adaptation – and even greater innovations in their political and social structures. Mere borrowing or adaptation of existing materials and social tools would not suffice. This means that an extended period of experimentation and adjustment can be expected in the struggle to attain a viable political framework which is compatible with adequate economic growth in the developing countries. This process would become more problematic if the gap between what has been attained and what is attainable were to widen (Kuznets 1973:257).

The development problem encompasses more than poverty and the inability to obtain the basic material needs of life – which may be expressed in terms of per capita income. There is also the subjective problem of discontent in the underdeveloped countries about their international status, based on psychological and political drives to obtain national prestige, equal status and international esteem (Kuznets 1973:19).

Kuznets (Myint 1980:84) concluded that the steady growth models based on constant capital/output ratios are quite unrealistic and that the reason why so few countries have become developed must be not their lack of capacity to increase their savings, but their inadequate institutional frameworks and their inability to provide minimal political stability and the efficiency that sustained growth requires. An increasing share of the growth issues mentioned in this chapter receive renewed empirical focus and elaborate theorising in the new growth theories discussed in chapters 3 and 5.

2.9 CONCLUSION

Although the term “economic growth” was possibly first used by Schumpeter, there is little doubt that a large body of the writings of the classical school and other economists who expounded their ideas widened the scope of this subject to a considerable degree. The classical school, and Ricardo in particular, “explained” the process of growth in terms of the law of diminishing returns, which implies that growth would eventually stagnate.

History proved that the notion of Marx and Schumpeter that capitalism would eventually be replaced by socialism was wrong, because most socialist economies reverted to capitalism. A vital reason for declining growth in the socialist economies was the elimination of the role of and incentive for innovative entrepreneurs. Ironically, the entrepreneur was a pivotal force in Schumpeter’s growth theory.

Adam Smith professed the virtues of specialisation and the gains flowing from economies of scale, which opened up the possibilities of continued or even accelerated growth. Marshall provided valuable theoretic tools to analise the economy at micro level, which later contributed to the analysis of economic growth at macro level. Kuznets laid the foundation for modern growth research with his work on national accounts and institutions. These tools are important building blocks for empirical growth analyses.

The more contemporary literature in the advanced countries largely focuses on models and production functions, without the sociohistorical sweep of the Smith-Marx-Schumpeter tradition. This literature propounded two important new ideas that added to capitalist development analysis, namely the notions of technical progress being “embodied” in capital stock, and of education as a form of “human capital” embodied in the labour force (Maddison 1982:22).

It has been said that economic growth is both a short-term and a long-term concept. In the former, output increases by using existing production factors more intensively. In the latter, more output is produced by net additions to the stock of physical and human capital. It also transpired that technical progress

(greater factor productivity) is another cause of economic growth. The introduction of technical progress lengthens the perspective of economic growth even more to enter what is called the “very long-term period” in economic analysis.

CHAPTER 3

EXOGENOUS AND ENDOGENOUS GROWTH

Neo-classical theory, in all its forms, shows a strong tendency to reduce the economic complexity of the analysis, doing so by holding the institutional framework constant.
Choi (1983:33)

3.1 INTRODUCTION

In terms of the initial neoclassical theory described by Solow (1956) and augmented by others, sustained economic growth occurs through an exogenous factor of production, that is, the passage of time. The neoclassical production function used in this theory relates output to factor inputs, which consist of the stock of accumulated physical capital goods (buildings, machinery, transport equipment, computers, and so on) and labour, which is regarded as only one type. The theory imposes decreasing returns with respect to the use of each (reproducible) factor of production (and constant returns overall). From these assumptions it follows that an increase in the stock of capital goods will result in a less than proportionate increase in output, provided the amount of labour employed stays the same (Van der Ploeg and Tang 1992:15). Eventually more capital stock will produce no more output, resulting in lower profits, and for this reason output growth cease.

If new technologies improve the productivity of labour and of capital and so prevent a decrease in the rate of return on investment, the labour force will grow at an exogenous rate. The growth of output is accordingly related to the amount and quality of the stocks of production factors. That part of output growth that cannot be explained by the growth in production factors is often called the Solow residual by economic researchers and/or total factor productivity in applied work. The calculation of total factor productivity assumes perfect competition in labour and capital markets, but also in product and

service markets. This assumption allows the calculation of multifactor inputs by weighing labour and capital input increases in terms of their national income shares (remuneration of employees and gross operating surplus respectively). This joint factor contribution to output is usually substantially less than the growth in output.

This unexplained part of output growth is often called the Solow residual, which he termed the "measure of our ignorance". This is a rather ambiguous phrase, because it refers to the nebulous knowledge of economists on the matter, but signifies improvement in the knowledge base of the workforce in general.

The labour force grows in accordance with population growth and is augmented by technical progress, both exogenously determined. Eventually capital, output and consumption will also grow at this exogenous rate and converge to an equilibrium growth path. Accumulation of capital in exogenous growth theory is a vehicle for ongoing technical development. Neoclassical theory gives no economic explanation for such development, but instead includes a time trend (usually representing technical progress) in the model for the long-run rate of economic growth.

The exogenous technical progress assumed in the older versions of growth theory limits the explanation of the growth process. When the standard Solow model is used with real data in order to explain adjustment to balanced growth paths, predictions for the speed of convergence and the capital income share in national income are generally too high.

3.2 KALDOR'S STYLISED FACTS

Stylised facts are "broad generalizations that are true in essence, though not always in detail" (Bannock 1998:396). Bannock states: "this is one of the most important, but least acknowledged forms of empirical testing in economics…. Many models are designed simply to explain behaviour at its simplest, and can be judged only against the broad truth, rather than the detail".

The broad facts about the growth of advanced industrial economies, which a well-specified growth model should be able to explain, are summed up in Kaldor's (1961:178-179) "stylised facts". Solow (1970:2) agrees with the stylised label, but casts doubt on the factual claim. He nevertheless concedes that "they are what most of the theory of economic growth actually explains". The exogenous technical progress of the neoclassical theory fits into Kaldor's stylised facts (Van der Ploeg and Tang 1992:16).

Kaldor's (1961:178-179) "stylised facts" are as follows:

- continued growth in the aggregate volume of production and in labour productivity;
- continued increase in the amount of capital per worker, over fairly long periods;
- a steady rate of profit on capital;
- a steady capital-output ratio over long periods (this is contested by Jorgensen and Grilliches (1967:265-267) who pointed out short-term cyclical variations and that one should rather use flows of capital services instead of capital stocks. Solow (1970:3) pointed out that capital and output could vary substantially as a result of shift work, downtime and running speed);
- economies with a high share of profits in income tend to have a high ratio of investment to output;
- appreciable differences in the rate of growth of labour productivity and total output in different societies.

Solow (1970:3) is less interested in the latter two facts "because they relate more to comparisons between different economies than to the course of events within one economy". The statement could relate to the fact that international comparisons in the form of cross-country analyses requiring internationally comparable data are a rather recent event, dating to the ground-breaking work of Summers and Heston (1991, 1988) in the late1980s and early 1990s.

Although many of these facts feature in the neoclassical theory, Kaldor (1961:179) maintains that "none of these 'facts' can plausibly be 'explained' by the theoretical constructions of neoclassical theory". For example, according to the neoclassical marginal productivity theory, one should expect a

continued fall in the rate of profit with capital accumulation, not a steady rate of profit. Kaldor's purpose is therefore to present a model of income distribution and capital accumulation that is capable of explaining at least some of the above stylised facts (Choi 1983:44-45).

Kaldor (1978b:76) makes use of a virtuous growth spiral involving cumulative causation that was often used by Myrdal (1957:11-16), and the concept of increasing returns described by Allyn Young (1928:2). With the concept of the virtuous spiral and cumulative causation, success breeds success whereas failure begets more failure. Kaldor constructed a two-sector model as a tool to explain the differences in growth rates as well as the seemingly permanent gaps in growth rates among different economies and regions in a country.

3.3 STYLISED FACTS USED BY OTHER RESEARCHERS

Some contemporary researchers refer to Kaldor's stylised facts and amend the original six facts for their purposes or create entirely new ones. Boltho and Holtham (1992:2) are two researchers who followed the tradition of borrowing from Kaldor but also collecting and creating their own facts. The following are their stylised questions (facts), which they contend a useful model should be able to explain:

- Why have countries, or groups of countries, been able to grow for decades in succession with no apparent tendency to slow down, despite rising capital-labour ratios?
- Why has convergence in per capita incomes across the world seemingly failed to materialise?
- Why have countries or groups of countries generally exhibited medium- to long-term accelerations or decelerations in their growth? (Also see Van der Ploeg and Tang 1992:21.)

Romer (1989b:54) quotes Kaldor's stylised facts and agrees with Kaldor's idea that these broad tendencies are essential in the conceptual stages of a body of theory. He is of the opinion that without stylized facts to aim at, "theorists would be shooting in the dark". Romer paraphrased Kaldor's stylized as follows:

- Wide differences are observed in growth rates of productivity between countries;
- There is no apparent tendency for productivity growth rates to decline over time;
- Capital per worker seems to grow continuously;
- The capital/output ratio is steady;
- The rate of return on capital is steady;
- The shares of capital and labour in the total income remains virtually constant;

Romer (1989b:55) is of the opinion that the basic questions about growth need to be re-examined. He then extends Kaldor's stylized facts to "make sure not only that the facts have some connection with measured data but also that the list be as inclusive as possible". He augments the original facts by observing that there are five other prominent features that characterise economic data:

- There appears to be no correlation between the mean growth rate and the level of output per head in cross section analyses
- The contribution of measurable factor inputs leaves a substantial residual in growth accounting;
- Growth in trade volumes are positively correlated with the level of income;
- Population growth rates show a negative correlation with the level of income;
- Both skilled and unskilled workers tend to migrate to high income countries.

Easterly and Levine (2000:1) produced the following stylised facts of economic growth:

- The "residual" rather than factor accumulation accounts for most of the income and growth differences across nations;
- Income diverges in the long run;
- Factor accumulation is persistent whereas growth is not persistent;
- Economic activity is highly concentrated, with all factors of production flowing to the richest areas;
- National policies exert a considerable influence on long-run economic growth rates.

Easterly and Levine (2000:37) suggest that these facts are more consistent with a technology explanation of growth and income differences than a factor accumulation explanation. Empirical work, however, does not yet decisively distinguish between different theoretical conceptions of "total factor productivity growth". Economists should devote more effort to modeling and quantifying total factor productivity. Klenow (2000:221) agrees with the first four of Easterly and Levine's stylised facts and believes that facts 1 and 3 provide strong support for the conclusion that total factor productivity should become a priority area for economic research.

3.4 CONCLUSIONS REGARDING STYLISED FACTS

Stylised facts give a structured and demarcated area for research on economic growth as these facts are formulated to connect informally with observed data. What seems common to most sets of stylised facts is the observed differences in growth rates across countries and the fact that there is no consistent tendency for the decline in growth rates. Most sets of stylised facts somehow include the importance of productivity growth. The widening of the array of stylised facts by Romer is in line with the wider availability and scope of international data, notably work on growth accounting, international trade, population growth and migration trends. Regarding the latter, Lucas (1988:25, 40) has shown that migration trends are a crucial piece of evidence in distinguishing between theories based on constant and on increasing returns to scale.

3.5 EXOGENOUS GROWTH

The neoclassical model states that in the long term, the growth rate of output per worker is dependent on the rate of labour-augmenting improvement in technology, which is determined by factor(s) not contained in the model (also known as exogenous factors). The model implies that all economies that use similar technology, which could improve over time, should have converging productivity growth rates (Solow 1991:398). Permanent differences in productivity levels are caused by faster/slower population growth or a

higher/lower savings rate. Lower productivity could be due to climate deficiencies or other factors not accounted for in the model (Solow 1991:398).

The Cobb-Douglas (1928) production function, also called the neoclassical production function, is expressed as follows:

$$Y = L^{a}K^{b}T \qquad \text{where } a+b=1 \qquad (1)$$

where:
Y= output
L= labour
K= capital
T= time or the rate of technological progress which changes over time

The weights a and b represent the proportion of Y that accrues to labour (L) and capital (K) respectively. The inclusion of the technology variable freed the neoclassical theory from the doomsaying of Malthus and Ricardo and formulated the ultimate destiny of mature economies in terms of the more acceptable but still rather conservative stationary state, where all real variables grow at a constant, proportional rate. Robert Solow (1970:7) remarked that “the steady state is not a bad place for the theory of growth to start, but may be a dangerous place for it to end”.

The simple Solow (1956:85) model depicts the output, Y, of a business, as a function of three variables: capital, K, labour, L, and knowledge or the “effectiveness of labour”, A_t.

$$Y = K^{a}(A_tL)^{1-a} \qquad 0 < a < 1 \qquad (2)$$

Knowledge or technical progress is assumed to be independent of both the capital and labour inputs and to be a nonrival good, which is free for all businesses. It appears multiplicatively with labour in (1), denoting that knowledge contributes by “augmenting” labour and not affecting capital. The exponents a and (1-a) measure the relative contribution of the two inputs of capital and “effective labour”. These exponents add to unity, to comply with the constant-returns-to-scale assumption for production (e.g. doubling of factor

inputs resulting in output also increasing by 100 per cent). Equation (1) describes how actual output is determined. The equation is simplified by taking logs, after which the equation indicates output growth so that:

$$y = ak + (1-a)(a + l) \quad (3)$$

Lower-case letters represent the proportional growth rates of their upper-case equivalents. This equation may be rewritten as:

$$y - l = ak' + a \quad (4)$$

where: $y - l$ = the growth of output per worker
k' = the growth of capital per effective worker (K/AL)

To see what the neoclassical growth model predicts, we can simplify matters by assuming that there is no labour force growth (annual entry to the labour market is equal to annual retirement) - a situation not too far removed from the reality in many countries. This means that, in terms of equation (2), y equals the growth of income **per worker** (i.e. labour productivity).

This model has three important features which recent growth theories have challenged:

- If markets are competitive, the contributions of each factor input to output (i.e. a and (1-a)) are equal to their respective shares in the total income (output). For all businesses in an economy taken together, this could be approximated by the national accounts breakdown into wage and non-wage income.
- If people were to save a constant proportion of their income, capital per effective worker would be constant in the long run, so that $k' = 0$ in (2) and per capita income growth is therefore entirely determined by knowledge growth, a.
- Increasing the savings (i.e. investment) ratio could raise an economy's income level (permanently) by raising the growth rate of capital (and income) in the short run, but since the ratio of savings to income cannot continue to increase indefinitely, investment cannot cause income to grow permanently. Countries that invest more would be wealthier but would

not grow faster since the only source of long-term growth is technical progress (or “knowledge accumulation”), which is assumed to occur at an exogenous rate. According to this model, income growth rates are beyond business and government control. This is a disappointing and dubious outcome because real-life experiences point to the contrary, especially in the case of businesses.

3.6 GROWTH ACCOUNTING

Growth accounting is an attempt to allocate growth rates in national output or output per person employed to the determinants of output in order to isolate the causes of growth. The aims are to determine the causes of international differences in output levels and the determinants responsible for differences in growth rates. This is also a method to organise quantitative information conveniently and systematically.

Growth accounting stems from an investigation by Denison (1987:572) of the sources of growth in the USA from 1909 to 1958. It has also been used to estimate probable future growth potential (obtained by adding the expected contributions of these sources) and the extent to which the future growth rate could be altered by each of a list of alternate sources.

Among the output determinants that were examined were the characteristics of labour that affect its knowledge, skills and energy. This was criticised by Schultz 1961:3) who made the point that “treating a count of (employed persons) as a measure of the quantity of an economic factor is no more meaningful than it would be to count the number of all manner of machines to determine their economic importance either as a stock of capital or as a flow of productive services”.

Denison (1987:572) nevertheless found the following to be the most positive sources of growth:

- increased employment;
- improved education of the employed;
- more and better capital stock;

- growth in the size of markets;
- improved resource allocation;
- advances in the extent of knowledge relevant to production.

The study's most important lesson was that extensive and costly changes would be required if policies were to be adopted to raise the high-employment growth rate (by one per cent) above its normal level. This finding contrasted with the common view that it would be easy to add a whole percentage point to the growth rate.

Growth accounting starts by recognising that many different determinants govern the size of a country's output at any given time. It deals in the first instance with:

- different determinants of output such as the number, hours, demographic composition and education of employed persons;
- quantities of land and capital;
- the stock of knowledge;
- the size of market;
- the extent to which actual practice departs from lowest-cost practice;
- the extent to which resource allocation departs from the output-maximising allocation;
- the intensity with which factor inputs are used.

Changes in these determinants caused changes in output – or growth. Sources-of-growth tables are obtained by measuring changes in each determinant and the effect this change had on output.

Direct determinants of output are of course influenced by a host of indirect determinants such as tax structure, attitudes to work, inflation, deaths in war or birth control information. Growth accounting studies do not ignore such indirect determinants of output, but measure them indirectly by first judging the extent to which a change in any one (or a difference between two situations, e.g. two tax structures) alters all the direct determinants, and then calculating the effect of these changes on output.

Maddison (1982:22) states that Denison is the most ambitious and successful of the modern analysts and has used production functions to cast light on the relative importance of the factors that contribute to growth. Maddison (1982:23) points out that Denison uses land, labour and capital for his calculations and subdivides them where possible. He adjusts labour input in terms of differences in age, sex and education but does not adjust capital stock. He makes allowances for gains due to economies of scale, sectoral shifts in production, international specialisation and disembodied technical progress. All these factors aggregate into what he calls “total factor productivity” and an unexplained residual.

Maddison (1982:24) mentions major problems with Denison's method, which understates the weight of capital in the production process. Denison (1967:135-136) also gives zero weight to government capital because no return is attributed to such capital in the national accounts. This means that capital invested in roads, schools, railways and protection services is ignored because governments do not generally charge for the use of such facilities. Denison also excludes depreciation from his capital weights.

Maddison (1982:24) quantifies the understatement of capital by using Denison's (1967) basic data to compile results for the same period with Denison's methodology as well as his own. For the period 1950 to 1962, the average GDP growth rate in the nine countries (Italy, France, Germany, Denmark, Norway, the Netherlands, Belgium, the UK and the USA) was 4.29 per cent per year according to Denison. He explained 0.87 percentage points of this growth as originating from capital inputs, 0.76 from augmented labour input and 2.66 from total factor productivity.

Maddison used his own methodology and calculated the average GDP growth rate in the nine countries marginally higher at 4.39 per cent per year, with capital input explaining 2.14 percentage points, thus considerably higher than the 0.87 percentage points of Denison and the augmented labour input of 0.83 percentage points which is more or less in line with Denison’s 0.76 percentage points and 1.42 points for the rest which he deliberately did not ascribe to total factor productivity.

More recent growth accounting figures for the period 1960 to 1995 show that technological progress in the European countries contributed between 40 and 65 per cent to growth, whereas this source played a less significant role in the East Asian economies. In fact, in some of the latter countries, technological progress contributed negatively to growth.

Table 3.1: Sources of growth for nine newly industrialised Asian economies and non-Asian G-5 countries, 1960-95

Country	Capital	Labour	Technical progress
China	92.2	9.2	-1.4
Hong Kong	55.8	16.0	28.2
Indonesia	115.7	11.5	-27.2
Japan	62.9	4.7	32.4
Malaysia	70.9	18.7	10.4
Philippines	99.5	18.0	-17.5
Singapore	60.0	20.9	19.1
South Korea	86.3	12.7	1.0
Taiwan	88.9	8.6	2.5
Thailand	71.9	12.7	15.4
France	37.8	-1.3	63.5
West Germany	43.7	-6.3	62.6
UK	46.0	3.7	50.3
USA	32.9	26.2	40.9

Source: Lau (2000:5)

Lau (2000:20) attributes the negative contribution of technology to growth in some newly industrialised economies to the fact that the utilisation of intangible assets in countries other than those that invented it, is not costless, because technology and its development are fully priced for secondary users. In many instances this means monopolistic pricing of new capital equipment as well as critical components and license fees.

3.6.1 Growth accounting in South Africa

Du Plooy and Fourie (1992:83) performed a growth accounting exercise. It showed that output during the period 1960 to 1985 grew by 4.65 per cent on average, of which 1.76 percentage points (or 37.8 per cent) were contributed by additional input of labour and 2.46 percentage points (or 52.9 per cent) by additional capital input. The remaining 0.43 percentage points (or 9.3 per cent) was contributed by total factor productivity. The only other notable contributor was economies of scale, which contributed 0.58 percentage points (or 12.5 per cent) of total growth.

3.7 ENDOGENOUS GROWTH THEORY

According to Romer (1994:31) “Endogenous growth embraces a diverse body of theoretical and empirical work. The empirical work does not settle for measuring a growth accounting residual that grows at different rates in different countries. It tries instead to uncover the private and public sector choices that cause the rate of growth of the residual to vary across countries.”

The endogenous growth theory has sparked and retained the interest of social scientists since the publication of Romer’s article in 1986. This interest is witnessed by the spurt of research papers during the late 1980s and 1990s. Two mainstreams of endogenous growth theories have emerged, namely those focused on technological change and those mainly concerned with human capital.

3.7.1 Endogenous growth through technological innovation

According to Romer (1994:13), technological advances occur as a result of “things that people do”. He explained the endogeniety of technological progress by observing that no economist is willing to “make a serious defense of the proposition that technological change is literally a function of elapsed calendar time”. Even if discoveries are made only by chance, more discoveries will be made if more researchers work to produce them.

A factor that induces research in the private sector is the fact that discoveries are partially excludible and as such do not meet one of the criteria needed to be classified as a public good. Individuals or firms have some control over the information produced by most discoveries. This mere fact enables the individual or firm that makes a discovery to charge a price that is higher than zero and so earn monopoly profits because information has no opportunity cost.

While the traditional growth theory considered only two factors of production, namely capital and labour, this new growth theory adds a third, technology. Edogenous growth theory focuses on the wider concept of technology, which is expressed through ideas, instead of objects or products. It necessitates a different set of institutional arrangements, like pricing systems, taxation or incentives to ensure the efficient allocation of ideas. These types of models are sometimes called Schumpeterian models because Schumpeter emphasised the importance of temporary monopolistic power over discoveries, as a motivating force for continued innovative processes (see 2.8.1).

Large research and development and technology-intensive companies such as Microsoft and IBM, expressed interest in the new growth theory because of its view of monopolistic power and changes in institutional arrangements suggested by the theory. IBM (1999:3) highlights the importance of having some monopolistic power (as proposed by the new theory) by pointing out that no one would “spend their own resources to produce a new idea if they didn’t have any monopoly power over it. Allowing companies monopoly power over their new ideas, through patents, creates incentives for other firms to go out and make discoveries of their own”. Financial analysts have also taken note of this “ideas versus objects” point and are following through on it in their valuations of the companies listed on stock markets.

Romer (1998:116) makes a convincing argument for perpetual and even accelerating growth as he is of the opinion that: “We will never run out of things to discover, a reassuring fact since the process of discovery is the mainspring of economic growth.” He gives an idea of the scope for new ideas by pointing out that with 60 basic elements there are about 100 billion billion mixtures. If all laboratories around the world were each to evaluate a thousand of these

mixtures every day, they would only have evaluated about 330 billion in a million years (Romer 1998b:2).

Despite the purported tendencies to converge indicated by the Solow model, this seems unlikely between advanced industrial countries and most of the nations of Latin America, Africa and much of Asia – especially if such convergence is to come about merely as a result of the passage of time as the Solow model would have it. This realisation motivated Romer (1986) and Lucas (1988) to explore other possibilities. Their research gave rise to the endogenous growth theory or what is also referred to as the "new growth theories". Their point of departure was that if convergence did not occur, then the growth rate itself should be endogenous (implying that it could be determined by factors within countries, including different sets of policy alternatives – Solow (1991:398)).

King and Robson (1992:45) observe that exogenous growth models provide no analytical tools to determine the role government policy might play in influencing the growth rate. They contend that in the absence of economic growth models, which include a role for government, "many policies might be misguided at best and counterproductive at worst". Romer (1989:51) stated: "In models with exogenous technological change ... it never really mattered what the government did."

3.7.2 Endogenous growth with human capital

One way to explain differences in national economic growth rates is to introduce the stock of human capital or alternatively, technology improvement as a causal factor or producible input (see Young 1928:3-4; Arrow 1962:155-157; Uzawa 1965:26-28; Solow 1991:398; Conlisk 1967:349; and Choi 1983:99). Arrow's (1962:155) point of departure is the neoclassical theory and he does not contradict the "production function as an expression of technological knowledge". All that has to be added is that "knowledge is growing in time". He concludes that time as an explanatory variable is intellectually and empirically unsatisfactory and basically a confession of ignorance. Moreover, it contributes nothing in terms of policy variables. He wants to analyse the human knowledge, which underlies the production function, as it accumulates over time.

Arrow (1962:157) devised a model of learning-by-doing, which shows that experience in production, results in higher productivity and economic growth. The question then arises how "experience" should be measured for these purposes. The model Arrow chose, from various alternatives, assumed that learning-by-doing is embodied in the technology of capital equipment during a specific period. Arrow (1962:156,157) wrote: "Learning is a product of experience ... (However,) learning associated with repetition ... is subject to sharply diminishing returns ... To counteract this tendency so as to produce continuous improved performance implies that the stimulus situations must themselves be steadily evolving rather than merely repeating … I therefore take ... cumulative gross investment … as an index of experience. Each new machine produced and put into use, is capable of changing the environment in which production takes place, so that learning is taking place with continually new stimuli" (Arrow 1962:155-157).

The effect on productivity of learning-by-doing is external to the individual company. Arrow (1962:156,157) assumes that companies do not incorporate the effects of investment on learning possibilities, and thus reconciles increasing returns to scale at an aggregate level with perfect competition. Van der Ploeg and Tang (1992:18) observe that because learning-by-doing is subject to fast decreasing returns in the Arrow model, economic growth is still exogenous and determined by population growth.

King and Robson (1992:45) point out that "Arrow's model cannot generate endogenous growth". Fonseca (1998:18) argues that "Arrow's model can indeed provide endogenous growth if both capital and labour expand simultaneously". He adds that Arrow's original model "exhibits non-increasing returns to scale in aggregate if the rate of growth in an economy is steady". This might be one of the problems in the South African economy during recent years because investment as a percentage of GDP remains too low and too little learning-by-doing occurs to allow the economy to break out of the unemployment/poverty trap.

What might be needed are the new inventions described by Young (1928:534), or actions that involve "a fresh application of the fruits of scientific progress to industry, (which) alters the conditions of industrial activity and initiates

responses elsewhere in the industrial structure which in turn have a further unsettling effect. Thus change becomes progressive and propagates itself in a cumulative way".

Boltho and Holtham (1992:5) observe that what seems to be missing in Arrow's formulation is that optimal investment cannot be assumed to prevail in an uncertain world, as Arrow presupposes. In the current tepid investment climate and its attendant slump in employment opportunities, South Africans can testify to the validity of this argument. In practice, fixed investment is likely to be stimulated by growth. This reiterates the importance of the circular growth path described by Young (1928:542) and by Kaldor (1978:76). What remains to be "invented" is the initial spurt of growth that would bring poor or stagnating countries to above the take-off threshold and into the virtuous spiral of growth, investment, innovation and more growth.

The aggregate production function of Uzawa (1965:18) determines annual output by using the existing capital stock and the quantity of labour employed. All changes in technological knowledge are embodied in labour. The improved efficiency of labour is not dependent on the amount of capital employed, but on activities in the form of education, health, construction and maintenance of public goods. All these activities are aggregated in an education sector and the impact of this sector is diffused uniformly over the whole economy.

Uzawa's inclusion of human capital through the education sector breaks the constraint of diminishing returns to capital where capital is defined in the broader sense to include human capital. Long-term per capita growth can therefore be achieved in the absence of exogenous technological progress. The production of human capital is an alternative to improvements in technology as a mechanism to generate long-term endogenous growth (Barro and Sala-i-Martin 1995:172).

Human capital accumulation differs from the creation of knowledge in the form of technological progress. If human capital is defined as the skills embodied in a worker, then the use of these skills in one activity precludes their use in another, making human capital a rival good. Human capital is also an excludable good since people have property rights over their own skills and their raw

labour. People's ideas or knowledge may be non-rival as they can be spread freely over activities on an arbitrary scale and may in some circumstances be non-excludible (Barro and Sala-i-Martin 1995:172).

Conlisk (1967:349) modified the neoclassical model slightly to construct a growth model in which technological progress is affected by investment and in which the share of investment affects the long-term growth rate. His model contains both endogenous and exogenous capital to augment technological progress.

In the first instance, labour grows in proportion to the population. However, this growth is enhanced by a labour-augmenting technology multiplier measured in technology-augmented (or efficiency or productivity) units. The first labour growth component grows exogenously at a constant and non-negative rate, whereas the second growth component is the endogenous labour-augmenting technology multiplier. The endogenous component takes the form of labour-augmenting technical change. The productivity sector's outputs are new capital and technical change, and these are the mechanisms in the model by which output or productivity per worker may be increased. The mechanisms behind the productivity sector may be viewed as an aggregation of various interrelated activities such as research and development, education, capital construction, and so on.

Wading through the mathematics of the models of Arrow (1962), Uzawa (1965) and Conlisk (1969), the following observation by Choi (1983:33) becomes appropriate. He believes that the absorption with mathematical elegance diverted the attention, intellect and effort of subsequent generations of economists from important real issues. Economic growth theory has been shrouded by a spell of "technical" economic thinking, and empirical testing was neglected.

Analyses in terms of the neoclassical theory and its variants generally show a strong tendency to simplify the economic complexity, usually by assuming that institutional influence remains neutral. In addition, the practical value of the theories was reduced by inadequate practical incorporation of important economic phenomena encountered in the real world (Choi 1983:33).

Blaug (1992:238) is exasperated by the absence of practical application of intricate growth theories, and laments: “Consider, for example, the pre-occupation since 1945 of some of the best brains in modern economics with the esoterica of growth theory, when even practitioners of the art admit that modern growth theory is not as yet capable of casting any light on actual economies growing over time. The essence of modern growth theory is simply old-style stationary state analysis in which an element of compound growth is introduced by adding factor-augmenting technical change and exogenous increases in labour supply to an otherwise static, 1-period, general equilibrium model of the economy … To put it bluntly: no economy has ever been observed in a steady-state growth and, besides, there are deep, inherent reasons why actual growth is always unsteady and always unbalanced.”

Romer (1994:11) observes that “too many theories are consistent with the same small number of facts”. He takes it a step further to include subsequent empirical regression overload by saying that “many recent attempts at testing models of growth proceed without making any reference to evidence from economic history … they focus on questions about models instead of the questions about the world” (Romer 1996:202). Furthermore, “As is usually the case in macro economics, many different inferences are consistent with the same regression statistics” (Romer 1994:10).

He then redirects attention by employing Einstein, Podolsky and Rosen’s (1935) method of thought experiments and combining them with Kaldor’s (1961:178-179) stylised observations. He uses the observation by Lucas (1988:25) “that international patterns of migration and wage differentials are difficult to reconcile with the neoclassical model. If the same technology were available in all countries, human capital would not move from places where it is scarce to places where it is abundant and the same worker would not earn a higher wage after moving from the Philippines to the United States”.

He recommends that when models are evaluated, observations such as those of Lucas are “as powerful a piece of evidence as all the cross-country growth regressions combined. But this kind of fact, like the fact about intra-industry trade or the fact that people make discoveries, does not come with an attached

t-statistic ... (they) tend to be neglected in discussions that focus too narrowly on testing and rejecting models" (Romer 1994:19).

He uses the following observations to describe the growth process and its important determinants:

Fact 1: There are many businesses in a market economy.

Fact 2: Discoveries differ from other inputs in the sense that many people can use them at the same time. Ordinary goods are rival goods, but information is non-rival.

Fact 3: It is possible to replicate physical activities. However, there are no economies of scale from building a single plant that is twice as large as an existing one using the same technology.

Fact 4: Technological advance comes from things that people do. There is no serious defence of the proposition that technological change is literally a function of elapsed calendar time. Even if discoveries occur by chance, if more people set out to make discoveries, more would be made, so that the aggregate rate of discoveries would be endogenous.

Fact 5: Many individuals and businesses have market power and earn monopoly rents on discoveries. Information from discoveries is non-rival but partially excludable for at least some period of time. If a person or business can control access to a discovery, he/she or it can charge a price for it and even a very low price earns monopoly profits because information has no opportunity costs (Romer 1994:2-13).

Neoclassical theory incorporated facts 1 to 3, but did not take facts 4 and 5 into account. Romer's (1986:1005-1008) analysis resembles the work of Arrow (1962) on learning-by-doing. However, Romer enhances the concept of physical capital by adding investment in knowledge. Knowledge cannot be patented perfectly to obscure it from rivals in the industry or the economy. Investment in knowledge by one business would therefore spill over to its rivals and enhance their production possibilities. This could, for example, happen through reverse engineering or the movement of workers between rival businesses companies.

In the Romer model (1994:12-16), production of consumption and capital goods could yield constant or increasing returns on reproducible physical capital and knowledge at macro level, but decreasing returns at micro or business level. This goes beyond the rapidly decreasing returns at micro level in the Arrow (1962) model. Romer (1990:74) argues that as a result of an imperfect patent market, the stock of knowledge is virtually free (partially excludable and non-rival) like a public good.

The Arrow (1962) and Romer (1986) models incorporate human capital as consequences of investment rather than the intentional accumulation of knowledge. Subsequent models formulate the concept of human capital precisely and describe knowledge explicitly as a non-rival productive factor, almost a public good – like language or computer software, which is of use only with people who have similar or the same skills. (Van der Ploeg and Tang 1992:19).

Lucas (1988:19) constructs his model on the intentional accumulation of knowledge. Individuals can increase their human capital by devoting time to learning, which would reduce the time available for work or leisure. Human capital (training, education, etc.) is considered an asset, and financial return on this investment can be compared to the return on non-human financial assets. In line with Uzawa's (1965) pioneering approach, Lucas (1988:17-28) proposes that the accumulation of human capital is subject to constant (or increasing) returns to scale (Van der Ploeg and Tang 1992:19).

Research by Mankiw, Romer and Weil (1992:414-415) tested the Solow model by using international data. They conclude that capital's share of national income as estimated by the Solow model is too high and labour's share too low. They then included the ratio of working age population attending secondary school as a measure of investment in human capital and have found that this model, which assigns a more definite role to labour-related or human capital, offers a better explanation of the data (Romer 1994:7-10).

A common feature of all endogenous growth models with human capital is the concept that the individual yield on investment in human capital is higher when the aggregate stock of human capital in the economy is larger. These models

therefore explain why a South African medical doctor with a valuable and scarce skill in this country will earn more if he emigrates to the Canada or the USA where his skills are plentiful.

Romer (1986:1018-1020) assumes that human capital displays increasing marginal productivity (Solow 1991:399). This divergent process causes small shifts in initial conditions and small adaptations due to in-process corrections to magnify themselves into growing differences over time. This process provides scope for policy to have considerable and enduring effects of the sort that seem to be suggested by the observed data (Solow 1991:400). The increasing returns to scale make increasing returns to (human) capital easier to achieve.

This growth hypothesis makes a substantial difference because it theoretically allows the growth rate to increase indefinitely, despite reaching a ceiling during each successive phase. This is technically true, but not very important in the long term. An upper limit is the human capacity to work faster, harder or for longer hours. Eventually only new machinery or technology can further improve on human effort. The fastest walker cannot keep up with a man on horseback (who has better equipment and enhanced human skills, namely the ability to ride). This rider is in turn left behind by a man in a motorcar, who cannot overtake an air traveller, and so on. There is also an upper limit to the accumulation of human capital since it is not viable to keep on accumulating capital and postponing consumption forever (Solow 1991:401).

As in the basic neoclassical model, the possibility of a low-level equilibrium trap arises (Solow 1991:399). In view of South Africa's below par education system, low skills base, high unemployment rate, exacerbated by continued job losses, the country appears to be in the grip of just such a low-level equilibrium trap.

When human capital is defined as the phenomenon inherent in people, it is rival and mortal and can be lost. Human capital is therefore defined as the stock of knowledge of a business and refers to a body of endogenous technological progress. This definition of human capital obviates the human mortality and attrition problems (Lucas 1988:28; Solow 1991:401).

In the endogenous growth theories it is possible for growth rates to increase indefinitely over time and for larger economies to grow faster than small ones as has been illustrated by the strong and sustained growth of Japan for many decades and by the USA in the 1990s. Temporary reversals in trends, for example, due to inadequate public or private policies, are also possible. The effects of these policies could magnify themselves over time instead of subsiding (Solow 1991:402). Another feature of endogenous growth models is that the "state of knowledge" is invariably related to the physical or human capital stock. Both physical and human capital stock could therefore be expanded or contracted or sidelined through public policies or collective consensus – apartheid education and freedom before education are both local examples of this phenomenon (King and Robson 1992:45).

With constant returns to scale and exogenous technological progress, national boundaries have little effect on the growth. With increasing returns, on the other hand, international trade becomes an extremely important factor, because anything that enlarges the market can increase the level and rate of output growth (Solow 1991:407). The allocation of comparative advantage thus widens. The familiar concept of comparative advantage being dominated by the historical accident of who came first, or jointly either through pure scale effects, is now further enhanced through learning-by-doing.

Scott (1992:37) challenges the growth accounting approach as well as some of the new growth theories by contending that they underestimate the role of investment in growth. He says that the way to measure the contribution of investment to growth is in proportion to gross investment, and not the customary net addition - in other words, in proportion to the *change* in capital stock. Since the former may double or treble the latter, the difference is bigger and can easily explain the "unexplained residual" in conventional growth accounting.

Denison (1987:572) estimated, with conventional growth accounting techniques, that investment in the USA between 1948 and 1973 accounted for less than one-fifth of the growth in non-residential business, including an allowance for economies of scale, whereas the estimates by Scott (1992:37) put the share at over half. Scott contends that his estimates represented an

econometric test of his theory, which is superior to growth accounting, which provides no test of any theory. In his model, a constant that had been added to the question to allow for independent technical progress was negative and differed insignificantly from zero (Scott 1992:37).

Blaug (1980:244) remarked that "economics continually touches on questions that are subject to government policy, so that ... the attempt to separate positive from normative propositions in economics, and clearly to specify the conditions for submitting positive propositions to the text of experience, remains a task which is as important to the progress of economics today as it ever was".

Manuelli (1994:299) suggests that research in the growth area "should not try to find an endogenous factor (like capital) that accounts for other endogenous variables." Research should instead emphasise both careful modeling and measurement of a candidate exogenous factor. Manuelli believes that "the" candidate exogenous factor should be government policy. He suggests that it would be appropriate to look for a set of policies and institutions that affect all the endogenous variables and, through these effects, influence both the level and growth rate of income. However, as he remarks: "a reasonable objection that can be raised to this interpretation is that policies and institutions are not exogenous". The best candidates to account for cross-country differences in income levels and rates of growth are broadly understood to include taxation, spending and regulatory policies and institutions. He states that much more work is needed before these true measures of government policies would be available, but emphasises that "the payoff is likely to be very high".

3.8 CONCLUSIONS

The growth accounting approach to economic growth delivers rather limited insights about the process because it is rather static, and depending on the periods that it spans, could be influenced by business cycles and could therefore measure cyclical swings rather than growth trends. Furthermore, it assumes that capital and labour and the unexplained residual are rather parallel streams or separate pockets, while economists are acutely aware of the integrated nature of these factors. This is equally true of the exogenous growth models,

which are closely linked to growth accounting. These calculations nevertheless contributed by giving insight into the relative importance of the factors that are measured. The unexplained residual posed a challenge to researchers to explain the unexplained.

Endogenous growth theories widened the research ambit, by breaking the growth constraint of constant or even decreasing returns and expanding it to perpetual or even accelerating growth. It also renovated, widened and diversified the concepts of technology and of human capital, adding to the spectrum of prospective growth-enhancing variables.

Nevertheless growth theories, from growth accounting through exogenous growth and endogenous growth, remains fragmented with pockets of insight and rather nebulous and even speculative indications of how the theory could steer policy directions towards higher growth achievement. Currently there is little or no direct empirical evidence of how policy instruments such as higher or lower direct or indirect taxes used by ministers of finance or monetary policy instruments such as interest rates and exchange rates used by governors of reserve banks, impact on growth. Where such policy instruments exist, the question still remains whether the same policies are applicable to countries at the same level of development, but with different physical environments in the form of location and raw materials, let alone countries that are at different stages of growth or development. At this stage, growth theory may be likened to a horse and carriage in the age of space flight, despite its mathematical intricacies and elegance.

Chapter 4 investigates South Africa's growth performance in the light of some of the factors that have been identified in growth theory as being of importance in the growth process. Chapter 5 investigates and identifies statistically significant growth factors that have been empirically tested in cross-country studies as explaining economic growth internationally. In chapter 6, time series analysis is used to test the factors identified in chapter 5 to ascertain their contribution to South Africa's growth history.

CHAPTER 4

SOUTH AFRICA'S GROWTH PERFORMANCE 1960 TO 2001

World competitiveness nowadays depends as much on comparative advantage in the public policy arena as it relies on technology, human resources and physical capital.
GEAR *(1996:21).*

4.1 INTRODUCTION

In this chapter, South Africa's growth performance is assessed, firstly, in relation to the growth potential as set out by the best-known documents on this subject, namely the Economic Development Plan, which commenced in the mid-1960s and the more recent Growth, Employment and Redistribution: – a macroeconomic strategy (GEAR) of 1996. Secondly, performance in the light of the outward-orientation strategies of the newly industrialised East Asian economies is appraised.

Economic growth itself is the joint outcome of changes in aggregate demand and aggregate supply (Truu and Contogiannis 1987:269). Growth occurs through the extra inputs that enter the economy, but is empirically measured by the extra outputs that emerge from it. This implies that it is determined by both short-term and long-term forces. Thus, positive growth is caused partly by increases in aggregate demand (greater capacity utilisation) and partly by increases in aggregate supply (greater productive capacity), and *vice versa*.

The recent growth performance of the economy has proven that even though South Africa has achieved a period of political stability, it does not necessarily follow that the growth rate will rise in the long term to an average level that will permit a steady improvement in per capita welfare (University of Pretoria 1989:1). It is imperative that South Africa should raise its long-term growth rate. With 36.2 per cent of its economically active population unemployed (Stats

SA 2000:vii), the country certainly cannot afford to struggle through another decade with a stuttering economic performance or with experiments with unproven economic policies.

The potential real growth rate of the South African economy is quite rightly a matter of immense interest. The concept of the potential growth rate does not refer to what rate of real growth is likely to be achieved, but rather to the rate of real growth that could be achieved, given the right set of circumstances. It therefore refers to a ceiling that the economy will not be able to exceed. Determining this ceiling in quantitative terms is difficult, problematic and often controversial, if not impossible (University of Pretoria 1987:1).

The 1960s, in particular, represented a period of comparatively rapid economic growth, virtually on a worldwide scale, and growth came to be accepted as a policy objective practically everywhere. This trend was reflected in South Africa by the introduction of an official Economic Development Programme (EDP) in 1964, the first of nine such programmes. The key variable of those programmes has been the potential growth rate of the economy, estimated as the maximum average annual increase in the output of final goods and services that should be attainable, without placing undue strain on the balance of payments (Truu and Contogiannis 1987:269). In other words, a target growth rate was established for the economy, expressed in terms of the potential increase in real income.

Various more recent studies (GEAR 1996:7; NEM 1993:250; EDP 1981; University of Pretoria 1987:9; University of Pretoria 1992:6) have determined that the country's potential real growth rate varies widely (between 3.5 and 6 per cent per annum or even 7 per cent) largely because of differences in the underlying assumptions. These potential growth rates are much higher than the realised growth rates of about 2 per cent in recent years. Heilbroner (1970:231) is of the opinion that “we must think of growth not only as a means of remedying the under-use of resources, but as setting the trajectory that will define for us the scope of our realisable potential”.

According to Truu and Contogiannis (1987:271), the actual output of the South African economy exceeded its estimated potential level until 1969, after which the position was reversed. Moreover, the range between actual and potential

growth rates tended to increase over time, except for the brief period spanning 1993 to 1996 when it momentarily decreased. It subsequently took another turn for the worst.

This is clearly disappointing growth performance. It can be attributed to forces related to both aggregate demand and supply. As in other oil-importing countries, aggregate supply was adversely affected by the steep increases in the international oil price that occurred in 1973 and 1979. But a more fundamental factor inhibiting both potential and actual output has been a steady process of so-called “capital deepening” in the South African economy (Truu and Contogiannis 1987:271).

It appears that the level of potential output – in other words, productive capacity – still remained underutilised. On the surface, such a situation might suggest that the authorities should have acted more vigorously to stimulate aggregate demand by fiscal and/or monetary policy. The evident reluctance to do so in a consistent manner may also be related to the observed process of capital deepening, in conjunction with the “open” nature of the South African economy (Truu and Contogiannis 1987:272).

To raise the growth rate to the potential targets, a deliberate strategy must be devised and implemented. This strategy must be simple in order to have a reasonable chance of success in the long term. Such strategies exist and have been followed with great success, particularly in the newly industrialised countries of the Far East. The core of this strategy essentially requires that the private sector should serve as the engine of growth to produce higher material welfare on a continuous basis. The government in turn should pursue its policies and activities in a way that is fully supportive of, rather than competitive with, the private sector (University of Pretoria 1989:1).

The ANC government published the Growth Employment and Redistribution (GEAR) macroeconomic strategy in 1996, which in brief targeted a reduction in government consumption expenditure, a moderation of private and public sector wages increases, the acceleration of tariff reform and an improvement in domestic savings performance. The compilers envisaged that these measures would counteract the inflationary impact of exchange rate adjustment, permit

fiscal deficit targets to be reached, establish a climate for continued investor confidence and facilitate the financing of both private sector investment and accelerated development expenditure (South Africa GEAR 1996: 5). The compilers envisaged that the GDP growth would accelerate from 3.3 per cent in 1996 to 6.1 per cent by 2000 and that additional employment would be created in 1996 for 126 000 people, increasing to 409 000 new jobs by 2000.

The following section analyses and evaluates the efforts towards sustained growth and development since 1960 through the decades and ends with the new political dispensation that followed the general elections in 1994. The latter highpoint witnessed an upsurge in the expectations of the previously disadvantaged South Africans, and aided the process of transition towards a liberalised economic system (Truu 1998:23).

4.2 THE GROWTH CONCEPT, POPULATION GROWTH AND WELFARE

Living standards in South Africa have declined during the past three decades. Economic analysts often contend that the decline started in the early 1970s, but judging by the performance of the real per capita income, this process had already commenced during the second half of the 1960s (Truu 1998:23). The golden sixties aptly named after the gold-induced prosperity associated with that decade, was not really Nirvana. The newly industrialised countries of the Far East showed that well-managed outward-oriented economic strategies, the enhancement of human capital and higher productivity, are the true engines of growth.

Negative growth rates were an unusual occurrence until 1972. During the 1970s and thereafter, the growth performance changed drastically for the worse and deteriorated even further as negative growth rates became commonplace (University of Pretoria 1992:2).

Many international growth studies use GDP per capita as their measure of growth. It is of course necessary to take account of the rate of population growth especially in countries with a high population growth. If not, this may

result in an overestimation of the improvement in the standard of living. The per capita approach is of cardinal importance when growth rates decline to a level lower than the population growth rate, because declining living standards will result.

The relationship between economic growth and living standards may be further complicated by changes in the distribution of income. The famous economist AC Pigou (1912:34, 364)) assumed constant population numbers and showed that a gain in economic welfare (living standards) would result from the following combination of events:

- positive economic growth together with an unchanged distribution of income, or
- zero economic growth together with a more even distribution of income.

The process can therefore be accelerated if positive economic growth and a more even income distribution can be achieved at the same time. However, like most statements on the subject of income distribution, the above-mentioned propositions are, essentially, subjective value judgments rather than objective scientific conclusions.

4.3 INCOME DISTRIBUTION IN SOUTH AFRICA COMPARED WITH OTHER COUNTRIES

During the early stages of economic development, the distribution of income is usually unequal and the inequality could even increase because of the Kuznets (1973:252) effect. As the development process proceeds, income distribution should spread more equally. Income distribution in South Africa is rather skew since the largest part of the population has been deprived of quality education, training and equal opportunities.

Table 4.1: Human development index (HDI) and income shares (%) for selected groupings

HDI rank	Country (year)	Poorest 10%	Poorest 20%	Richest 20%	Richest 10%	Gini index
94	South Africa (1994)	1.1	2.9	64.9	45.9	59.3
69	Brazil (1997)	1.0	2.6	63.0	46.7	59.1
61	Venezuela (1997)	1.6	4.1	53.7	37.6	48.8
56	Malaysia (1997)	1.7	4.4	54.3	38.4	49.2
66	Thailand (1998)	2.8	6.4	48.4	32.4	41.4
27	Korea (1993)	2.9	7.5	39.3	24.3	31.6
70	Philippines (1997)	2.3	5.4	52.3	36.6	46.2
89	Tunisia (1995)	3.3	7.6	44.4	29.8	41.7

Note: A total of 162 countries are included in the ranking of which 48 were ranked in the high, 78 in the medium and 36 in the low human development ranges.

Source: United Nations, Human Development Report (2001:182-183)

Table 4.1 shows that the richest 20 per cent of the population in South Africa accumulates 64.9 per cent of the income, while the 10 per cent super rich enjoy 45.9 per cent. The table shows that South Africa's income distribution is much skewer than those of some of the newly industrialised countries of South East Asia. The South African distribution is more in line with that of Brazil.

The Gini index measures inequality of income over the entire distribution of income or consumption. A value of zero represents perfect equality and a value of 100 perfect inequality. Once more the Gini index for South Africa and Brazil at 59.3 and 59.1 are at the same level, and substantially higher than those of the other countries that range from the 49.2 of Malaysia to the 31.6 of Korea. Whiteford and McGrath (1994:50) calculated the Gini-coefficient for South Africa as 0.68 (1991). They compare South Africa's income distribution with those of Latin American countries (known for their skew income distributions) at the same level of development and show that these countries' coefficients are lower, ranging from 0.42 (1982) in Costa Rica to 0.61 (1972) in Brazil.

Pearce (1992:172) warns that the Gini coefficient is only a measure of *relative* size. He cautions that "one distribution might be more equal than another over one range, less equal over a succeeding range, and yet both might record the same coefficient".

The gulf between rich and poor in South Africa is therefore one of the widest in the world. This implies that the economy faces lower growth prospects, because countries with a more equitable distribution of assets grow faster than those with unequal distributions. Reducing wage differentials as well as unemployment would be an appropriate method of reducing income inequality in South Africa.

To return to the per capita concept, population growth figures prior to 1946 vary rather widely, casting doubt on the accuracy of these statistics. Table 4.2 bears testimony to that effect.

Table 4.2: Population census results and growth rates, 1904 to 1996

Census date	Population ('000)	Growth rate (% pa)
1904	5175	
1911	5973	2.1
1921	6927	1.5
1936	9588	2.2
1946	11416	1.8
1951	12672	2.1
1960	16002	2.6
1970	18299	1.4
1980	24264	2.9
1985	27704	2.7
1991[1]	30987	1.9
1991[2]	37944	-
1996	40584	1.4

[1] Figures for 1970 to 1991 exclude former TBVC states and include Walvis Bay.
[2] Figures include former TBVC states and exclude Walvis Bay.

Note: 1985 population figures are HSRC estimates

Sources:
South Africa Republic. Bureau of Statistics, Statistical Yearbook (1964:A-7)
South Africa Republic. South African Statistics (1995:1.4)
South Africa Republic. South African Statistics (2000:1.4)

The wide swings in the population growth rates contained in table 4.2 can in some measure be ascribed to nonrecurring random events or phenomena. For example, the decrease in the population growth rate from 2.1 per cent during the 1904 to 1911 period to 1.5 per cent during the 1911 to 1921 period, could have been the result of the flu epidemic which occurred during 1919. Similarly, the decline from 2.2 per cent during the 1921 to 1936 period to 1.8 per cent during the 1936 to 1946 period could have been the result of the intervening Second World War. The other wide swings cannot be explained by any particular phenomenon and must therefore be ascribed to deficiencies in enumeration or a lack of compatibility of data associated with a number of border changes. These wide swings in the population growth rates could divert the economic and policy focus and bring in demographic complications without necessarily adding value.

The problem of incompatible or suspect statistics is not limited to either the subject of economic growth or the field of economics in general. Professional statisticians would be the first to reject the claim that “figures cannot lie”, and seem fond of the old cliché, usually attributed to Benjamin Disraeli: “There are three sorts of lies: lies, damned lies and statistics.” The potential uses and abuses of statistics fall outside the ambit of this study, but it is obvious that statistics cannot always serve as the sole and final arbiter of economic disputes. The truth “behind” the statistics must always be tested by innate theory.

The smoothed population growth trend over the entire period 1910 to 1946 comes to 2 per cent per annum. It appears to be a satisfactory assumption to take a threshold growth rate of 2 per cent per annum for the growth in the economy over this period to have been sufficient to maintain living standards. A lower growth rate will have meant lower living standards, and one that exceeds 2 per cent, rising living standards.

A similar analysis for the 1946 to 1996 period (latest available census statistics) returns a smoothed growth trend of 2.6 per cent per annum, thus raising the threshold growth rate by 0.6 percentage points. The adjusted population figures for 1970 to 1991 using 1991 boundaries gives a population growth of 2.5 per cent per annum. The assumption of a population growth rate between 2 and 2.5 per cent therefore seems appropriate.

It is obvious that economic growth, by itself, does not signify an increase in economic welfare or the standard of living. For the purposes of this study, economic growth is not defined in such rigorous terms, but takes any measured increment in total output, over a period of time, to be acceptable evidence of economic growth. According to this viewpoint, economic growth is thus a necessary, but not a sufficient, condition for economic progress or betterment to take place.

4.4 SOUTH AFRICA'S GROWTH RECORD OVER THE DECADES

The following sections will follow the macro approach and the growth rates in GDP as the comparative measure. Where appropriate, reference will be made to the threshold population growth rate to draw attention to the danger of declining living standards.

Table 4.3: Growth rate in GDP per decade, using upper turning points in the business cycle closest to decade endings and beginnings

Upper turning point periods	Exponential trend growth percentage per annum
1946-51	4.2
1951-60	4.5
1960-70	5.7
1970-81	3.5
1981-89	1.3
1989-01	1.9

Source: South African Reserve Bank, Quarterly Bulletin, June 2001, September 2002

The economic growth rate increased steadily from the 4.2 per cent in the 1940s to 4.5 per cent in the 1950s and 5.7 per cent in the 1960s.

During the 1970s the growth rate decreased by 2.2 percentage points followed by a further and an equally dramatic drop of 2.2 percentage points during the 1980s, pushing the rate of growth down to 1.3 per cent, while the rate seemed

to have stabilised somewhat during the 1990s, rising marginally to 1.5 per cent. The last two decades of the 20th century therefore returned declining living standards for the average South African as the economic growth rate decreased below the 2.5 per cent per annum population growth rate.

The harmful effects of these declines went beyond the economic implications to the social sphere, leaving in their wake the deterioration in income distribution and even more pernicious, a sharp increase in the unemployment rate. According to the October Household Survey of 1999 (Statistics SA 2000:vii) the unemployment rate was 36.2 per cent in 1999 having declined slightly from the 37.5 per cent in 1998, but still much higher than the 29.3 per cent in 1995. The Labour Force Survey (Statistics SA 2002:11, 13) conducted in February 2002 estimates the unemployment rate at 29.4 per cent according to the official definition and at 40.9 per cent using the expanded definition.

Three of the most basic driving forces in the economy have been performing below par during the last three decades (University of Pretoria 1992:fig 2c) The first of these growth factors is a growing, but less efficient institutional environment; secondly, South Africa's declining share in world trade; and thirdly, reducing foreign direct investment. This resulted in a steady decline in welfare.

4.5 THE INSTITUTIONAL ENVIRONMENT

Experience gained from successful developing countries over the past 30 years shows that governments have a clear and well-defined role to play. Apart from their indisputable role as provider of social wants, and a conducive economic growth environment, governments could and should provide assistance in certain carefully selected areas of economic activity. They should encourage those who are already successful, to expand both domestically and internationally. This should be done within a strictly limited government budget to leave the bulk of the country's economic resources and economic initiatives in the private sector. This ensures that efficiency is a matter of survival in the largest share of the economy, making it possible to be successful like most

outward and private sector oriented countries (University of Pretoria 48 1992:1).

There has been a long-term increase in the size of the public relative to the private sector of the South African economy. The term “public sector” includes a great deal more than the central government itself, for example, government at lower levels of authority, public enterprises (Transnet, the Post Office and Telkom), public corporations (Eskom, Iscor, SAA), agricultural control boards (most of which closed in the 1990s), and various official funds (housing, road construction and strategic supplies). The full extent of the public sector in South Africa has not been measured, partly because of the accounting difficulties arising from interrelated budgets. However, by the mid-1980s, total public sector expenditure was evidently more than twice the amount of the central government's budgetary expenditure (Truu and Contogiannis 1987:279). The latter concept is generally accepted as the pivotal concept in fiscal policy, as illustrated in figure 4.1.

The two most important measures to assess a conducive institutional environment are the economic growth performance and the employment performance of the economy. Table 4.4 shows employment growth rates in the public and private sectors respectively.

Table 4.4: Employment growth percentages in the nonagriculture sectors for selected upper turning points: exponential growth trends

Periods	Private sector	Public sector	Total
	Percentage annual average change		
1967-70	4.2	2.3	3.7
1970-81	2.7	4.3	3.4
1981-89	0.5	2.0	0.9
1989-01	-2.1	-0.9	-1.7

Source: SARB, Quarterly Bulletin, various issues

The table highlights the fact that the growth in public sector employment has exceeded private sector employment growth rates for the three decades since 1970. Truu (1998:25) observed that this trend did not decline, even during recessions. The result was that the state's share in the economy increased continuously. This is directly contrary to the policy objective applied by the successful newly industrialised countries, of efficiency in production via market orientation.

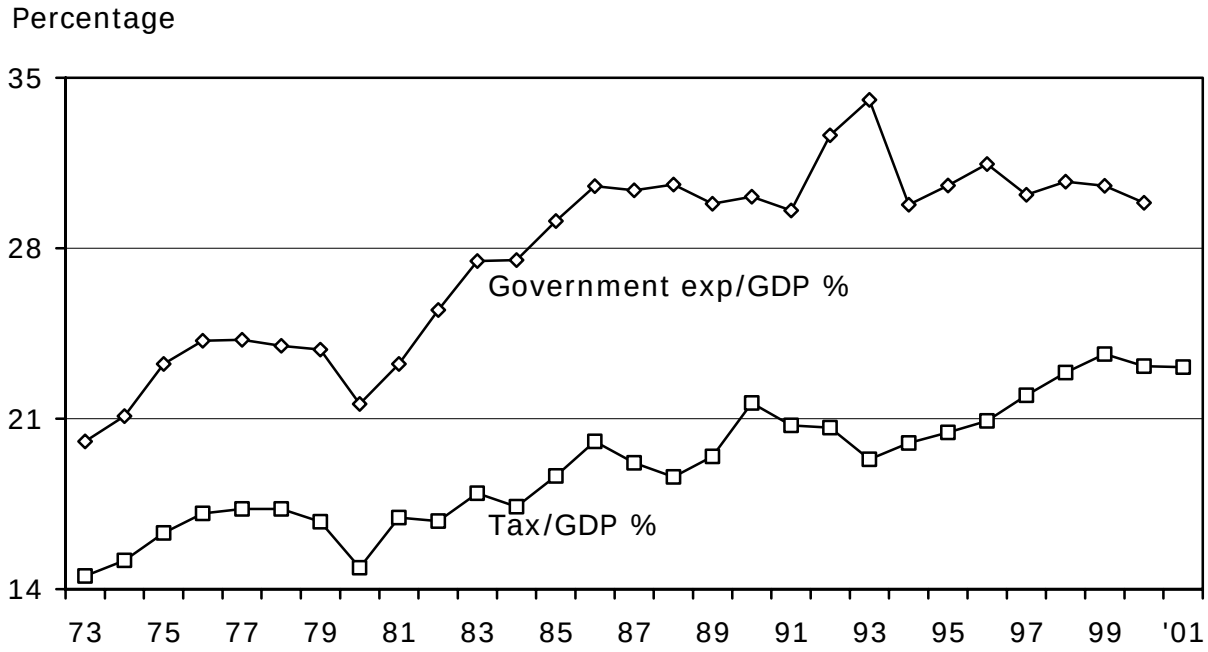
The growing public sector phenomenon also decreases the probability of achieving the objective of “limited but good governance” which is an essential requirement for sustained growth (Truu 1998:25). With such high growth in state employment the economy can be expected to become more lethargic and less competitive. To be able to finance this burgeoning giant, private sources are tapped in the form of increasing taxation in order to foot the government wage bill, which according to Truu (1998:25), is another form of nationalisation.

University of Pretoria’s Focus No. 48 (1992:5) used a sample of developed and developing countries, which includes South Africa, to show that there is an “inverse relationship between the rate of real economic growth and government revenue as a percentage of total output”. A rising trend in government expenditure to GDP is shown for South Africa in conjunction with a decline in economic growth as predicted by the model and it is concluded that “it must therefore be one of South Africa’s growth inhibitors”.

Barro and Lee (1993:21) states that economic growth is subject to aggregate consistency conditions, which requires that the total of goods sold by suppliers must equal the total bought by demanders. He maintains that the idea that markets clear is closely related to the notion that private markets function efficiently. With cleared markets, it is impossible (for the state) to improve on any outcomes by matching potential borrowers and lenders or by bringing together potential buyers and sellers of goods. “Clear markets already accomplished all these mutually advantageous trades.”

For this reason, public sector encroachment on the domain of the private sector undermines efficiency of markets and distorts and reduces growth. Figure 4.1 shows two growth-determining factors of the public sector involvement in the economy.

Figure 4.1: Government expenditure and tax income as a percentage of GDP (1973-2001)



Source: SARB, Quarterly Bulletin, various issues

The general trend of government expenditure to GDP has clearly been upwards, rising from approximately 20 per cent in 1973 to 34 per cent in 1993, after which it declined and stabilised at a still relatively high level of 30 per cent from 1994 onwards. This reflects the expansion of state-supplied goods and services across a wide front, which cannot be consistently attributed to any specific source of expenditure.

South Africa is still an economically developing society and the upward trend in government expenditure has been associated with expanding socio-economic infrastructure rather than the proliferation of social welfare services, as in several economically more advanced countries. This is partly so because the proportion of the working population liable to income tax, is comparatively low in South Africa (Truu and Contogiannis 1987:280).

Figure 4.1 also shows that taxation as a share of GDP has increased over the decades, from 16.4 per cent in the 1970s to 18.4 per cent in the 1980s and further to 21.5 in the 1990s. This tendency is the directly opposite of the goals of efficiency in production via market orientation.

According to Sachs (1996:24), “African nations need simple, low taxes, with modest revenue targets as a share of GDP. Easy taxes are most essential in international trade, since successful growth will depend, more than anything else, on economic integration with the rest of the world.” He states that Africa has to a large extent exiled itself from world markets and that it can end quickly by cutting import tariffs and removing export taxes on agricultural exports. He is also of the opinion that corporate tax rates should be cut from rates of 40 per cent and higher now prevalent in Africa, to rates between 20 and 30 per cent, as in the outward-oriented East Asian economies. He proposes a rule of thumb, that marginal tax rates of not higher than 20 per cent are realistic, as any higher rates will be evaded, and lead to corruption.

A positive development noticeable in figure 4.1 has been the narrowing gap between state incomes and expenditure since 1994. The new government achieved this by keeping expenditure from rising, but increasing tax incomes. This signifies the new government’s commitment to move closer to a balanced budget, thus requiring less government borrowing, debt and interest payments, but still showing little evidence of reducing the expenditure of the public sector. The lower tax growth requirement enunciated by Sachs (1996:24) is therefore only a remote possibility under current circumstances.

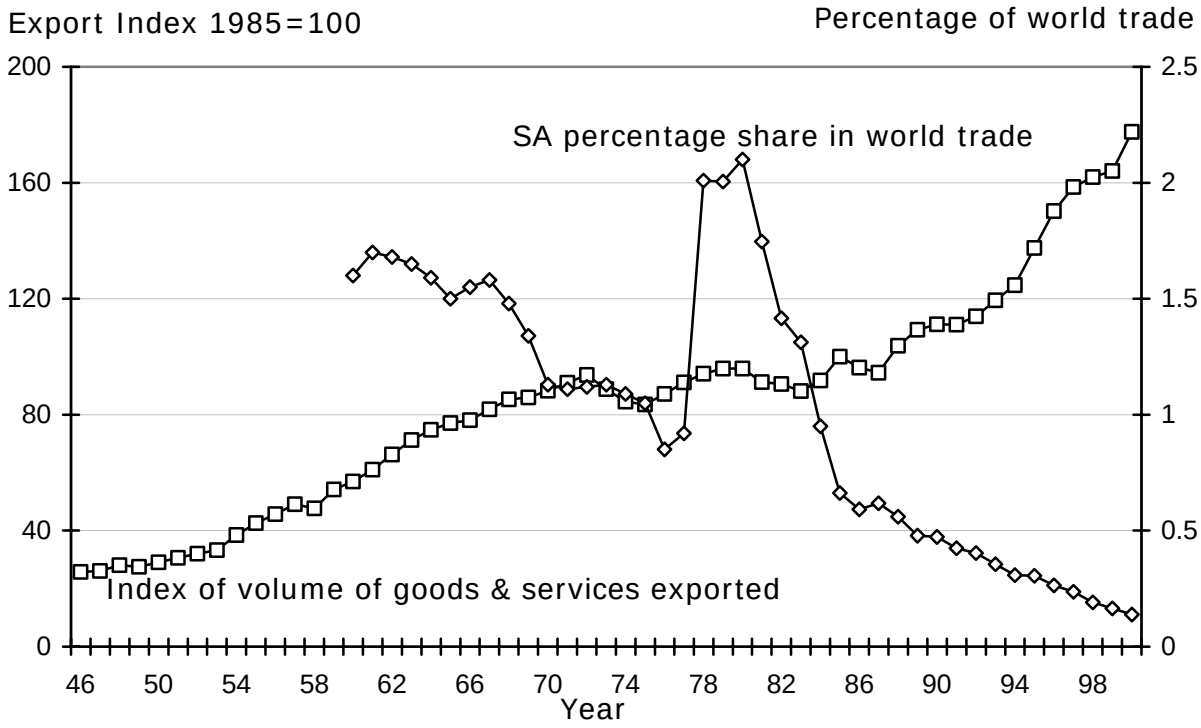
If government goes beyond its role of creating a conducive environment (by becoming increasingly involved in the provision of goods and services), it runs the risk of being a growth inhibitor. Apart from these structural constraints, other destabilising or growth inhibiting factors including various external shocks like declining commodity prices, a volatile gold price and economic sanctions, had a profound impact on economic stability in South Africa.

4.6 THE OUTWARD ORIENTATION OF THE SOUTH AFRICAN ECONOMY

This section examines the outward orientation of the South African economy and its effect on economic growth. University of Pretoria Focus No 48 (1992:6) suggests that a policy regime that is conducive to increasing South Africa’s

share in world trade could grow South Africa out of its inward-oriented poverty trap.

Figure 4.2: South Africa's volume of exports and share in world trade (1946 – 2001)



Source: SARB, Quarterly Bulletin, various issues

Figure 4.2 shows that the export growth volume has increased continuously, but the country's share in world trade has declined steadily, from 1.6 per cent in the 1960s to 1.2 per cent in the 1970s, 1 per cent in the 1980s and further to 0.3 per cent in the 1990s. One may therefore conclude that over the decades South Africa's export growth was lower than the average growth in world trade, causing a loss in world market share. A more equitable outcome would have been the maintenance of its share, and with increased economic growth as the target, a steadily increasing share.

Since exports constitute about one-third of total output, one would indeed expect South Africans' material welfare to fall behind in world terms over the long term.

Simulations with the econometric model of the University of Pretoria (1992:6) showed that the average annual real growth rate of South Africa could be

increased to more than 7 per cent if South Africa could succeed in raising its share in world trade from the present level of 0.7 to 1.1 per cent over a period of seven years. While South Africa's share in world trade has been decreasing and direct foreign capital has become even scarcer, the situation has been aggravated by both the previous and the current governments through their redirecting an increasing share of scarce resources from the more productive private sector to the less productive public sector.

Holden (1993:225) points out that the new growth theories emphasise the importance of maintaining an outward-oriented trade policy to facilitate the introduction of new ideas and technology into an economy. South Africa traditionally followed an inward-looking policy, necessitated by economic sanctions. She also maintains that when exports were given more attention by policy makers in South Africa, it was found that growth in manufacturing exports had been closely tied to the growth of the economy. This growth is, however, only suggestive of the experience of other countries because the domestic R&D expenditures reveal that industries with a high propensity to export have not been R&D intensive.

Holden (1993:225) finds that although in terms of the new trade theory (with its emphasis on economies of scale, product differentiation and R&D expenditures) and despite the existence of intra-industry trade in South Africa, it was not possible to establish any relationship between economies of scale, R&D expenditures and the extent of intra-industry trade. Trading patterns in South Africa appear to be primarily driven by factor endowments, including the availability of natural sources.

However, theories of dynamic comparative advantage indicate that in the face of rising unit labour costs in the late 1980s and the 1990s, labour should have reallocated from low value-added activities towards high value-added activities in order to preserve export performance. Holden, however, found that export performance had been maintained and developed in those industries where the increases in unit labour costs had been less pronounced. In addition, the more successful exporters had not experienced greater increases in total factor productivity; nor had they located in higher value-added industries. Faced with ongoing domestic low-growth conditions, manufacturers who served the

domestic market turned to the export market and failed to develop new or higher value-added export industries based on comparative advantage.

Holden (1993:226) recommends that an increase in productivity and competitiveness can be achieved through better technology and the introduction of new ideas as well as through better education. Holden advises that the state could play a role in this process by the subsidisation of the R&D expenditure of private firms for the purposes of exports.

Lewis (2001:13) is of the opinion that "there may be some benefit from promotion of non-minerals exports through export processing zones or duty drawback schemes, especially if these efforts concentrate on employment creation". Lewis (2001:v) compared the current tariff regime with the one prior to reforms, and found that the recent tariff reforms have lowered average protection and removed most nontariff barriers, but that the spread of effective protection remains high, and that the structure of protection remains complex because it comprises 45 different rates.

In addition, the WTO agreement required the elimination of export incentives, which resulted in a higher anti-export bias for many exports. This was exacerbated by South Africa's failure to create a functioning duty drawback or tariff rebate system that would allow exporting firms to obtain inputs at world prices. Although negotiations have taken place to establish preferential trade agreements with the EU, SADC and possibly Brazil and India, which will bring some benefits, this may have shifted the focus from the pressing necessity to improve incentives and create a more solid foundation for long-term trade (Lewis 2001:v).

4.7 INVESTMENT AND ECONOMIC GROWTH

Easterly and Levine (2000:36) reviewed the role of investment and physical capital accumulation in economic growth and development. They concluded that the modern version of capital fundamentalism, which describes capital and investment as the primary determinants of economic development and long-run growth, should be revised. They propose that the relationship should be viewed as a part of the process of economic development and growth and not as the

primary connecting source. The new view should be the guide to research and policy advice.

Truu and Contogiannis (1987:271) regard capital and labour as both complements and substitutes in the process of production. Thus, while additional investment creates new jobs in the short term, it also establishes the scope for replacing labour with capital in the long-term. The authors are of the opinion that many of the large investment projects undertaken by the public sector in South Africa, especially during the 1970s, were for infrastructural and strategic purposes – that is, largely motivated by broad social and political rather than just economic considerations. Examples are irrigation schemes, the Sishen-Saldanha and Richards Bay railway lines, harbours, power stations, Sasol synthetic fuel plants, arms production and strategic stockpiles.

It is well known that these developments have been more conducive to capital-intensive production methods than a rapid increase in the output of the economy's combined stock of labour and capital. Capital deepening also occurred in the economy as a whole. This is evidenced by the growth in capital per worker as indicated in table 4.5.

Table 4.5: Growth rate in the average capital labour ratio, using upper turning points in the business cycle closest to decade endings and beginnings

Upper turning point periods	Private economy[1]	Private economy, excluding agriculture	Services[2]	Public sector including public corporations
1970-81	4.3	4.0	3.3	2.9
1981-89	2.1	3.9	3.1	2.8
1989-00	2.6[3]	3.3	1.9	0.9

Source: National Productivity Institute, Productivity Statistics (2001:9-10, 13)

Notes:

1. Private economy includes agriculture, mining, manufacturing, electricity, construction, commerce, transport, communications and finance. Community services and the government sector are excluded.

2. The service sector includes finance, commerce, transport and communications. Since real estate is included in finance, the data should be interpreted with the limitations of the real estate component in mind. Real estate represents around 20 per cent of the service sector total.
3. For 1989-96, because of unavailability of agriculture employment.

The growth rate in the capital labour ratio during 1970-81 was the highest in the private economy, with an average annual rate of 4.3 per cent. It is interesting to note that the growth in capital intensity was even higher in the agriculture sector between 1970 and 1981 because growth in the private sector excluding agriculture was lower. The situation reversed in the subsequent two periods. The services and the public sector generally had lower rates of growth in capital intensity.

More capital-intensive production techniques displaced labour and as such contributed to (structural) unemployment, but did not necessarily have a reducing effect on economic growth. The fact remains that it did occur, and even the private sector of the South African economy tended to become "overcapitalised" after 1970. This is not tantamount to saying that there has been overinvestment in South Africa; on the contrary, from time to time declining investment growth has been one of the primary contributors to differences between potential and actual growth. Capital deepening is a relative concept, and the problem with the increasing capital-labour ratio was that it did not always happen for purely economic reasons, but for institutional reasons, which included restricted mobility of labour, a chronic shortage of skilled workers, wage increases unrelated to productivity, as well as strikes and work stoppages organised by trade unions. The disturbing outcome was that the change in the relative composition of South Africa's stock of production factors, in favour of capital, had reduced the rate of economic growth and increased the rate of unemployment (Truu and Contogiannis 1987:271).

Increasing capital intensity also frequently caused a rise in the ratio of investment to saving. In turn, the domestic savings needed to finance desired investment were frequently insufficient and caused a deficit on the current account of the balance of payments. This "overinvestment" savings gap had to be neutralised by an adequate net inflow of foreign capital to avoid depletion of

the foreign reserves. One of the more acceptable options to alleviate the problem was a flexible exchange rate and the “correction” was ultimately made in this way because the international value of the rand depreciated from 1971 onwards when the Bretton Woods system of fixed exchange rates was abandoned. This, however, did not balance the current account, and for quite a while before the debt “standstill” of 1985, South Africa was unable to attract sufficient foreign capital, on a regular basis, to compensate for a frequent shortfall of domestic saving to finance the domestic investment. The balance of payments deficit frequently aborted an economic upswing even before the economy needed slower expansion as a result of impending inflationary pressures.

In the domestic economy, a government can finance the deficit on its budget through money creation, although it might not be the most prudent policy alternative, but a country cannot create foreign exchange. It must be earned through exports (preferred option) or negotiated through borrowing (costly route) or come about through a spontaneous inflow of foreign financial capital – the latter being the best short-term alternative.

As mentioned above, the other growth-limiting factor was the fading interest of foreign investors to choose South Africa as a prospect for their investments. Their interest had already started to decline gradually in real terms during the early 1970s and almost disappeared in the mid-1980s. Towards the end of the s 1970s, foreign loans (indirect investment) overtook direct investment in real terms as the preferred mode for provision of foreign capital. This change has two important disadvantages for South Africa. Firstly, loans carry an interest burden, and secondly, they must ultimately be repaid (University of Pretoria 1992:2).

Foreign direct investment is regarded as one of the best choices for South Africa to improve its growth performance over the long term because the most ominous growth-defeating factor in the growth history of the South African economy was the recurring deficit on the current account of the balance of payments. When this had occurred in the past, the authorities were obliged to implement deflationary domestic demand management to curb the rising imports associated with economic growth. The level of reserves and the

extremely sparse inflow of foreign capital were not sufficient to finance the current account deficits.

Furthermore, South Africa (after the 1985 debt-standstill agreement) had to service and repay its foreign debt according to a debt-standstill schedule. A threshold surplus had to be maintained on the current account to finance these repayments. This mandatory surplus imposed a growth ceiling on the economy, which meant that the economy could not exceed a growth rate of 2 to 3 per cent in real terms. South Africa was thus under an “iron law of the current account” (De Wet 1990:47). What is more, South Africa was compelled to be a net exporter of financial capital (as a result of the disinvestment campaign) and had to maintain a surplus rather than merely avoiding a deficit on the current account. This placed a functional ceiling on the average real economic growth rate lower than three per cent per annum in real terms (De Wet 1995:474).

After the democratic elections in April 1994, sanctions were abolished and the disinvestment campaigns against South Africa withdrawn. These processes, served to reopen foreign markets, and during 1997 alone, in excess of R17.5 billion of foreign direct investment capital flowed into the economy although R10.8 billion was disinvested, leaving a net inflow of R6.8 billion as well as a net inflow of R30.6 billion portfolio investment (SARB, December 2001:S-90).

The structural constraints imposed by the balance of payments appeared to have vanished. The relatively peaceful first democratic election, the initial political stability and ameliorating economic climate such as the declining rate of inflation, the record agricultural crops, higher real interest rates and a stable exchange rate, attracted foreign capital. The real economic growth responded favourably and swiftly increased, from 1.2 per cent in 1993 to 3.2 per cent in 1994 and peaking at 4.3 per cent in 1996 (SARB, December 2001:S-148).

Renewed political uncertainty, especially in Kwazulu-Natal, and the apparent uncontrollable high levels of crime and unrest, as from the latter half of the 1990s onwards, led to a swift repatriation of foreign capital. This resulted in a precipitous depreciation of the rand (-3 per cent in the first quarter of 1996 - 12.6 per cent in the second quarter and -3.6 in both the third and fourth quarters – in total -22.8 per cent compared with -3.2 per cent for 1995),

followed by uncertainty and volatility on the capital and share markets. The growth ceiling imposed by the balance of payments appeared to be back in force. This tendency continued through the 1990s with more precipitous falls in the value of the rand in 2000, and again in 2001, in the aftermath of the New York terror incidents and the war in Afghanistan.

An even greater blow for South Africa (in terms of economic growth as a result of reduced foreign direct investment) is the loss of new technological know-how usually embodied in these investments. It breaks the cycle of technology diffusion, brought about by the movement of employees, and reverse engineering. Another lost advantage is that these investments come with no strings attached and they are unlikely to contribute to capital flight and downward pressure on the local currency.

The new government introduced a comprehensive macroeconomic strategy (GEAR) by the middle of 1996 in an attempt to revitalise local investor confidence, attract foreign capital, reduce the external pressures and instability of the rand, and reverse concerns over the commitment to sound macro policies. With this in mind, GEAR built upon the strategic vision set out in the RDP rather than replacing it. In GEAR, the government committed itself to specific macro targets, including a programmed fiscal deficit reduction plan that provided for more stringent reduction phases than the existing ones.

GEAR also provided for better policy coordination and development, with planned involvement of selected government departments and the Reserve Bank. It was sanctioned by Cabinet and laid before Parliament by the (then) Deputy President Mbeki as the “central compass” giving direction to all other government programmes.

During the latter half of the 1990s South Africa improved its public financial management to the extent that in 2002, three USA investment grading agencies namely Standard & Poor, Moody’s Investor Service and Duff & Phelps awarded South Africa “investment grade” ratings, which indicate that South Africa has the future ability, legal obligation and willingness to make full and timely payments due to investors.

Turning to investment, and specifically the area of investment incentives, the World Bank (Lewis 2001:13) advises that: “Targeted investment incentive schemes should be approached with caution”. In South Africa, the Spatial Development Initiatives (SDIs) have concentrated on huge capital-intensive projects oriented towards exploitation and “beneficiation” of mineral resources with the result that the incentives for ordinary manufacturing enterprises have been limited, and the employment creation minimal. Lewis (2001:13) points out “international evidence suggests that schemes such as this frequently fail to attract the expected new investment, and are often costly and result in resource misallocation”.

Lewis (2001:13) is of the opinion that labour market flexibility is an area of critical concern in South Africa, a viewpoint supported in surveys of South African managers and international investors. The evidence on unemployment by skill class and remuneration trends also confirms that job creation among the unskilled and semiskilled labour force has been constrained by rising real wages. Recent efforts to introduce modest changes in labour legislation to offset “unintended” employment consequences have proven contentious, and illustrate the difficulties in reforming labour market institutions and practices. But initiatives to enhance flexibility and market efficiency must be continued if the steady growth in unemployment is to be reversed. The focus should perhaps be on introducing greater wage flexibility for special groups (e.g. youth, high-unemployment areas, successfully applied in Australia) and reconsidering minimum wage levels for agricultural and domestic workers.

This leads to the conclusion that the macroeconomic growth performance of the South African economy remains disappointing in terms of domestic and foreign investment and its associated employment effects, despite a positive macroeconomic policy environment. The institutional environment appears to require attention.

During the first half of 2002 foreign investor sentiment towards emerging market started to improve. In the case of South Africa the low prices of domestic financial assets stemming from the sharp depreciation in the external value of the rand in the latter half of 2001, contributed to renewed foreign investor interest in South Africa. This was witnessed by an inflow of R1.6 billion

during the first quarter of 2002, which almost recovered the outflow of R1.9 billion lost during the fourth quarter of 2001 (SARB Quarterly Bulletin, June 2002:32).

The World Competitiveness Yearbook (WCY) (International Institute for Management Development 2000) investigated the macroeconomic and microeconomic environments of 49 countries by sending questionnaires to a representative sample of business executives operating in a wide spectrum of activities in the economies of these countries. The executives were requested to rank their country on a scale of 1 to 6 on a number of microeconomic and macroeconomic factors that contribute to or impinge on their activities. The results of these questionnaires are aggregated and the business environments of the respective countries are scored so that the best-scoring country is ranked as number one and the worst as 49. The areas of the microenvironment in South Africa found to be lacking in terms of competitiveness according to the World Competitiveness Yearbook (2002) are listed in table 4.6.

Table 4.6: Growth limiting factors in South Africa highlighted by the World Competitiveness Yearbook (2002)

Factor	Ranking out of 49 countries
Equal opportunity: race, gender, family background	49
Murders, violent crime and armed robberies impair business	49
Labour regulations are flexible/not flexible in terms of hiring and firing, minimum wages	47
Immigration laws hinder/do not hinder the use of foreign labour	47
Investment incentives are attractive/not attractive to foreign investors	45
Education system meets/does not meet the needs of a competitive economy	48
Economic literacy is generally low/high among the population	49
Education in finance is sufficient/not sufficient in your country	48
Labour relations are generally hostile/productive	48
Skilled labour is available/not available	49
Customer satisfaction is emphasised/not emphasised in your country	46
Image of your country abroad hinders/supports business development	46
Science is/is not adequately taught in compulsory schools	49

Source: International Institute for Management Development (2002)

Since the scores of the factors in table 4.6 are close to or equal to 49, this means that South Africa scored low or last (49^{th}) in the array of the alternative foreign investment destinations. Alternatively, all countries that scored closer to the best (which is number one) have a better chance than South Africa of attracting foreign investment.

Some of these areas have also been researched by Lewis (2001:vi), for example *indirect* measures aimed at making the economy more competitive and attractive to investors (through improvements in labour markets, enhanced trade competitiveness, promotion of SMMEs, etc.), but also *direct* measures (such as efforts to improve the quality and quantity of physical investment, or enhance opportunities for skill accumulation for the poor).

4.8 PROGNOSIS

From the above analysis it can be deduced that the economic adjustment process of the 1980s and 1990s fell short of sound economic growth fundamentals and growth and development were therefore seriously impaired. These growth-limiting factors had the effect that the country was unable to grow at a rate that would enable the employment of an expanding labour force. It is obvious that an ever-smaller portion of the labour force is absorbed in the formal sector, notwithstanding or even because of the endeavours of the public sector to reduce unemployment by raising its own employment number.

Given the fact that the largest share of South Africa's imports are intermediate and capital goods, which are relatively price inelastic, the declining exchange rate or any form of import restrictions will not enhance growth, but are more likely to further reduce growth through escalating cost structures for intermediary and capital goods, lack of cutting edge technology, and even worse in the case of import restrictions, more bureaucracy.

A higher real growth rate cannot be sustained because the higher growth would require more imports, and because of the fixed import content of the increased output, it would be impossible to pay for the increased imports. The import-reduction option therefore places the economy in a catch 22 situation. The balance of payments restriction on growth can thus best be solved or alleviated through sustained export growth and supplemented by FDI flows. Lewis (2001:13) is of the opinion that instead of targeted investment incentive schemes, the focus should rather be on efforts to improve the overall business climate.

The government has committed itself to a revised strategy to privatise the four largest state-owned enterprises (Transnet, Telkom, Eskom, and Armscor) by 2004. The broader investor community's reaction was subdued and even reserved, with concerns expressed over the slow pace and relatively limited scope of actual privatisation. Delays with privatisation also seem to have the effect that the perceived market value of the candidate privatisation corporations appears to deteriorate as investors become choosy and prefer to invest in countries with decisive privatisation track records.

4.9 POLICY OPTIONS FOR SUSTAINED HIGH ECONOMIC GROWTH

To break the privatisation and FDI *hiatus,* the World Bank advises more decisive action and faster progress with privatisation, which would bring immediate benefits. According to Lewis (2001:13), accelerating privatisation, together with market liberalisation can provide an important initial stimulus to FDI because it draws in foreign firms directly (through the purchase of assets) and indirectly (by sending a strong signal of the government's continuing commitment). Since FDI projects often have a strong export orientation, the trade balance will improve, increasing the economy's import capacity and providing an important stimulus for job creation Lewis (2001:24).

South Africa is currently in the back row as far as the promotion of non-mineral exports through export-processing zones or duty drawback schemes are concerned. There is no reason why these schemes and zones cannot be adapted to suit South Africa's circumstances as long as the conditions and institutional environment remain transparent, free of bureaucratic red tape, and these schemes concentrate on employment creation. There are encouraging indications that South Africa is moving in that direction with the Couga Harbour project.

It is also clear that South Africa should improve the institutional environment in other areas such as crime, more flexible labour regulations, human capital to enhance the availability of skilled labour, economic literacy, better education in areas such as finance and science and a business climate conducive to customer satisfaction.

According to De Long (1997:3), in sub-Saharan Africa, only Botswana, Lesotho and the Cameroon, have managed to reduce the relative income gap vis-à-vis the industrial west. In Africa as a whole, Kenya, Mali, Malawi, Zimbabwe, Guinea, the Côte d'Ivoire, Nigeria and South Africa, among others, have seen improved living standards, but an increasing relative income gap regarding the industrial core. In these countries the cup is still only half full – increasing relative income gaps regarding the industrial core have nevertheless been accompanied by improved living standards and productivity levels.

4.10 CONCLUSION

The growth performance of the South African economy remains lethargic, despite political liberalisation, the lifting of sanctions and prudent fiscal and monetary policies. In a seemingly positive environment, the growth performance remains below expectations and its estimated potential. Its lack of labour absorption capacity is its main shortcoming.

International investors remain aloof although some interest is noticeable with inflows of foreign direct investment recorded during the first quarter of 2002. Prospective investor surveys and international financial institutions indicate microeconomic rigidities as a deterrent to foreign direct investment. The international and local financial press points to slow or minimal progress with privatisation. Rather thin foreign exchange reserves and emerging market contagion keep the rand vulnerable and foreign direct investment at a trickle. Zimbabwe is not helping either.

The low value of the rand makes local manufactured exports profitable, especially in the motor-vehicle manufacturing industry and its upstream supply chain. With greater pressure on industrialised countries to dismantle trade barriers against products from emerging markets, exports could become an engine for accelerated growth.

CHAPTER 5

FACTORS INFLUENCING GROWTH: AN INTERNATIONAL PERSPECTIVE

While economists may not trust politicians, it would seem that politicians have not trusted economists either – and perhaps with at least as good a reason.
Boltho and Holtham (1992:12)

5.1 INTRODUCTION

The last two decades have seen increasing research on the reasons why some countries are more successful than others in raising the living standards of their citizens. Old growth theories based on infant industry and tariff protection have been replaced by new growth theories, which favour open economies and export-led growth. The research, which was responsible for these changes, was facilitated by the increasing availability of country data on income levels at constant prices, particularly the data sets compiled by Summers and Heston (1988). The data enabled the empirical analyses to indicate the factors that seem to favour rapid and sustained economic growth.

Growth literature (Barro and Lee 1994:18; Maddison 1982:97-125; Kuznets 1973:247) indicates that certain factors may be more important to growth at different stages of the growth process than others. To capture this effect researchers analyse a cross-section of data over a time span or successive time spans (ie panel data analysis) to see how the growth process develops over time. To establish which approach could be used for a single country, Truu (1999:1) consulted with Barro as follows:

> I hope that you don't mind being approached by a complete stranger. To save time, I will come straight to the point.

> … I am … presently supervising a student who's writing a PhD dissertation on the nature and causes of economic growth in South Africa, over the approximate period 1960 to the present …
>
> Now, the question I'd like to ask you is this: Is it feasible and meaningful to test endogenous growth theory by a time-series analysis of only one country? Alternatively put, do the sources of economic growth in your above-mentioned publications (which are cross-country studies) also lend themselves to a one-country time-series study? (Such a one-country study would naturally be analysed against the background of available cross-country studies.) I'm confident that the necessary data for such a test exist (or can be proxied) in South Africa, and that we have the necessary econometric know-how for it.

Professor Barro (1999:1) replied:

> There is nothing wrong in principle with estimating growth equations for a single country. The problem in practice is that one tends to rapidly run out of degrees of freedom. The kind of medium- to long-term growth that I analyse does not pertain much to business fluctuation but rather to periods of, say, 5 to 10 years or more. So, if one used 5-year observations over 35 years one would have 7 observations on growth. This means that one could not possibly estimate the effects of more than 6 policy/institutional variables with the one-country data. More realistically, the number of independent effects that could be isolated would be much less than six. This is why my own emphasis has been on large samples of countries, supplemented as far as possible by long time series for the countries.

It would therefore seem that replicating the Barro-type analysis for a single country would be too restrictive to be useful, and in this study, time-series econometric techniques are used.

What complicates growth analysis is that characteristics not included in the information set, say, oil reserves, gold reserves, navigable rivers or trade routes, and most importantly government policies, could also have influenced growth.

King and Levine (1994:286) express the hope that "research into economic, institutional, and legal determinants underlying innovation, human capital accumulation, and physical capital investment will improve our ability to design policies that promote sustained economic growth".

Manuelli (1994:299) addresses the core issue by inferring that "the best candidates for variables that can account for cross-country differences in income levels and the rate of growth are government policies (broadly understood to include taxation, spending and *regulatory policies*) as well as institutions". He is of the opinion that the data on government policies are as yet not enough or suitable to conduct proper analyses on their effect on growth. Manuelli (1994:299) concludes: "…much more work is needed before we can have available true measures of government policies. The payoff is likely to be very high".

The purpose of this chapter is to identify growth-inducing or growth-detracting factors tested in international cross-sectional studies in order to use them in a time-series context in the next chapter to determine whether these factors have had a meaningful causal link to growth in South Africa in the past four decades or more. Of importance here is whether this could indicate the causes of the poor growth performance in the last decade and provide alternatives to revitalise the growth process – that is, to suggest a set of policy measures to put South Africa in a position to achieve higher growth rates in the future.

5.2 LITERATURE REVIEW

Robert Solow (1991:393) refers to what he wrote in 1982 namely that "anyone working inside economic theory these days knows in his or her bones that growth theory is now an unpromising pond for enterprising theorists to fish in". Fortunately, in the same article he added: "I do not mean to say confidently that this state of affairs will last … as a good idea can transform any subject". This did in fact happen when Romer published his now famous paper in 1986. This endogenous growth theory revived interest in economic growth and a large number of research reports in the last two decades have focused on some or several of the research fields identified above.

This revival came about largely through research done by Lucas (1988:33) and Romer (1994:16) who showed that there are good theoretical reasons for believing that countries can maintain different rates of economic growth. This is contrary to the convergence theory propounded by Tinbergen (1961:333, 338). The long-term consequences of economic policies could therefore have a profound influence on economic growth and the well-being of people if the theories of Lucas and Romer are empirically valid.

Barro and Lee (1994:11) tested a number of determinants of economic growth empirically using a sample of 95 countries which included a range of economies from developing to fully developed countries. They studied growth rates over the two decades 1965 to 1975 and 1975 to 1985, thus including a limited amount of time-series variation. They regressed the real per capita growth rate on a set of variables that they classified broadly into two groups, namely levels of state variables and control or environmental variables.

5.2.1 Levels of state variables

Barro and Lee (1994:11) defined state variables as

- the stock of physical capital; and
- the stock of human capital in the forms of educational attainment and health.

5.2.2 Control or environmental variables

This type of variable is conventionally controlled or determined by governments, but some of them can also fall within the influence of private agents. The following are examples of these variables used by Barro and Lee (1994:11):

- the ratio of government consumption to GDP (without expenditure on education and defence);
- the ratio of domestic investment to GDP;
- the fertility rate;
- the black market premium on foreign exchange;
- changes in the terms of trade;
- measures of political instability;
- the extent of political instability;

- the extent of political freedom and civil liberties;
- tariff rates.

The authors theorised that some degree of endogeneity can be accommodated in the variables by using lagged dependent values as instruments.

A number of the variables listed above and others collated by Sala-i-Martin 1997:21) are more suitable for cross-sectional analysis because they are measured irregularly (e.g. the black market premium on foreign exchange); others change slowly over time and are not easily influenced by policy changes (e.g. the fertility rate); while another group is related to the physical characteristics of the country (e.g. the percentage of GDP in mining). The following section will identify a group of variables that change sufficiently over time and are usually measured on a regular basis.

Quah (1996a:1048-1050; 1996b:1370-1373) developed alternative research methods to standard cross-country regression frameworks. He contended that using cross-sectional averages over long periods of time may mislead, and proposed analysing the evolution of the entire distribution, which reveals different kinds of convergence, which he terms convergence clubs. This could shed some light on the observations that the rich become richer, the poor poorer and that in some cases the middle class vanishes. Quah (1996b:1355) contends that standard models “generate empirics that are ill-suited for comparisons with dynamics of a rich cross-section of data.” Other researchers, such as Bernhard and Durlauf (1996:172), pointed out that “cross-section tests place weaker restrictions on the growth dynamics between countries compared with similar time-series tests”. Arestis and Demetriades (1996:3, 4, 14) suggested that time-series regression for individual countries may be more appropriate to assess the effects of various variables on growth and productivity. As indicated earlier, cross-country regressions typically involve averaging out variables over relatively long periods of time. This procedure complicates the interpretation of variations in results of cross-country studies. It is also difficult to address the question of causality in cross-section frameworks. The time-series approach allows the investigator not only to analyse the possibility of bidirectional causality but also to account for differences in the

institutional framework and policy regimes. The variables in such a framework may have a crucial effect on growth.

A range of variables is now discussed in greater depth. The list is compiled from the literature. Most of the variables are used in the empirical analysis in this study as defined in this section; others are supplemented or adjusted, mainly where the same data is not available for South Africa.

5.2.3 Government expenditure as a percentage of GDP

The relationship between government expenditure and economic growth is somewhat precarious. Thomas Hobbes (1950:65: first published 1651) described life "during the time men live without a common Power to keep them all in awe" (government) as "solitary, poor, nasty, brutish, and short". This alludes to the role of government in the protection of individuals and their property and the operation of a court system to resolve disputes. These functions include secure property rights, enforcement of contracts and a stable monetary regime, which provide the foundation for the smooth operation of a market economy. Government enhances growth through efficient provision of this infrastructure. In addition, it provides "public goods" that markets find troublesome to provide because their nature makes it difficult (or costly) to establish a close link between payment for and receipt of such goods. Romer (1990b:S74) describes these as nonrival and nonexcludable goods. Roads and national defence fall into this category. Government provision of such goods may also promote economic growth.

There are, however, also adverse effects of government interventions on economic growth, which fall mainly into three categories.

Firstly, the higher taxes and/or additional borrowing required to finance government expenditures have a negative effect on the economy. Borrowing, like taxes, will crowd out private investment and will also lead to higher future taxes. The productivity of government expenditure is usually lower than that of the private sector and even if it was not, the disincentive effects of taxation and borrowing would have a negative impact on economic growth.

Secondly, as government grows relative to the market sector, diminishing returns will result. In the provision of collective goods such as infrastructure and education, the government could improve performance and promote growth, even though the private sector has demonstrated its ability to effectively provide these things. However, when the government becomes involved in the provision of private goods like food, housing, medical service and childcare they cannot provide such goods more efficiently than the market sector. When government do, the result usually is negative returns, and ultimately lower economic growth.

Thirdly, adjustment to change is much slower in the public sector. Competition in the private sector rewards alertness, but also imposes swift and sure punishment on those who make bad decisions. Adjustment to change is much slower in the public sector because the incentives and punishment are less certain, which, since it relates to economic growth, is a major shortcoming.

Private sector entrepreneurs discover new and improved technologies, better methods of production and opportunities which were previously overlooked. They are able to combine resources into goods and services that are more highly valued, which is a central element of wealth creation and growth.

A small government per se is not an asset. When a small government fails to focus on and efficiently provide core functions such as protection of persons and property, a legal system that helps with the enforcement of contracts, and a stable monetary regime, economic growth is more likely to suffer. Unless these core functions are in place and properly enforced, the empirical relationship between the size of government and economic growth is likely to be a loose one.

Gwartney, Lawson and Holcombe (1998:4) studied government expenditures as a share of GDP and showed that in 1960, the government expenditures of a group of OECD countries averaged 27 per cent of GDP, and by 1996, the share had grown to 48 per cent of GDP. They looked at a scatter graph with size of government at the beginning of the period on one axis, and the growth of real GDP during the decade measured on the other. They reported that the relationship is clearly negative and the regression line suggests that a 10 percentage point increase in government expenditure as a share of GDP leads to

an approximately one cent reduction in economic growth (Gwartney, *et al.* 1998:8).

5.2.4 Government spending (less defence and education)

Barro and Lee (1994:19) intended this variable to provide an indication of the effect of government spending that does not improve productivity, and refer to it as *government consumption*. They estimated the coefficient of the ratio of government consumption to GDP as -0.17 (standard error [s.e.] = 0.026), which is significantly negative. The mean of G/Y was 0.1 (standard deviation =0.06) in 1965-1975 and 0.11 (standard deviation [s.d.] = 0.06) in 1975-1985. Thus one standard deviation increase in G/Y is associated with a fall in the growth rate of one percentage point per year. The authors state that the estimated effect on growth is so strong because the G/Y variable may to some extent be a proxy for political corruption, as well as for the direct effects of non-productive public expenditure and taxation.

Sala-i-Martin (1997:17, no. 27) tested the statistical significance of a range of variables on growth running four million regressions. He also used public consumption of government less spending on education and defence (no. 27 of his list of variables) as the dependent variable and called it “public consumption share”. He identified the variable from work done by Barro (1997:26). The variable was ranked 27th on Sala-i-Martin’s table of main results and fell just outside the 10 per cent level of significance, but showed a beta coefficient of -0.022, indicating a negative effect on growth.

In a subsequent study, Barro (1997:13, 26) used a panel of 100 countries with the dependent variable being the growth in per capita GDP for three periods 1965-1975, 1975-1985 and 1985-1990. One of the independent variables was again the ratio of government consumption (also measured without spending on education and defence) to GDP. The regression coefficient for this variable was -0.136 (s.e. = 0.026). He concluded that a greater volume of nonproductive government spending – and the associated taxation to finance it – reduces the growth rate for a given starting value of GDP. He concluded that, in this sense, large governments are bad for growth.

Government expenditure as a percentage of GDP in South Africa did not exceed 16 per cent in the period up to 1972, after which it increased sharply to 21 per cent in 1973, and in the subsequent 24 years, dropped only twice to below 20 per cent. In five of the post-1973 years, it exceeded 25 per cent. A strong negative correlation of -0.6 was measured between growth and government consumption as a percentage of GDP for the period 1960 to 2002.

Gwartney, *et al.* (1998:3) found that the five fastest-growing economies in the world from 1980 to 1995 had total government expenditures as a percentage of GDP averaging 20.1 per cent, which is less than half the average of OECD countries. The levels in South Africa are therefore considerably below those of developed countries, but currently somewhat more than the ideal 20 per cent rate of the fast growers.

5.2.5 The investment to GDP ratio

Economists used to work with the incremental capital output ratio (ICOR), which was the ratio of "required" investment to desired growth and deemed it to be somewhere between two and five. According to Lewis (1959:225-226), "the central problem in the theory of economic growth is to understand the process by which a community is converted from being a 5 per cent to a 12 per cent saver – with all the changes in attitude, in institutions and techniques which accompany this conversion." This ratio of 12 per cent of GDP was arrived at by setting a target per capita growth rate of 2 per cent per annum, assuming an annual 2 per cent population growth rate and a capital-output ratio of 3 – thus 2 x 2 x 3 =12. A country that wanted to develop had therefore to increase its investment rate from a 2 to 4 per cent ratio of GDP to 12-15 per cent of GDP (Myint 1980:78). Easterly (1997:6) called this approach to development "a race between machines and motherhood". This Harrod-Domar type model of economic development has been discredited because, according to Easterly (1997:35), it "makes no sense theoretically and fails empirically".

Barro and Lee (1994:18) investigated the influence of the ratio of real gross domestic investment to real GDP on economic growth and found a significantly positive coefficient of 0.12 (s.e. = 0.020). The size of the coefficient means that a rise in the investment ratio of 10 percentage points will lead to an increase of

the economic growth rate of 1.2 per cent per year (less than half the Harrod-Domar prediction). They also used lagged values of the I/Y ratio to lessen the tendency to overestimate the convergence effect because of measurement error in GDP and also to see whether lagged values will reduce the original coefficient (Barro and Lee 1994:20). If it does, they surmise it would be an indication of reverse causation from growth to investment opportunities and hence an overestimation of the growth effect of the investment ratio. According to them, the use of the lagged variables would obviate this problem. They found that the use of the lagged variable reduced their coefficient of I/Y from 1.2 (s.e. = 0.020) to 0.077 (s.e. = 0.027), indicating an overstatement of the effect of the investment ratio on economic growth because of reverse causation. They subsequently used the lagged variable to reduce the overestimation.

Kaldor (1961:259) deduced that “capital accumulation is a feature of economic growth, not a fundamental cause: ... neither the proportion of income saved nor the rate of growth of productivity per man (nor, of course, the rate of increase in population) are independent variables with respect to the rate of increase in production”.

Pack and Page (1994:219), however, investigated the growth effects of foreign direct investment and found that it permits local production to take place along the world's best-practice production function by substituting foreign physical and human capital for the absent local factors. They base their argument on the fact that foreign investors prefer to locate production in less developed countries with rapid export growth which is a sign of good macroeconomic management. These policies usually minimises the risk from inflation, exchange rate volatility, and changes in the regulatory regime. They regard Singapore as an example of a country that achieved success using this strategy.

Grossman and Helpman (1991:205-206, 330-338; 341-347) find that foreign direct investment generates significant externalities. These externalities come into effect as and when domestic firms who are in competition with these foreign firms become aware of new technologies and practices; workers move from the foreign firm to other local firms, or establish their own businesses, thus disseminating knowledge that was originally propriety. Such real externality is indirectly attributable to export growth from the high technology country, which

provides the signal upon which multinational firms base their initial investment decision.

Levine and Renelt (1992:959) found the share of capital investment in GDP as the only truly robust variable with growth, according to the criterion they designed for robustness, namely that the variable should keep its sign and remain statistically significant irrespective of which other variables are included in the regressions.

Sala-i-Martin (1997:1) regarded the extreme bounds method of identifying "robust" empirical relations by Levine and Renelt (1992:942) as too narrow. Sala-i-Martin (1997:2-3) suggested an approach that analyses the entire distribution in sets of eight variables, which include a set of four fixed variables, the variable (z) to be tested and a vector of up to three variables from a pool of chosen variables. His aim was to widen the scope of robust variables and thus empirical growth analysis. In this method, Sala-i-Martin (1997:20) added a substantial number of variables that are strongly related to growth. Two of these variables are investment variables, namely equipment investment and non-equipment investment. These variables are presented in the following two sections, to investigate investment as a source of growth in more detail.

5.2.6 Machinery and equipment investment

The contribution of machinery equipment investment to economic growth goes as far back as the Industrial Revolution and the two machines associated with it, namely the steam engine and the cotton-spinning jenny. The historical contribution of machinery to economic growth since then has been documented in detail in more recent study by Landes (1969:40) who proclaimed that "the machine is at the heart of the new economic civilization"; and Mokyr (1990:vi) who saw the role of technology embodied in machinery in Western economies as "the lever to its riches".

However, growth accountants like Denison (1967:192) ascribed a diminished share of growth to have originated from nonresidential structures and equipment accumulation in the USA, and North-West Europe between 1950-55 and 1955-62. From Denison's study, no decisive trend is noticeable for the

individual countries that could lead to the conclusion that growth in nonresidential structures and equipment contributed to productivity growth. In the case of Belgium, Denmark and France, increased investment in nonresidential structures and equipment contributed to growth in productivity, but in Germany, the Netherlands, the UK and Italy, more equipment yielded lower productivity growth. Norway in fact recorded higher productivity growth with lower equipment investment.

Jorgensen (1988; 1990) disaggregated capital to equipment investment level and found a remarkable complementarity between this part of capital accumulation and total factor productivity – his growth measure (De Long and Summers 1991:480). The latter authors (1991:484) also showed that the high cost of equipment investment in India, for example, diminished its beneficial effects on growth. They recommended that equipment should be applied to the most productive uses by being market conforming, and not market replacing, to realise the desirable extremely high social rates of return. They contended that this distinction explains the superior performance of the activist governments in East Asia over the industrial policies of South America (except Brazil) and Africa, since the former nations correctly supported industrialisation, while the less successful nations supported industrialists instead (De Long and Summers 1991:486). Nations that invested heavily in equipment relative to other nations at the same stage of economic development enjoyed rapid growth over the period 1960 to 1985 (De Long and Summers 1991:485).

They tested the hypothesis that the quantity of equipment is a proxy for some other well-known determinant of growth omitted from their list of independent variables. They tested for the effects of

- the share of manufacturing in value added
- the importance of public investment
- the real exchange rate in 1980
- the continent.

The only case in which the inclusion of an additional variable has a material impact on the coefficient of equipment investment is that in which continent dummies are added to the regression using the high productivity sample (De Long and Summers 1991:461). One might feel inclined to think that since better

performance in terms of economic growth comes from South-East Asia and worse from South America, that the higher growth of South-East Asia has something to do with Asian and/or Latin American culture or religion. They disprove this hypothesis by indicating that the high performance Asian economies (HPAEs) - Hong Kong, Korea and Japan - have low equipment prices and large equipment quantities with high economic growth, while neighbouring Sri Lanka and the Philippines have high equipment prices, low quantities and low growth. It would appear as if low import tariffs on equipment might be a growth stimulant. De Long and Summers (1991:467,473) found a strong negative association between high equipment prices and growth. They regarded the association of growth with high quantities and low prices of equipment as strong evidence that equipment investment drives growth. They made a strong case for a growth strategy based on equipment investment with the *proviso* that it must be market conforming, not market replacing, to realise the extremely high social rates of return on equipment investment. They stressed the fact that policies must be designed to increase the quantity of equipment investment by encouraging purchasers rather than raising return on capital.

De Long and Summers (1991:449) made a distinction between equipment and non-equipment investment. They found that there was little explanatory evidence in the transportation component of durables and focused on the equipment part, which included electrical and non-electrical machinery. On the basis of this, Sala-i-Martin (1997:20) separated investment into these two parts and found that both made positive contributions to growth, but that the coefficient for the equipment part at 0.218 was significantly larger than non-equipment investment at 0.056. It therefore seems important to investigate the equipment part of investment separately for South Africa.

5.2.7 Investment in transport and communication

The Easterly and Rebelo's (1993:36-48) data set included a variable that refers to the average public investment in transport and communication for each of the three decades they investigate (1993:43-45). They expressed most of their investment series as percentages of GDP.

Investment in public capital projects was identified by Sala-i-Martin (1997:15) from work done by Barro and Lee (1993:19). He warned that public investment is less efficient than private investment to the extent that a growing fraction of public investment is bad. Frankel (1997:3) identified investment in jinfrastructural projects like telecommunications and electric power as possible growth stimuli.

Easterly and Levine (1997:1211) reported that low-quality infrastructure can hinder growth by depressing the marginal product of private investment. They refer to an exhaustive study by Aschauer (1989:191-198), in which he found that infrastructure (highways, streets, water systems and sewers) had large positive effects on US productivity growth. Similar findings were reported by Easterly and Rebelo (1993:13) who used consolidated public sector investment in transport and communications expressed as percentages of GDP in a cross-country study. They concluded that this type of investment is uncorrelated with private investment and increase growth by lifting the social return of private investment but not by raising private investment. Canning (1998:27) used cross-country data on telephone stocks and telephone mainlines per capita and found a strong link between the latter variable and growth. The World Bank (1994:14) concludes that a “strong association exists between the availability of certain infrastructure – telecommunications (in particular), power, paved roads, and access to safe water and per capita GDP”. The World Development Report (World Bank 1994:17, table 1.2) shows that the average rates of financial return on World Bank supported projects from 1983 to 1992, varied between the 6 per cent of water projects and 29 per cent in the case of highways.

5.2.8 The ratio of value added in agriculture to total GDP

Sachs and Warner (1995:5) reported the linkages approach formalised by Matsuyama (1992:318-319) who examines the role of agriculture in economic development in a model in which manufacturing expands through a process of learning-by-doing technological change. There are two sectors in this model, namely agriculture and manufacturing. Forces that push the economy away from manufacturing towards agriculture lower the growth rate, by reducing the learning-by-doing effect, which, according to Matsuyama (1992:328), is proportional to the sector but external to the firm. The adverse effects of

agriculture growth are of the result of the agriculture sector employing production factors that would otherwise be used in manufacturing. The latter sector has superior learning-by-doing properties resulting in higher, or in this case, lower overall growth.

5.2.9 Crime

Brown (1998:18) contended that crime in South Africa has more causes than the pure economic theory of crime suggests, namely the influence of law enforcement. Brown showed that the most significant determinants of crime in South Africa appear to be the socioeconomic variables of population density, low income, unemployment and the extent of industrialisation, but law enforcement variables are not insignificant and the probability of prosecution is far more significant than the expected punishment. Brown stated that the positive correlation between the level of educational attainment and the crime rate cannot be explained without challenging the assumption that the skills acquired are more suited to legitimate activities.

5.2.10 The ratio of value added in mining to total GDP

Sala-i-Martin (1997:17) tested the robustness of the variable, which he identified from work done by Hall and Jones (1996:9), who used the variable to eliminate the effect on growth of oil-rich countries. The variable was ranked 11th on Sala-i-Martin's table of main results and signified that the variable will be an insignificant contributor to growth in only one per cent of the cases. Most researchers accept the contribution to growth of mining and resource abundance, but also stress the numbing effect it has on the rest of the economy, because it focuses attention almost entirely on the resource and diverts the resolve (talents, entrepreneurship) of inhabitants to acquire the human capital and know-how to pursue the more lasting sources of economic growth such as productivity and technology.

5.2.11 The ratio of value added in manufacturing to total GDP

Sachs and Warner (1995:43) put forward the ratio of value added in manufacturing to total value added (MSGDP) as a source of growth. They made

a case for the effect of the reduction in growth in the manufacturing sector as a result of a windfall either through an increase in the price of a natural resource of a country or the discovery of a new natural resource, which then retards growth in the manufacturing sector as a result of the onset of the Dutch disease.

The Dutch disease model assumes a three-sector economy, consisting of a tradable natural resource sector, a tradable (nonresource) manufacturing sector and a nontraded sector, which includes inter alia railways, pipelines or communications facilities. A substantial resource endowment leads to an increased demand for nontradable goods and as a result there will be a smaller pool of labour and capital for the manufacturing sector. The greater the natural resource endowment, the higher the demand for nontradable goods is, and consequently, the smaller the pool of labour and capital available for the manufacturing sector will be. Therefore, when natural resources are abundant, tradables production is concentrated in natural resources rather than manufacturing, and capital and labour that might otherwise be employed in manufacturing are pulled into the nontraded goods sector. As a corollary, when an economy experiences a resource boom (either a terms-of-trade improvement or a resource discovery), the manufacturing sector tends to shrink and the nontraded goods sector tends to expand.

The decline of the manufacturing sector is dubbed the “disease”, although there is nothing harmful about the decline in manufacturing if neoclassical, competitive conditions prevail in the economy. The Dutch disease can be a real disease, however – and a source of chronic slow growth – if there is something special about the sources of growth in manufacturing, such as the “backward and forward linkages” stressed by Hirschman (1964:100), or the learning-by-doing stressed by Matsuyama (1992:328). If manufacturing is characterised by externalities in production, then the shrinkage of the manufacturing sector leads to technology resource abundance, which can lead to a socially inefficient decline in growth.

5.2.12 Growth in the manufacturing sector as a source of growth

Kaldor (1978:101) asserted that “fast rates of economic growth are associated with the fast rate of growth of the ‘secondary’ sector of the economy – mainly the manufacturing sector”. He (1978:103) provided evidence of this by means of regression analyses between economic growth and manufacturing growth of 12 industrialised countries for the period 1953 to 1954 and 1963 to 1964. He stated that the R^2 was 0.96 between the growth rates of GDP and that of the manufacturing sector, and emphasised that the regressions reveal more than the large contribution of the manufacturing sector to these economies (25 to 40 per cent). He asserted that “the positive constant (1.153) in the equation and the (0.614) regression coefficient which is significantly less than unity” means that “rates of growth above 3 per cent a year are found only in cases where the rate of growth in manufacturing output is in excess of the overall rate of growth of the economy”.

Choi (1983:151) refers to similar findings by Cripps and Tarling (1973:22), the United Nations (1970:78) and Stoneman (1979:311).

The significance of these figures is confirmed by investigating the opposite relationship between the growth of GDP and the growth of output in a number of other branches of production. The relationship between the growth in services and the GDP renders a coefficient which is larger than unity (1.06) and a negative constant (-0.188), which, according to Choi (1983:152), suggests that it is the rate of growth of GDP that determines the rate of growth of the service sector.

A similar exercise in which time-series data from the UK over the period 1800 to 1969 was used, confirms the relationship between industrial growth and productivity growth. The results lead to the conclusion that there is strong support for the relationship between the growth of GDP and the growth of manufacturing production, and that in no other branch of production does the growth of output exhibit such a close correlation to the growth of GDP; where it does, the causal relationship seems to be that GDP influences the growth in the other sector (Choi 1983:152).

Kaldor provided three explanations for the high correlation between productivity in manufacturing activities, compared with the rest of the economy. Firstly, he asserted that the higher level of productivity of the manufacturing sector was the reason for its influence on overall growth. He then hypothesised that since the incidence of technological progress, and thus productivity, is higher in manufacturing than in the rest of the economy, it follows that with the large employment complement in this sector, it lifts the average productivity. Secondly, he observed that technological progress is higher in the manufacturing sector and the higher employment numbers in this sector bring about a higher growth of productivity for the whole economy. He rejected these explanations and concluded that the third possible explanation was the most plausible. This explanation suggests a strong association between the growth rate of manufacturing output and the rate of overall productivity growth stemming from economies of scale or increasing returns. Kaldor (1967:15) emphasised a dynamic relationship between productivity change involving both technical progress and economies of large-scale production and not a static relationship in which the level of productivity is derived from the levels of output and associated inputs (Choi 1983:152).

5.2.13 Public expenditure on education as a percentage of GDP

Barro and Lee (1994:14) were of the opinion that the best currently available data to assess the quality of schooling are pupil teacher ratios and public spending on education. Barro and Lee (1997:26) confirmed the notion in this later study by defining the variable on public spending as less defence and education and described it as a variable to measure nonproductive public spending. By implication, public spending on education should therefore have a positive effect on growth.

5.2.14 Primary school attainment

Sachs and Warner (1995:44) used the primary school enrolment rate as a growth factor (Pri70), which they defined in line with Barro and Lee (1994:14), who assembled data on educational attainment. These data were sourced from census and/or survey information on schooling of the adult population (aged 25 and above) by gender and level. The data distinguished seven levels, namely no

schooling, incomplete and complete primary, incomplete and complete secondary, and incomplete and complete higher (Barro and Lee 1994:13). The latter authors found that the data set that does not distinguish between complete and incomplete education at each level, was more plentiful, and therefore used it.

Federke (2001:7-12) defined a range of variables measuring investment in human capital at the secondary and primary schooling as well as tertiary educational levels in South Africa. The intention of this group of variables is to control for both the quantity and the quality of human capital investment.

The variables used to indicate levels of investment in primary and secondary human capital are:

- the school enrolment rate, for the "white" racial group in South Africa. This variable and others to follow were all expressed as the enrolment rate of the relevant age cohort, obtained from census data. For whites, the age cohort is the 5-19 age group, as the schooling pupil statistics covers both primary and secondary schooling. This variable is likely to result in underestimation, since a substantial part of white pupils are likely to complete schooling by the age of 18.
- the school enrolment rate, for the blacks were calculated using the 5-24 age cohort, as a significant proportion of pupils in the black schooling system are likely to complete schooling into their mid-20's.
- the total school enrolment rate, for all racial groups is taken as the ratio of pupils enrolled in primary and secondary schooling as a proportion of the total age cohort eligible for schooling.
- the proportion of pupils sitting for mathematics in their matriculation examination in white schooling.

Federke (2001:13) regressed growth in total factor productivity on capital stock growth, as well as the abovementioned range of alternative indicators of human capital investment. He (2001:14) found the coefficient on the growth rate of the capital stock to be consistently negative and statistically significant (even where he controlled for investment in human as well as physical capital). The proportion of matriculation students taking mathematics, and the proportion of mathematical, natural and engineering sciences (NES) degrees in total degrees

are the only two human capital variables that provide a positive and significant contribution to productivity growth in South African manufacturing industry over the 1970-97 period. Kularatne (2001:22) using cointegration techniques, similarly found that human capital does have a positive, statistically significant effect on per capita growth in South Africa.

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

5.2.15 Secondary school attainment

Sachs and Warner (1995:44) also used the secondary school enrolment rate as a growth factor (Sec70) and defined it in line with the Barro and Lee (1994:14) concept described in 5.2.14 above. The Sec70 variable (secondary school enrolment ratio in 1970) had a 5.3 coefficient (the t-ratio [2.73] was significant), which made it the largest positive contributor to growth of all the above-mentioned categories defined by them.

Federke (2001:8) gave two schooling enrolment rates to serve as the quality deferential between the schooling provided for the racial groups in South Africa. He is of the opinion that simple incorporation of the aggregate school enrolment rate may not differentiate properly for the substantial quality differentials in South African schooling and could render the aggregate enrolment rate insignificant or perverse. The school enrolment rates are employed as proxies for the quantity of primary and secondary human capital investment. He also used the proportion of matriculation students studying mathematics, to indicate the quality of schooling. Fedderke, de Kadt and Luiz (2000) use the mathematics proportion in the matriculation year as a proxy for the quality of schooling. This study shows that the white schooling system provided the best available schooling in South Africa and that the mathematics quality indicator is a good indicator for the quality of schooling.

5.2.16 Higher education

Barro and Lee (1994:14) constructed a series on female and male secondary school attainment. A problematic finding of their study was the negative coefficient of female secondary education levels. They attributed it to the wide spread between male and female attainment, which, to a degree, manifests as a measure of backwardness (Barro and Lee 1994:18). No source variables are available in the South African data set to construct a time-series to be used with the time-series methods applied in chapter 6.

In terms of the tertiary human capital variables Federke (2001:11) used:

- the total number of degrees awarded by South African universities.
- the total number of degrees awarded by South African universities in the mathematical, natural and engineering sciences
- the ratio of mathematical, natural and engineering science degrees to the total degrees issued by the university system
- apprenticeship contracts issued per capita
- the total number of patents registered in South Africa, as a proxy for the quality of intellectual property rights
- an index of property rights in South Africa, as a second proxy for the quality of the property rights.

5.2.17 Openness to international trade and investment

There is a substantial and growing body of empirical literature investigating the relationship between openness and growth. A number of empirical studies on growth across countries find that the ratio of exports to GDP, or some other measure of openness, is a significant determinant of growth, and often that it is an important determinant of growth in East-Asian economies in particular.

Various definitions of openness are found in the literature. Sachs and Warner (1996:8) defined their variable as the fraction of years between 1965 and 1989 that the country was integrated with the global economy. The integration with the global economy was measured by the maintenance of relatively low tariffs and quotas and by not having an excessively high black market exchange rate premium.

Feder (1982:65) regressed growth rates for 31 semi-industrialised countries over the period 1964 to 1973 against three variables: investment as a share of income, the rate of growth of the labour force, and the rate of growth of exports. In this analysis the coefficient on the export variable was statistically highly significant. Agénor (2000:416) found that growth in the volume of exports and imports (used as the degree of openness) are positively correlated with growth.

Similarly, Edwards (1993:9-11) regressed the rate of growth of total factor productivity on two measures of openness – total trade as a percentage of GDP and total tariff revenue as a percentage of trade – along with some other variables, and found that "in every regression the proxies for trade distortions and openness are highly significant". Summers and Heston (1991:362) measured openness as imports plus exports as a percentage of GDP.

Frankel (1997:17) set out the mechanism through which openness to trade and investment influences growth. He described the old exogenous foreign trade growth process as one that facilitated specialisation in the production of goods at which a country was good – the products in which it had a comparative advantage. This model raised the efficiency of the use of existing resources and this also raises the real level of per capita income. The growth rate was, however, unaffected.

The new growth theory with its endogeneity of technological change, in tandem with the new international trade theory which integrates the notion of imperfect competition, opens up the possibility of achieving perpetually higher growth rates, at least in theory. Openness to trade and foreign direct investment allows the transfer of technology, while world-class management practices are assimilated which, in turn, introduces innovation, cost-cutting and thus eliminates monopolies. These factors together can permanently raise the growth rate.

Coe, Helpman and Hoffmeister (1995:27) show that the transfer of technology can be accomplished through trade openness and concomitant knowledge spillovers from advanced to developing economies. The spillovers through

export flows are mostly achieved by the ability of developing countries to imitate high-technology products by reverse engineering (Coe, *et al.* 1995:8). Importing high technology components and incorporating them into local production can achieve the transfer of technology via the import route. In this way, higher value-added products can be manufactured in less developed countries. They also found that these spillovers are more successful in economies with better and more advanced education. Coe and Helpman (1995: 872, 874-876) found that the productivity levels of countries were positively affected by domestic as well as bilateral imported components embodying foreign research and development, that is, intermediate goods that embody technology.

Keller (1997:21) investigated 13 manufacturing industries in eight OECD countries for the period 1970 to 1991 using input-output matrices and found that R&D increases productivity and that foreign and local R&D is indeed transmitted within local and foreign firms. The highest productivity-increasing effect from R&D expenditures is derived from own-industry R&D and the returns vary between 7 and 17 per cent (Keller 1997:33). Benefits from foreign R&D expenditures in the same industry are lower for local industry and vary between 50 and 95 per cent of local R&D. A third R&D benefit is derived from businesses in other sectors (outside industry sectors), which contribute between 20 and 50 per cent of the benefits that can be obtained from own industry R&D.

Harrison and Revenga (1995:27-28) correlated trade policy reform and increased investment flows, and found a significant influence of more liberal trade on inward investment flows. They suggested, however, that other factors – such as the general macroeconomic environment and macro-conditionality imposed by international organisations – could have largely contributed to this result.

Foreign direct investment is an excellent vehicle for the transfer of technology because it transfers technology that is embodied in capital and machinery, as well as through new managerial practices and worker skills that are disseminated through the local economy by locals working in the foreign company. These locals subsequently move to local firms taking the acquired

skills and techniques to them. These advantages accrue over and above the inherent characteristics of the new products or processes.

Romer (1989:2) found that openness to foreign trade seems to cause increases in the growth rate of technology, which he implied would increase the overall growth rate. He stated that countries that are more open tend to have a higher rate of investment and thus capital stock, without effecting a reduction in the marginal output of capital. Higher output of capital is facilitated by an intensified participation in international trade.

It is also interesting to note the flying geese pattern of development in which latecomers can derive more benefit from other developing countries that are just ahead of them in the process than from the technology leaders themselves. Countries with large unskilled labour to capital ratio, such as Indonesia and China, can learn more from ones, such as Korea, that have recently made the transition, rather than from the leaders, such as Japan and the USA. This principle is akin to a newly appointed worker who can learn more from a colleague who was recently promoted than from the managing director.

Furthermore, Coe and Helpman (1995:875) argued that the countries that gain the most from foreign R&D are those whose economies are most open to foreign trade. Lichtenberg (1992:10, 17) used the Summers-Heston data set and extended it to include the effect of private and government-funded R&D as well as fixed and human capital. For a cross-section of 53 countries, he found that labour productivity growth between 1960 and 1985 was positively influenced by the ratio of private R&D to GNP. The estimated social rate of return to private R&D investment was about seven times as large as the return to physical investment, with an elasticity of output with respect to private R&D of about 7 per cent (Lichtenberg 1992:21). The social marginal product of government-funded R&D was found to be much lower than that of private R&D. The findings of Lichtenberg (1992:26) suggest that international spillover of technical knowledge is neither complete nor instantaneous.

Export-oriented industrialisation, on the other hand, prescribes a complex set of policies intended to make exports a leading sector. The notion is to exploit opportunities presented by trading with the rest of the world on market terms,

rather than adopting a strategy that deliberately tries to limit imports. This approach further relies on the exploitation of increasing returns to scale (World Bank 1993:358-362).

Harrison (1996:8) investigated the policy determinants that underlie openness. These included a trade liberalisation index, the black market premium, trade shares, movements towards institutional prices and the bias against the agriculture index. Instead of using period averages for these openness variables, annual data were used in this study to uncover exchange rate changes over time. These occur as a result of policy interventions, which are marred when using period averages. Harrison (1996:18) used cross-country time-series panel techniques and seven openness variables. Of these variables, three are significant at the 5 per cent level and another at the 10 per cent level. Harrison (1996:20) used five-year averages or annual data. These specifications show a positive, often significant association between the various openness variables and productivity growth. By contrast, Harrison (1996:40) showed that cross-sectional data reveal only a significant relationship between openness and growth for two of the seven indicators with one having the wrong sign.

Frankel, Romer and Cyrus (1996:15) also studied the causality problem: Does openness lead to growth, or does growth lead to openness? They concluded that the effect of openness on growth turns out to be even stronger when correcting for simultaneity compared with standard estimates. Each additional percentage point in openness (expressed as imports plus exports, divided by GDP) raises income per capita between 1960 and 1986 by an estimated 0.34 per cent (Frankel, *et al.* 1996:12).

To develop successfully, Romer (1998b:2) argued, countries should be open to new ideas and capture the benefits of the latest technologies. The only logical path, he suggested, was to embrace free trade and encourage investment by large corporations. These companies will then bring the necessary knowledge of industrial organisation, international markets and product differentiation to allow developing nations to become truly global players. Romer's theory hinted at an unexpected benefit of free trade, namely access to new ideas.

Wei (2000:18) found that because foregone trade and business opportunities due to corruption and bad governance would be greater for naturally more open economies, they would choose to invest more in building good public governance and would display less corruption.

5.2.18 Exogenous increases in the savings rate

Romer (1989:2) found no substantial evidence to show that exogenous increases in the savings rate causes increases in the rate of technological change and the growth rate. There is, however, some evidence to the contrary, namely that these exogenous changes in savings and investment in fact lower the rate of return on capital as predicted by the neoclassical model. In the light of these findings and the fact that an exhaustive analysis was done on investment, and seeing that investment and saving should largely follow similar trends, no further analysis on saving seemed appropriate.

5.2.19 Average share of exports in GDP

Two variables that had explanatory power for the investment share were the average share of exports in GDP and the average level of real income (Romer 1989:24). Pack and Page (1994:229) endeavoured to answer the question of increasing growth performance by analysing the strategies of the high-performing Asian economies. They found that these countries were more successful than other comparable countries in raising investment levels and developing human capital and that these factors had contributed largely to their growth.

They then pursued the question of what the possible sources of rapid technical efficiency change in the high-performing Asian economies might be and concluded that on the basis of both cross-country evidence and a more detailed examination of Korea and Taiwan, rapid productivity change was partly a result of the superior manufactured export performance. They found that after allowing for the potential productivity-enhancing effect of exports there remained some unexplained component in the growth performance of these countries. They also found that exports, rather than openness, were one element in the trade productivity nexus that could have important implications

for the design of trade policy. This is because manufactured exports work through several mechanisms to improve technical efficiency, thereby contributing to rapid productivity change.

The productivity-driven high-performance Asian economies, while they had moderate distortions in the relative prices, did not attempt to achieve neutral incentives until quite late in their growth cycle. Instead, they engaged in an export-push strategy. The lesson from this is that other developing countries should sequence trade policy reforms by beginning with a modest reduction in import protection, combined with greater uniformity of the structure of effective protection (something South Africa has not yet achieved [Lewis 2001:v]). This should be followed by a period of favouring exports in their trade policy before final liberalisation of the domestic market.

5.2.20 Income distribution

The notion that inequality is in some way linked to economic development dates back at least to Kuznets (1955:23), who argued that inequality should rise during the early stages of economic development, stabilise, and then decline as a country becomes more wealthy (a pattern that was dubbed the “Kuznets curve”). One mechanism that was suggested as the cause of this process is the increasing degree of urbanisation that typically accompanies industrialisation, the argument being that inequality is lower in rural areas.

There is no continuous time series on income distribution in South Africa which means that the relation of income distribution to growth cannot be tested with the techniques used in this study.

5.2.21 Productivity growth and quality improvements

Adam Smith contemplated that the initial start of the process of the division of labour was the extent of the market. “When the market is very small, no person can have encouragement to dedicate himself entirely to one employment ...” (Smith 1776:1981ed.:31). A larger market stemming from higher or continuous growth therefore leads to higher productivity. Allyn Young (1928:8) observed the endogenous nature of the causal relationship by stating that “the division of

labour depends upon the extent of the market, but the extent of the market also depends upon the division of labour".

Early empirical evidence of a positive relationship between the growth of output and labour productivity for 51 manufacturing industries in the USA over the period 1899 to 1937, was presented by Solomon Fabricant (1942:33-37). In a subsequent publication, he (1969:33, 90) observed that "labour productivity generally rises less rapidly when national output is falling and more rapidly when national output is expanding," implying that output growth determines productivity growth. Verdoorn (1949:3) showed empirically that productivity growth in manufacturing depends on output growth in that sector, which became known as Verdoorn's law. Kendrick (1961:207) presented rank correlation coefficients of 0.68 between relative changes in productivity and output for 33 industry groups; 0.67 for 80 manufacturing industries; and -0.10 for 12 farm groups in the USA for the period 1899 to 1953.

Choi (1983:159) pointed to the uncertainty regarding the line of causation, and posed the question whether it is the high rate of growth of output that causes the high rate of growth of productivity, or the other way round. He contended: "In principle either sequence is possible". He then arbitrarily chose the direction of causation "from growth of output to growth of productivity".

Englander and Mittelstadt (1988:47, 48) found that the lack of output growth "shows up as productivity declines rather than as input reductions" (p 47), and that "demand policy should be used to increase output growth in order to improve TFP performance" (p 48). This indicates that they were of the opinion output causes changes in productivity. This is confirmed by their recommendations that "demand policy should be used to increase output growth in order to improve TFP performance".

Thompson and Waldo (1997:155, 157) asserted that unobserved quality improvements may account for at least half but even as much as a three-quarters of growth, and that real productivity growth in post-war USA was two to five times greater than measured TFP growth; also that 15 per cent of the observed productivity slowdown in TFP growth could be ascribed to unobserved increases in the relative importance of product innovations.

Harberger (1998:3) investigated the residual in terms of cost reductions, which would then explain or induce productivity increases. He implored economists to investigate a large number of factors that could produce real cost reductions and thus higher productivity, and challenged that "there are at least 1001 ways to reduce real costs and that most of them are actually followed in one part or other of any modern complex economy, over any plausible period …".

Keller (1997:31) produced evidence that a country's own R&D contributes more to local productivity and growth than that of an "average" foreign country. Secondly, he found that the foreign R&D in the same industry, in turn, is more productive than local outside industry R&D; and thirdly, that international trade in the form of foreign R&D investments is low because it tends to be monopolistic and contributes little to the total effect on productivity (Keller 1997:34).

Easterly and Levine (2000:4) used growth accounting and panel data to establish the reasons for growth differences between countries and also the reasons for changes in economic growth over time. They used the Mankiw, Romer and Weil (1992:410-412) methodology and extended it to allow for changes in technology. The results showed that wide differences in total factor productivity (TFP) account for the largest share of cross-country differences in economic growth. These results were obtained after adjustments had been made for country-specific effects, which could have biased TFP shares upwards, such as large increases in capital stock and increases in education attainment. They found that TFP growth accounted for about 50 per cent of growth in OECD countries and an average of about 30 per cent in Latin American countries.

5.2.22 Institutional factors

Commander, Davoodi and Lee (1997:56) affirmed that policy distortions have a negative effect on growth, but that the positive effects of well-functioning institutions and high-quality government bureaucracies can offset the negative influence of large government.

Brunetti, Kisunko and Weder (1997a:1-2, 29-30) and the World Development Report (1997:34-37) proposed new measures of institutional uncertainty

designed to capture predictability of rules, the fears of entrepreneurs of policy surprises and reversals, their perception of safety and security of property, the reliability of the judiciary and their problems with bureaucratic corruption. All these factors were combined in an overall indicator of credibility of rules. Brunetti, *et al.* (1997:30) found that this new indicator was significantly related to higher rates of growth and investment in their cross-country analyses using a sample of 52 countries for which comparable data were available. They (1997:25) show that the subindicator of "predictability of judiciary enforcement" was significant at the 1 per cent level for both growth and investment regressions. The "security of property rights" indicator was closely related to growth, but at lower levels of significance in investment regressions.

5.3 SYNOPSIS OF FACTORS TO CONSIDER WHEN DESIGNING POLICIES FOR FASTER GROWTH

If the developmental state approach is correct, countries investing more heavily in and enjoying lower equipment prices should enjoy more rapid growth (De Long and Summers 1991:448). Developing countries may wish to sequence trade policy reforms in the form of lower tariff protection by beginning with a modest reduction in the protection of importables, combined with greater uniformity of the structure of effective protection. This should be followed by a period of tilting trade policy in favour of exports before final liberalisation of the domestic market (Pack and Page 1994:230).

Lewis (2001:v) found that the recent tariff reforms in South Africa have lowered average protection and removed most nontariff barriers, but that the spread of effective protection remains high, and that the structure of protection remains complex because it comprises 45 different rates. Rama and Tabellini (1995:1) advised that conditionality by foreign agencies should target product market distortions and not labour market distortions because the latter are likely to respond in the desired direction once product market distortions have been removed or diminished.

Brunetti, Kisunko and Weder (1997a:30) found that the institutional factors of security of person and credibility of rule-making are most closely associated with

growth and investment. Burnside and Dollar (1997:32) found that the policies that have a great effect on growth are those related to fiscal surplus, inflation and trade openness.

Romer (1989:34) recommended that the key determinant of the growth rate in less developed countries is the rate of expansion of investment opportunities. He advised that free trade increases investment opportunities, and most importantly, that it facilitates the purchase of a broad range of highly developed producer inputs from a wide range of foreign suppliers. Ng and Yeats (1999:1) found that improving African trade and economic governance policies to levels currently prevailing in such (nonexceptional) countries as Jordan, Panama and Sri Lanka would be consistent with a sevenfold increase in per capita GDP (about US$3 500) and an annual increase of three or four percentage points in the growth rate.

5.4 CONCLUSION

This chapter identified the most frequently cited and internationally used growth determinants in cross-country analyses. These include the following: the ratio of value added in mining to total GDP; the ratio of value added in manufacturing to total GDP; the growth rate in the manufacturing sector as a source of growth; public expenditure on education as a percentage of GDP; primary school attainment; secondary school attainment; openness to international trade and investment; exogenous increases in the savings rate; average share of exports in GDP; income distribution; productivity growth and quality improvements; investment in various types of infrastructure; and institutional factors.

Time-series tools may be better empirical instruments to assess the effects of various variables on growth because cross-section tests place weaker restrictions on the growth dynamics than similar time-series tests. Typically, cross-country regressions involve averaging out variables over relatively long periods of time. This procedure obliterates important dynamics between interactive variables, which complicates the interpretation of variations in results of cross-country studies. It is also difficult to address the question of causality in cross-section frameworks. The time-series approach allows the investigator not

only to analyse the possibility of one directional, but also bidirectional causality and to account for differences in the institutional framework and policy regimes.

The variables identified in this chapter as having some effect on growth in cross-country analyses will be used in chapter 6, and by applying time-series tools like Granger-causality tests, variance decomposition and response functions, those variables affecting growth in South Africa in a crucial manner will be identified.

CHAPTER 6

GROWTH DETERMINANTS IN SOUTH AFRICA

The only cure for the shortcomings of econometrics is more and better econometrics.
Pesaran as quoted in Blaug (1992:246:1)

6.1 INTRODUCTION

Chapter 5 discussed a number of growth determinants often used in cross-country growth analyses. These cross-country tests show that certain variables make statistically significantly contributions to growth, while the signs of the coefficients indicate whether such contributions are negative or positive. The value of the coefficient indicates the importance of the variable's contribution to growth, but does not necessarily prove causality.

In this chapter, empirical time-series tools are used to determine the validity of the assumptions of causal relationships between some of these growth determinants and economic growth in South Africa. The analysis is conducted according to five broad categories, namely openness variables, investment variables, sectoral variables, human capital and institutional variables, and technology and productivity variables.

This chapter starts with a discussion of the data series used, the sources and construction thereof, and the univariate characteristics of the data. The empirical methodology is set out in section 6.3, followed by the empirical results in section 6.4. A number of conclusions are drawn in section 6.5.

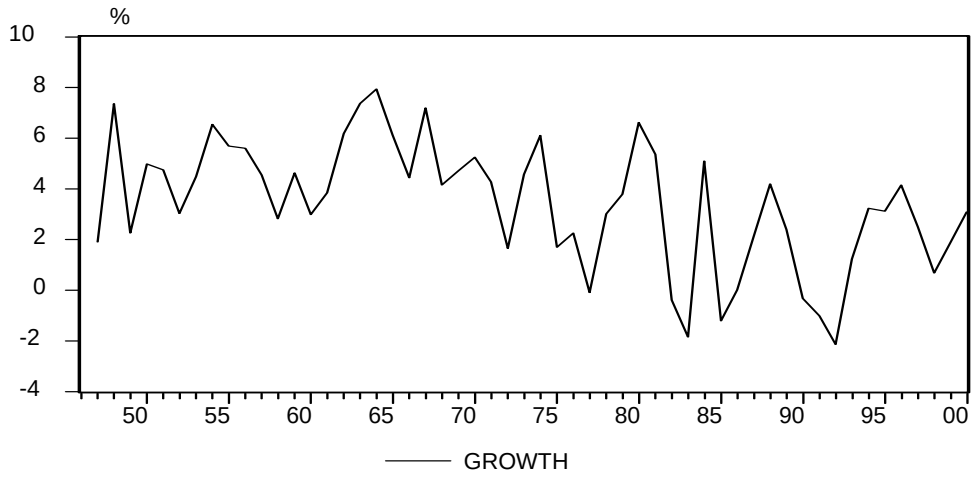
This is done in the spirit of the recommendations of Thomas Mayer (1980:18) who urged that "most applied econometrics should seek to replicate previous results using a different data set and by doing this to rely increasingly on the weight of many pieces of evidence, rather than a single crucial experiment." In

addition, the Socratic approach of deductive thinking remains crucial for the interpretation of the results of empirical tests by researchers.

However, before any growth empirics are analysed, the South African growth performance is revisited. Figure 6.1 demonstrates that growth rates in the South African economy accelerated during the period 1946 to the late 1960s, but declined sharply in subsequent periods. The average growth rate measured 3.42 per cent for the whole period from 1946 to 2000. When considering the period 1960 to 2000, the growth is lower at 3.07. The average growth rate, however, is substantially lower at 2.29 per cent for the period from 1970 to 2000.

Since the growth rates in the last two decades were lower than the population growth (see table 4.3), this implies that the average living standard (as measured by the GDP per capita) of South Africa declined during this period – the average GDP per capita growth for the 1980s and 1990s measured -0.2 per cent and -0.77 per cent respectively.

Figure 6.1: Real economic growth in GDP at market prices, 1946 to 2000



Source: SARB Quarterly Bulletin, various issues

6.2 THE DATA

The sources and construction of the data series used to empirically test and estimate the hypothetical causalities, set out in section 6.4, are discussed in this section, as well as the ways in which the univariate and bivariate characteristics of the data are analysed in subsequent sections.

6.2.1 Sources of data and calculations

Table 6.1 contains a list of the variables employed in subsequent sections containing empirical results. The dependent variable in all instances was the growth rate in GDP at market prices (at constant 1995 prices).

Variables expressed in levels and differences are more difficult to assess, while growth rates are easier to interpret because the analyst can state that growth in the variable should exceed the growth in the GDP or a desired growth in GDP when it makes a positive contribution to growth. Also, that the variable should not exceed the rate of growth in GDP when it is essential for the economic system but has a negative effect on growth.

When the variable is expressed as a ratio of GDP, it has the additional advantage of possible international comparison. A number of variables are therefore expressed as ratios of GDP, or as growth rates, and by exception, in terms of first or second differences, should a variable prove to be nonstationary.

The majority of the data series was obtained from the SARB Quarterly Bulletin. A number of series, such as the human capital series were obtained from Statistics South Africa, while data on productivity were obtained from the National Productivity Institute and data on crime incidents from the SA Police Force.

Table 6.1: List of variables

Series	Description
CAP_GR	Growth in fixed capital stock, at constant 1995 prices
CRIME	Crime incidence
CRIME_GR	Growth rate in crime
CRIME95	Crime incidence index 1995=100
ED_ST10_POP_GR	Number of matric enrolments as a percentage of the total population
G_ED	Government spending on education, deflated by the CPI
G_ED_PERC	Government spending on education as a percentage of total government expenditure
G_GDP	General government expenditure as a percentage of GDP, at constant 1995 prices
G_GDP_GR	Growth in general government expenditure as a percentage of GDP at constant 1995 prices
G_DE_GDP	General government expenditure, less defence and education expenditures, as a percentage of GDP, at constant 1995 prices
G_DE_GDP_GR	Growth in general government expenditure, less defence and education expenditures as a percentage of GDP, at constant 1995 prices
GROWTH	Growth in GDP at market prices at constant 1995 prices
GVA_AGR_GDP	Ratio of gross value added of the agriculture sector to GDP at constant 1995 prices
GVA_AGR_GR	Growth in gross value added of the agricultural sector, at constant 1995 prices
GVA_MAN_GDP	Ratio of gross value added of the manufacturing sector to GDP, at constant 1995 prices
GVA_MAN_GR	Growth in gross value added of the manufacturing sector, at constant 1995 prices
GVA_MIN_GDP	Ratio of gross value added of the mining sector to GDP, at constant 1995 prices

Table 6.1: List of variables (continued)

GVA_MIN_GR	Growth in gross value added of the mining sector, at constant 1995 prices
GVA_RES_GDP	Ratio of gross value added of residual sector to GDP, at constant 1995 prices
GVA_RES_GROWTH	Growth in gross value added of the residual sector, at constant 1995 prices (RES=GDP-GVA_AGR-GVA_MIN-GVA_MAN)
I_GDP	Gross fixed capital formation to GDP %, all at constant 1995 prices
I_GROWTH	Growth in gross fixed capital formation, at constant 1995 prices
I_MAEQ_RAT	Gross fixed capital formation (investment) in machinery and other equipment as a percentage of gross fixed capital formation (total), at constant 1995 prices
I_MAEQ_RAT_D	Gross fixed capital formation (investment) in machinery and other equipment as a percentage of gross fixed capital formation (total), at constant 1995 prices, first difference
I_TRCO_RAT	Gross fixed capital formation (investment) in transport and communication as a percentage of gross fixed capital formation (total) at constant 1995 prices
OPEN_AVE_XZ	Openness of the economy to international trade, measured by the average of the ratios of exports to GDP and imports to GDE, at constant 1995 prices
OPEN_SUM_XZ	Openness of the economy to international trade, measured as exports plus imports to GDP %, at constant 1995 prices
PTGR_CAP_AGR	Growth in capital productivity – agriculture
PTGR_CAP_MAN	Growth in capital productivity - manufacturing
PTGR_CAP_MIN	Growth in capital productivity – mining
PTGR_CAP_PR_EC	Growth in capital productivity - private economy

Table 6.1: List of variables (continued)

PTGR_LAB_AGR	Growth in labour productivity - agriculture
PTGR_LAB_MAN	Growth in labour productivity - manufacturing
PTGR_LAB_MIN	Growth in labour productivity - mining
PTGR_LAB_PR_EC	Growth in labour productivity - private economy
PTGR_MFP_AGR	Growth in multifactor productivity growth - agriculture
PTGR_MFP_MAN	Growth in multifactor productivity growth - manufacturing
PTGR_MFP_MIN	Growth in multifactor productivity growth - mining
PTGR_MFP_PR_EC	Growth in multifactor productivity growth - private economy
PTGR_ULC_AGR	Growth in unit labour cost – agriculture
PTGR_ULC_MAN	Growth in unit labour cost – manufacturing
PTGR_ULC_MIN	Growth in unit labour cost – mining
PTGR_ULC_EC	Growth in unit labour cost – private economy
X_GDP	Exports as a percentage of GDP
X_MAN_GDP	Exports of manufactures as a percentage of GDP at current prices

6.3 EMPIRICAL METHODOLOGY

This section contains a discussion of the econometric tools used in the analysis of growth empirics for South Africa, while section 6.4 contains the empirical results. It presents the determination of potential relationships and empirical causalities between certain stationary economic variables and the economic growth rate over time, of which the underlying data-generating process is also stationary (see appendix A for a list of unit root test results).

The same strategy was broadly followed for each variable analysed, namely to first present the data by means of a simple scatter graph with a fitted regression line of the potential explanatory variable and the economic growth rate – often already a most insightful analysis. A correlation matrix containing simple correlation coefficients supplements this. To proceed beyond the contemporaneous effects and in an attempt to establish causality – and in cases

where it is found to exist, its direction – a Granger causality test was performed. The first step in establishing causality would be to select the proper lag order for each series. In each case, the lag order was selected by specifying an AR model with a maximum of six lags[1] for each variable. Then t-statistics (or p-values) on the last lag were considered and lags dropped until the final lag was significant. A vector autoregression (VAR) model was subsequently fitted to establish the significance of the relationships. If significant, the tools of variance decomposition and impulse response functions were used to throw more light on the relationship.

6.3.1 Order of integration

In analysing the univariate characteristics of the data, the Augmented Dickey-Fuller (ADF) test was employed to establish the order of integration of the data series. The testing strategy, as suggested by Dolado *et al.* (1990:253-262) and applied by Sturm and De Haan (1995:69), was used.

The number of lags used in the estimated equations was determined in a similar way to that suggested by Perron (1989:1384), namely starting with eight lags and testing downwards, until the last lag is significant or there are no lags left. In addition, graphing the data series in levels as well as their first and second differences and looking at autocorrelation functions (correlograms) and spectrum analysis, proved to be helpful when ADF-test results were inconclusive.

The respective tables reporting on the outcomes of the ADF-tests for the relevant data series employed in estimations, are included in appendix A and follow the convention set out below. The series that were tested are listed in the first column. The second column reports the sample period, and the third column whether a trend and a constant (Trend), only a constant (Constant), or neither one (None) is included. In the fourth column, the number of lags included in the test regression is reported. The next column shows the ADF t-statistic, called τ_τ when a trend and a constant are included, τ_μ when only a

[1] Said and Dickey (1984), have shown that an unknown ARIMA(p,1,q) can be well approximated by an ARIMA(n,1,0) where $n \leq int[T^{1/3}]$ with T the number of observations.

constant is included, and τ when neither is included. The last column reports the F statistic, Φ_3 (Φ_1), testing whether the trend (constant) is significant under the null hypothesis of no unit root.

The question of causality and its direction, may best be answered with the Granger causality test. The results are reported in the respective tables in each section. Data series from 1946 to 2000 were generally used. The order of the Granger causality test first has to be determined. This can be done either through an AR specification on the individual time series, starting by including a sufficient number of lags, and omitting statistically insignificant last lags, in order to render the residual of the test regression white noise. Alternatively, the Akaike and Schwarz information criteria on the underlying vector autoregression (VAR) model with different lag orders can be used.

To further investigate the dynamics of the system, the vector autoregression (VAR) model is estimated. The general VAR specification can be written as:

$$Y_t = \alpha + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \beta_3 X_{t-1} + \beta_4 X_{t-2} + \beta_5 Z_{t-1} + \beta_6 Z_{t-2} + \ldots + \varepsilon_t.$$

The tables in the various sections report the results of the VAR with the lag order determined by testing the relevant AR specification for individual series. What is important in these tables is the first column of results with growth as the dependent variable. When the slope coefficients are significant and carry the correct sign, this is a good indication that the variable contributes to growth.

Sims (1980, 1982) introduced a different test for causality, or future impact, based on the variance decomposition of a variable's forecast error variance. The decompositions show the proportion of forecast error variance for each variable that is attributable to its own innovations and those of others. Thus relationships between variables may be evaluated in terms of degree of causality. Where the VAR results indicated positive contributions to growth, the strength of the causality was usually further investigated with the Sims variance decomposition test.

Finally, impulse response functions for the two-variable system are examined in order to throw light upon the dynamics of the relationship. Impulse responses summarise the short-run and long-run effects of various shocks to the system and are displayed in groups of four graphs.

The first of the four graphs proves that economic growth is responsive to shocks to itself, while in the second graph, innovations in the tested explanatory variable serve as a stimulus for higher growth in most of the tested variables (one exception being government spending). Convergence back to the long-run growth level is shown in these graphs after innovations in the independent variable.

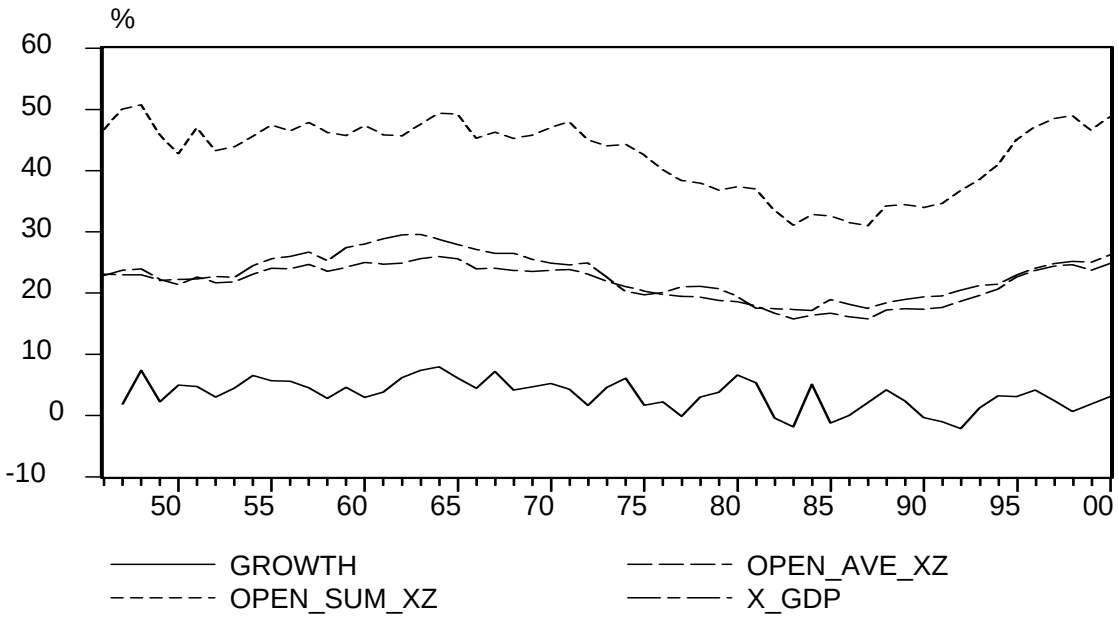
6.4 EMPIRICAL RESULTS

The analysis is categorised in five broad groups, namely openness variables, investment variables, sectoral contribution variables, human capital and institutional variables, and technology or productivity variables.

6.4.1 Openness to international trade and investment

This section investigates the implications for growth in South Africa from a number of variables measuring openness to foreign trade that are often used in international growth studies to investigate the effect of these variables on growth. Different measures of the openness of the South African economy to international trade are used. Firstly, it is derived as (X+Z)/GDP*100; with X and Z representing exports (of goods and services) and imports (of goods and services) respectively. According to Mohr et al (1995:93), a more accurate way of determining openness would be ((X/GDP)+(Z/GDE))/2. In addition, the ratio of exports to GDP and manufacturing exports to GDP, expressed as a percentage, is tested (see section 5.2.17 on p114 and Edwards (1993:9-11) on p115).

Figure 6.2: Openness to international trade variables and economic growth



It is evident from figure 6.2 that there seems to be a coherent movement between all measurements for the openness of the economy and economic growth. Figure 6.2 (above) and table 6.2 confirms this because they show positive correlations ranging from 0.51 to 0.56 between openness variables and economic growth.

Figure 6.3: Simple scatter graphs of growth versus openness variables

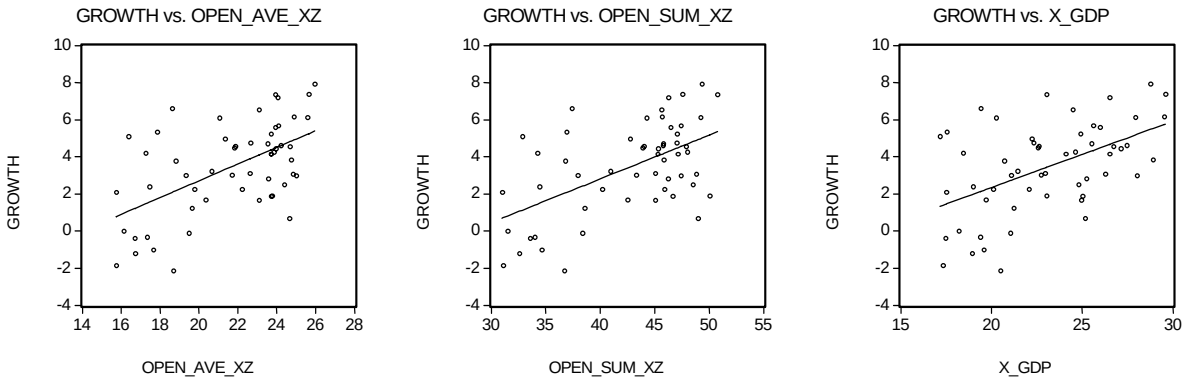


Table 6.2: Correlation matrix for GROWTH, OPEN_SUM_XZ, OPEN_AVE_XZ and X_GDP

	GROWTH	OPEN_SUM_XZ	OPEN_AVE_XZ	X_GDP
GROWTH	1.000	0.555	0.559	0.512
OPEN_SUM_XZ	0.555	1.000	0.972	0.839
OPEN_AVE_XZ	0.559	0.972	1.000	0.942
X_GDP	0.512	0.839	0.942	1.000

The question of causality and its direction is best answered by a test for Granger causality. The first step in establishing causality would be to select the proper lag order for each series. The results are reported in table 6.3. The sample period is 1946 to 2000.

Table 6.3: Test results of the lag order of openness variables

	Lag order	p-value	AIC	SIC
GROWTH	1	0.0005	4.482	4.482
OPEN_AVE_XZ	2	0.0327	2.474	2.474
OPEN_SUM_XZ	1	0.0000	4.312	4.312
X_GDP	1	0.0179	2.759	2.759
X_MAN_GDP	3	0.0322	2.292	2.466

Results describe p-values on the last lag as well as Akaike and Schwarz selection criteria results for the final model. The lag orders are subsequently used in Granger causality tests. The results are provided in table 6.4.

Table 6.4: Pairwise Granger causality tests for openness and economic growth, 1946 to 2000

Null hypothesis:	Lag order	Obs	F-stat	Probability
OPEN_AVE_XZ does not Granger Cause GROWTH	2	52	5.52	0.0070***
GROWTH does not Granger Cause OPEN_AVE_XZ			5.06	0.0102**
OPEN_SUM_XZ does not Granger Cause GROWTH	1	53	4.94	0.0308**
GROWTH does not Granger Cause OPEN_SUM_XZ			0.00	0.9342
X_GDP does not Granger Cause GROWTH	1	53	12.90	0.0008***
GROWTH does not Granger Cause X_GDP			0.75	0.3915
X_MAN_GDP does not Granger Cause GROWTH	3	37	2.37	0.0907*
GROWTH does not Granger Cause X_MAN_GDP			0.61	0.6134

Note: ***/**/* indicate rejection of the hypothesis at the 1/5/10 per cent level of significance.

All measures of openness are indicative of a causal relationship running from openness to economic growth. In the case where openness is measured as the sum of exports and imports as a percentage of GDP, there is indication of bidirectional causality.

To further investigate the dynamics of the system, the vector autoregression (VAR) model is estimated. Table 6.5 reports the results of the VAR with lag order 1 for the relationship between growth and openness according to the measure of imports plus exports as a percentage of GDP. What is important is the first column of results with growth as the dependent variable. Both slope coefficients are significant and carry the correct sign. Results for other measures are in accordance and therefore not reported.

Table 6.5: Vector autoregression model estimating the effect of openness, measured by the sum of exports and imports, on economic growth

Sample (adjusted): 1948-2000
Included observations: 53 after adjusting endpoints
t-statistics in parentheses

	GROWTH	OPEN_SUM_XZ
GROWTH(-1)	0.2777	-0.0113
	(1.922)	(-0.083)
OPEN_SUM_XZ(-1)	0.1381	0.9370
	(2.223)	(15.979)
C	-3.3692	2.6936
	(-1.396)	(1.1824)
R-squared	0.2828	0.8815
Adj R-squared	0.2541	0.8767
Sum sq resides	231.58	206.28
SE equation	2.1521	2.0311
F-statistic	9.8591	186.03
Log likelihood	-114.28	-111.21
Akaike IC	4.4257	4.3100
Schwarz IC	4.5372	4.4215

Statistical significance exists to support the theoretical positive impact of openness on the economic growth rate. Economic growth is also impacted by its first lag. The positive sign shows a positive momentum to economic growth.

The strength of the causality was further investigated with the Sims variance decomposition test. Table 6.6 contains the results from this analysis for a 10 year period for the measurement of openness as the sum of exports and imports as a percentage of GDP.

Table 6.6: Variance decomposition of growth due to innovations in openness

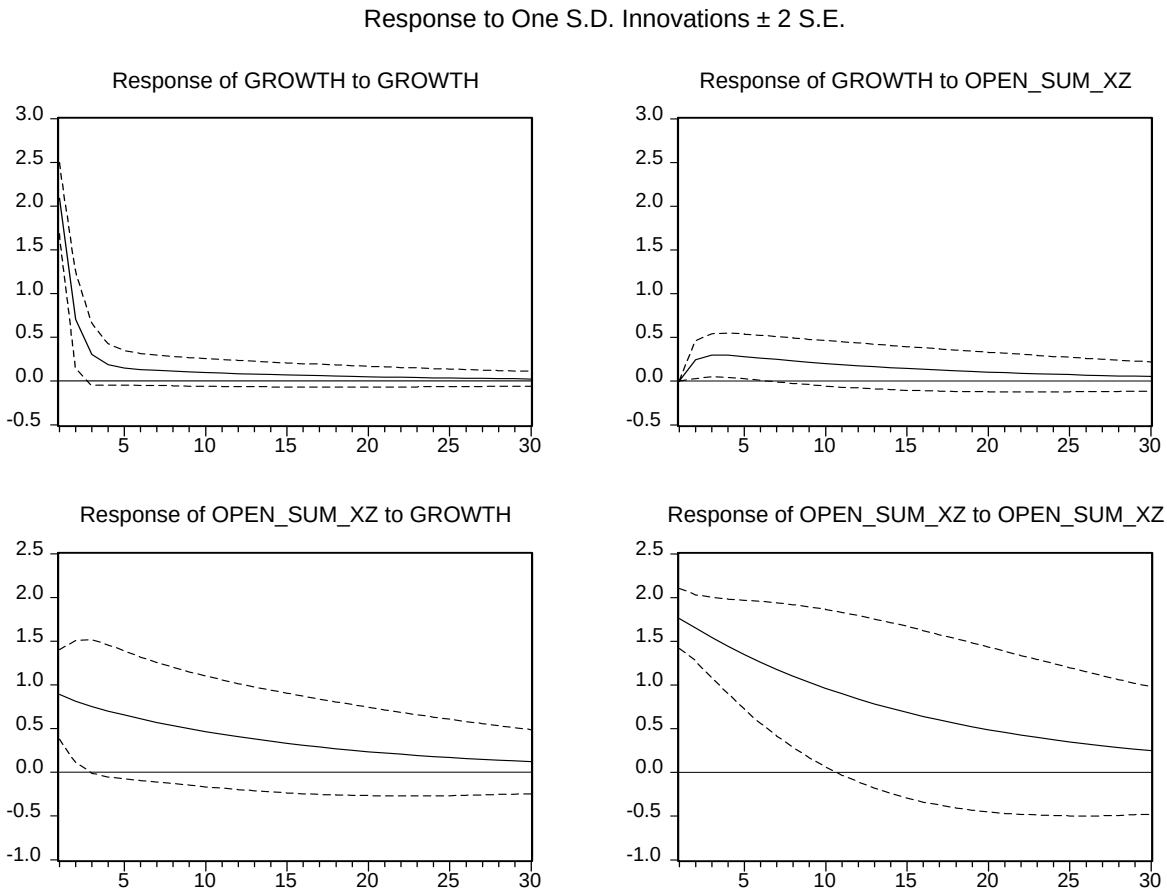
Period	SE	GROWTH	OPEN_SUM_XZ
1	2.090	100.000	0.000
2	2.218	98.799	1.200
3	2.259	97.134	2.865
4	2.286	95.536	4.463
5	2.308	94.138	5.861
6	2.327	92.944	7.055
7	2.343	91.928	8.071
8	2.357	91.061	8.938
9	2.369	90.321	9.678
10	2.380	89.687	10.312

For the period under consideration, innovations in openness explain a relatively small portion, but with an increasing long-run significance (up to 10 per cent), of the forecast error variance of the economic growth rate directly, and thus support results obtained from Granger causality tests.

Finally, impulse response functions for the two-variable system are examined in order to throw light upon the dynamics of the relationship. Impulse responses summarise the short-run and long-run effects of various shocks to the system and are displayed in figure 6.4.

The first of the four graphs in figure 6.4 proves that economic growth is responsive to shocks to itself, while in the second graph, increases in the openness of the economy to international trade and investment serves as a stimulus for higher growth. This positive impact is sustained, and after 30 periods the relationship is still above the long-run level. Convergence back to the long-run growth level therefore takes place more than 30 periods after innovations in openness.

Figure 6.4: Impulse response functions of economic growth due to innovations in openness



The conclusion that can be drawn from the above analysis of the relationship between openness of the economy to international trade and investment is that barriers to openness must be limited in the form of import tariffs and quotas, and exports must be promoted since export-led growth in line with the new growth theories remains important for the future. For obvious reasons, however, imports of productive capital goods are needed more than imports of nonproductive luxury goods in order to revive the economy. Export promotion should concentrate on manufactured goods rather than primary products in the long run, a skilled workforce may contribute to higher competitiveness in the export of manufactured goods.

To complete the analysis on openness and its impact on economic growth, the share of manufactured exports in GDP is analysed. The share of manufactured exports in GDP is stationary in levels, and according to table 6.4, the ratio of manufactured exports in GDP Granger causes economic growth.

Since the prerequisites of stationarity of the series allow it, a vector autoregression model with lag order 3 is fitted to establish the significance of the relationship.

Table 6.7: Vector autoregression model estimating the effect of the ratio of manufacturing exports to GDP on economic growth

Sample(adjusted): 1960-1996
Included observations: 37 after adjusting endpoints
t-statistics in parentheses

	GROWTH	X_MAN_GDP
GROWTH(-1)	0.4888	0.0071
	(2.960)	(0.132)
GROWTH(-2)	-0.0049	-0.0419
	(-0.026)	(-0.698)
GROWTH(-3)	0.1184	-0.0336
	(0.710)	(-0.623)
X_MAN_GDP(-1)	0.0491	0.8067
	(0.093)	(4.726)
X_MAN_GDP(-2)	0.9122	-0.0755
	(1.324)	(-0.338)
X_MAN_GDP(-3)	-1.2558	-0.3533
	(-2.403)	(-2.087)
C	3.5573	5.0909
	(0.977)	(4.319)
R-squared	0.4127	0.6389
Adj R-squared	0.2952	0.5666
Sum sq resides	155.0516	16.281
SE equation	2.2734	0.7366
F-statistic	3.5135	8.8465
Log likelihood	-79.0082	-37.314
Akaike IC	4.6490	2.3953
Schwarz IC	4.9538	2.7001

According to the above result, in addition to the first lag of growth itself, the only other significant independent variable was the third lag of the manufactured exports to GDP ratio, which carries a negative sign. This either insignificant or negative relationship between manufactured exports and economic growth is confirmed by the fact that the simple correlation coefficient between these two variables is -0.052. This may be indicative that manufacturing exports did not really contribute to economic growth in the past, contrary to the experience of the fast-growing East Asian countries. This could be an indication that the largely primary exports of the past (Dutch disease effect) and the sanctions campaign of the late 20th century detracted from manufacturing export growth and that potential additional sources of growth can be induced with a policy regime conducive to manufacturing rather than primary exports.

In the light of the above results, the tools of variance decomposition and impulse response functions are not all that useful, and are therefore not explored any further.

6.4.2 Investment and selected constituent parts as stimuli to economic growth

This section deals with the validity of the notion that investment is a stimulus to growth. From the early growth models of Harrod (1959:295) and Domar (1947:282), the neoclassical theory (Solow 1957:312), the growth accounting work of Denison (1967:159, 194) and the endogenous growth theory (Romer 1990b:S89), investment featured prominently in one of its various forms. More recent research also focused on this variable. Levine and Renelt (1992:959) used the extreme bounds test and found the share of capital investment to GDP to be the only robust growth variable (see section 5.2.5 on p102).

Other researchers subsequently felt that the extreme bounds criteria were too stringent which resulted in the conclusion that nothing is robust. Sala-i-Martin (1997:17) devised new criteria for significant growth-inducing variables, which widened the scope for robust variables and also included, *inter alia,* equipment investment and non-equipment investment. De Long and Summers

(1991:449) justified the exclusion of the transportation investment component, because it "reflects differences in the 'need' for transportation caused by differences in urbanization and population density".

In South Africa where large portions of the production facilities are located far from the coast, a lack of transport infrastructure investment could impede growth (see section 5.2.7 on p106). It was therefore decided to test for such a possibility (I_TRCO_RAT, representing the portion of capital formation of transport, storage and communication in total gross fixed capital formation). In line with other international studies, the following representative set of variables was also tested: the ratio of gross fixed capital formation to GDP (I_GDP), growth in gross fixed capital formation (I_GROWTH), investment in manufacturing and other equipment as ratio of total gross fixed capital formation (I_MAEQ_RAT). Since this variable is not stationary, the first difference thereof was also subjected to the tests of Granger causality, that is, testing the hypothesis that the change in the ratio would contribute towards growth.

The logic for choosing the machinery and equipment part of total investment as a possible source of growth lies in the new technology that is inevitably incorporated into new machinery and equipment. The new growth theory stresses the importance of technology as a pivotal factor in endogenous growth. Romer (1994:21) stressed that the best way for a developing country to accelerate its growth would be to find the best institutional arrangements for gaining access to the knowledge that already exists in the world. Keller (1997:1) estimated that as much as 20 per cent of growth can be attributed to foreign R&D investments in developed countries, and he conjectures that "this effect could be higher for less industrialised countries importing from OECD countries."

A discussion of the empirical results follows. Firstly, simple correlations between the selected investment variables and economic growth are reported in table 6.8. Of these, a significant positive relationship exists between investment growth and economic growth, with a simple correlation coefficient of 0.51. Investment in transport, storage and communication displayed only a weak positive relationship with economic growth, while the ratio of investment

in machinery and other equipment displayed a rather strong negative relationship with economic growth, with a simple correlation coefficient of –0.43. The reason for that is that this type of investment increased from around 20 per cent of total capital formation in the 1950s to more than 50 per cent in the 1990s, and could therefore be considered a growth inhibitor.

This is in contradiction with *a priori* expectations since equipment investment was found to be a significant growth contributor by both De Long and Summers (1991:485), and subsequently confirmed by Sala-i-Martin (1997:17). Since the above-mentioned variable is not stationary in levels, the first difference was also analysed, that is, the change in the ratio. However it bears no significant relationship to economic growth.

Table 6.8 Correlation matrix for GROWTH, I_GDP, I_GROWTH, I_TRCO_RAT and I_MAEQ_RAT

	GROWTH	I_GDP	I_GROWTH	I_TRCO_RAT	I_MAEQ_RAT
GROWTH	1.000	-0.045	0.512	0.119	-0.429
I_GDP	-0.045	1.000	0.145	0.314	-0.068
I_GROWTH	0.512	0.145	1.000	0.102	-0.159
I_TRCO_RAT	0.119	0.314	0.102	1.000	-0.352
I_MAEQ_RAT	-0.429	-0.068	-0.159	-0.352	1.000
I_MAEQ_RAT_D	0.007	-0.061	0.294	-0.055	0.486

Analysing the above results further, the proper lag length was selected with the aid of an AR model on individual series. These results are reported in table 6.9.

Table 6.9: Testing for the lag order of investment variables

	Lag order	p-value	Akaike	Schwarz
GROWTH	1	0.0005	4.482	4.482
I_GDP	3	0.0126	2.971	3.123
I_GROWTH	1	0.0005	6.680	6.794
I_TRCO_RAT	1	0.0000	-4.762	-4.688
I_MAEQ_RAT	1	0.0000	-5.496	-5.422
I_MAEQ_RAT_D	1	0.0820	-5.486	-5.412

Given the above lag orders, Granger causality tests were performed on the data, and the results reported in table 6.10. A bidirectional relationship seems

to exist between investment and growth, except for the investment in transport and communication variable, where the Granger causality test suggests an inverse causality. (Although the test was performed for the variable measuring investment in machinery and other equipment and its first difference, less value should be attached to it, given the negative and almost zero correlation coefficients reported in table 6.8.)

Barro and Sala–i–Martin (1995:433) refer to the possible reverse relation between growth prospects and investment by observing that: "... much of the positive estimated effect of the investment ratio on growth in typical cross-country regressions reflects the reverse relation between growth prospects and investment". Investment appears to lead to higher growth, but growth prospects also play a role in the level and increase in investment.

Table 6.10: Pairwise Granger causality tests for investment and economic growth, 1946 to 2000

Null hypothesis:	Lag order	Obs	F-stat	Probability
I_GDP does not Granger Cause GROWTH	3	50	3.40	0.03**
GROWTH does not Granger Cause I_GDP			4.71	0.007***
I_GROWTH does not Granger Cause GROWTH	1	52	2.50	0.08*
GROWTH does not Granger Cause I_GROWTH			3.65	0.02**
I_TRCO_RAT does not Granger Cause GROWTH	1	52	1.56	0.21
GROWTH does not Granger Cause I_TRCO_RAT			5.98	0.02**
I_MAEQ_RAT does not Granger Cause GROWTH	1	52	7.56	0.008***
GROWTH does not Granger Cause I_MAEQ_RAT			1.96	0.17
I_MAEQ_RAT_D does not Granger Cause GROWTH	1	52	0.34	0.56
GROWTH does not Granger Cause I_MAEQ_RAT_D			6.25	0.02**

Note: ***/**/* indicate rejection of the hypothesis at the 1/5/10 per cent level of significance.

The inverse relationship between investment in transport and communication seems to reveal that public sector participation through the South African railways and harbour projects and the large investment of ESKOM could have

reflected the result of the need for such infrastructure because of the remoteness of the large PWV industrial area from the main harbours, but did not really contribute to growth. This finding is thus in line with that of De Long and Summers (1991:449) who justified the exclusion of the transportation investment component because it "reflects differences in the 'need' for transportation caused by differences in urbanization and population density".

Table 6.11 reports the results of the VAR with lag order 1 for the relationship between growth and investment growth.

Table 6.11: Vector autoregression model estimating the effect of investment growth on economic growth, and *vice versa*

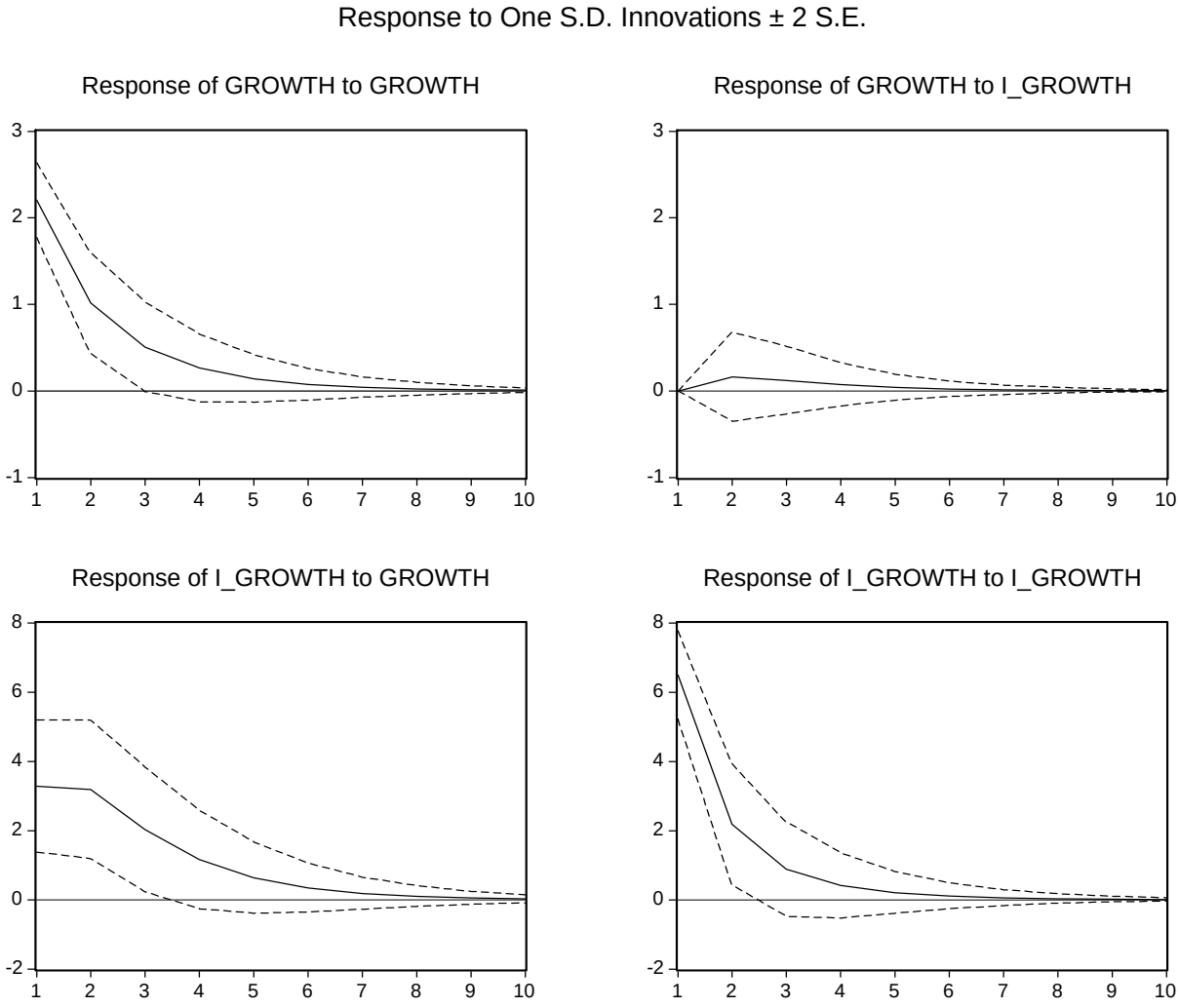
Sample(adjusted): 1948 2000 Included observations: 53 after adjusting endpoints t-statistics in parentheses		
	GROWTH	I_GROWTH
GROWTH(-1)	0.4221 (2.886)	0.9465 (1.958)
I_GROWTH(-1)	0.0247 (0.608)	0.3351 (2.489)
C	1.8747 (3.445)	-0.9210 (-0.512)
R-squared	0.2220	0.2893
Adj R-squared	0.1902	0.2603
Sum sq resides	252.71	2758.7
SE equation	2.2710	7.5033
F-statistic	6.9929	9.9767
Log likelihood	-114.89	-177.03
Akaike IC	4.5342	6.9245
Schwarz IC	4.6468	7.0371

The bidirectional causality is evident from the result with the causality running from economic growth to investment growth containing a statistically significant coefficient on the lagged economic growth variable. In the case of economic

growth as a dependent variable, the coefficient on the lagged investment variable is statistically insignificant, but positive.

The strength of the effect is also noticeable from the impulse response functions reported in figure 6.5. According to this result, an innovation in investment growth seems to have a relatively smaller effect on economic growth, than the other way round, namely that stimuli to economic growth will lead to higher investment demand and consequently higher rates of investment.

Figure 6.5: Impulse response functions of economic growth due to innovations in investment growth



The conclusion of this section on investment and economic growth is that the investment to GDP ratio had a negative (-0.05) correlation with growth, while the first difference of this ratio had a positive and impressively stronger (0.31)

correlation with growth. Contrary to the findings of Levine and Renelt (1992:959), who used the extreme bounds test and found that the share of capital investment to GDP was the only robust growth variable, this analysis for South Africa shows that the effect of investment variables on economic growth in South Africa was rather disappointing because its influence on growth was statistically insignificant.

However, the reverse influence of growth on investment was statistically significant and positive, in line with the finding of King and Levine (1994:259) who came to a similar conclusion as the one tested in this study and advised that the role of investment and physical capital accumulation in economic growth and development should be revised. They concluded that the modern version of capital fundamentalism describing capital and investment as the primary determinants of economic development and long-run growth should be scaled down. They proposed that the relationship should be viewed as a part of the process of economic development and growth and not as the primary connecting source. The new view should be the guide to research and policy advice.

The findings of the current study and the one quoted above are in line with those of Easterly and Levine (2000:17) who conclude that "… evidence suggests that physical and human capital accumulation do not cause faster growth". A study by Blomstrom, Lipsey and Zejan (1996:275), show that "simple causality tests suggest that growth induces subsequent capital formation more than capital formation induces subsequent growth." Injections of capital do not seem to be the driving force of future growth. Easterly and Levine (2000:4), found evidence which "suggests that creating the conditions for productive capital accumulation is more important than capital accumulation *per se* and that policymakers should focus more on policies that encourage total factor productivity growth". Section 6.4.7, specifically 6.4.7.1 to 6.4.7.5, confirms this finding for South Africa.

6.4.3 Government spending

In this section, different measures of government spending are used: firstly, the ratio of government spending to GDP used by Gwartney *et al* (1998:4), as well as the ratio of government spending less spending on education and defence to the GDP. The second variable is what Barro (1997:26) terms "nonproductive" spending. In both instances, the growth rates in these variables are also analysed (see section 5.2.3 on page 99).

Figure 6.6: Simple scatter graphs of growth versus government spending variables

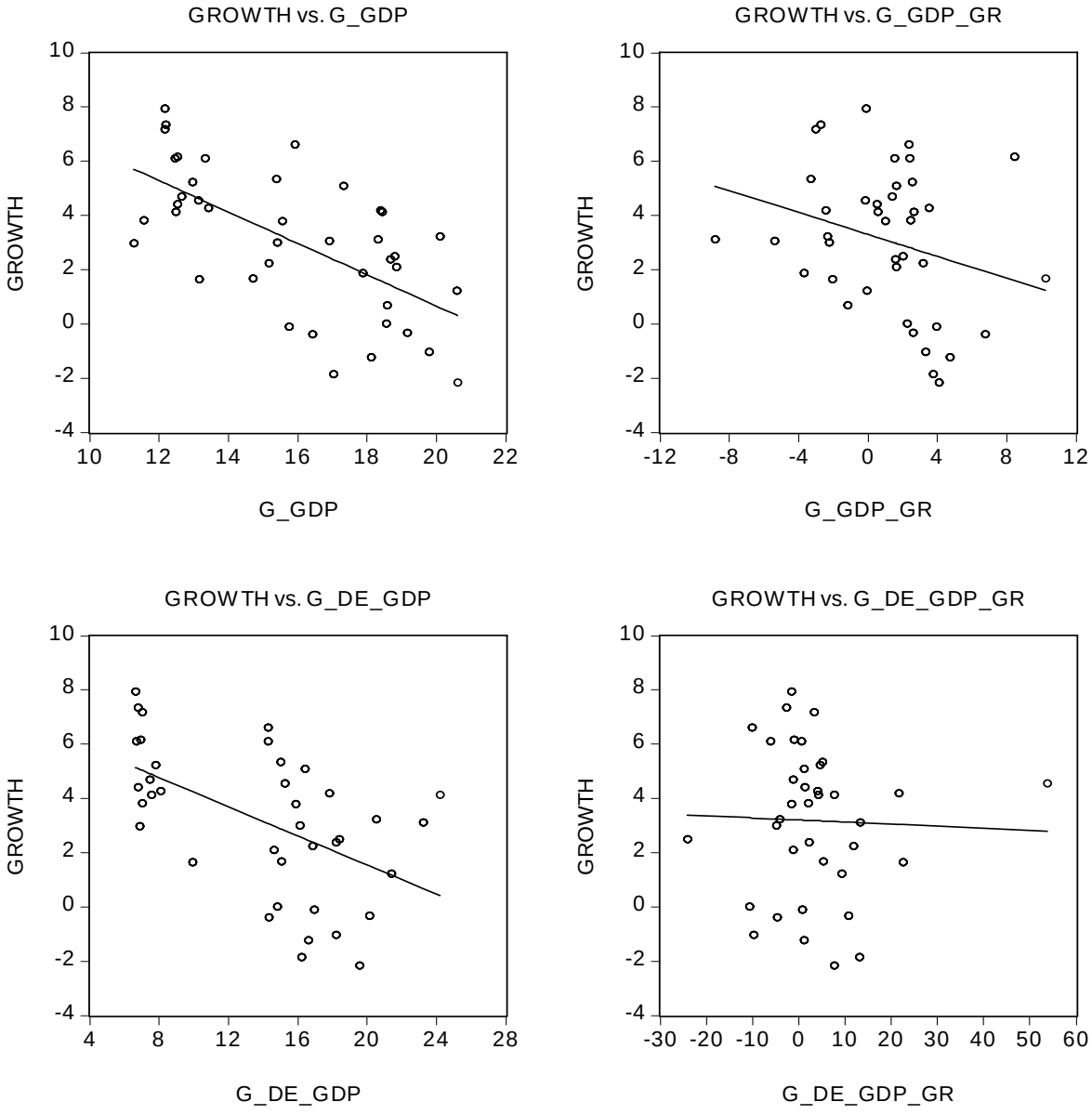


Table 6.12: Correlation matrix for growth, G_GDP G_GDP_GR, G_ED_GDP and G_ED_GDP_GR

	GROWTH	G_GDP	G_GDP_GR	G_ED_GDP	G_ED_GDP_GR
GROWTH	1.000	-0.641	-0.275	-0.535	-0.034
G_GDP	-0.641	1.000	-0.097	0.885	-0.134
G_GDP_GROWTH	-0.275	-0.097	1.000	-0.145	-0.207
G_ED_GDP	-0.535	0.885	-0.145	1.000	0.071
G_ED_GDP_GR	-0.034	-0.134	-0.207	0.071	1.000

In all cases a negative relationship exists between government spending variables and the economic growth rate. The ratios of government spending to GDP are better (although negatively) correlated with growth if compared to the growth rates in these ratios. In order to establish causality, the lag order for each individual series should first be determined. These results are reported in Table 6.13.

Table 6.13: Testing for the lag order of government spending variables

	Lag order	**p-value**	**AIC**	**SIC**
GROWTH	1	0.0005	4.482	4.482
G_GDP	1	0.0000	1.763	1.848
G_GDP_GROW	0	-	-	-
G_ED_GDP	1	0.0000	3.994	4.081
G_ED_GDP_G	0	-	-	-

The results describe p-values on the last lag as well as Akaike and Schwarz selection criteria results for the final model. Two variables, namely G_GDP_GR and G_ED_GDP_GR, do not necessitate the inclusion of any lags to render the series white noise. A lag order of one would therefore be used for analyses of government spending variables. Results of Granger causality tests are provided in table 6.14.

Table 6.14: Testing for Granger causality of government spending variables

Null hypothesis:	Lag order	Obs	F-stat	Probability
G_GDP does not Granger Cause GROWTH	1	40	6.33	0.0163**
GROWTH does not Granger Cause G_GDP			0.79	0.3772
G_GDP_GROWTH does not Granger Cause GROWTH	1	39	0.09	0.7660
GROWTH does not Granger Cause G_GDP_GR			0.97	0.3550
G_ED_GDP does not Granger Cause GROWTH	1	37	4.79	0.0355**
GROWTH does not Granger Cause G_ED_GDP			2.59	0.1167
G_ED_GDP does not Granger Cause GROWTH	1	36	1.08	0.3067
GROWTH does not Granger Cause G_ED_GDP			0.24	0.6269

Note: ***/**/* indicate rejection of the hypothesis at the 1/5/10 per cent level of significance.

For two of the measured variables, the Granger causality tests suggest the causality exists, running from government spending to growth. Thus an increase in government spending, especially nonproductive spending, might lead to a decrease in economic growth. Both the VAR models are presented in tables 6.15 and 6.16. In both cases, using government spending to explain growth, coefficients are negative and statistically significant. Comparing the impulse response functions, presented in figure 6.7, on can deduce that the negative effect of nonproductive spending on growth is higher than that of total government spending. This is also a long-run effect, since after 20 periods the growth level is still below the original long-run path.

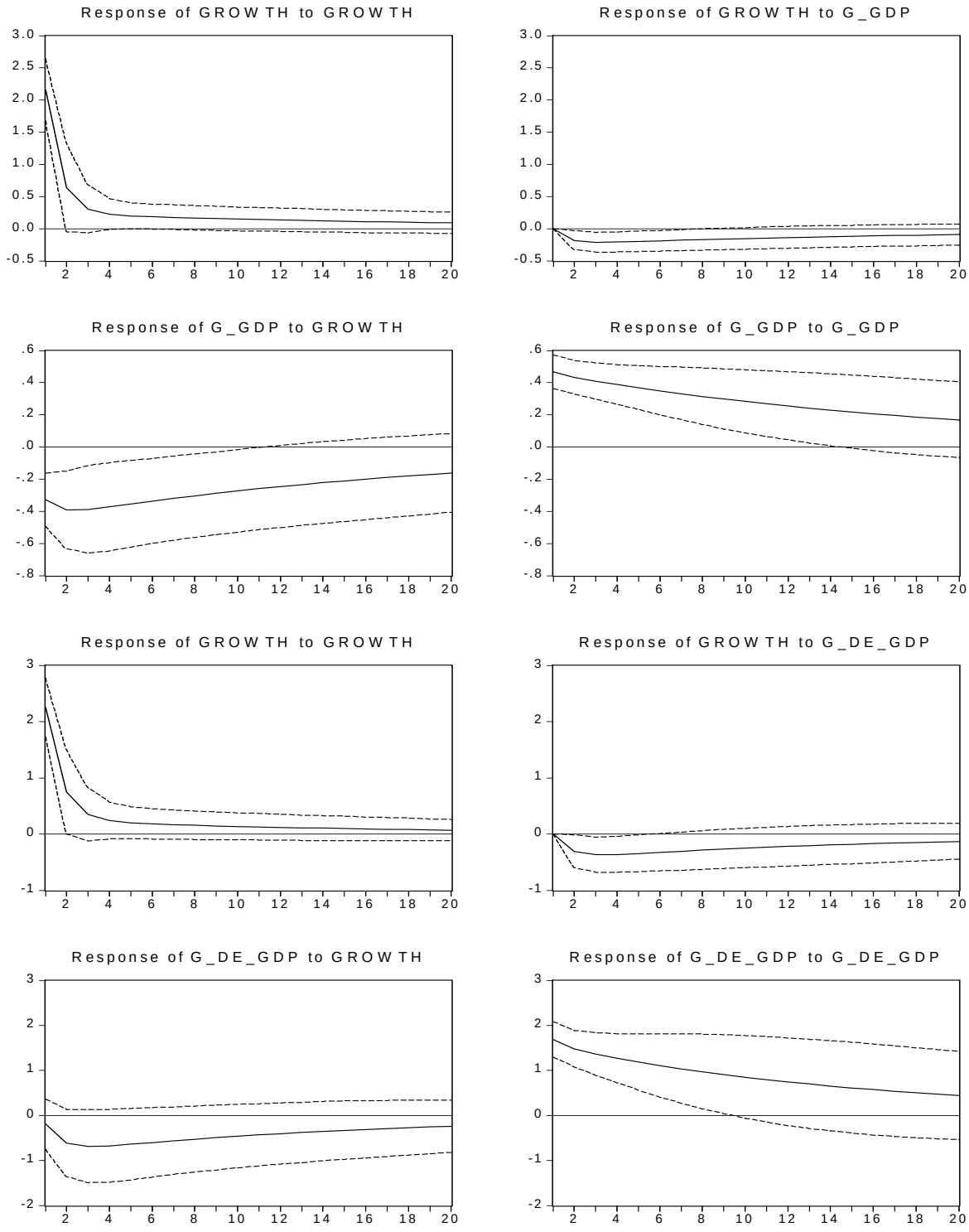
Table 6.15: Vector autoregression model estimating the effect of government spending as a ratio of GDP on economic growth and *visa versa*

Sample(adjusted): 1961-2000 Included observations: 40 after adjusting endpoints t-statistics in parentheses		
	GROWTH	G_GDP
GROWTH(-1)	0.2367 (1.390)	-0.0403 (-0.893)
G_GDP(-1)	-0.3871 (-2.516)	0.9272 (22.71)
C	8.4642 (3.006)	1.4144 (1.894)
R-squared	0.3699	0.9615
Adj R-squared	0.3359	0.9594
Sum sq resides	172.06	12.103
SE equation	2.1564	0.5719
F-statistic	10.863	462.31
Log likelihood	-85.937	-32.849
Akaike IC	4.4468	1.7924
Schwarz IC	4.5735	1.9191

Table 6.16: Vector autoregression model estimating the effect of government spending, less defence and education spending, as a ratio of GDP on economic growth and *vice versa*

Sample(adjusted): 1961-2000 Included observations: 40 after adjusting endpoints t-statistics in parentheses		
	GROWTH	G_DE_GDP
GROWTH(-1)	0.3180 (1.943)	-0.1987 (-1.609)
G_DE_GDP(-1)	-0.1813 (-2.190)	0.8779 (14.05)
C	4.6704 (3.040)	2.6322 (2.271)
R-squared	0.3509	0.9023
Adj R-squared	0.3127	0.8966
Sum sq resides	172.36	98.050
SE equation	2.2515	1.6981
F-statistic	9.1929	157.11
Log likelihood	-80.966	-70.530
Akaike IC	4.5387	3.9746
Schwarz IC	4.6693	4.1052

Figure 6.7: Impulse response functions of economic growth due to innovations in government spending as a ratio of GDP (G_GDP) and innovations in government spending, excluding spending on defence and education as a ratio of GDP (G_DE_GDP).



6.4.4 The ratios of gross value added in agriculture, mining, manufacturing and the remaining residual (construction, electricity, retail, wholesale, etc) to GDP and its respective relationships with economic growth

The focus of this section is on a group of variables consisting of the ratios of gross value added to GDP. Sachs and Warner (1995:42,43) used the share of agriculture as a percentage of the GDP and also the gross value added of manufacturing as a percentage of GDP. Sala-i-Martin (1997:17) and Hall and Jones (1996:9) used the gross value added of mining as a percentage of GDP in their analyses. This section throws light on the growth empirics of these sector contributions. To complete the analyses, the gross value added of the remaining sectors combined expressed as a percentage of GDP is termed the residual sector in this study (see section 5.2.8 on page 107).

The contribution of the agricultural sector to GDP was the highest in 1947 and 1948 when it was 7.2 percent and the lowest in 1983 when it was only 3.2 per cent. The relative contribution of the sector declined. The average year-on-year growth rate of gross value added for the agricultural sector for the period 1960 to 2000, namely 2.8 per cent, is lower than the average real economic growth rate of 3.4 per cent for the period. This phenomenon may be regarded as an impeding effect on total GDP growth. The contribution of the agricultural sector at constant 1995 prices increased from the initial R6.4 billion in 1946 to over R24 billion in 2000, which is almost a fourfold increase. Table 6.18 shows a simple correlation coefficient of 0.42 between growth and agriculture to GDP ratio.

The growth rate of the agriculture gross value added series shows wide variations over time, ranging between –27 per cent and +30 per cent. These variations are the result of unpredictable weather conditions exacerbated by the wide range of agricultural land, which varies from semi-arid to sub-tropical.

The contribution of the mining industry to GDP increased from just over 13 per cent in the late 1040s to reach its pinnacle of 16.2 per cent in 1962. Thereafter it declined steadily to 8.5 per cent of GDP in 1975. The mining contribution then increased marginally with the freeing of the gold price, making possible

the mining of lower grade ore, and also as a result of the exploitation of new minerals such as chrome and platinum. The declining trend nevertheless resumed and the contribution of this sector was at an all-time low of 5.5 per cent of GDP in 2000. These shrinkages of the contribution of the mining sector as a percentage of GDP are an indication of lower growth in the mining sector, which reduced the economic growth stimulus stemming from this sector – the average year-on-year growth for the mining sector was only 0.6 per cent for the period 1960 to 2000 (see section 5.2.10 on page 108).

The contributions of mining to GDP in constant prices are more stable than the current price contributions because wide swings in the price of gold increased the current price contribution between 1970 and 1990. The gold price soared from $35 an ounce in 1970 to reach its highest ever level of $613 (average) in 1980. Thereafter it dwindled to below $300 in 1998, and further to below $280 in 2000. The ratio of mining to GDP (constant prices) is positively correlated to economic growth with a coefficient of 0.58 (table 6.18).

The share of manufacturing to GDP rose steadily over the decades from about 10 per cent in the 1940s to its highest contribution of 21.3 per cent in 1981, where after it stabilised on just over 20 per cent for the whole of the 1980s. In the 1990s it declined steadily to just over 18 per cent by 2000 (see section 5.2.11 on page 108).

The figures on the manufacturing to GDP ratio against the growth of the economy shows that as the contribution to GDP from the manufacturing sector increased, the growth in real GDP remained around an average of about 4 per cent per annum. The real GDP growth rate decreased to about 2 per cent or half of its former average when manufacturing growth declined, causing the manufacturing sector contribution to stabilise at first, and subsequently to decline. Figure 6.8 depicts the two growth rates (manufacturing and GDP) over time and shows a remarkable tandem movement. The simple correlation coefficient of this variable to GDP is a high 0.86 as reported in table 6.18.

The graph depicting the contribution of the residual group to GDP and growth show an almost perfect mirror image. When this ratio declined between the 1940s and the 1960s, the GDP growth rate increased, and when this ratio rose

from the late 1960s to the present, the GDP growth rate recorded a declining trend.

The figure representing the growth of GDP and the growth of the residual group reveals a remarkable similarity, which is partly the result of the large share of this group in total GDP. The correlation coefficient (0.98) between the GDP growth rate and the residual series growth rate is high, while the correlation between the share of the residual group and the GDP growth rate is negative at -0.51, implying that the growth rate declines with an increasing share of the residual group.

Table 6.17 confirms that the agriculture and mining sectors, on average, grew at a slower rate than the total economy, while the manufacturing and service sectors grew at a faster rate. As such, these are therefore important variables in determining the growth rate of the country.

Table 6.17: Average growth rates and spread of growth for agriculture, mining, manufacturing and residual sectors, 1960 to 2000

GROWTH	Agriculture	Mining	Manufacturing	Residual	Total economy
Mean	2.8	0.6	4.1	3.2	3.1
Maximum	30.4	7.9	15.8	6.9	7.9
Minimum	-27.3	-7.9	-5.2	-1.2	-2.1

Figure 6.8: Main sector contributions to GDP and main sectoral growth rates and its respective relationships to economic growth

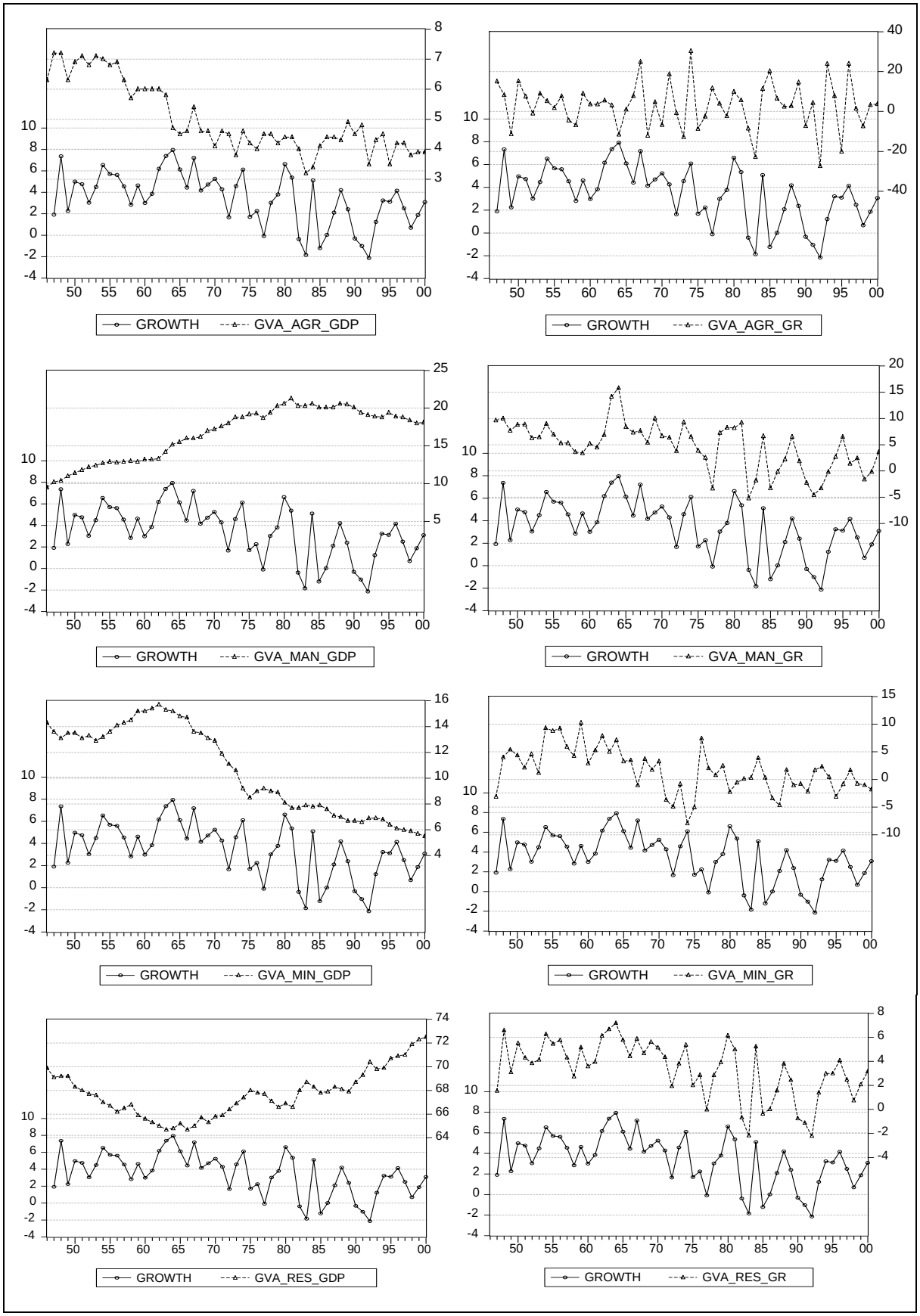


Table 6.18: Simple correlation coefficients for the contributions to GDP and growth rates of agriculture, mining, manufacturing and the residual sector and economic growth, 1946 to 2000

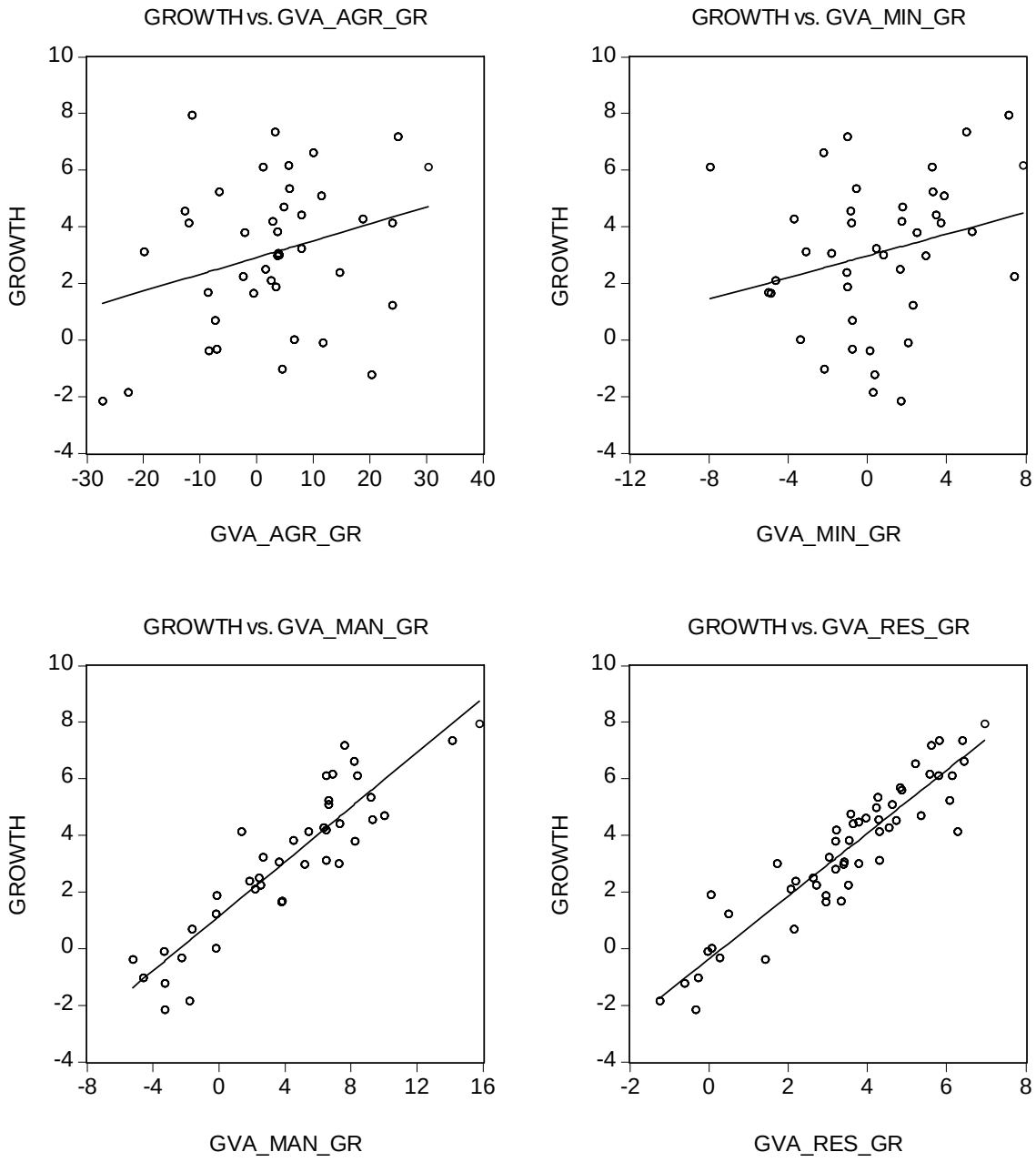
Variable	Correlation coefficient
GVA_AGR_GDP	0.424
GVA_MIN_GDP	0.576
GVA_MAN_GDP	-0.435
GVA_RES_GDP	-0.513
GVA_AGR_GROWTH	0.299
GVA_MIN_GROWTH	0.368
GVA_MAN_GROWTH	0.861
GVA_RES_GROWTH	0.983

The simple correlation coefficients for the growth rates of the agriculture and mining sectors are lower than for their shares in GDP respectively. For the manufacturing and service (residual) sectors, the correlations to growth for the growth rates of the sectors are more pronounced than for their shares in GDP. The shares to GDP of the latter sectors show negative correlations to growth, the result of a substantial increase in both of these sectors' contributions to GDP, while the long-run growth trend is rather flat to slightly negative, as indicated in figure 6.8. The data clustering in figure 6.9 confirms these observations.

The simple correlation coefficient of the residual sector ratio to GDP growth is - 0.51 indicating that if the sector increases relative to other sectors, the economic growth rate can be expected to decline. Because of the size of this sector it is not surprising that the correlation of its growth to economic growth was remarkably high at 0.98, which is indicated by the scatter graph in which the individual points are concentrated around the fitted line.

Since only the growth rates of the gross value added series are stationary and the gross value added expressed as a percentage of GDP are not, only the first mentioned variables will be analysed further, applying econometric tools applicable to stationary time series.

Figure 6.9: Simple scatter graphs of growth in different sectors and real economic growth rate



In the case of the manufacturing sector and the tertiary sectors, the growth rates shows closer correlations to growth, indicating the importance of the size of these sectors in a more mature economy.

The next section addresses the lines of causality between this group of variables and growth, firstly determining the proper lag order for this set of variables.

Table 6.19: Testing for the lag order of gross value added variables

	Lag order	p-value	AIC	SIC
GROWTH	1	0.0005	4.482	4.482
GVA_AGR_GR	2	0.0150	2.816	7.944
GVA_MIN_GR	1	0.0072	5.249	5.333
GVA_MAN_GR	1	0.0005	5.800	5.800
GVA_RES_GR	1	0.0001	4.012	4.087

The table gives p-values on the last lag as well as Akaike and Schwarz selection criteria results for the final model. The lag orders are subsequently used in Granger causality tests. These results are provided in Table 6.20.

Table 6.20: Pairwise Granger causality tests for gross value added growth rates in different sectors of the economy and economic growth, 1960 to 2000

Null hypothesis:	Lag order	Obs	F-stat	Probability
GVA_AGR_GR does not Granger Cause GROWTH	2	39	2.43	0.1029
GROWTH does not Granger Cause GVA_AGR_GR			1.01	0.3744
GVA_MIN_GR does not Granger Cause GROWTH	1	40	1.68	0.2022
GROWTH does not Granger Cause GVA_MIN_GR			0.00	0.9527
GVA_MAN_GR does not Granger Cause GROWTH	1	40	7.52	0.0094***
GROWTH does not Granger Cause GVA_MAN_GR			0.00	0.9740
GVA_RES_GR does not Granger Cause GROWTH	1	40	0.73	0.3984
GROWTH does not Granger Cause GVA_RES_GR			4.89	0.0315**

Note: ***/**/* indicate rejection of the hypothesis at the 1/5/10 per cent level of significance.

The most important sector for growth seems to be the manufacturing sector, firstly because it displays direct and highly significant Granger causality from

manufacturing sector growth to economic growth. Stimulation of growth in this sector would therefore have job creation spin-offs in the rest of the economy as well. The growth in this sector could be further enhanced if growth in manufacturing exports could also be stimulated. The effect of manufacturing export growth on economic growth is illustrated by the fast-growing East Asian economies and China.

However, a reverse causality seems to exist between growth in the service sectors and economic growth in general. A significant reason for this could be the large share of public corporations or state institutions that are included in the services sector, such as rail transport and harbours, post and telecommunications, which are virtually state monopolies and therefore in most cases lack the pressure of competition. This is compounded by the notorious difficulty of measuring productivity in service sectors, and if productivity is not measured, there is no way of showing that it is high or low or improving or deteriorating. Although some of the public corporations have been privatised, the largest part of their data reflects the performance of their previous status as public institutions.

To further investigate the dynamics of the system, the vector autoregression (VAR) model for the manufacturing sector is estimated. Table 6.21 reports the results of the VAR with lag order 1 for the relationship between growth and the growth in gross value added in the manufacturing sector. What is important is the first column of results with growth as dependent variable. The coefficient for manufacturing is significant and carries the correct sign.

Table 6.21: Vector autoregression model estimating the effect of growth in the manufacturing sector on real economic growth

Sample(adjusted): 1961-2000 Included observations: 40 after adjusting endpoints t-statistics in parentheses		
	GROWTH	GVA_MAN_GROWTH
GROWTH(-1)	-0.2527 (-1.822)	0.0205 (0.032)
GVA_MAN_GROWTH(-1)	0.4472 (2.741)	0.5151 (1.544)
C	2.0552 (3.687)	1.8527 (1.625)
R-squared	0.3867	0.2760
Adj R-squared	0.3535	0.2369
Sum sq resides	167.48	700.38
SE equation	2.1275	4.3507
F-statistic	11.666	7.0551
Log likelihood	-85.398	-114.01
Akaike IC	4.4199	5.8506
Schwarz IC	4.5465	5.9772

Statistical significance exists to support the theoretical positive impact of growth in the manufacturing sector on the economic growth rate. The strength of the causality is further investigated with the Sims variance decomposition test. Table 6.22 contains the results from this analysis for a 10-year period for manufacturing growth.

Table 6.22: Variance decomposition of growth due to innovations in growth in the manufacturing sector

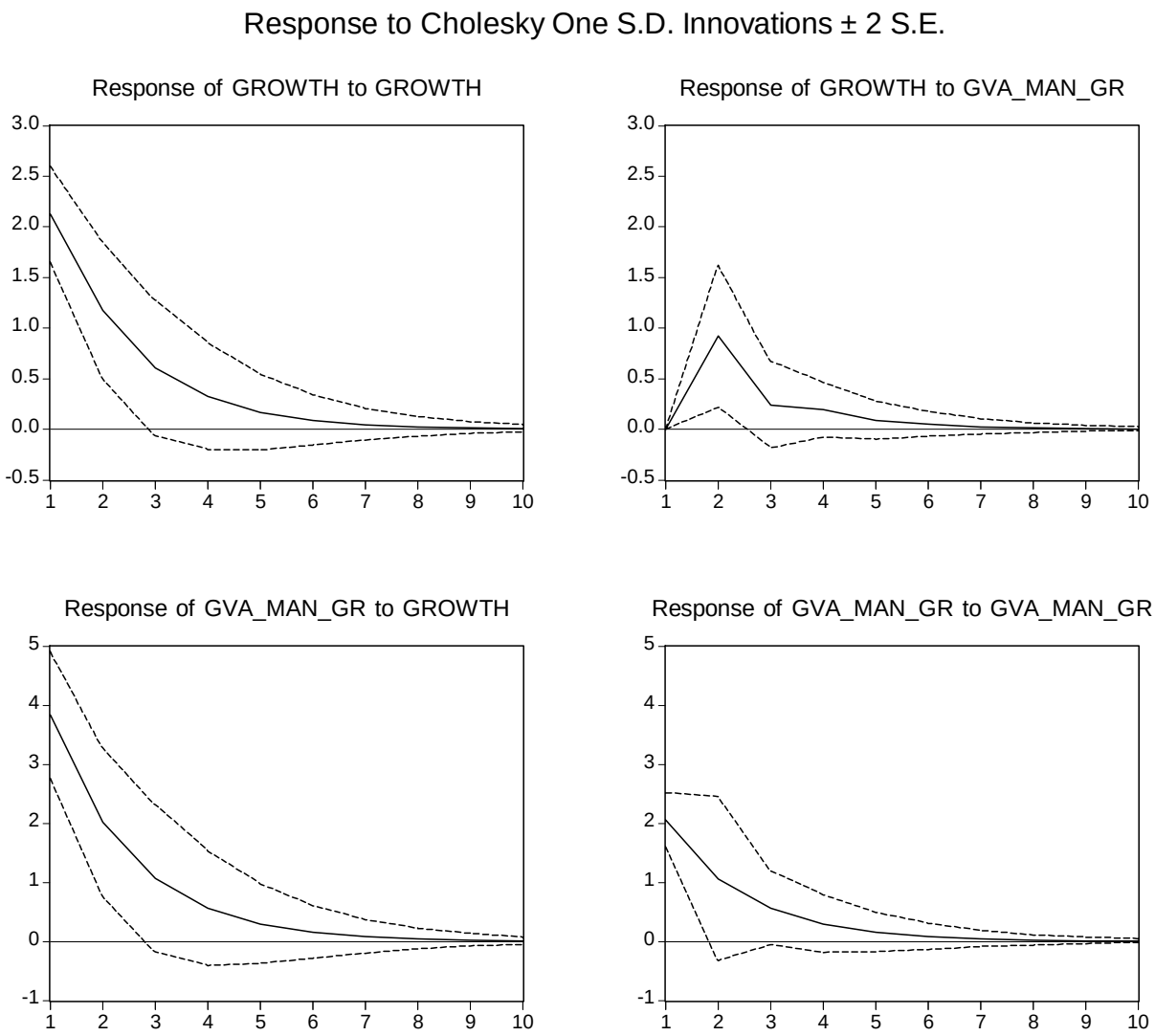
Period	SE	GROWTH	GVA_MAN_GROWT
1	2.127	100.000	0.0000
2	2.599	87.499	12.500
3	2.679	87.429	12.570
4	2.706	87.170	12.829
5	2.712	87.137	12.862
6	2.714	87.123	12.876
7	2.715	87.120	12.879
8	2.715	87.119	12.880
9	2.715	87.119	12.880
10	2.715	87.118	12.881

For the period under consideration, innovations in manufacturing growth explain a relatively small portion, but with a stable long-run significance (up to 12.9 per cent), of the forecast error variance of the economic growth rate directly, and thus support the results obtained from Granger causality tests.

Finally, impulse response functions for the two-variable system are examined in order to throw light upon the dynamics of the relationship. Impulse responses summarise the short-run and long-run effects of various shocks to the system and are depicted in figure 6.10.

The first of the four graphs proves that economic growth is responsive to shocks to itself, while in the second graph, increases in the growth in the manufacturing sector serve as a stimulus for higher growth. This positive impact is sustained and convergence back to the long-run growth level takes place seven to eight years after innovations in manufacturing growth. Of particular significance is that manufacturing growth feeds on it self while simultaneously contributing to long-term economic growth. The last-mentioned feedback effect is confirmed by the fourth graph of the series.

Figure 6.10: Impulse response functions of economic growth due to innovations in manufacturing growth



The same analysis for agricultural and mining indicates a relatively small positive response in economic growth due to innovations in growth in these sectors. Policy should therefore be directed towards developing manufacturing in general for local as well as global consumption and service sectors such as trade and transport. The privatisation of state monopolies in electricity, transport and communication sectors should be expedited, in the process guaranteeing that competition, especially foreign competition, is ensured. Export promotion could facilitate this and has indeed been emphasised in the analysis of the openness of the economy, as indicated in section 6.4.1.

6.4.5 Crime

Crime incidents in South Africa escalated from the late 1980s into the 1990s with a slight respite during 1996 to 1997. The increases resumed after 1997. Both the crime index and the growth rate in crime are as logic anticipates, that is, negatively correlated to economic growth. Figure 6.11 depicts the economic growth rate, the crime index and the percentage growth in crime (see section 5.2.9 on page 108).

The simple correlation coefficient of -0.06 for crime incidents levels is rather weak. A substantially higher negative correlation between the crime growth rate and economic growth of -0.47 is shown in table 6.23. This is also evident from figure 6.12. The public and media opinion that the increase in crime has negative effects on sentiment in general, and investor confidence, the fact that crime is also responsible for the so-called “brain-drain”, and ultimately, stunts economic growth, seems to be confirmed by this test.

Figure 6.11: Economic growth, crime index and the growth rate in crime incidents

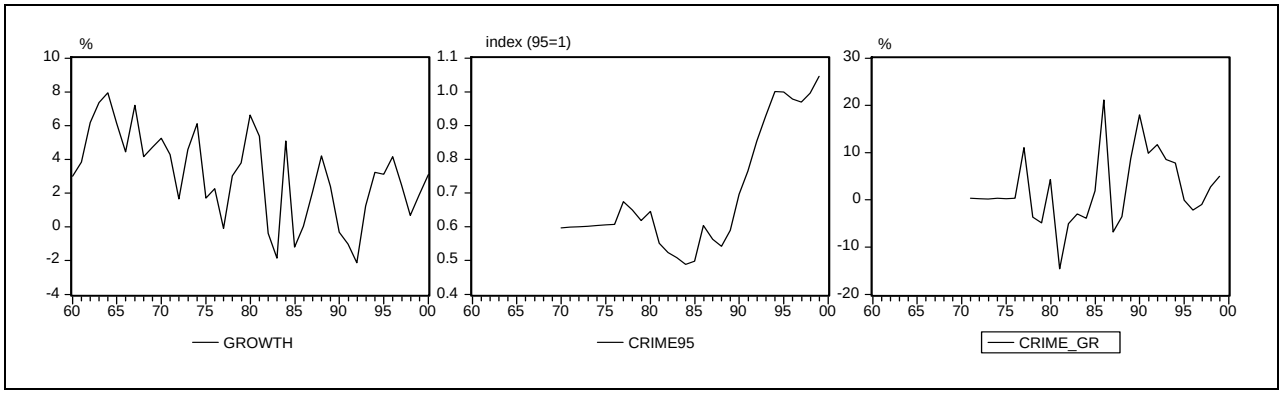
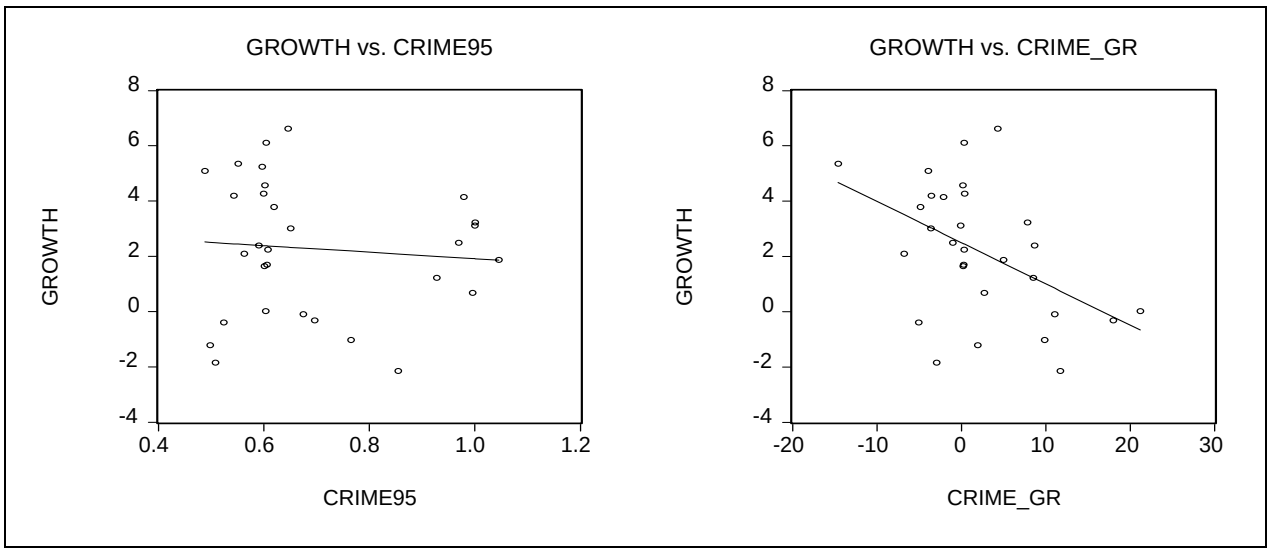


Table 6.23: Correlation matrix for growth, crime incidents and growth in crime incidents

	GROWTH	CRIME95	CRIME_GR
GROWTH	1.000000	-0.064497	-0.473544
CRIME95	-0.064497	1.000000	0.277744
CRIME_GROWTH	-0.473544	0.277744	1.000000

Figure 6.12: Simple scatter graphs of growth verses crime variables



The question of causality and the direction thereof is investigated in this section. The proper lag length is selected with the aid of an AR model on individual series. The proper lag order in this case is 1, since specifying an AR model for growth rendered only one lag significant. This is also the case for CRIME95, while for CRIME_GR no lags are needed to ensure that the series is white noise. The data series from 1960 to 2000 were used. Results for pairwise Granger causality tests are provided in table 6.24.

Table 6.24: Pairwise Granger causality tests for crime, 1960 to 1999

Null Hypothesis:	Lag order	Obs	F-stat	Probability
CRIME95 does not Granger Cause GROWTH	1	29	0.24	0.6258
GROWTH does not Granger Cause CRIME95			5.64	0.0251**
CRIME_GR does not Granger Cause GROWTH	1	28	0.02	0.8958
GROWTH does not Granger Cause CRIME_GR			2.64	0.1175

Note: ***/**/* indicate rejection of the hypothesis at the 1/5/10 per cent level of significance.

According to table 6.24, there is no evidence to suggest that crime Granger causes a lack of growth. The opposite seems to hold true, namely that a lack of growth and the concomitant absolute and relative poverty levels are conducive to criminal activities.

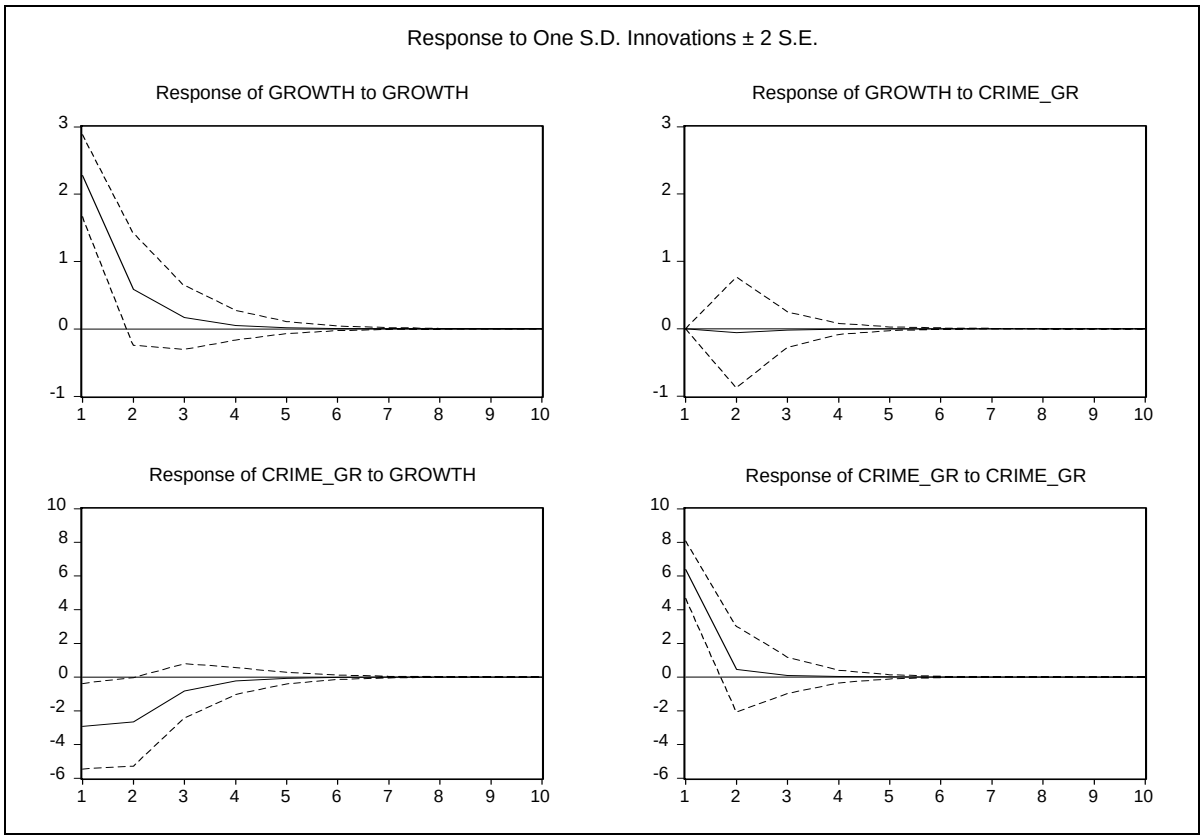
Based on the VAR model with lag order 1 for the relationship between growth and the growth rate in crime incidents, innovations in crime serve to directly explain a very small portion of decline in the economic growth rate. We know, however, that it impacts negatively on variables such as investor confidence and is in itself a difficult concept to measure, but can be sensed indirectly from variables such as gross capital formation, direct foreign investment, and the like. Unfortunately, political issues such as sanctions and disinvestments are also reflected in the time trend of capital formation, making it difficult to isolate the effect of crime on variables such as capital formation and economic growth.

Table 6.25: Variance decomposition of growth due to innovations in crime

Period	SE	GROWTH	CRIME_GR
1	2.273	100.000	0.000
2	2.348	99.940	0.059
3	2.355	99.934	0.065
4	2.355	99.933	0.066
5	2.355	99.933	0.066
6	2.355	99.933	0.066
7	2.355	99.933	0.066
8	2.355	99.933	0.066
9	2.355	99.933	0.066
10	2.355	99.933	0.066

Impulse response functions for the two-variable system demonstrate the dynamics of the relationship. Impulse responses summarise the short-run and long-run effects of various shocks to the system and are displayed in figure 6.13.

Figure 6.13: Impulse response functions of economic growth due to innovations in crime incidents



The first of the four graphs proves that economic growth is responsive to shocks to itself, while in the second graph, increases in the growth rate of crime incidents serve as a negative shock to higher growth. This negative impact, however, dies out quite quickly – convergence back to the long-run growth level takes place after only about four periods. This may be good news in the sense that an improvement in the safety and security setup may soon lead to a situation that is more conducive to economic growth.

6.4.6 Capital stock

In this section, the two state (or stock) variables referred to in empirical growth analysis, namely measures of physical capital and human capital stock, are analysed.

As a measure of physical capital stock, we analysed the growth in real capital stock taken from the national accounts (CAP_GR). This yielded a positive correlation with economic growth of 0.49.

Theoretically speaking, the measurement of human capital should cover the range of investments made in formal and informal education, on-the-job training and health. Proxies for these include enrolment rates, adult literacy rates and health indicators. The trend has been to develop education stock estimates based on the mean school years of education per working person in the economy. Continuous time series data of this nature, however, are not readily available for South Africa.

One quantitative measure that was examined was the number of matric enrolments as a percentage of the total population (ED10_POP_GR). Government spending on education represents a qualitative measure. Two variables were employed, namely government spending on education (G_ED) and government spending on education measured as a percentage of total government spending (G_ED_PERC) (see section 5.2.13-16 on pp111-114).

It is evident from figure 6.14 that there seems to be a positive relationship between economic growth and measures of growth in physical as well as human capital stock. The correlation between growth and growth in physical capital stock, however, is stronger than between growth and human capital stock, using the measures for human capital stock as described above. Table 6.31 which contains simple correlation coefficients, confirms this, with positive correlations only ranging from 0.07 to 0.16 between human capital variables and economic growth, while the correlation between growth in physical capital stock and economic growth is 0.49.

Figure 6.14: Simple scatter graphs of growth versus capital stock variables

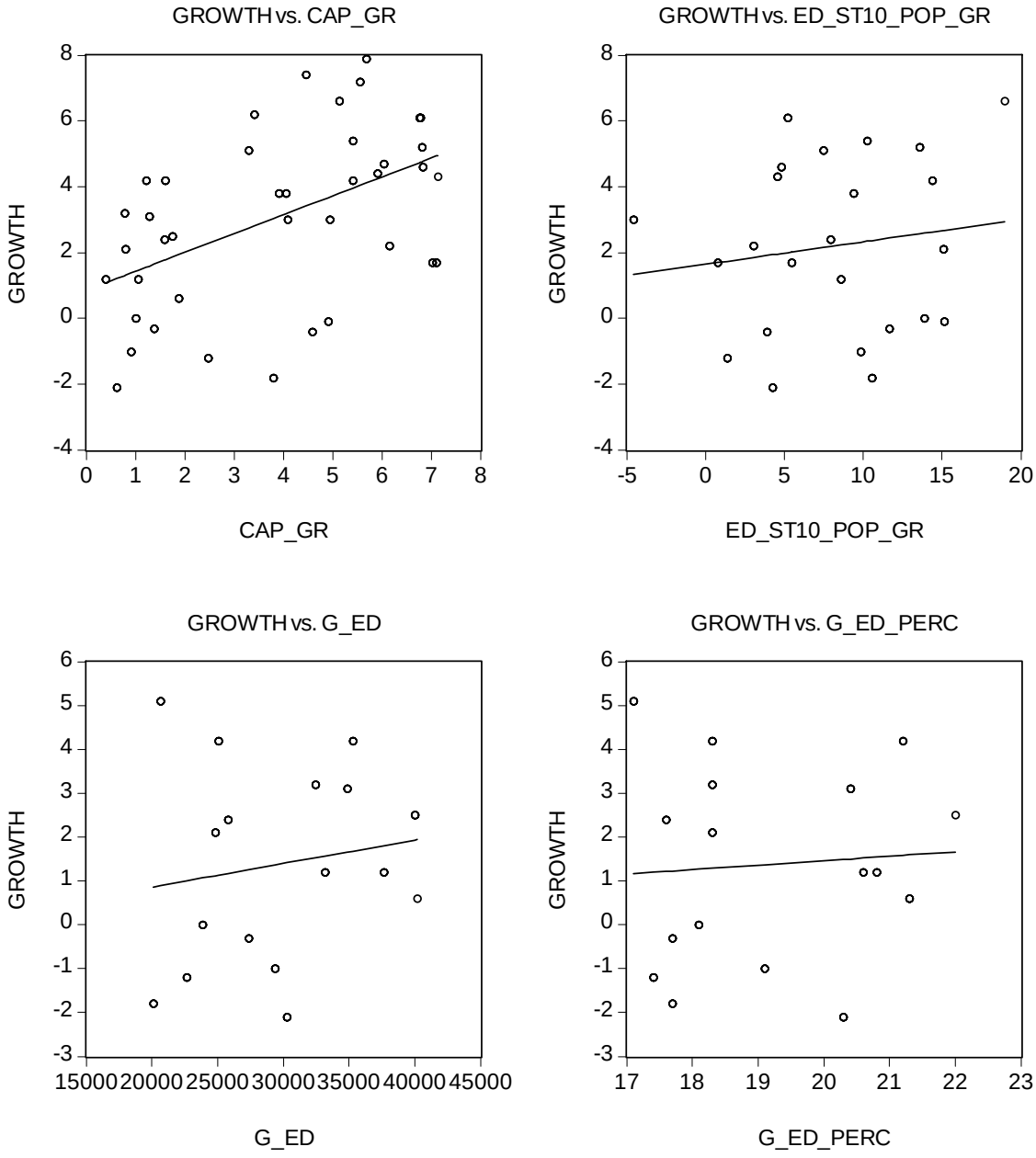


Table 6.26: Correlation matrix for GROWTH, CAP_GR, ED_ST10_POP_GR, G_ED and G_ED_PERC

	GROWTH	CAP_GR	ED_ST10_POP_GR	G_ED	G_ED_PERC
GROWTH	1.000	0.493	0.143	0.157	0.074
CAP_GROWTH	0.493	1.000	-0.277	-0.429	-0.366
ED_ST10_POP_GR	0.143	-0.277	1.000	-0.075	-0.090
G_ED	0.157	-0.429	-0.075	1.000	0.905
G_ED_PERC	0.074	-0.366	-0.090	0.905	1.000

The question of causality, and the direction thereof, is answered by a test for Granger causality. The first step in establishing causality would be to select the proper lag order for each series. The results are reported in table 6.27. The sample period varies, from 1960 to 2000 for CAP_GR and ED_ST10_POP_GR to only 1983 to 2000 for G_ED and G_ED_PERC.

Table 6.27: Testing for the lag order of physical and human capital stock variables

	Lag order	p-value	AIC	SIC
GROWTH	1	0.0005	4.482	4.482
CAP_GROWTH	3	0.0028	1.696	1.870
ED_ST10_POP	3	0.0803	5.722	6.531
G_ED	1	0.0000	17.685	17.783
G_ED_PERC	1	0.0002	2.286	3.084

Results describe p-values on the last lag as well as Akaike and Schwarz selection criteria results for the final model. The lag orders are subsequently used in Granger causality tests. The results are provided in table 6.28.

Table 6.28: Pairwise Granger causality tests for human and physical capital stock and economic growth, 1960 to 2000

Null hypothesis:	Lag order	Obs	F-stat	Probability
CAP_GR does not Granger Cause GROWTH	3	37	2.69	0.0636*
GROWTH does not Granger Cause CAP_GR			2.91	0.0506*
ED_ST10_POP_GR does not Granger Cause GROWTH	3	37	2.66	0.0719*
GROWTH does not Granger Cause ED_ST10_POP_GR			0.88	0.4612
G_ED does not Granger Cause GROWTH	1	16	0.66	0.8856
GROWTH does not Granger Cause G_ED			0.02	0.4288
G_ED_PERC does not Granger Cause GROWTH	1	16	0.39	0.5427
GROWTH does not Granger Cause G_ED_PERC			0.01	0.9301

Note: ***/**/* indicate rejection of the hypothesis at the 1/5/10 per cent level of significance.

The Granger causality tests suggest that a bidirectional causality exists between growth in capital stock and economic growth. This result is in line with the results obtained for growth in fixed investment and economic growth. The same holds true for the quantitative proxy for human capital. For the two proxies for qualitative measures of human capital, we fail to establish causality, possibly because of the very low correlation between these series and economic growth.

To further investigate the dynamics of the system, the vector autoregression (VAR) model is estimated for the growth in physical capital stock and economic growth. Table 6.29 reports the results of the VAR with lag order 3. As is often the case with a VAR with lag order higher than 1, one of the coefficients of the lagged explanatory variable has a negative sign. The coefficient of the second and third lags of growth in capital stock is significant. The statistical insignificance of the first lag may be explained by the time lag necessary between the outlay for the acquirement of new capital equipment and the positive contribution to economic growth.

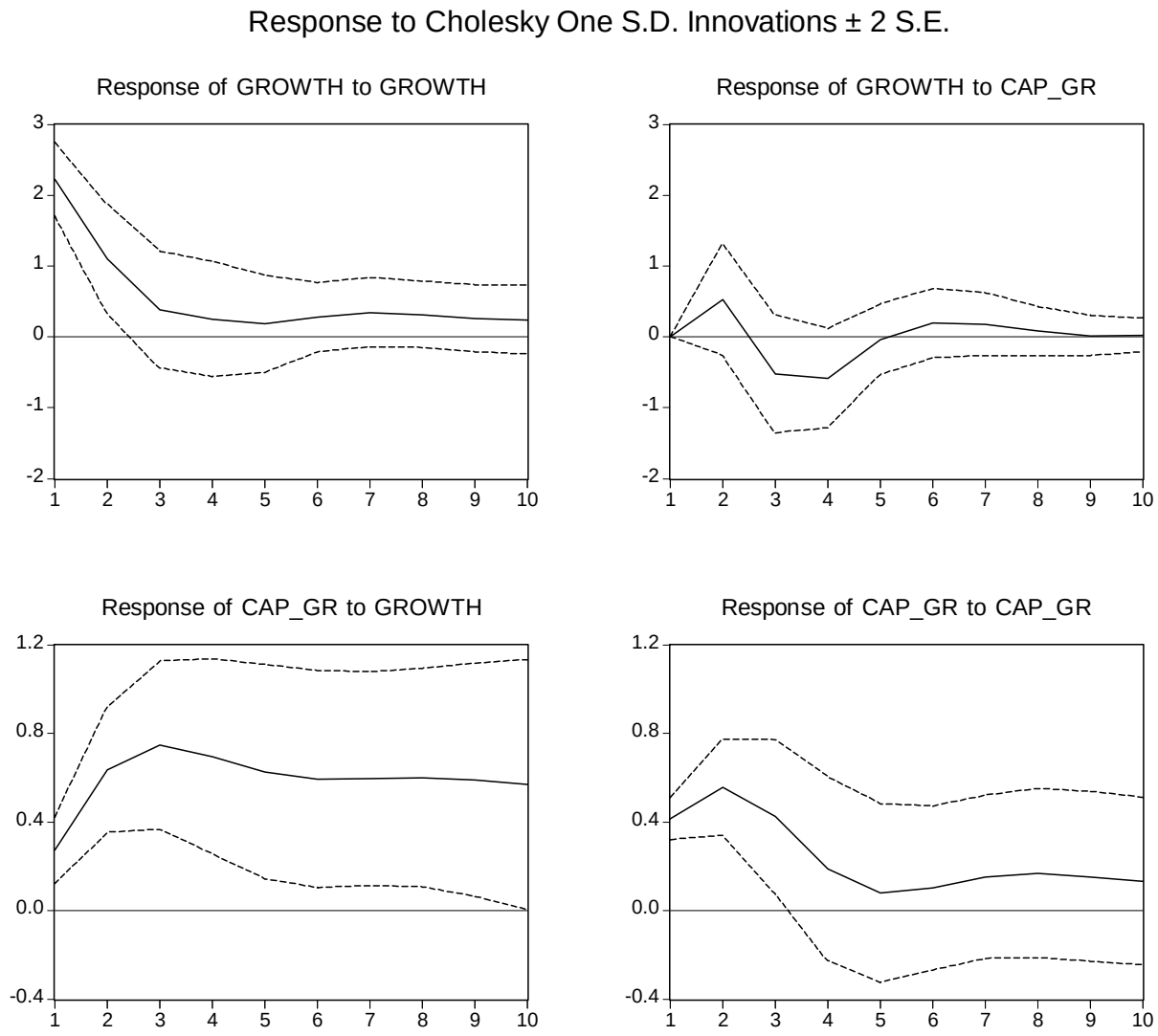
Table 6.29: Pairwise Granger causality tests for human and physical capital stock and economic growth, 1960 to 2000

Sample(adjusted): 1963-2000 Included observations: 38 after adjusting endpoints t-statistics in parentheses		
	GROWTH	CAP_GR
GROWTH(-1)	0.3417 (1.693)	0.1207 (2.688)
GROWTH(-2)	0.0564 (0.257)	0.0071 (0.146)
GROWTH(-3)	0.2945 (1.469)	0.0450 (1.008)
CAP_GR(-1)	1.2604 (1.331)	1.3438 (6.379)
CAP_GR(-2)	-3.3826 (-2.402)	-0.9375 (-2.992)
CAP_GR(-3)	2.2088 (2.780)	0.4867 (2.752)
C	0.3172 (0.373)	-0.2044 (-1.080)
R-squared	0.4356	0.9633
Adj R-squared	0.3228	0.9560
Sum sq resides	148.79	7.3712
SE equation	2.2270	0.4956
F-statistic	3.8601	131.51
Log likelihood	-78.246	-22.653
Akaike IC	4.6079	1.6029
Schwarz IC	4.9126	1.9076

Statistical significance exists to support the overall theoretical positive impact of the growth in capital stock on the economic growth rate. This is evident from the impulse response functions depicted in figure 6.15. The initial effect

of a positive innovation in capital stock on economic growth is positive, followed by a slight negative effect, which turns into a positive effect again by period 5. This positive effect lasts until period 9 or 10, after which the system returns to its original long-run growth level.

Figure 6.15: Impulse response functions of economic growth due to innovations in growth in physical capital stock



6.4.7 Productivity

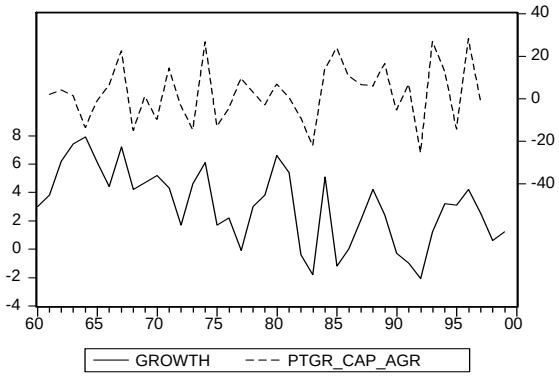
To augment the variables on human capital, a number of productivity variables were tested, which will simultaneously also serve to indicate the role that technology played in the past growth performance of South Africa.

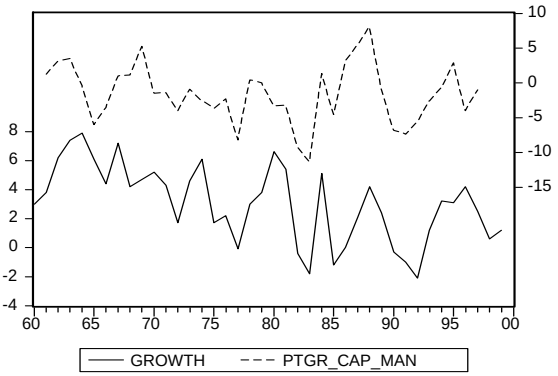
Various authors have referred to the importance of the contribution of productivity growth to economic growth, notably Solow (1957) who referred to it as the "measure of our ignorance". This later became known as the Solow residual. Denison (1962) used this theoretical model to establish his growth accounting techniques, which he used in his well-known book *Why growth rates differ* (Denison 1967:9, 282, 233), to apportion economic growth to various sources like "contribution of inputs", "advances in knowledge" such as education, "economies of scale" and "output per unit of input" (productivity).

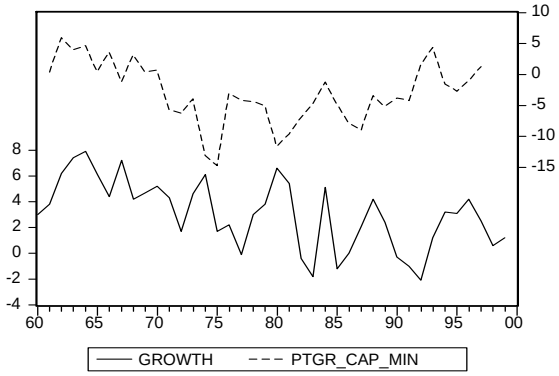
In this section, the relationships of various productivity measures to growth are examined. Productivity growth measures include capital productivity, labour productivity and multifactor productivity. Unit labour cost represents a measure for competitiveness. Sectoral analyses cover the agricultural, mining and manufacturing sectors, as well as the so-called "private economy" - the most aggregate productivity measure (GDP by kind of economic activity less community, social and personal services, where the latter include government services). More in-depth sectoral analysis includes the following: labour and multifactor productivity in the manufacturing sector, capital and multifactor productivity in the mining sector and unit labour costs for the manufacturing sector.

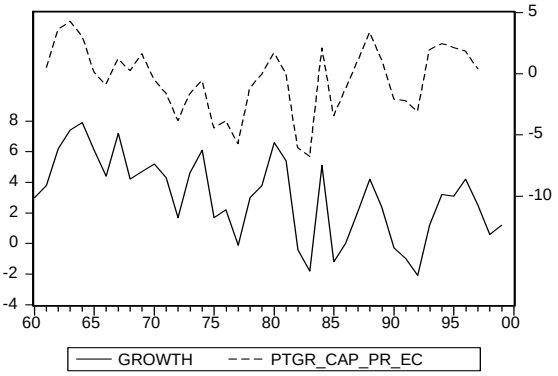
Figure 6.16 contains a graphical representation of economic growth *vis*-à-*vis* a wide spectrum of productivity growth rates (see section 5.2.21 on page 120).

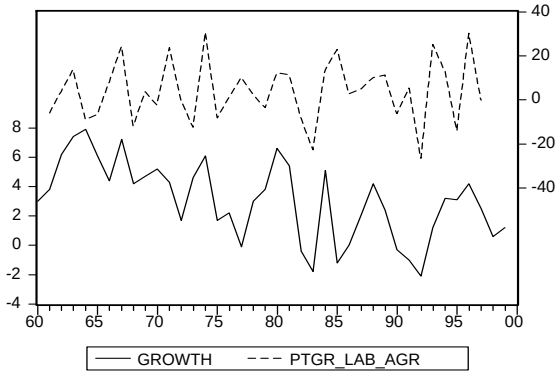
Figure 6.16: Graphical representation of economic growth against growth rates of productivity and unit labour costs, 1960-2000

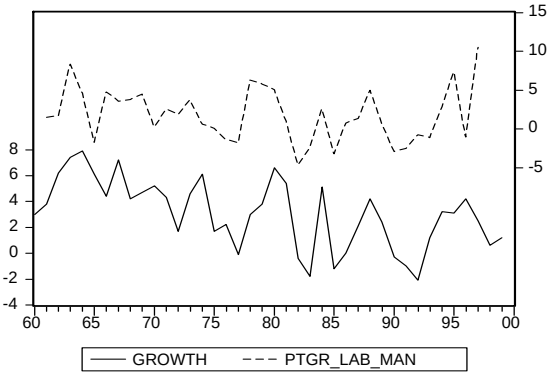


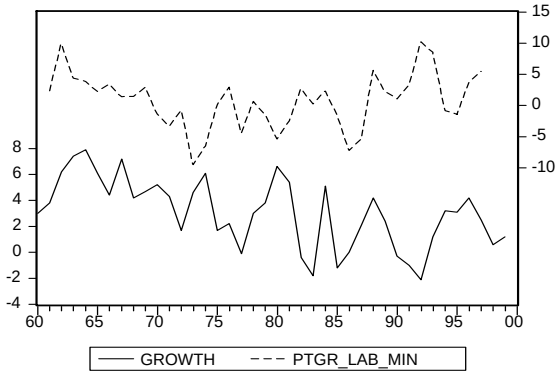












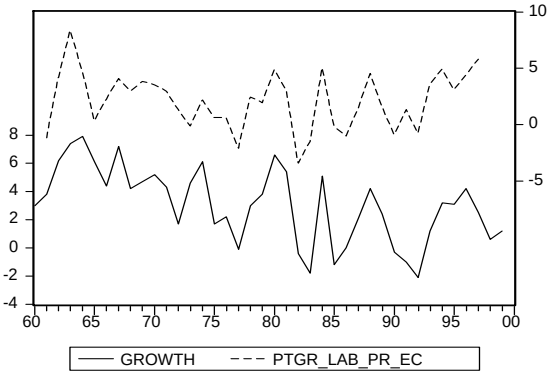
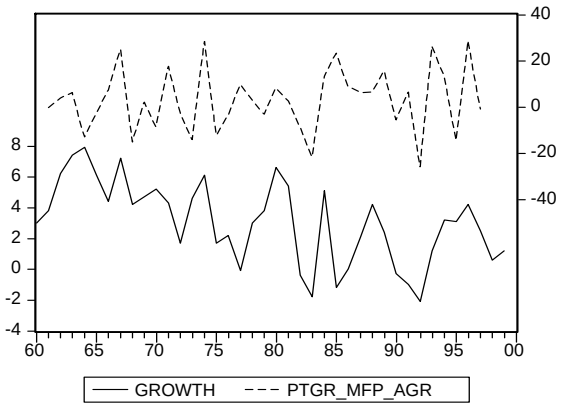
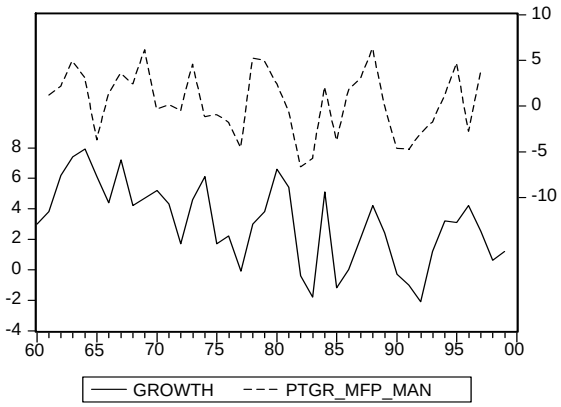
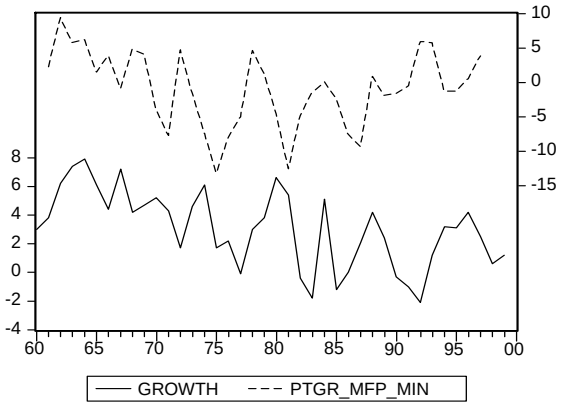
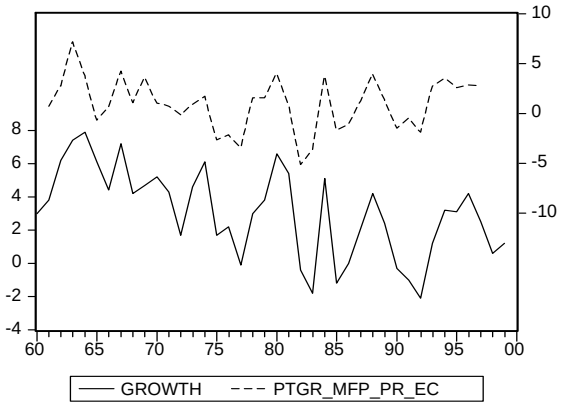


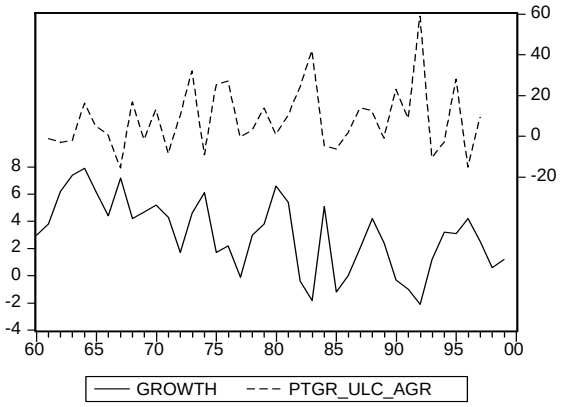
Figure 6.16: Graphical representation of economic growth against growth rates of productivity and unit labour costs, 1960-2000 (continued)

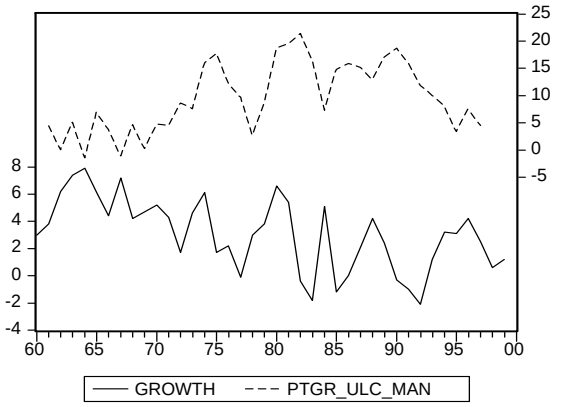


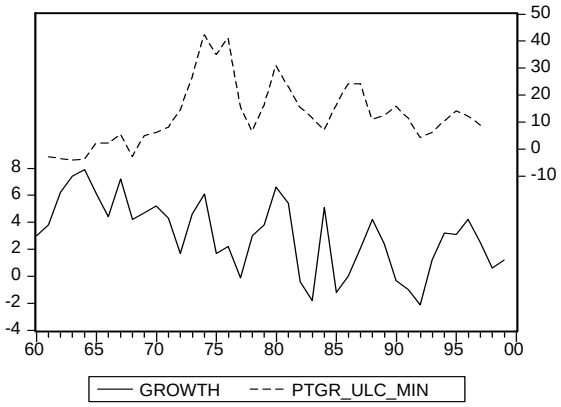


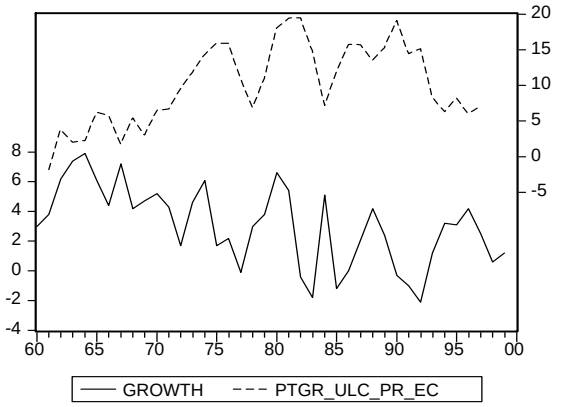






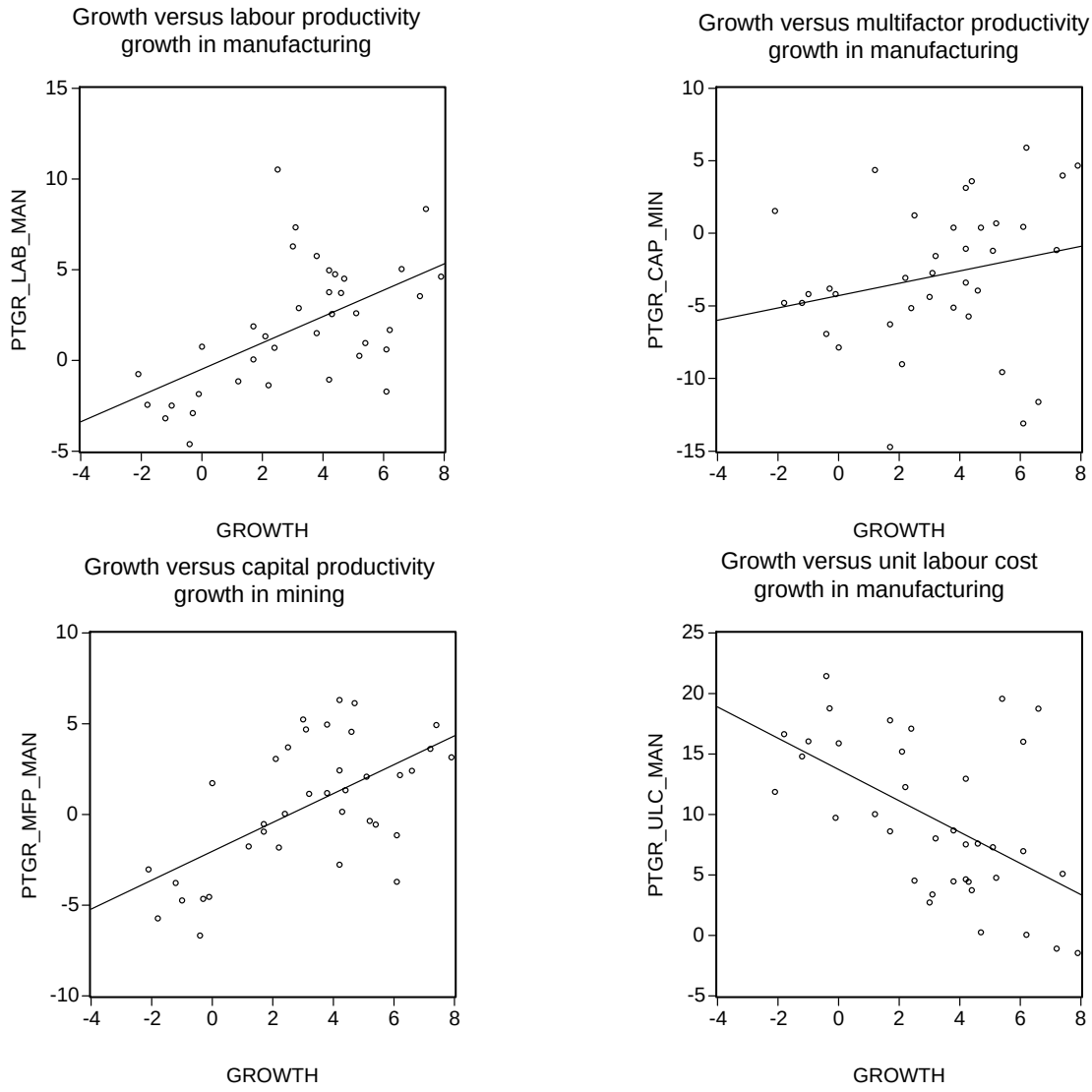






The graphs in figure 6.16 show the expected close relationship between growth and productivity growth variables as well as the contra-tendencies for the graphs depicting growth against unit labour cost growth rates.

Figure 6.17: Simple scatter graphs of growth versus a selection of productivity growth variables



Positive relationships between growth and selected productivity variables are evident from figure 6.17 above. This is confirmed by the information in table 6.30 which reports simple correlation coefficients for a broader spectrum of productivity variables.

Table 6.30: Simple correlation coefficients between productivity variables and economic growth, 1960 to 2000

Variable	Correlation coefficient
PTGR_CAP_AGR	0.173
PTGR_CAP_MAN	0.516
PRGR_CAP_MIN	0.231
PTGR_CAP_PREC	0.714
PTGR_LAB_AGR	0.309
PTGR_LAB_MAN	0.564
PRGR_LAB_MIN	-0.036
PTGR_LAB_PREC	0.696
PTGR_MFP_AGR	0.213
PTGR_MFP_MAN	0.606
PRGR_MFP_MIN	0.163
PTGR_MFP_PREC	0.747
PTGR_ULC_AGR	-0.444
PTGR_ULC_MAN	-0.546
PRGR_ULC_MIN	-0.198
PTGR_ULC_PREC	-0.538

The correlations given in table 6.30 reveal that the manufacturing sector correlations are more pronounced than those of the mining industry, while those of the private economy in turn exceed manufacturing productivity correlations. As can be expected, unit labour cost series are negatively correlated with growth.

The question of causality, and the direction thereof, is answered by a test for Granger causality, and the proper lag order for each series is determined by fitting a simple AR model to the series. The results are reported in tables 6.31 and 6.32. The sample period is 1960 to 2000.

Table 6.31: The lag order of productivity growth variables

	Lag order	p-value	AIC	SIC
GROWTH	1	0.0005	4.482	4.482
PTGR_CAP_AGR	1	0.0946	8.093	8.182
PTGR_CAP_MAN	1	0.0191	5.664	5.361
PTGR_CAP_MIN	1	0.0000	8.098	8.185
PRGR_CAP_PREC	1	0.0039	4.756	4.844
PTGR_LAB_AGR	2	0.0078	7.944	8.077
PTGR_LAB_MAN	1	0.0000	5.222	5.340
PRGR_LAB_MIN	1	0.0050	5.709	5.797
PRGR_LAB_PREC	2	0.0466	4.611	4.744
PTGR_MFP_AGR	2	0.0975	8.095	8.228
PTGR_MFP_MAN	1	0.0000	5.273	5.360
PRGR_MFP_MIN	1	0.0016	6.047	6.135
PTGR_MFP_PREC	1	0.0605	4.769	4.857
PTGR_ULC_AGR	0	-	-	-
PTGR_ULC_MAN	1	0.0000	5.961	6.049
PRGR_ULC_MIN	1	0.0000	6.974	7.061
PTGR_ULC_PREC	1	0.0000	5.287	5.375

Table 6.31 describes p-values on the last lag as well as Akaike and Schwarz selection criteria results for the final model. The results in table 6.31 show that in most cases one lag will be sufficient to render the residual white noise and these lags will subsequently be used in Granger causality tests. The results are provided in table 6.32.

Table 6.32: Pairwise Granger causality tests for productivity growth variables and economic growth, 1960 to 2000

Null hypothesis	Lag order	Obs	F-stat	Probability
PTGR_CAP_AGR does not Granger Cause GROWTH	1	36	4.39	0.0438**
GROWTH does not Granger Cause PTGR_CAP_AGR			0.14	0.7089
PTGR_CAP_MAN does not Granger Cause GROWTH	1	36	0.65	0.4237
GROWTH does not Granger Cause PTGR_CAP_MAN			2.84	0.1009
PTGR_CAP_MIN does not Granger Cause GROWTH	1	36	4.42	0.0433**
GROWTH does not Granger Cause PTGR_CAP_MIN			0.73	0.3983
PTGR_CAP_PREC does not Granger Cause GROWTH	1	36	0.01	0.9338
GROWTH does not Granger Cause PTGR_CAP_PREC				0.0237**
PTGR_LAB_AGR does not Granger Cause GROWTH	2	35	2.71	0.0831*
GROWTH does not Granger Cause PTGR_LAB_AGR			1.33	0.2792
PTGR_LAB_MAN does not Granger Cause GROWTH	1	36	8.32	0.0068***
GROWTH does not Granger Cause PTGR_LAB_MAN			0.23	0.6325
PTGR_LAB_MIN does not Granger Cause GROWTH	1	36	0.02	0.8953
GROWTH does not Granger Cause PTGR_LAB_MIN			0.00	0.9540
PTGR_LAB_PREC does not Granger Cause GROWTH	2	35	0.71	0.4979
GROWTH does not Granger Cause PTGR_CAP_PREC			0.07	0.9313
PTGR_MFP_AGR does not Granger Cause GROWTH	1	36	4.48	0.0417**
GROWTH does not Granger Cause PTGR_MFP_AGR			0.00	0.9661
PTGR_MFP_MAN does not Granger Cause GROWTH	1	36	5.03	0.0317**
GROWTH does not Granger Cause PTGR_MFP_MAN			0.48	0.4891
PTGR_MFP_MIN does not Granger Cause GROWTH	1	36	9.08	0.0049***
GROWTH does not Granger Cause PTGR_MFP_MIN			0.58	0.4509

Table 6.32: Pairwise Granger causality tests for productivity growth variables and economic growth, 1960 to 2000 (continued)

PTGR_MFP_PREC does not Granger Cause GROWTH	1	36	0.28	0.5957
GROWTH does not Granger Cause PTGR_MFP_PREC			2.11	0.1551
PTGR_ULC_AGR does not Granger Cause GROWTH	1	36	1.33	0.2566
GROWTH does not Granger Cause PTGR_ULC_AGR			2.69	0.1102
PTGR_ULC_MAN does not Granger Cause GROWTH	1	36	9.87	0.0035***
GROWTH does not Granger Cause PTGR_ULC_MAN			3.95	0.0551*
PTGR_ULC_MIN does not Granger Cause GROWTH	1	36	4.04	0.0526*
GROWTH does not Granger Cause PTGR_ULC_MIN			0.00	0.9697
PTGR_ULC_PREC does not Granger Cause GROWTH	1	36	9.05	0.0050***
GROWTH does not Granger Cause PTGR_ULC_PREC			4.39	0.0439**

Note: ***/**/* indicate rejection of the hypothesis at the 1/5/10 per cent level of significance.

The results in table 6.32 above show that growth in *capital* productivity in both the agriculture and mining sector Granger causes growth, but that this is not the case in the manufacturing sector. A reverse causality seems to exist for the private economy. Granger causalities are also shown to exist between growth in *labour* productivity and economic growth in the agriculture and manufacturing sectors. Increases in *multifactor* productivity in the agriculture, mining and manufacturing sectors, Granger causes economic growth within these sectors. Lastly, it can be deduced from table 6.32 that *unit labour cost growth* will detract from growth in the mining sector, while a bi-directional Granger causality exists between unit labour cost growth and economic growth for the manufacturing sector and the combined private economy – that is, that higher growth may stimulate these sectors sufficiently to reduce unit labour costs.

Table 6.33 provides a summary of the Granger causalities, which is useful for interpretation purposes.

Table 6.33: Summary of Granger causality tests for relationships between productivity and economic growth

Productivity	Sector			
	Agriculture	Manufacturing	Mining	Private Economy
Capital	Causality		Causality	Causality
Labour	Causality	Causality		
Multifactor	Causality	Causality	Causality	
ULC		Bidirectional Causality	Causality	Bidirectional Causality

Given the importance of the manufacturing sector in most economies, and the fast-growing Asian economies in particular, and in view of its relatively large contribution to total GDP in most economies as well as in South Africa, it would appear that manufacturing sector productivity might give valuable insights into the country's growth potential. Furthermore, in the light of the importance of labour in the South African economy, stemming from its political influence in the governing tripartite alliance, the relationship between labour productivity in the manufacturing sector, and multifactor productivity for the manufacturing sector are further investigated. To balance these effects, it is also of interest to investigate the effects of unit labour cost growth on growth in the economy. The last section investigates the effects of unit labour cost increases in the manufacturing sector on growth. The Granger causalities running from labour productivity and unit labour cost to growth shown above, seem to indicate important relationships between these variables and economic growth, and they therefore merit further investigation. Capital productivity and multifactor productivity for mining are also included in this analysis, given the important influence of the mining sector on economic growth in South Africa's early growth path.

Vector autoregression (VAR) models for the above-mentioned cases are presented in tables 6.34, 6.36, 6.38 and 6.40 respectively. In all instances, the

productivity and unit labour cost coefficients in the models with growth as dependent variable are of the correct sign and statistically significant.

6.4.7.1 *Labour productivity growth in the manufacturing sector*

Table 6.34 reports the results of the VAR with lag order 1 for the relationship between growth and the growth rate in labour productivity in the manufacturing sector.

Table 6.34: Vector autoregression model estimating the effect of growth in labour productivity in manufacturing on economic growth

Sample(adjusted): 1962-1997 Included observations: 36 after adjusting endpoints t-statistics in parentheses		
	GROWTH	PTGR_LAB_MAN
GROWTH(-1)	0.1869 (1.071)	0.1418 (0.493)
PTGR_LAB_MAN(-1)	0.4324 (2.289)	0.1077 (0.4376)
C	1.8814 (3.281)	1.2034 (1.2752)
R-squared	0.4108	0.0355
Adj R-squared	0.3751	-0.0228
Sum sq resides	155.57	421.50
SE equation	2.1712	3.5739
F-statistic	11.505	0.6087
Log likelihood	-77.426	-95.367
Akaike IC	4.4681	5.4648
Schwarz IC	4.6000	5.5968

The first column of results in table 6.34, with growth as the dependent variable, shows that the coefficient for labour productivity growth in manufacturing is

significant and carries the correct sign. Labour productivity therefore makes an important contribution to growth.

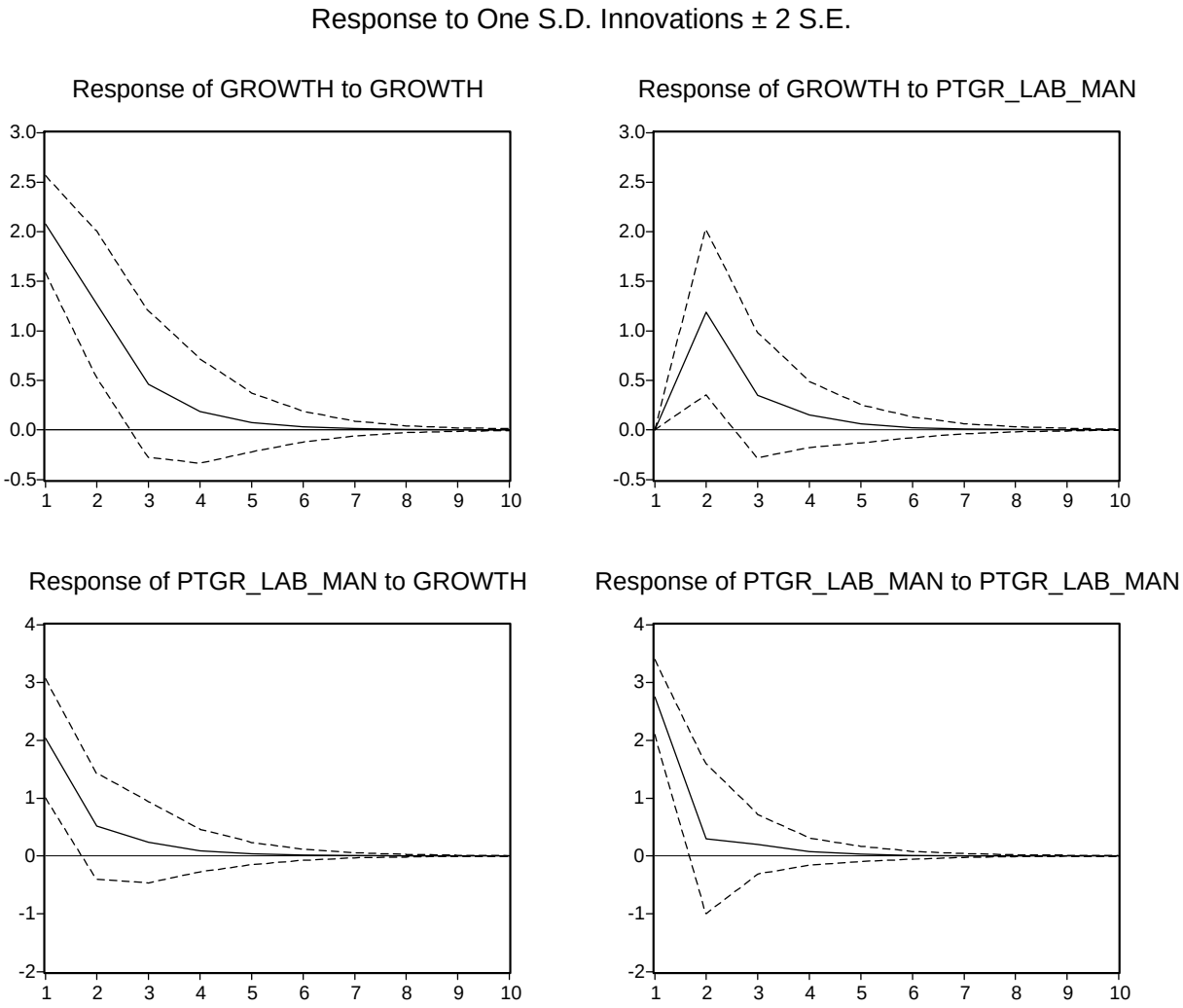
The strength of the causality was further investigated with the Sims variance decomposition test.

Table 6.35: Variance decomposition of growth due to innovations in labour productivity growth in the manufacturing sector

Period	SE	GROWTH	PTGR_LAB_MAN
1	2.078	100.00	0.000
2	2.710	80.753	19.246
3	2.771	79.992	20.007
4	2.781	79.843	20.156
5	2.783	79.821	20.178
6	2.783	79.818	20.181
7	2.783	79.817	20.182
8	2.783	79.817	20.182
9	2.783	79.817	20.182
10	2.783	79.817	20.182

For the period under consideration, innovations in labour productivity growth in manufacturing explain an important portion of growth, with a sustained long-run significance (of just more than 20 per cent), of the forecast error variance of the economic growth rate directly, and thus support results obtained from Granger causality tests.

Figure 6.18: Impulse response functions of economic growth due to innovations in labour productivity growth in manufacturing



The second graph shows that increases in the growth in labour productivity of the manufacturing sector serve as a stimulus for higher growth. This positive impact of just more than 1 per cent takes place in the second period and is sustained, although at lower levels, for just more than five periods, during which the relationship remain above the long-run level. Convergence back to the long-run growth level takes place about six periods after innovations in the growth in labour productivity of the manufacturing sector.

6.4.7.2 Multifactor productivity growth in the manufacturing sector

Growth in multifactor productivity gives another dimension to the impact of technology on growth as the physical content of the use of more capital and more labour is neutralised by the formula:

(multifactor productivity=(output index/(weighted labour input index plus weighted capital input index))

It therefore leaves a residual that mainly incorporates changes in human knowledge and technology embodied largely in capital equipment used in the manufacturing sector.

Table 6.36: Vector autoregression model estimating the effect of growth in multifactor productivity in manufacturing on economic growth

Sample(adjusted): 1962-1997. Included observations: 36 after adjusting endpoints t-statistics in parentheses		
	GROWTH	PTGR_MFP_MAN
GROWTH(-1)	0.2645 (1.489)	-0.1941 (-0.689)
PTGR_MFP_MAN(-1)	0.3060 (2.243)	0.3378 (1.563)
C	2.1935 (3.346)	0.9541 (0.918)
R-squared	0.3592	0.0722
Adj R-squared	0.3204	0.0160
Sum sq resides	169.17	424.43
SE equation	2.264	3.5863
F-statistic	9.2529	1.2851
Log likelihood	-78.935	-95.491
Akaike IC	4.5519	5.4717
Schwarz IC	4.6839	5.6037

Table 6.36 reports the results of the VAR with lag order 1 for the relationship between growth and the growth in multifactor productivity in the manufacturing sector. The important first column of results with growth as the dependent variable shows that the coefficient for multifactor productivity growth in manufacturing is significant at the 1 per cent level and carries the correct sign. Human and capital-embodied technology in the manufacturing sector therefore played a significant part in the overall growth of the economy.

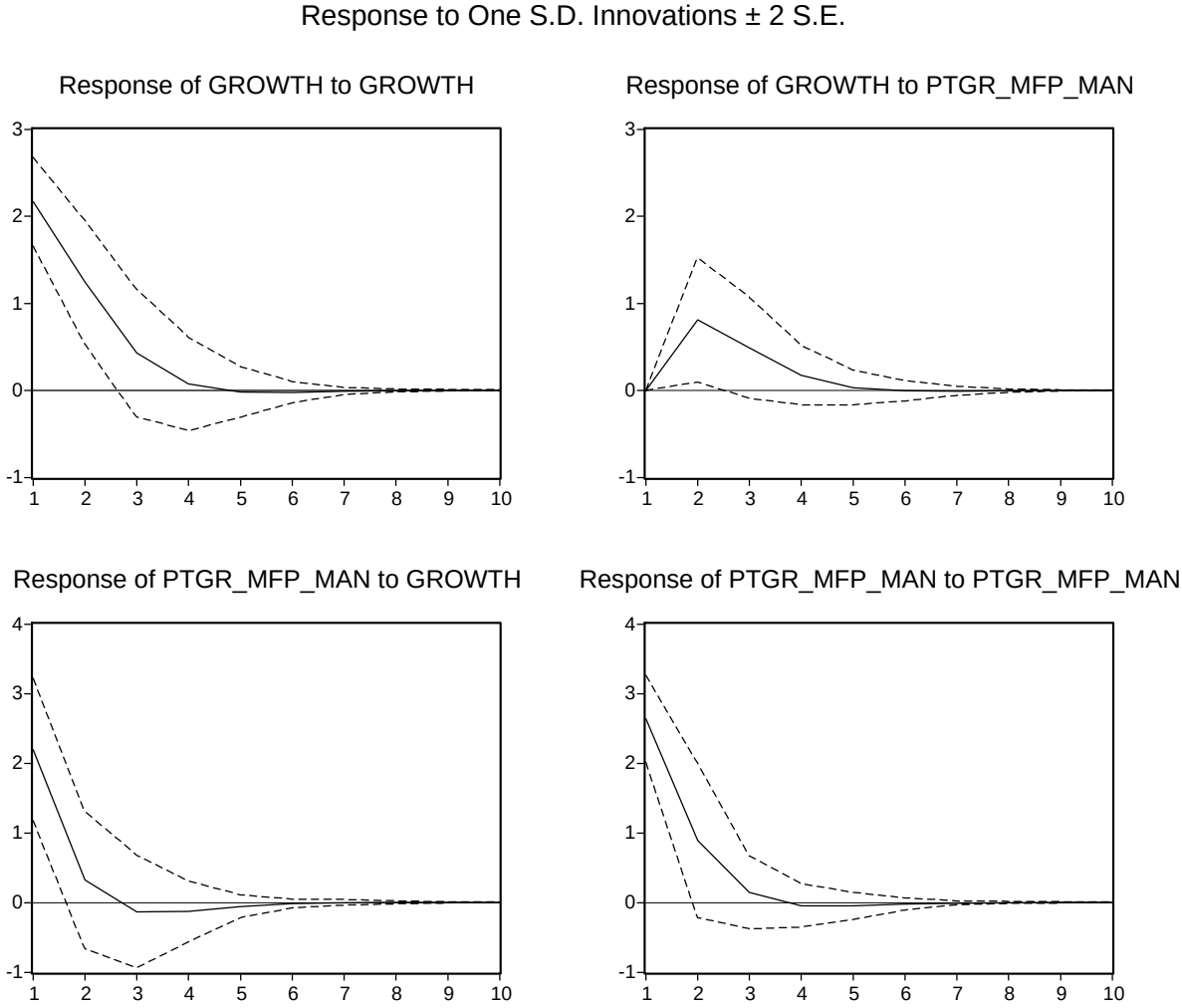
Table 6.37: Variance decomposition of growth due to innovations in growth in the multifactor productivity in the manufacturing sector

Period	SE	GROWTH	PTGR_LAB_MAN
1	2.167	100.00	0.000
2	2.627	90.547	9.452
3	2.705	87.855	12.144
4	2.712	87.507	12.492
5	2.712	87.496	12.503
6	2.712	87.496	12.503
7	2.712	87.495	12.504
8	2.712	87.495	12.504
9	2.712	87.495	12.504
10	2.712	87.495	12.504

For the period under consideration, innovations in multifactor productivity growth in manufacturing explain a relatively small portion, but with a stable long-run significance (up to 12.5 per cent), of the forecast error variance of the economic growth rate directly, and thus support the results obtained from Granger causality tests.

In testing the likely development over time of the relationship, impulse response functions for the two-variable system are examined in figure 6.19 to throw light upon the dynamics of the relationship.

Figure 6.19: Impulse response functions of economic growth due to innovations in multifactor productivity growth in manufacturing



The second graph in figure 6.19 shows that multifactor productivity growth in manufacturing had a rather modest (less than 1 per cent) effect on growth. This positive effect lasts for about five periods, after which the system returns to its original long-run growth level.

6.4.7.3 *Capital productivity growth in the mining sector*

Recognising the vulnerability of the mining sector to developments in the international arena and its dependency on capital productivity enhancements to remain internationally competitive, this section proceeds with an analysis of the effect of capital productivity growth in the mining industry on economic growth. The relationship between capital productivity growth and economic growth is

captured in the vector autoregression (VAR) model reported in table 6.38, while the magnitude of the effect of an innovation in capital productivity in the mining sector on economic growth is evident in figure 6.20.

Table 6.38: Vector autoregression model estimating the effect of growth in capital productivity in mining on economic growth

Sample(adjusted): 1962-1997
Included observations: 36 after adjusting endpoints
t-statistics in parentheses

	GROWTH	PTGR_CAP_MIN
GROWTH(-1)	0.4389	-0.2063
	(3.032)	(-0.847)
PTGR_CAP_MIN(-1)	0.1665	0.6896
	(2.096)	(5.155)
C	2.2669	-0.2655
	(3.300)	(-0.229)
R-squared	0.3484	0.4476
Adj R-squared	0.3089	0.4141
Sum sq resides	172.04	487.56
SE equation	2.2833	3.8437
F-statistic	8.8232	13.370
Log likelihood	-79.238	-97.987
Akaike IC	4.5687	5.6104
Schwarz IC	4.7007	5.7424

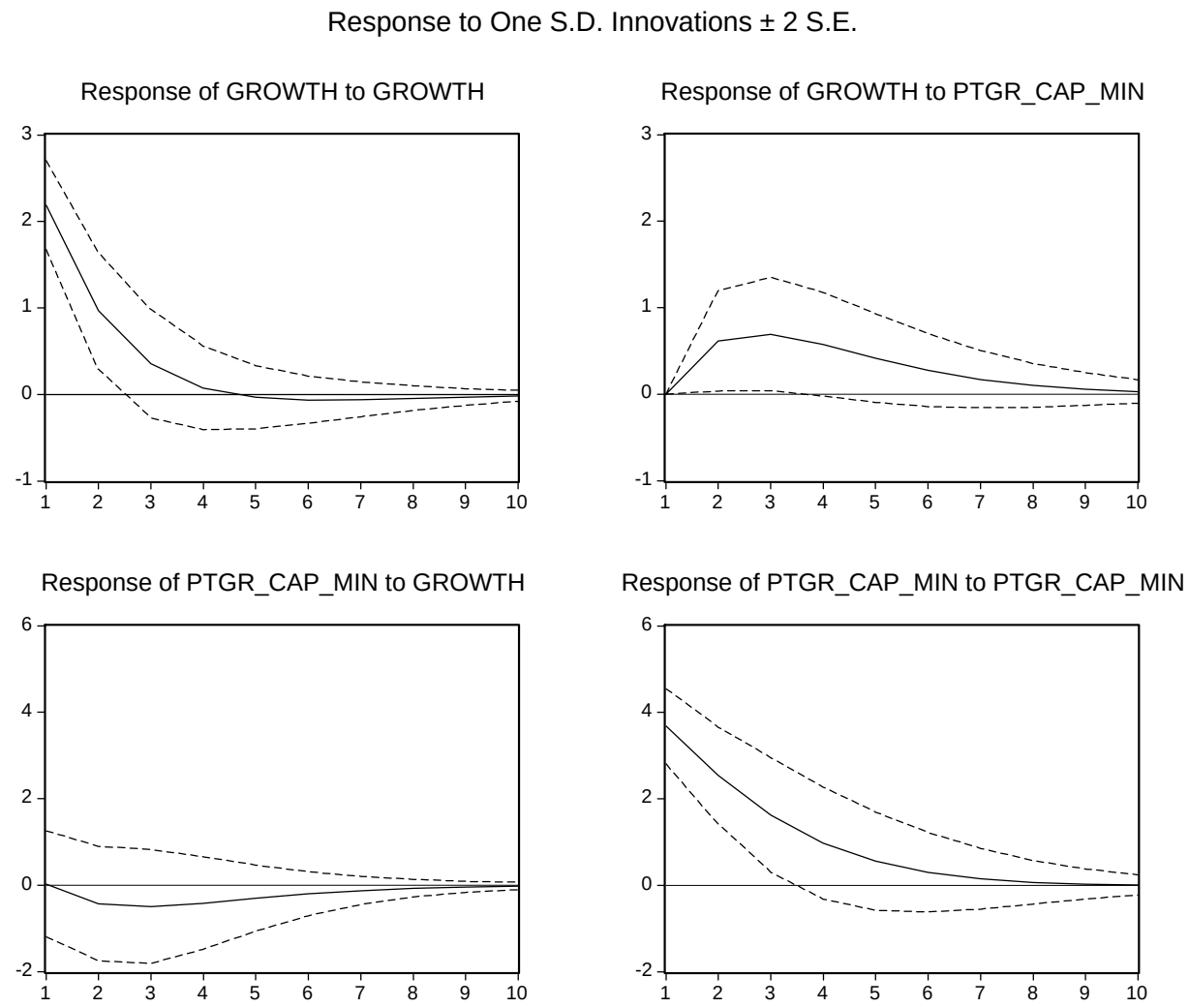
Table 6.38 reports the results of the VAR with lag order 1. The first lag is significant and positive indicating a positive effect on economic growth from innovations in capital productivity growth in the mining sector. Growth and capital productivity growth are also influenced by their first lags respectively.

Table 6.39: Variance decomposition of growth due to innovations in capital productivity growth in the mining sector

Period	SE	GROWTH	PTGR_LAB_MAN
1	2.186	100.00	0.000
2	2.466	93.820	6.173
3	2.586	87.226	12.771
4	2.650	83.142	16.857
5	2.682	81.158	18.841
6	2.697	80.328	19.671
7	2.703	80.021	19.978
8	2.705	79.920	20.079
9	2.706	79.890	20.109
10	2.706	79.882	20.117

For the 10-year period, innovations in capital productivity growth in mining explain a relatively small initial portion, but with an accelerating stable long-run significance (up to 20 per cent), of the forecast error variance of the economic growth rate directly, and thus support the results obtained from Granger causality tests.

Figure 6.20: Impulse response functions of economic growth due to innovations in capital productivity growth in mining



The initial effect of a positive innovation in capital productivity growth in the mining sector on economic growth is zero (shown in the second graph above). This is followed by a positive effect of about 0.5 per cent in the second period, which increases slightly in the third period and then gradually decreases over time, to its original long-run growth level by the 10th period. The impacts of the first lags of growth and of capital productivity growth in mining on itself respectively, mentioned above, are confirmed by the positive contributions depicted in graphs 1 and 4 above.

6.4.7.4 *Multifactor productivity growth in the mining sector*

Since capital productivity in the mining sector contributes significantly to growth, it will be interesting to determine whether pressures of international competition will secure a similar result for multifactor productivity in this sector. The relationship between multifactor productivity and growth is captured in the vector autoregression (VAR) model reported in table 6.40, while the extent of the effect of an innovation in multifactor productivity in the mining sector on economic growth is evident in figure 6.21.

Table 6.40: Vector autoregression model estimating the effect of growth in multifactor productivity in mining on economic growth

Sample(adjusted): 1962-1997
Included observations: 36 after adjusting endpoints
t-statistics in parentheses

	GROWTH	PTGR_MFP_MIN
GROWTH(-1)	0.4420	-0.2287
	(3.286)	(-0.750)
PTGR_MFP_MIN(-1)	0.2019	0.5289
	(3.010)	(3.481)
C	1.9417	0.3218
	(3.393)	(0.248)
R-squared	0.4207	0.2689
Adj R-squared	0.3856	0.2246
Sum sq resides	152.94	784.62
SE equation	2.1528	4.8761
F-statistic	11.985	6.0713
Log likelihood	-77.120	-106.55
Akaike IC	4.4511	6.0862
Schwarz IC	4.5830	6.2181

Table 6.40 reports the results of the VAR with lag order 1 for the relationship between growth and the growth in multifactor productivity in the mining sector. Of significance is the first column of results with growth as the dependent

variable. The coefficient for the multifactor productivity in the mining sector is significant and has a positive sign indicating a positive impact on economic growth. The strength of the relationship is further supported by the significant first lag of growth on itself as well as the first lag of multifactor productivity in the mining sector on itself.

Table 6.41: Variance decomposition of growth due to innovations in growth in multifactor productivity in the mining sector

Period	SE	GROWTH	PTGR_MFP_MIN
1	2.061	100.00	0.000
2	2.424	84.914	15.085
3	2.604	74.594	25.405
4	2.677	70.541	29.458
5	2.701	69.372	30.627
6	2.707	69.131	30.868
7	2.708	69.102	30.897
8	2.708	69.103	30.896
9	2.708	69.103	30.896
10	2.708	69.103	30.896

Table 6.41 shows that for the 10-year period, innovations in multifactor productivity growth in the mining sector, explain an initial modest portion of 15 per cent for the second period, but with an accelerating and impressively stronger and stable long-run significance (up to 30.8 per cent by the 10th period), of the forecast error variance of the economic growth rate directly, and thus support the results obtained from Granger causality tests.

Figure 6.21: Impulse response functions of economic growth due to innovations in multifactor productivity growth in the mining sector

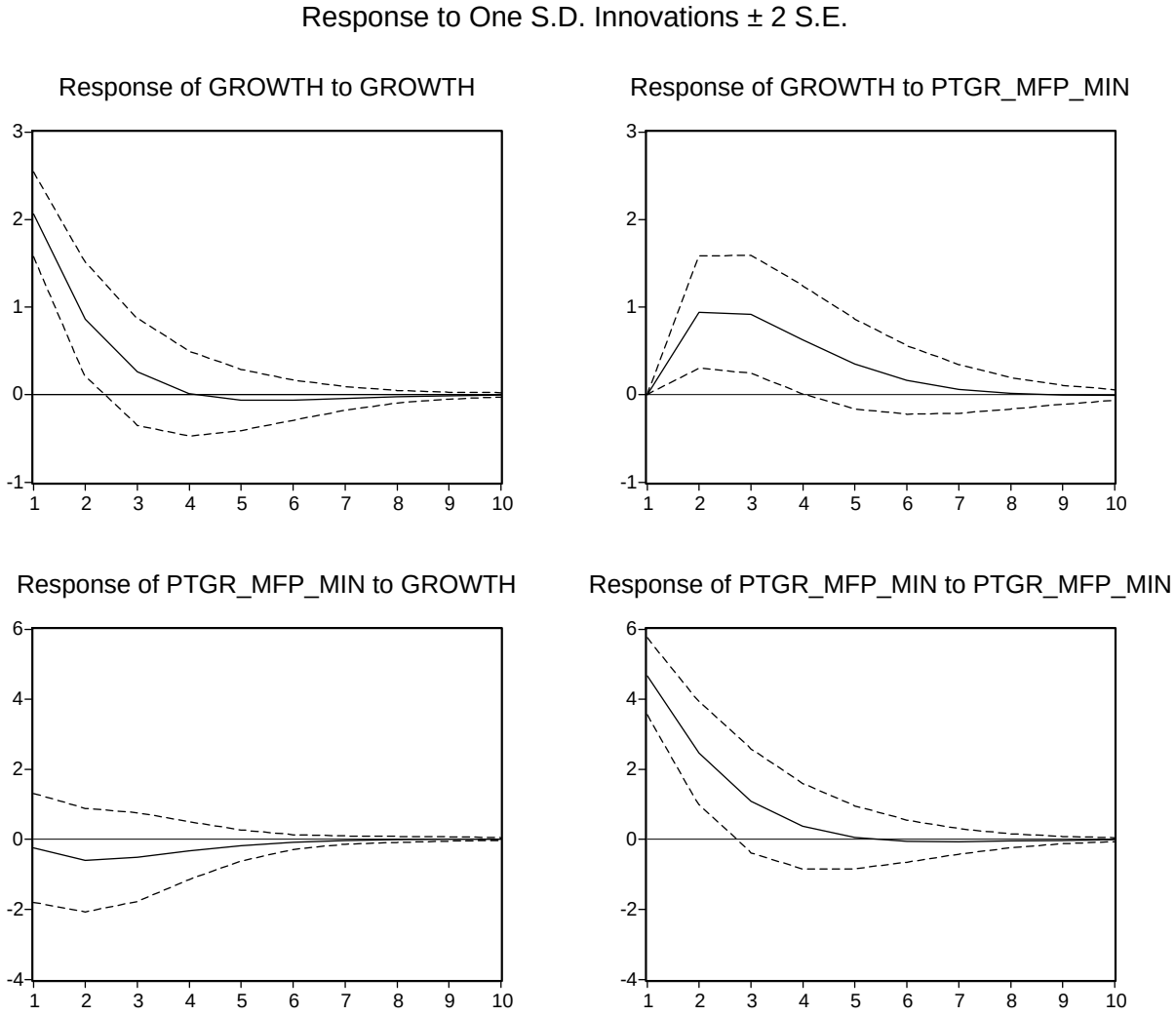


Figure 6.21 depicts the short-run and long-run effects of various shocks to the system and shows no immediate effect on growth from innovations in growth of mining multifactor productivity shocks. However, it predicts a 1 per cent effect by the next period, which subsides in the second period and gradually fades away to its long-run trend by the seventh period. The first and fourth graphs give indications of the positive and statistically significant effect of the impacts on these variables by their respective first lags.

The analyses of the effects of various productivity growth rates on growth reaffirm the importance of the contribution of all types of productivity increases to growth, and verify the role that growth accounting suggested in this respect.

6.4.7.5 *Unit labour cost in the manufacturing sector*

To conclude this chapter, this final section examines the effect of unit labour cost in the manufacturing sector on economic growth. Intuitive responses tend to lead one to expect that there would be a negative effect on economic growth stemming from higher unit labour costs. This, off course, overlooks the purchasing power stimulus that higher incomes will have on demand, and ultimately on future growth. The bidirectional Granger-causalities reported in table 6.33 confirm this notion.

Table 6.42: Vector autoregression model estimating the effect growth in unit labour cost in the manufacturing sector has on economic growth

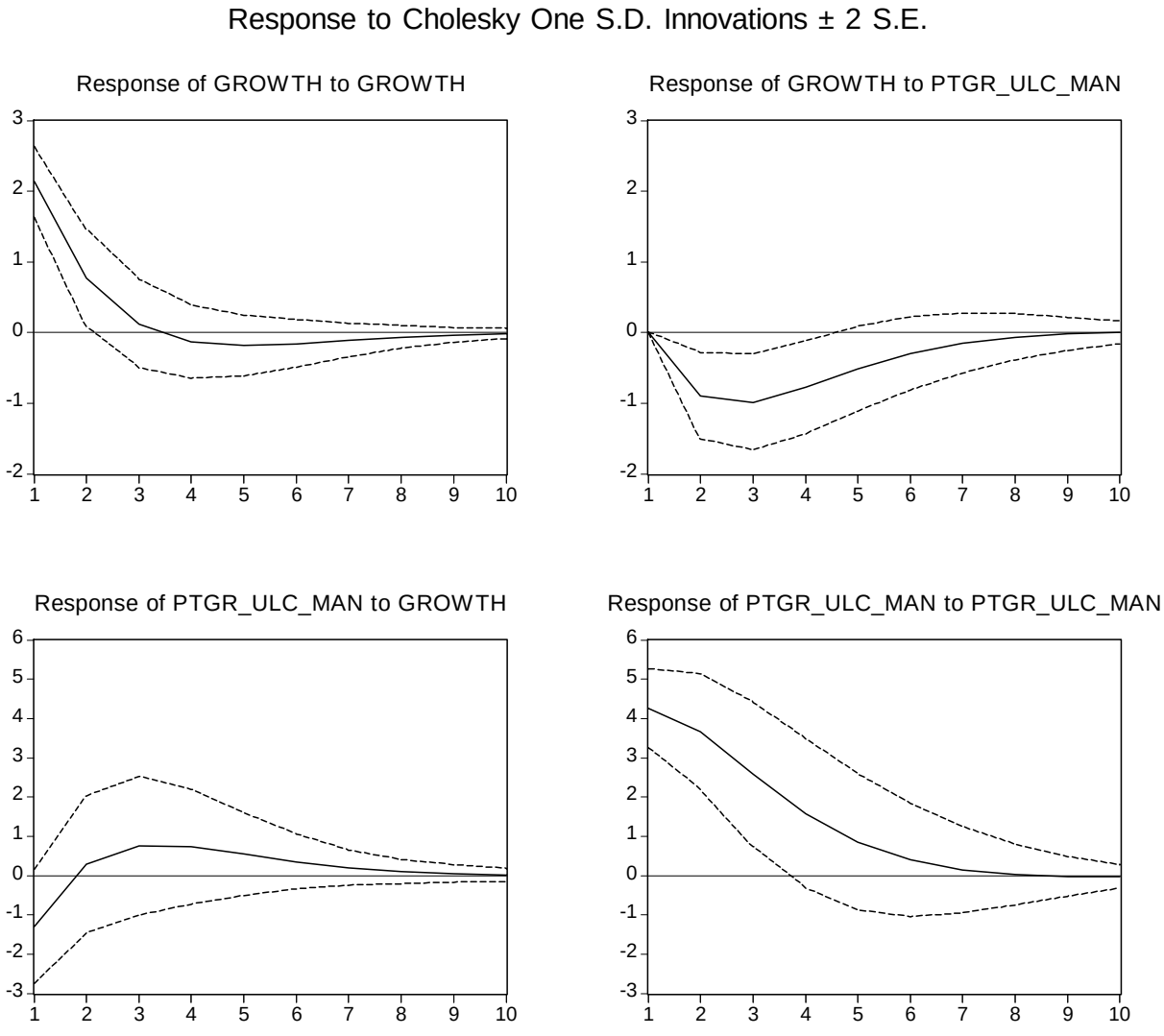
Sample(adjusted): 1962-1997 Included observations: 36 after adjusting endpoints t-statistics in parentheses		
	GROWTH	PTGR_ULC_MAN
GROWTH(-1)	0.2345 (1.487)	0.6673 (1.994)
PTGR_ULC_MAN(-1)	-0.2119 (-3.151)	0.8623 (6.163)
C	4.4646 (4.123)	-0.7618 (-0.337)
R-squared	0.4324	0.5538
Adj R-squared	0.3980	0.5268
Sum sq resides	149.86	653.09
SE equation	2.1310	4.4486
F-statistic	12.571	20.486
Log likelihood	-76.753	-103.24
Akaike AIC	4.4307	5.9027
Schwarz SC	4.5627	6.0347

The vector autoegression results given in table 6.42 confirm the notion that increases in unit labour costs detract from economic growth. The expected

negative sign of the sizeable unit labour cost coefficient and its statistical significance confirm the expected negative effect on growth.

The expected reverse effect indicated by the Granger causality of growth to higher unit labour cost is also confirmed by the positive sign and the statistically significant coefficient of growth to unit labour cost in the manufacturing sector, and also by the statistically significant and positive lagged effect of unit labour cost on itself, indicating that unit labour cost increases have a built-in self-perpetuating mechanism.

Figure 6.22: Impulse response functions of economic growth due to innovations in unit labour costs in the manufacturing sector



The impulse response graphs show the bidirectional causalities suggested by the Granger causality tests. The second graph in the series shows a negative effect of unit labour cost on growth of about 0.8 per cent by the second period, which increases to 1 per cent by the third period and gradually fades away to its long-run level by the ninth period. The third graph displays the opposite effect of growth on unit labour costs. The initial reducing effect on unit labour cost possibly represents positive scale effects of higher demand from higher wages on growth which is summarily overtaken by cost-push factors which then dampen further growth. The cost-raising effects reduce more slowly and only converge to its original long-run trend by the ninth period.

Table 6.43: Variance decomposition of growth due to innovations in growth in unit labour cost in the manufacturing sector and *vice versa*

Variance decomposition of GROWTH:			
Period	SE	GROWTH	PTGR_ULC_MAN
1	2.040	100.00	0.0000
2	2.335	86.421	13.578
3	2.521	74.335	25.664
4	2.631	68.480	31.519
5	2.682	66.313	33.686
6	2.702	65.673	34.326
7	2.708	65.534	34.465
8	2.709	65.518	34.481
9	2.710	65.520	34.479
10	2.710	65.522	34.477
Variance decomposition of PTGR_ULC_MAN:			
Period	SE	GROWTH	PTGR_ULC_MAN
1	4.259	8.494	91.505
2	5.528	5.286	94.717
3	6.095	5.743	94.256
4	6.316	6.569	93.430
5	6.389	7.083	92.916
6	6.409	7.308	92.691
7	6.413	7.384	92.615
8	6.414	7.403	92.596
9	6.414	7.406	92.593
10	6.414	7.406	92.593

Table 6.43 shows that for the 10-year period, innovations in unit labour cost growth in the manufacturing sector rises from an initial zero effect on growth to a modest 13 per cent depressing effect for the second period. However, sharply

accelerating to 34 per cent by the sixth period, after where it stabilises in the long-run and thus supports results obtained from Granger causality tests.

Of further interest is the lower part of table 6.43 which indicates the decomposition of unit labour cost increases stemming from growth and from itself. The third column shows a modest 8.5 per cent stimulus on unit labour cost from growth in the first period supporting similar evidence from the impulse response graphs. It reduces sharply to 5.2 per cent in the second period and gradually edge up to its long-run level of 7.4 per cent by the eighth period, supporting the initial growth scale effect hypothesis mentioned earlier and the effects from the additional lagged response from itself as well as from the lagged growth response.

6.5 SUMMARY AND CONCLUSIONS

The plethora of research papers on economic growth, using cross-country analyses indicates which growth inducing factors are statistically significant contributors to growth. The latter factors, for which time series are available in South Africa, have been used to determine which of them caused growth in South Africa. This summary provides a brief overview of the results of this research.

The openness variables are all indicative of a causal relationship using Granger causality tests, and the causalities run from openness to economic growth. In the case where openness is measured as the sum of exports and imports as a percentage of GDP, there is an indication of bidirectional causality.

The results suggest that barriers to openness such as import tariffs and quotas must be limited and exports must be promoted since export-led growth in line with the new growth theories remains vital for the future. For obvious reasons, however, imports of productive capital goods are needed more than imports of nonproductive luxury goods to revive the economy. Export promotion should concentrate on manufactured goods rather than primary products. Also, in the long run, a skilled workforce may contribute to higher competitiveness in the export of manufactured goods.

The relationship between economic growth and investment growth, as well the investment-gdp ratio, displayed a bidirectional causality. Causality was also established, running from investment in machinery and other equipment to economic growth. A reverse causality between investment in transport and communication and economic growth also seems to exist. The relationship between growth and investment should thus be viewed as a part of the process of economic development and growth and not as the primary connecting source.

Although injections of capital are important, it does not seem to be the sole driving force of future growth. Creating the conditions for productive capital accumulation is more important than capital accumulation *per se* and policy makers should focus more on policies that encourage total factor productivity growth, as shown in the sections on productivity growth in this study (see section 6.4.7 on p176, specifically 6.4.7.1 on p185 and 6.4.7.5 on p197).

The effects on growth of the ratio of government spending to GDP, as well as the ratio of government spending less spending on education and defence to the GDP or so-called “nonproductive” spending and the growth rates in these variables were also analysed. Granger causality tests conducted on these variables, show causality from government spending to growth. Using this evidence in tandem with VAR models for both variables (tables 6.15 and 6.16) show that in both cases, coefficients are negative and statistically significant, implying that excessive government spending detracts from growth. The negative effect of nonproductive spending on growth is higher than that of productive government spending (fig 6.7). This is a long-run effect, since after 20 periods the growth level is still below the original long-run path. These findings imply that benign government spending, mainly on domestic defence and personal safety and security as well as education, should constitute almost the entire budget and that other government activities falling outside of this group should be privatised.

Internationally, rapid rates of growth are almost invariably associated with the rapid rate of growth of the secondary sector, mainly the manufacturing sector.

The influence on growth of various variables defined in terms of the main sectors was investigated.

Results show that there is statistical significance to support the theoretical positive impact of growth in the manufacturing sector on the economic growth rate. Of particular significance is that the manufacturing growth feeds on itself, while simultaneously contributing to long-term economic growth. It would therefore appear that the manufacturing sector is a formidable engine to drive economic growth. The same analysis for agricultural and mining indicates a relatively small positive response in economic growth because of innovations in growth in these sectors.

Policy should therefore be directed towards creating an environment conducive to developing manufacturing in general for local as well as global consumption and its downstream service sectors such as trade and transport. The privatisation of state monopolies in the electricity, transport and communication sectors should be expedited, in the process ensuring competition, especially foreign competition.

Export promotion could facilitate sectoral growth and has indeed been emphasised in the analysis of the openness of the economy, as set out in section 6.4.1.

South Africa's high crime rate is has a further negative effect on economic growth. Impulse response graphs show that economic growth is responsive to increases in the growth rate of **crime** incidents, which serves as a negative shock to higher growth. This negative impact, however, dies out relatively quickly as the convergence back to the long-run growth level takes place after only about four periods. This implies that an improvement in the safety and security setup may soon lead to a situation more conducive to economic growth.

The two state (or stock) variables, namely measures of physical capital and human capital stock, were also analysed. The Granger causality tests suggest that a bidirectional causality exists between growth in capital stock and economic growth. This result is in line with the results obtained for growth in

fixed investment and economic growth. The same holds true for the quantitative proxy for human capital. For the two proxies for qualitative measures of human capital, causality was not established, possibly because of below par education standards, low availability or poor education quality in the past.

Statistical significance exists to support the overall theoretical positive impact of the growth in capital stock on the economic growth rate. This is evident from the impulse response functions showing that the initial effect of a positive innovation in capital stock on economic growth is also positive.

To augment the variables on human capital, a number of productivity variables were tested, which will simultaneously also serve to indicate the role that technology played in the past growth performance of South Africa. Results show that innovations in labour productivity growth in manufacturing were a statistically significant contributor to economic growth and to explain an important portion of growth, with a sustained long-run significance.

Multifactor productivity in manufacturing also made a statistically significant contribution to economic growth. Simulated innovations explaining an initial 9 per cent portion, increasing to more than 12 per cent by the third period and thus supports results obtained from Granger causality tests.

Innovations in capital productivity growth in mining explain a relatively small initial portion, but accelerating to 20 per cent of the forecast error variance of the economic growth rate and thus support results from Granger causality tests. Innovations in multifactor productivity growth in the mining sector explain an initially modest 15 per cent accelerating to 30.8 per cent in the 10th period and thus support results obtained from Granger causality tests.

The analyses of the effects of various productivity growth rates on growth reaffirm the importance of the contribution of all types of productivity increases to growth, and verify the role that growth accounting suggested in this respect. It also suggests that multifactor productivity growth and labour productivity growth in manufacturing in particular, are strong growth stimulants. Policy options that will stimulate productivity growth in manufacturing and induce

exports of manufactures should be carefully chosen and constantly honed in consultation with private sector institutions. Policies used by the high performing Asian economies that pursued rapid industrialisation could be of particular importance in this respect.

Innovations in unit labour cost growth in the manufacturing sector, initially have a zero effect on growth which increases to 13 per cent depressing effect on growth for the second period, but with a sharply accelerating influence of more than 34 per cent from the sixth to the 10th period. The bidirectional influences of unit labour cost must be carefully examined and strategically managed because excessive increases could compromise international competitiveness while excluding the large unemployed labour contingent. Instead, the focus should rather be on the bidirectional initial effect, which could be enhanced by the employment of the unemployed rather than higher increases for current job incumbents. The initial effect of the purchasing power of the newly employed on manufacturing itself seems to be greater because of the statistically significant bidirectional influences and lagged positive contributions of productivity growth on itself, and by implication, the negative effects of unit labour cost increases by its significant first lag.

CHAPTER 7

SUMMARY AND CONCLUSION

The best way I know of persuading you of anything is not to plead with you to trust me, not to invoke authority in general, not even to call upon some expert, but to show you just what it is that persuaded me.
MIT physicist, Philip Morrison (1992:5)

7.1 INTRODUCTION

This chapter provides an abridged version of the study. **The findings and policy recommendations are presented in bold print.**

7.2 FINDINGS OF THE STUDY AND POLICY RECOMMENDATIONS

Chapter 1 contains various definitions of economic growth used in the literature. It outlines the rationale for the different definitions of economic growth and discusses the merits of the various concepts. It also deals with the criticisms levelled at some of the definitions. It outlines population data limitations in South Africa and uses this as the basis to define growth for this study as the percentage increase in gross domestic product at constant prices from one year to the next. This variable is the dependent variable of growth when econometric tools are used to test for factors determining economic growth in South Africa.

Chapter 2 commences with an analysis of the classical roots of economic growth, from the optimism of Adam Smith (1723-1790) to the pessimism of Malthus (1766-1834) and Ricardo (1972-1823). The classical phase ends with the work of John Stuart Mill (1806-1873). The next section touches briefly on the socialism of Marx and then fast-forwards to the neoclassical hiatus, focusing on Marshall (1842-1924). Chapter 2 concludes with a discussion of Schumpeter

(1833-1950) and Kuznets (1901-1985), whose work has important links with our modern growth theory.

Chapter 3 outlines the evolution of the exogenous growth theory by Solow, using *inter alia* the foundations laid by Nicholas Kaldor with his stylised facts. According to Bannock (1998:396), stylised facts are "broad generalizations that are true in essence, though not always in detail". He also states that "this is one of the most important, but least acknowledged forms of empirical testing in economics… . Many models are designed simply to explain behaviour at its simplest, and can be judged only against the broad truth, rather than the detail". Van der Ploeg and Tang (1992:16) are of the opinion that the exogenous technical progress of the neoclassical theory fits into Kaldor's stylised facts.

Romer (1989b:54) quotes Kaldor's stylised facts and agrees with his idea that these broad tendencies are essential in the conceptual stages of a body of theory. He is of the opinion that without stylised facts at which to aim, "theorists would be shooting in the dark".

Romer (1989b:55) contends that the basic questions about growth need to be re-examined. He then elaborates on Kaldor's stylised facts to "make sure not only that the facts have some connection with measured data but also that the list be as inclusive as possible". The chapter goes on to outline the stylised facts proposed by Romer as well as those of Easterly and Levine (2000:1).

The widening of the array of Romer's stylised facts is in line with the wider availability and scope of international data, notably work on growth accounting, international trade, population growth and migration trends. Regarding the latter, Lucas (1988:25, 40) has shown that these trends are a crucial piece of evidence in distinguishing between theories based on constant and increasing returns to scale.

Easterly and Levine (2000:37) suggest that their stylised facts are more consistent with a technology explanation of growth and income differences than a factor accumulation explanation. Empirical work, however, does not yet distinguish decisively between different theoretical conceptions of "total factor

productivity growth". They recommend that economists should put more effort into modelling and quantifying total factor productivity. **This recommendation is heeded in this study at the end of chapter 6 where the influence on the growth of several productivity variables is examined.**

Growth accounting is then examined. It stems from an investigation by Denison (1987:572) of the sources of growth in the USA from 1909 to 1958. It is an attempt to allocate growth rates in national output or output per person employed to the determinants of output in order to isolate the causes of growth. Further aims are to determine the causes of international differences in output levels and then show which are responsible for differences in growth rates.

The conclusion on growth accounting is that it delivers somewhat limited insights into the growth process because it tends to be static, and depending on the periods it spans, could be influenced by business cycles and therefore measure cyclical swings instead of growth trends. These calculations nevertheless contributed by giving some insight into the relative importance of the factors that are measured. The unexplained residual posed a challenge to researchers to explain the unexplained, or what is also termed "the measure of our ignorance" or multifactor productivity.

Endogenous growth theories widened the research ambit, by breaking the growth constraint of constant or even decreasing returns and extending it to perpetual or even accelerating growth. It also modernised, widened and diversified the concepts of technology and human capital, adding to the spectrum of prospective growth-enhancing variables. It quantified relationships between growth and arrays of independent variables, usually in cross-country analyses.

Chapter 4 investigates and assesses South Africa's growth performance, firstly, in relation to the growth potential as set out by the best-known documents on this subject, namely the Economic Development Plan, (which commenced in the mid-1960s), and the more recent Growth, Employment and Redistribution: a macroeconomic strategy (GEAR) of 1996. Secondly, performance in the light of the outward-oriented strategies of the newly industrialised East Asian economies is appraised. It investigates South Africa's growth performance in the

light of some of the factors that have been identified in growth theory as being of significance in the growth process.

Evidence is presented which shows that the actual output of the South African economy exceeded its estimated potential level until 1969, after which the position was reversed. Moreover, the gap between actual and potential growth rates tended to increase over time, except for the brief period spanning 1993 to 1996 when the gap momentarily decreased. It subsequently took another turn for the worst.

South Africa's growth potential is then examined in terms of the outward-oriented policies of the East Asian economies. **Looking at South Africa's outward orientation, it is concluded that over the decades, South Africa's export growth was lower than the average growth in world trade, causing a loss in world market share. A more equitable outcome would have been the maintenance of its share, and with increased economic growth as the target, a steadily increasing share.**

Simulations with the econometric model of the University of Pretoria (1992:6) showed that **the average annual real growth rate of South Africa could have been increased to more than 7 per cent if South Africa had succeeded in raising its share in world trade from the present level of 0.7 to 1.1 per cent over a period of seven years.**

The observation is made that while South Africa's share in world trade has decreased and the inflow of foreign direct investment has declined, the situation has been aggravated by both the previous and the current governments through their redirection of an increasing share of scarce resources from the more productive private sector to the less productive public sector.

Holden (1993:225) finds that although, in terms of the new trade theory (with its emphasis on economies of scale, product differentiation and R&D expenditures), and despite the existence of intra-industry trade in South Africa, it was not possible to establish any relationship between economies of scale, R&D expenditures and the extent of intra-industry trade. Trading patterns in

South Africa appear to be primarily driven by factor endowments, including the availability of natural sources.

In a seemingly positive environment, growth performance remains below expectation and its estimated potential. Its lack of labour absorption capacity is its main shortcoming. The chapter comments on South Africa's trade and labour policies and their effect on employment, and shows that the following recommendations could steer the economy into a more amiable employment and trade regime:

- More action is needed to break the privatisation and FDI hiatus, which would bring immediate benefits. **Accelerated privatisation can provide an important initial stimulus to FDI because it directly draws in foreign firms by their purchasing of assets**. **Privatisation should be complemented by market liberalisation, because it indirectly demonstrates government's continued commitment to openness.** Since FDI projects often have a strong export orientation, they improve the trade balance and currency stability, thus increasing the economy's import capacity and provide an important stimulus for job creation.
- South Africa currently occupies a backseat in the promotion of nonmineral exports through **export-processing zones or duty drawback schemes**. There is no reason why these schemes and zones cannot be adapted to suit South Africa's circumstances, as long as the conditions and institutional environment remain transparent, free of bureaucratic red tape, and these schemes concentrate on employment creation. There are encouraging indications that South Africa is moving in that direction with the Couga Harbour Project.
- It is also clear that South Africa should improve the **institutional environment** in other areas such as **crime, more flexible labour regulations, human capital and private sector competition.** These institutional enhancements should improve the availability of skilled labour, enhance economic literacy, upgrade education in areas such as finance, science and technology and ensure a business climate conducive to customer satisfaction through healthy private sector competition.
- The successes in the motor-vehicle manufacturing industry and its upstream supply chain have shown that an **outward orientation** in South Africa can work. With greater pressure on industrialised countries to

dismantle trade barriers against products from emerging markets, exports could become an engine for accelerated growth.

The purpose of chapter 5 is to identify growth-inducing or growth-detracting factors tested in international cross-country studies in order to use them in a time-series context in chapter 6 to determine whether these factors have had a meaningful causal link to growth in South Africa in the past four decades or more. Of importance here is whether this could indicate the causes of the poor growth performance in the last decade and provide alternatives to revitalise the growth process – that is, to suggest a set of policy measures to put South Africa in a position to achieve higher growth rates in the future. What complicates growth analysis is that characteristics not included in the information set such as oil reserves, gold reserves, navigable rivers or trade routes, and most importantly government policies, could also have influenced growth.

Chapter 5 identifies the most frequently cited and internationally used growth determinants in cross-country analyses. A range of variables compiled from growth literature is discussed in greater depth. Most of the variables defined in chapter 5 are used in the empirical analysis of chapter 6 in this study; others are supplemented or adjusted, mainly where the same data are not available for South Africa. The identified data series includes the following:

- government expenditure as a percentage of GDP;
- government spending (less defence and education);
- the investment to GDP ratio;
- investment in machinery and equipment;
- investment in transport and communication;
- the ratio of value added in agriculture to total GDP;
- the ratio of value added in mining to total GDP;
- the ratio of value added in manufacturing to total GDP;
- the ratio of value added in residual (excluding the preceding three), to total GDP;
- crime incidents and their growth;
- the growth rate in the manufacturing sector as a source of growth;
- public expenditure on education as a percentage of GDP;
- primary school attainment;
- secondary school attainment;

- higher education attainment;
- openness to international trade and investment;
- exogenous increases in the savings rate;
- average share of exports in GDP;
- income distribution;
- several productivity growth and unit labour cost variables;
- growth in capital stock; and
- institutional factors.

Chapter 6 empirically tests the effect on growth of some of the factors identified in cross-country research papers. These identified growth-inducing factors give an indication of which factors could be important in the quest to find causal growth factors in individual countries. **The time-series approach used in this study allows the researcher to analyse causality in either way, as well as statistical significance, and to simulate the likely impact of a specific factor on growth and on itself.** The results are now summarized.

Various openness variables are used internationally to determine their effect on growth. The variables used in this study were the ratio of imports plus exports as a percentage of GDP, followed by exports as a percentage of GDP, and lastly, the average of exports as a percentage of GDP and imports as a percentage of GDE.

These measures of openness are all indicative of a causal relationship using Granger causality tests, and the causalities run from openness to economic growth. Where openness is measured as the sum of exports and imports as a percentage of GDP, there is an indication of bi-directional causality.

The World Bank favours a strategy whereby developing countries should sequence trade policy reforms, beginning with a modest reduction in import protection, combined with **greater uniformity in the structure of effective protection (something South Africa has not yet achieved**) (Lewis 2001:v). This should be followed by a period of favouring exports, prior to final liberalisation of the domestic market.

Using manufacturing exports as a percentage of GDP as an openness variable in a VAR model of order three, a significant impact on economic growth was found. However, it carries a negative sign (-1.26 for the third lag), which indicates that in the past, manufacturing exports did not really contribute to economic growth. This is contrary to the experience of the fast-growing East Asian countries. This could be an indication that the largely primary exports of the past detracted from manufacturing export growth (Dutch disease effect) or that the sanctions campaign had the intended retarding effect on growth. This evidence, however, also shows that a **potentially powerful additional source of growth can be induced with a policy regime conducive to manufacturing rather than primary exports**.

Accelerating privatisation, in conjunction with market liberalization, can provide an important initial stimulus to FDI because it draws in foreign firms both directly (through the purchase of assets) and indirectly (by sending a strong signal of the government's continuing commitment). Since FDI projects often have a strong export orientation, the trade balance could improve, thus strengthening the economy's import capacity and providing the much needed stimuli for job creation.

Empirical evidence in the study shows that the openness of the economy to international trade and investment should be prioritised. Import tariffs and quotas must be reduced and ultimately eliminated according to a set and tight timetable. The relevant government departments and prospective local and foreign investors should agree on attractive incentive schemes to upgrade local skills, production facilities and technology. Export promotion should include set targets linked to incentives which increase progressively with the ratio of exports to turnover ratio. These should be included in the agreements, since export-led growth, in line with the new growth theories, remains critical for the future. For obvious reasons, imports of productive capital goods should have priority over imports of nonproductive luxury goods, to revive the economy. Export promotion should concentrate on manufactured goods rather than primary products (see findings on manufacturing growth on page 218).

To ensure success, the President's Office should be the state institution responsible for formulating and implementing an openness-promoting strategy of this kind. In the future, through the African Union structures, this could widen to include other African states.

Higher education levels contributing to a more skilled workforce were found to have a positive impact on growth and in the long run should also contribute to higher competitiveness in the export of manufactured goods. This means that school curricula should be adapted to favour subjects such as science, mathematics and biology which enhance and enrich the technological capabilities of South Africa's human capital. It is therefore vital for growth that these achievements be commended. **Presidential accolades for achievements in these subjects should be instituted; South African schools should participate in TIMMS (Trends in International Mathematics and Science Study) projects and the government and press give prominence to the results.**

The effect of investment variables on economic growth in South Africa was found to be statistically significant, but these variables appear to be ambivalent contributors to economic growth. The relationship between economic growth and investment growth, as well as the investment-gdp ratio, displayed a bidirectional causality. Causality was also established, running from investment in machinery and other equipment to economic growth. However, a VAR analysis showed that **the only significant relationship was the reverse relationship from investment to growth**, which was supported by the impulse response graph. There seems to be a **reverse causality between investment in transport and communication and economic growth. These results indicate that investment promotion as a growth-promoting vehicle is likely to miss the target and should be avoided.**

King and Levine (1994:282, 286) drew a similar conclusion to the one tested in this study and recommended a revision of **the role of investment and physical capital accumulation in economic growth and development. They propose that because of the bidirectional causality in the relationship, it should be viewed as part of the process of economic development and growth, and not as the primary connecting source.** Of

specific importance is the feedback from economic growth to investment growth. The results and recommendations of this study are therefore in accordance with their views.

Easterly and Levine (2000:4) found evidence which "**suggests that creating the conditions for productive capital accumulation is more important than capital accumulation per se and that policy-makers should focus more on policies that encourage total factor productivity growth**". The sections on productivity growth in this study confirm this finding for South Africa (see 6.4.7, specifically 6.4.7.1 to 6.4.7.5).

The effects of different measures of government spending on growth were also investigated. The first of these was the ratio of government spending to GDP used by Gwartney *et al* (1998:4), as well as the ratio of government spending less spending on education and defence to GDP. The second variable is what Barro (1997:26) terms "nonproductive" spending. In both instances, the growth rates in these variables are also analysed.

Granger causality tests conducted on these variables for South Africa show causality from government spending to growth. Using this evidence in tandem with a VAR model implies that an increase in government spending, especially **nonproductive spending, might lead to a decrease in economic growth.** VAR models for both variables (tables 6.15 and 6.16) show that in both cases, using government spending to explain growth, coefficients are negative and statistically significant, implying that **excessive government spending in the past detracted from growth**. Using impulse response functions (figure 6.7), one can infer that **the negative effect of nonproductive spending on growth is higher than that of productive government spending.** This is also a long-run effect since after 20 simulation periods, the growth level is still below the original long-run path. These findings imply that **benign government spending, mainly on domestic defence and personal safety and security as well as education, should constitute almost the entire budget and that other government activities falling outside of this group should be privatised**.

As ascertained by Kaldor (1967:12), and in accordance with several recent international studies, rapid rates of growth are almost invariably associated with the rapid rate of growth of the secondary sector, mainly the manufacturing sector. The influence on growth of various variables defined in terms of the main sectors was investigated.

Results show that **statistical significance exists to support the theoretical positive impact of growth in the manufacturing sector on the economic growth rate. Of particular significance is that manufacturing growth feeds on itself while simultaneously contributing to long-term economic growth. It would therefore appear that the manufacturing sector is a formidable engine to speed up economic growth**. The same analysis for agricultural and mining indicates a relatively small positive response in economic growth owing to innovations in growth in these sectors.

Policy should therefore be directed towards creating an environment conducive to developing manufacturing in general for local as well as global consumption and its downstream service sectors such as trade and transport. The privatisation of state monopolies in the electricity, transport and communication sectors should be expedited and the privatisation processes should ensure that competition, specifically foreign competition, is imbedded. Adopting and adapting some of the industrial and labour policies of the East Asian economies which industrialised successfully could be an example worthy of emulation. One important factor that could facilitate sectoral growth is their export promoting-strategies, which have indeed been emphasised in the analysis of the openness of the economy, in section 6.4.1 on page 134.

Besides excessive nonproductive government spending, a further possible negative impact on economic growth, namely South Africa's high crime rate, was also investigated. Impulse response graphs show that economic growth is responsive to increases in the growth rate of crime incidents, which serves as a negative shock to higher growth. This negative impact, however, dies out relatively quickly as the convergence back to the long-run growth level occurs after only about four periods. This may be good news in the sense that an improvement in the safety and security situation may soon lead to a situation

more conducive to economic growth. **Better preventive and visible policing and modern surveillance techniques in major metropolitan areas have been shown to reduce crime and should be extended. More importantly, these should be supplemented by job creation through the above-mentioned openness strategy, because the study also found that a lack of growth and the concomitant absolute and relative poverty levels tend to trigger criminal activities.**

The two state (or stock) variables referred to in empirical growth analysis, namely measures of physical capital and human capital stock, were also analysed for South Africa. **The Granger causality tests suggest that a bi-directional causality exists between growth in capital stock and economic growth. This result is in line with the results obtained for growth in fixed investment and economic growth. The same holds true for the quantitative proxy for human capital. Causality was not established for the two proxies for qualitative measures of human capital, namely government expenditure on education and government expenditure on education expressed as a percentage of total government expenditure.** This could be the result of the extremely low correlation that exists between these series and economic growth stemming from the below par education standards of the past or low availability or poor quality education in the past.

Statistical significance exists to support the overall theoretical positive impact of the growth in capital stock (an indicator of productive capacity) on the economic growth rate. This is evident from the impulse response functions showing that the initial effect of a positive innovation in capital stock on economic growth is also positive. **The high cost of new productive equipment could retard or stultify this progress. Foreign direct investment would be an ideal way of overcoming this obstacle. Its other beneficial effects in terms of cutting-edge technology spillovers and human capital enhancement were analysed in section 5.2.5 on page 103**.

The high cost of capital expenditure, exacerbated by an intermittent depreciating and appreciating currency, and the present sluggish foreign direct

investment, result in sluggish capital productivity growth. This effect could be counteracted and reversed by local initiatives. **An idea that could be pursued to enhance the country's productive capacity, improve capital productivity growth and create jobs, would be to encourage two shifts per day in manufacturing industries, until foreign investment picks up.** This could result in improved capital productivity, lower fixed unit costs, better export-pricing possibilities, less traffic congestion on roads, and most importantly, employment opportunities which the economy so urgently requires.

Manufacturing competitiveness and export performance could be further enhanced through a managed depreciating currency as a secondary, but equally important alternative monetary target to price stability.

Foreign direct investment could be encouraged, through programmes such as the Motor Industry Development Programme, in sectors that could also benefit from the African Growth and Opportunity Act (AGOA) and privatisation with ensured competition as mentioned above.

To augment the analysis on human capital, a number of productivity variables were tested, which simultaneously also served to indicate the role that technology played in South Afriaca's past growth performance.

For the period under consideration, innovations in labour productivity growth in manufacturing were found to Granger cause growth. It is also a statistically significant contributor to economic growth and directly explains a sizable portion of the forecast error variance of economic growth with a sustained long-run significance (of just over 20 per cent).

For the period under consideration, **multifactor productivity in manufacturing Granger caused growth, made a statistically significant contribution to economic growth,** while simulated innovations in multifactor productivity growth explained a 9 per cent portion of the forecast error variance of economic growth in the second period, increasing to more than 12 per cent by the third period and beyond.

Innovations in capital productivity growth in mining explain a relatively small initial portion, but with an accelerating stable long-run significance (up to 20 per cent) of the forecast error variance of the **economic growth rate. This supports the results obtained from Granger causality tests**.

Innovations in multifactor productivity growth in the mining sector explain an initially modest 15 per cent portion of the forecast error **variance of economic growth for the second period, but with an accelerating stable long-run significance (up to 30.8 per cent in the 10th period). This underscores the results obtained from Granger causality tests**.

The analyses of the effects of various productivity growth rates on growth reaffirm the importance of the contribution of all types of productivity increases to growth, and verify the role that growth accounting suggests in this respect. They also seem to indicate that multifactor productivity growth and labour productivity growth, in manufacturing in particular, are strong growth stimulants. The above-mentioned policy options on export-processing zones and multiple shifts, and local and foreign competition, will stimulate and enhance productivity growth in manufacturing, and induce exports of manufactures, but should be carefully chosen and constantly honed in consultation with private sector institutions. Foreign trade policies used by the high-performing Asian economies that pursued rapid industrialisation could be of vital importance to enhance the chances of success in this respect.

The role of the National Productivity Institute should be extended to focus on manufacturing activities, its local and international competitive abilities and manufacturing sector job creation and retention structures. These enhanced activities should be benchmarked with those of countries that have a proven and superlative industrial productivity performance record. The role of the Competition Commission should also be elevated to include competition issues in the process of privatisation and its findings given greater prominence in government communications and statements.

Innovations in unit labour cost growth in the manufacturing sector have an initial zero effect on growth, which increases to a modest 13 per cent retarding effect on growth for the second period. However, there is a sharply accelerating influence to 34 per cent by the sixth period, after which it stabilises at a long-run significance of 34.5 per cent to the 10th period. The bidirectional influences of unit labour cost must be carefully examined and strategically managed by both management and trade union leaders, because high increases in unit labour costs could compromise international competitiveness while also enhancing the risk of the long-term or permanent exclusion of the large unemployed labour contingent from gainful employment. Instead, the focus should be on the bidirectional initial effect, which could be enhanced by the employment of the unemployed rather than higher increases for current job incumbents. The initial effect of the purchasing power of the newly employed on manufacturing itself seems to be greater because of the statistically significant bidirectional influences and lagged positive contributions of productivity growth on itself, and by implication, the negative effects of unit labour cost increases by its significant first lag. **The analyses on unit labour costs favour an employment-creation strategy rather than a real average wage increase alternative in order to lift the economic growth rate.**

7.3 PROGNOSIS

The results of the analyses confirm the importance for economic growth of manufacturing, export and productivity growth and successful policies aimed at enhancing these stimulants of growth. If well managed, these factors could have a profound influence on South Africa's growth rate, employment creation and competitiveness.

Government expenditure should be limited and targeted towards an amiable growth environment focusing on rival private sector competition, education and health and safety and security. Government should also ensure a freer trade and investment environment, conducive to openness in terms of local and foreign trade and foreign investment, with its concomitant spinoffs for technology, productivity promotion and foreign direct investment.

This study encountered severe deficiencies in official data on human capital, which, in international studies, has been shown to be one of the crucial growth factors in most economies. Continuity in economic time series is vital when redesigning questionnaires involving both outputs and inputs. It is imperative to have proper time series on production, foreign trade, employment, hours worked and earnings in the different sectors, their capital inputs, as well as the skills profiles of these sectors. Statistics South Africa should be tasked, in cooperation with the main users of its outputs, to ensure the integrity and long-term trends of time series, especially production and labour series.

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APPENDIX A

The following conventions are used in reporting unit root test results. The series tested are listed in the first column. The second column reports the sample period and the third column whether a trend and a constant (Trend), only a constant (Constant), or neither one (None) is included. In the fourth column, the number of lags included in the test regression is reported. The next column shows the ADF t-statistic, called τ_τ when a trend and a constant are included, τ_μ when only a constant is included, and τ when neither is included. The last column reports the F statistic, Φ_3 (Φ_1), testing whether the trend (constant) is significant under the null hypothesis of no unit root.

Table A.1 Augmented Dickey-Fuller tests for non-stationarity, levels and first differenced, (data series in natural logarithmic form)

Series	Period	Model	Lags	τ_τ,τ_μ,τ [a]	Φ_3,Φ_1 [b]
CAP_GR	1962-2000	Trend Constant None	2 2 2	-2.90 -0.30 -0.83	10.38*** 8.02
CRIME95	1970-1999	Trend Constant None	0 0 0	-0.92 0.58 1.84	2.03 0.34
ΔCRIME95	1970-1999	Trend Constant None	0 0 0	-3.85** -3.58** -3.34***	7.43*** 12.80***
CRIME_GR	1970-1999	Trend Constant None	0 0 0	-4.18** -4.01*** -3.81***	8.74*** 16.11***
ED_ST10_POP_GR	1960-2000	Trend Constant None	0 0 2	-5.21*** -4.76*** -0.62	13.65*** 22.71***
G_ED	1983-2000	Trend Constant None	0 0 3	-2.43 0.72 3.08	3.15 1.91
ΔG_ED	1983-2000	Trend Constant None	2 2 0	-3.67* -3.77** -3.16***	7.79*** 10.35***
G_ED_PERC	1983-2000	Trend Constant None	0 0 3	-2.84 -1.47 1.82	4.07 2.17
ΔG_ED_PERC	1983-2000	Trend Constant None	2 2 0	-4.08** -4.33*** -4.22***	6.45*** 9.56***

Series	Period	Model	Lags	$\tau_\tau,\tau_\mu,\tau^a$	$\Phi_3,\Phi_1{}^b$
G_GDP	1960-1999	Trend Constant None	0 0 0	0.05 -1.58 1.22	1.40 2.50
ΔG_GDP	1960-1999	Trend Constant None	0 0 0	-4.76*** -4.50*** -4.41***	11.42*** 20.28***
G_GDP_GR	1960-1999	Trend Constant None	0 0 0	-5.25*** -4.89*** -4.67***	13.84*** 23.97***
G_DE_GDP	1960-1999	Trend Constant None	0 0 0	-2.57 -1.27 0.55	3.41 1.60
ΔG_DE_GDP	1960-1999	Trend Constant None	0 0 0	-5.07*** -5.12*** -4.86***	13.06*** 26.22***
GROWTH	1946-2000	Trend Constant None	0 0 0	-5.65*** -4.37*** -2.26**	15.98*** 19.08***
GVA_AGR_GDP	1960-2000	Trend Constant None	0 0 2	-3.99** -3.51** -1.41	8.16*** 12.31***
ΔGVA_AGR_GDP	1960-2000	Trend Constant None	1 1 1	-6.76*** -6.66*** -6.56***	27.54*** 40.60***
GVA_AGR_GR	1960-2000	Trend Constant None	1 1 1	-7.35*** -7.43*** -6.49***	30.37*** 46.58***
GVA_MAN_GDP	1960-2000	Trend Constant None	4 0 0	-0.47 -3.05** 1.38	4.26 9.31***
ΔGVA_MAN_GDP	1960-2000	Trend Constant None	3 0 0	-6.09*** -4.86*** -4.63***	14.04*** 23.66***
GVA_MAN_GR	1960-2000	Trend Constant None	0 0 0	-4.69*** -3.44** -2.58**	11.01*** 11.85***
GVA_MIN_GDP	1960-2000	Trend Constant None	1 1 1	-1.38 -1.52 -2.99***	2.88 3.39
ΔGVA_MIN_GDP	1960-2000	Trend Constant None	0 0 0	-4.47*** -4.32*** -3.30***	10.50*** 18.70***
GVA_MIN_GR	1960-2000	Trend Constant None	0 0 0	-4.39*** -3.95*** -3.96***	9.63*** 15.57***
GVA_RES_GDP	1960-2000	Trend Constant None	0 0 0	-2.09 -2.27 -0.31	2.68 5.18**

Series	Period	Model	Lags	$\tau_\tau,\tau_\mu,\tau^a$	$\Phi_3,\Phi_1{}^b$
ΔGVA_RES_GDP	1960-2000	Trend Constant None	0 0 0	-7.66*** -7.51*** -7.60***	29.37*** 56.51***
GVA_RES_GR	1960-2000	Trend Constant None	0 0 0	-5.36*** -4.29*** -1.78*	14.50*** 18.48***
I_GDP	1946-2000	Trend Constant None	2 2 2	-1.59 -1.62 -0.35	5.24 7.13*
ΔI_GDP	1947-2000	Trend Constant None	1 1 1	-6.72*** -6.81*** -6.89***	15.21*** 23.27***
I_GROWTH	1949-2000	Trend Constant None	1 1 3	-7.07*** -6.95*** -2.38**	16.97*** 24.36***
I_TRCO_RAT	1946-2000	Trend Constant None	0 0 6	-2.83 -2.75* -0.54	4.06 7.60***
I_MAEQ_RAT	1946-2000	Trend Constant None	0 0 0	-0.13 1.81 3.38	2.32 3.26
ΔI_MAEQ_RAT	1946-2000	Trend Constant None	0 0 0	-6.05*** -5.57*** -5.09***	18.23*** 25.71***
OPEN_AVE_XZ	1946-2000	Trend Constant None	3 3 3	-1.38 -1.48 0.22	2.27 2.86
ΔOPEN_AVE_XZ	1946-2000	Trend Constant None	2 2 2	-2.72 -2.66* -2.68**	8.50*** 11.35***
OPEN_SUM_XZ	1946-2000	Trend Constant None	4 4 0	-1.91 -1.61 -0.02	1.55 1.61
ΔOPEN_SUM_XZ	1946-2000	Trend Constant None	0 0 0	-6.96*** -6.71*** -6.77***	24.42*** 44.99***
PTGR_CAP_AGR	1961-1997	Trend Constant None	0 0 0	-7.99*** -7.79*** -7.54	31.90*** 60.73***
PTGR_CAP_MAN	1961-1997	Trend Constant None	2 2 0	-4.29*** -4.38*** -3.56***	5.48 7.48***
PTGR_CAP_MIN	1961-1997	Trend Constant None	0 0 0	-2.51 -2.61 -2.21**	3.32 6.81***
PTGR_CAP_PREC	1961-1997	Trend Constant None	0 0 0	-3.45* -3.51** -3.49***	5.98*** 12.31***

Series	Period	Model	Lags	τ_τ,τ_μ,τ [a]	Φ_3,Φ_1 [b]
PTGR_LAB_AGR	1961-1997	Trend	1	-7.31***	28.72***
		Constant	1	-7.39***	44.11***
		None	0	-7.43***	
PTGR_LAB_MAN	1961-1997	Trend	0	-4.32***	9.57***
		Constant	0	-4.37***	19.07***
		None	0	-3.50***	
PTGR_LAB_MIN	1961-1997	Trend	0	-3.41*	5.92***
		Constant	0	-3.46**	11.99***
		None	0	-3.43	
PTGR_LAB_PREC	1961-1997	Trend	1	-4.56***	7.39***
		Constant	1	-4.64***	11.23***
		None	2	-1.59	
PTGR_MFP_AGR	1961-1997	Trend	1	-6.26***	24.43***
		Constant	1	-6.07***	35.06***
		None	0	-7.67***	
PTGR_MFP_MAN	1961-1997	Trend	3	-4.69***	6.32***
		Constant	0	-4.49***	20.12***
		None	0	-4.48***	
PTGR_MFP_MIN	1961-1997	Trend	0	-3.23*	5.33
		Constant	0	-3.30***	10.88***
		None	0	-3.29***	
PTGR_MFP_PREC	1961-1997	Trend	0	-4.14**	8.57**
		Constant	0	-4.16***	17.34***
		None	0	-3.79***	
PTGR_ULC_AGR	1961-1997	Trend	0	-7.28***	26.48***
		Constant	0	-7.16***	51.39***
		None	0	-5.48	
PTGR_ULC_MAN	1961-1997	Trend	0	-2.44	3.17
		Constant	0	-2.42	5.83**
		None	0	-1.27	
PTGR_ULC_MIN	1961-1997	Trend	0	-2.21	2.71
		Constant	0	-2.36	5.59**
		None	0	-1.36	
PTGR_ULC_PREC	1961-1997	Trend	0	-2.21	3.32
		Constant	0	-2.61*	6.82***
		None	0	-0.81	
X_GDP	1946-2000	Trend	1	-0.95	2.17
		Constant	1	-1.16	3.33
		None	1	0.21	
ΔX_GDP	1946-2000	Trend	0	-5.11***	13.07***
		Constant	0	-5.10***	25.99***
		None	0	-5.13***	
X_MAN_GDP	1960-2000	Trend	2	-4.56***	5.81***
		Constant	2	-4.29***	6.84***
		None	0	-0.09	

*/**/*** Significant at a 10/5/1% level.

a At a 10/5/1% significance level, for t=25, the MacKinnon critical values are -4.38/-3.95/-3.60 when a trend and a constant are included (τ_τ), and -3.75/-3.33/-3.00 when only a constant is included (τ_μ) and -2.66/-2.26/-1.95 when neither is included (τ). The standard normal critical value is -1.32/-1.71/-2.49.

At a 10/5/1% significance level, for t=50, the MacKinnon critical values are -4.15/-3.80/-3.50 when a trend and a constant are included (τ_τ), and -3.58/-3.22/-2.93 when only a constant is included (τ_μ) and -2.62/-2.25/-1.95 when neither is included (τ). The standard normal critical value is -1.31/-1.68/-2.02.

b At a 10/5/1% significance level the Dickey-Fuller critical values for t=25 are 5.91/7.24/10.61 when a trend and a constant are included (Φ_3) and 4.12/5.18/7.88 when only a constant is included (Φ_1).

At a 10/5/1% significance level the Dickey-Fuller critical values for t=50 are 5.61/6.73/9.31 when a trend and a constant are included (Φ_3) and 3.94/4.86/7.06 when only a constant is included (Φ_1).