

**THE SAVING-GROWTH NEXUS IN THE SOUTH
AFRICAN ECONOMY**

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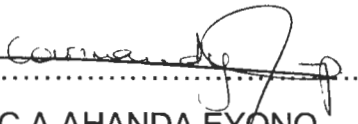
Dissertation submitted in fulfilment of the requirements for the
degree *Master of Commercii* at the Mafikeng campus of the North-
West University

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DECLARATION

I hereby declare that the dissertation "The Saving-Growth Nexus in the South African economy" submitted in fulfilment of the requirements for the degree *Master of Commercii* at the Mafikeng campus of the North-West University has not been previously submitted by me to any other university. This dissertation is the result of my own work and all the materials consulted in its making have been duly acknowledged.

A handwritten signature in black ink, appearing to read 'S.C.A Ahanda Eyono', is written over a horizontal line. The signature is stylized and cursive.

S.C.A AHANDA EYONO

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ABSTRACT

Since the early 1980s the South African economy has experienced a fall in aggregate saving, which has been criticised by the country's monetary authorities as a deterrent to growth. Although this decrease initially coincided with a phase of weak economic performance, South Africa has witnessed a resurgence of non-negligible economic growth rates in the last decade. Nevertheless aggregate saving has further lessened owing to the deterioration of private saving. Such discrepancy between saving rates and growth is in contrast with most growth theories, which argue that saving is a crucial contributor to growth. Furthermore the South African economy has been gradually liberalised since the early 1980s and, according to the McKinnon-Shaw model, should have therefore experienced a rise in saving rates. This paper examines the causal relationship between saving and economic growth in South Africa over the period 1965-2007. The study makes use of long-run regressions, unit root tests, error correction models and granger causality tests for empirical testing. The study pays particular attention to the relation between saving and economic growth and assesses the impact of financial liberalisation on South Africa's saving behaviour. Results suggest that saving has not been a fundamental driver of growth in South Africa and that financial liberalisation has inhibited private saving. Nonetheless the study supports that financial liberalisation has been conducive to higher growth, mostly through important inflows of foreign savings.

ACRONYMS AND ABBREVIATIONS

ADF	Augmented Dickey-Fuller
ARIMA	Auto Regressive Integrated Moving Average
ARMA	Auto Regressive Moving Average
ECM	Error Correction Model
GDP	Gross Domestic Product
IFIs	International Financial Institutions
IMF	International Monetary Fund
LCH	Life Cycle Hypothesis
LDCs	Less Developed Countries
MA	Moving average
NICs	Newly Industrialised Countries
OECD	Organisation for Economic Co-operation and Development
OPEC	Organisation of Petroleum Exporting Countries
PIH	Permanent Income Hypothesis
SAGI	South African Government Information
SARB	South African Reserve Bank

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CHAPTER 1

INTRODUCTION AND JUSTIFICATION FOR THE STUDY

Economic growth is the most important factor in the success of nations in the long-run (Samuelson & Nordhaus, 2001:568).

1.1 Background

The achievement of higher and sustainable economic growth is an objective shared by most if not all economies across the world, regardless of their history, nature, regime and location. However, despite voluminous research and empirical studies, such an achievement is still a dream to many countries as large economic gaps worldwide underscore the intricacy of the phenomenon of economic growth.

Modern history shows that economic growth has evolved differently both geographically and over time and that the now-developed economies have not always enjoyed their current prestigious standards. Maddison (2003) reports that average real incomes nowadays in the U.S. and Western Europe are between 10 and 30 times larger than they were a century ago and between 50 and 300 times larger than two centuries ago.

In contrast to these developed countries, several economies around the world, especially those located on the African continent are very poor and have not exhibited any significant improvement over the centuries. These countries, qualified as less developed countries (LDCs) are renowned for their economic and social problems and are the main concern of development economists.

In addition to the above two common yardsticks, the world records a few cases of growth miracles and failures. Between 1950 and the early 1990s several East-Asian economies recorded exceptional growth rates. Such never

seen before economic growth rates successively experienced by Japan, the Four Tigers (Taiwan, Hong-Kong, Singapore and South Korea) and later by Malaysia, Thailand and Indonesia, have been qualified as miraculous (Stiglitz & Uy, 1996:249). According to Sarel (1996:2), in 1990 the average South Korean was at least 638 per cent richer than his parents were 30 years before, as opposed to just 72 per cent for the average non-Asian residents over the same period.

Although NICs are not the only countries that experienced remarkable growth rates in the 1960s, the particularity about them is that they managed to sustain those high rates for over two decades as opposed to some other Latin American and sub-Saharan African economies. The latter countries either never recorded any significant growth or dismally collapsed after a few years of significant growth (Romer, D., 2006:6). Received as the evidence that underdevelopment is reversible, the East-Asian miracle triggered relentless efforts in LDCs to improve their growth rates in general and alleviate poverty in particular.

In their quest for the holy grail of growth, LDCs embarked on economic reforms and have subsequently implemented a wide range of programmes and policies. These reforms, mostly part of structural adjustment programmes, were recommended and to a certain extent imposed by the World Bank and the International Monetary Fund (IMF) and appear to have been fruitful as Greenspan (2007:A19) affirms that the growth rates of developing countries have considerably exceeded those of developed countries since 2000.

Although there is no scholarly consensus as to the fundamental driver of economic growth, the literature suggests several determinants of economic growth, which are mostly factors of production such as labour, capital (physical and human), technical progress and knowledge. This study is concerned with the sources of physical capital accumulation and draws particular attention to the relationship between saving and economic growth in the literature, putting an emphasis on the case of South Africa.

The interest in capital accumulation as an engine of growth dates back to the emergence of mercantilism, the doctrine that promoted the accumulation of precious metals such as gold and silver with the purpose of filling up a country's reserves and boosting the economy. Nonetheless it is the aftermath of World War II that paved the way for capital fundamentalism, a doctrine that advocates capital as the limit to growth.

Owing to the low performance of global economy after the devastating war, capital fundamentalism held sway in the 1950s and 1960s. During that time several countries amongst which East-Asian countries strove to revive their economies by boosting capital through higher saving and investment based on the argument that there is a virtuous circle between saving, investment and growth (Edwards, 1995:224; Economist, 1995:72; World Bank, 2003:218-220).

1.2 Justification for the study

Easterly (2001:29) asserts that the achievement of higher and sustainable economic growth has tormented economists as long as there have been economists. Over centuries governments have been seeking solutions to better the living standards of their population and South Africa is not an exception. The South African economy seems to be doing well especially considering the country's tumultuous political past. Figures show that in the past decade the economy has experienced a growth rate well above 2.5 per cent (excluding 1998 and 1999): reaching 4.9 per cent in 2004 and an outstanding 5 per cent in the past three years (SARB, 2008).

Furthermore, South Africa is often referred to as the powerhouse of the black continent and, according to Thornton (2008:3) counts along with Egypt, Algeria and Nigeria among the top twenty seven emerging market economies in the world. One would therefore believe that South Africa is poised to shift from its current dual economy status to become a developed economy. Yet, the sluggish levels of saving rates combined with the excessive use of credit

facilities are quite alarming and raise questions about the economic prospects of the country.

Savings and growth go together like port and heat in the making of a flambé (Trevor Manuel, [South African Government Information] 2004:2).

The issue of the scantiness of domestic saving in South Africa has long been raised by the country's monetary authorities. Since the mid 1990s, South Africa's monetary authorities have been calling on the population to cut back on consumption and save more as Manuel (2004:2) argues that higher saving induces greater growth levels, financial independence and security.

The low South African saving rates principally in the personal and government sectors have led some economists to affirm that South Africans lack the culture of saving. Prinsloo (2000:4) argues that an aggregate saving rate of more than 20 per cent of gross domestic product is required if a country wants to achieve a sustained growth rate of 3 per cent per year. In contrast to the above statistics, the South African economy has been depicting continuous low saving rates that Aron and Muellbauer (2000a:1) regard as a "persistent structural" problem.

Figures from the South African Reserve Bank (SARB, 2008), show that the ratio of gross saving to GDP, which had remained well above 20 per cent in the 1970s and early 1980s, drastically fell under this rate and has deteriorated since, reaching a poor 14 per cent in 2006. Similarly the ratio of households' saving to households' disposable income plummeted from 11 per cent in 1980 to -0.56 per cent in 2007. It therefore appears that South Africa has been financing the bulk of its domestic investment with foreign savings since the new regime has taken over.

Such financing methods are impractical over the long-run not only because foreign savings are expensive to repay (Manuel [South African Government Information], 2004:3), but especially because of the volatile character of capital flows. In this regard it is worth stressing that not so long ago, over the

period of sanctions (1985-1994), the South African economy was deprived of foreign capital and had to rely solely on domestic sources (Mohr et al., 2001:89). Furthermore, despite the resurgence of capital inflows into the economy in the early 1990s, figures (SARB, 2008) indicate that foreign direct investment, [which is one of the most profitable forms of investment for the receiving economy (Grossman & Helpman, 1991:205-206)], effectively took off again in 2004 and therefore cannot have generated significant externalities for the South African economy as yet.

Moreover, recent high inflation levels as well as ongoing crises such as soaring food and energy prices combined with the poor performance of the U.S. economy in general and the volatility of the dollar in particular throughout 2007 and 2008 have made the rest of the world and a small open economy like that of South Africa vulnerable to potential shocks and even recession.

Since its establishment in 1921 the South African Reserve Bank has been working hand in hand with the government in order to maintain financial stability and achieve balanced and sustainable economic growth. In the pursuit of its mission the SARB successively adopted four monetary regimes over the years; the last in date, the inflation targeting policy was announced in the February 2000 budget speech by the Minister of Finance Trevor Manuel (South African Government Information, 2004).

Inflation targeting is a policy that consists of controlling inflation through the manipulation or adjustment of the repo rate, which is the interest rate at which the Reserve Bank lends money to commercial banks. According to Van der Merwe (2004:5-6) when the inflation rate moves out of the targets accepted by the government and is expected to remain at that level for a long time, the central bank reacts by either increasing or decreasing the repo rate. That is, rather than using the current inflation rate, it is the expected inflation rate that guides the SARB in the adjustment of the repo rate.

Since June 2006 the SARB has embarked on a contractionary monetary policy in reaction to growing and pervasive inflation. The SARB gradually

increased the repo rate from 7.5 per cent in June 2006 to 12 per cent in August 2008 (SARB, 2008). Although inflation targeting is aimed at curbing inflation, Mohr et al. (2004:522) contend that the adjustment of the repo rate indirectly impacts on households' consumption behaviour through the interest rate channel, the asset price channel and the credit channel. In all of these channels, a raise in the repo rate generates a decrease in investment, consumption spending and aggregate demand respectively, through different mechanisms. It therefore means that the consumption and investment boom in the South African economy between 2000 and 2006 resulted from the combination of low repo rates (hence low nominal rates) and low inflation.

The use of interest rates as an instrument to influence an economy has a long pedigree. Initially suggested to be the principal driver of saving by the classical school of thought, the importance of interest rates was brought back to the fore in the 1970s when two economists, McKinnon (1973) and Shaw (1973) denounced the damages of financial repression for developing countries. The two economists argued that financial repression, which is the imposition of interest rates by government at a lower rate than if determined by market forces, generates low nominal interest rates which in periods of inflation discourage saving, curtail capital accumulation and efficient allocation of resources. The financial repression paradigm led to the McKinnon-Shaw model (1973), which suggests that market-determined interest rates spur saving, better investment and result in higher growth.

The McKinnon-Shaw model quickly became popular amongst economists at that time and was later in the 1980s, on recommendation of international financial institutions and the IMF, applied to most if not all developing countries, including South Africa. Aron and Muellbauer (2000a, 2002b) assert that financial liberalisation initially took place internally in South Africa in the late 1970s and expanded to world standards between the mid 1990s and the early 2000s. Nonetheless, as it was highlighted earlier on, South Africa's domestic saving has been experiencing a sharp decline since the early 1980s. Questions therefore arise on the efficacy of financial liberalisation in the South African economy.

1.3 Problem statement

The prolonged decline in South Africa's domestic saving has raised concern from the country's monetary authorities and as a result, the SARB has been appealing to the population to reduce consumption and save more. Yet despite such low saving, South Africa has achieved significant growth rates over the past decade. Such a discrepancy poses questions as to the importance of domestic saving for growth in South Africa. What is the direction of the causality between saving and economic growth in South Africa? Are higher domestic saving rates necessary for a higher and sustainable growth rate in South Africa? Further the study seeks to find what the responsiveness of saving to the real interest rate is. The latter is done mainly by assessing the impact of financial liberalisation on saving in South Africa.

1.3.1 Primary problem

The primary problem of the study is to ascertain how the South African economy has reacted to the low domestic saving levels recorded in the past two decades.

1.3.2 Secondary problems

The secondary problems of the study are:

- ❖ To what extent have interest rates through financial liberalisation affected the level of domestic saving and growth in South Africa?
- ❖ What has been the impact of foreign capital on domestic saving and growth in South Africa?
- ❖ What is the impact of the South African fiscal policy on saving rates and growth?

1.4 Research aim and objectives

This study is aimed at shedding light on the relationship between saving and economic growth in the South African economy. The objectives of the study are the following:

O1: To determine the respective impact of financial, government and foreign saving on the South African growth process.

O2: To determine the effect of income (GDP) on private saving.

O3: To test the McKinnon-Shaw's financial repression theory in the South African context by assessing the responsiveness of private saving and financial saving to changes in real interest rates.

O4: To determine the influence, if there is, of government saving on private saving.

O5: To determine the impact of foreign saving on private saving

1.5 Research hypotheses

The following hypotheses are tested in the econometric analysis (Chapter 6).

H1: High saving (financial, public and foreign) rates are necessary for long-run growth: low saving rates constrain growth.

H2: Private saving is positively related to income

H3: Private and financial savings are positively related to real interest rates: higher real interest rates lead to higher private saving and financial saving (McKinnon-Shaw's model).

H4: Budget deficits are offset by private saving: Ricardian equivalence.

H5: Foreign saving crowds out private saving.

1.6 Scope of the study

This study analyses South Africa's saving behaviour as an input in the growth process between 1965 and 2007. This period appears to be relevant because it encompasses the major political and economic changes that have impacted the South African economy in general and the saving behaviour in particular. Particular interest is paid to the role played by interest rates throughout that period, which is why in the econometric analysis the entire period of the study

(1965-2007) is divided into two periods: the pre-liberalisation period (1965-1995) and the post liberalisation period (1995-2007).

1.7 Importance of the study

Any research aims at answering unresolved questions over a specific issue and this study is no exception. Understanding the relationship between saving and growth in South Africa is of cardinal importance for the country as a whole. Although South Africa is an emerging market, it has a dual economy and therefore experiences all of the problems faced by less developed countries such as poverty, high unemployment and unequal redistribution.

Hence the results of the study, as part of a growing body of knowledge on saving and growth could contribute to the South African economy if taken account of by the relevant authorities. The study could help the government, monetary authorities and policy makers in the formulation, establishment and implementation of both fiscal and monetary policies. In case high saving rates are found to be necessary for sustainable high growth rates, fiscal and monetary policies could be oriented toward the increase of saving. Otherwise the focus should be turned to other factors.

In view of current global crises namely global soaring food and energy prices as well as the U.S. credit crunch, which have put the world on the brink of recession, this study adds to the numerous efforts of monetary authorities to make the South African population aware of the consequences of excess consumption on the future of any small open economy like that of South Africa.

Finally, as an emerging market economy and the powerhouse of the African continent, South Africa demarcates itself from other developing countries; therefore the results of this study can help in the development process of the rest of the continent.

1.8 Methodology

The methodological and analytical foundations for this study are drawn from the empirical literature focusing on the sources of saving and its impact on growth and development. An extensive review of the theoretical and empirical literature strengthens the analysis of the saving-growth nexus for South Africa.

The data consists of time series that cover the period 1965-2007 and are obtained from the SARB's quarterly bulletin. Descriptive statistics and econometric techniques are used to derive the results in this study. Two econometric models derived from the non-econometric McKinnon-Shaw model and inspired from Warman and Thirlwall (1994) are constructed and form the basis of the tests for the hypotheses suggested earlier. Graphic illustrations, data analysis, regressions, granger causality tests, unit root tests and error correction model tests are performed on the relevant variables of the study. The underlying reasons for the use of these tests are highlighted in the methodology. The policy implications of the results and areas that necessitate further research are highlighted in the final chapter.

1.9 Constraints and limitations of the study

The main constraint faced by the study is the quality of the results due to the calculation methods employed by the SARB. According to Prinsloo (2000), saving in the national accounts is not directly calculated as indicated by the definition but instead is derived as a balancing item in the use of disposable income account. Such calculation methods cast doubt on the accurateness of the results.

1.10 Deployment of the research

The remainder of the study is organised as follows:

Chapter 2: Growth theories

Chapter 2 is the first chapter of the literature survey and starts off with some accounting identities on consumption, saving, investment, imports, exports

and output. Then the study outlines the growth theories with an emphasis on the role of saving in the growth process and the results of empirical studies.

Chapter 3: Saving determinants

This chapter is the second part of the literature survey and reviews the encompassing literature on the determinants of saving. Much attention is paid to the fundamental difference between the classical and Keynesian determination of saving. The analysis of the intertemporal saving models gives an insight into the modern theories of saving. Then the study carries out an analysis of the role of interest rates in the saving process, as well as market integration and highlights the McKinnon-Shaw financial repression theory.

Chapter 4: South African perspective on saving

Chapter 4 is the last chapter of the literature review and unlike the two previous chapters, Chapter 4 steps away from general theories and focuses on the specific realities of the South African economy. South Africa's economic trends are analysed not only to understand South Africa's saving behaviour, but also to have an idea about the results that will be obtained in the econometric analysis.

Chapter 5: Research Methodology

Chapter 5 gives an in-depth explanation of the variables and data that are used in Chapter 6, the sources of the data as well as the underlying reasons for their use. A visual inspection of the time series is provided in order to give an idea as to the results of the tests that may be obtained in Chapter 6. Then the chapter provides comprehensive explanations about the tests that will be performed in the following chapter.

Chapter 6: Data analysis

In Chapter 6 the data is processed, using the software package R. Several tests are performed on the data namely long-regression tests of variables at levels, residuals tests, unit root tests, long-regression tests of residuals, error correction models tests and granger causality tests. The purpose of these

tests is to understand the characteristics and relationships of the variables; mainly if there is long-run relationship between these variables. Moreover the study wants to determine whether the time series help forecast each other and in which direction.

Chapter 7: Discussion and interpretation of the results

Chapter 7 provides an interpretation of the results obtained in the previous chapter. Then with the aid of the same results the study carries out the verification of the hypotheses suggested in Chapter 1.

Chapter 8: Conclusions and recommendations

This is where the study ends. Chapter 8 provides an overall conclusion to the study and offers suggestions for further research.

CHAPTER 2

GROWTH THEORIES

When one starts to think about [economic growth], it is hard to think about anything else (Lucas, 1988:5).

2.1 Introduction

Economic growth is widely accepted to be the prime objective of economies worldwide. This importance stems from the positive effects that a long-lived rise in growth has on the relevant population's living standards (Barro & Sala-i-Martin, 1995:2-4). Nevertheless economists do not seem to have a definite answer as to why some countries are much richer than others and what accounts for the huge increases in real income over time (Mankiw, 2007:186). This chapter, the first of the literature review analyses the existing growth theories in the literature pertaining to the role of saving.

Since the mercantilist era, saving has been linked to economic growth by several schools of thought, which, through their rise and fall have influenced the science of economics as a whole. The term growth was first coined by the founder of the classical school: Adam Smith. The classical doctrine promotes saving as a crucial element in the growth process through capital accumulation (Smith, 1776, vol.I:326). As opposed to the Classics, Keynesians stress that investment generates saving, implying that the role of saving in the growth process is minor (Keynes, 1973 [1939]:281).

As a result of the two above conflicting strands, the science of economics witnessed the emergence of several growth theories in the 20th century. Capital fundamentalism, exogenous and endogenous growth models each have a different view with regard to the major determinant of long-run growth and the role of saving in the growth process. Whilst capital fundamentalism

accredits capital accumulation as the *sine qua non* condition for growth, endogenous models argue that saving is necessary but not sufficient to generate permanent growth. Exogenous models for their share are very innovative as they not only combine the two diverging dogmas but extend them by incorporating several other factors ignored before (Romer, P., 1994:3).

In addition to the theoretical aspect, numerous empirical studies have been performed on the relationship between saving and economic growth. These studies, such as Schmidt-Hebbel et al. (1994); Blomstrom et al. (1993); World Bank (1993a, 1993b); Carroll and Weil (1994); King and Levine (1994); Edwards (1995); Jones (1995b) and Loayza et al. (1999), yield contradicting results.

The undertaking of such studies stems from the importance of understanding the exact causality between saving and growth for policy makers: if saving precedes growth, a country is likely to adopt policies that foster saving and *vice versa*. Although findings diverge, the majority of these studies such as World Bank (1993a, 1993b) and Edwards (1995) show that higher growth rates are associated with higher investment; higher investment with higher saving; and higher saving with higher growth rates.

2.2 Accounting identities

Drawn on Makin (2000), the following identities are discussed. In a closed economy with no government intervention, total output (Y) consists of consumption by households (C) and investment by firms (I).

$$Y = C + I \quad (1)$$

In a closed economy, ex post, investment by firms is solely financed by households' saving, that is:

$$S = I \quad (2)$$

However, economic decisions are not exclusive to households and firms and the role of government in the determination of final output cannot be

neglected. Governments, just as any other economic entity split their earnings (which emanate from the taxes that are paid by individuals) between consumption and saving. In a closed economy, ex post all the goods and services are absorbed domestically; that is gross domestic product equals gross national expenditure. However when allowance is made for government intervention gross domestic expenditure consists of consumption by households (C), investment by firms (I) and consumption by government (G). The sum of C, I and G is called total domestic absorption (A).

$$Y \equiv A \equiv C + I + G \quad (3)$$

As opposed to closed economies, open economies allow for free circulation of exports (X) and imports (M); that is local goods and services are produced within a specific economy to be sold abroad just as well as foreign goods and services are consumed within this economy. Hence in an open economy the equality between gross domestic product (Y) and gross domestic expenditure or total absorption (A) holds only if exports and imports cancel each other out: that is if $X = M$.

Similarly open economies entail capital mobility; therefore the availability of foreign capital annuls the equality between domestic saving and domestic investment in the medium to the long-run.

$$Y = C + I + G + X - M \quad (4)$$

$$S \neq I \quad (5)$$

Gross disposable income is the sum of gross domestic product plus net income received from abroad and net transfers paid abroad. Gross domestic saving is the difference between gross disposable income and the sum of consumption by households and government. Net domestic investment for its share is the difference between gross domestic investment and depreciation.

$$Y^d = Y + y_a + t \quad (6)$$

$$S = Y^d - C - G \quad (7)$$

$$I = GDI - d \quad (8)$$

Substitution of (4) into (6) yields

$$Y^d = C + I + G + X - M + y_a + t \quad (9)$$

Substitution of (9) into (7) gives

$$S = (C + I + G + X - M + y_a + t) - C - G$$

$$\rightarrow S = I + X - M + y_a + t$$

$$\rightarrow S - I = X - M + y_a + t = \text{CAB (current account balance)} \quad (10)$$

With

Y^d = gross disposable income

Y = gross domestic product

y_a = net transfers received from abroad

t = net transfers paid abroad

S = gross domestic saving

I = net domestic investment

GDI = gross domestic investment

d = depreciation

An economy where net investment exceeds gross domestic saving ($S < I$) is said to run a current account deficit in its balance of payments. On the contrary, when the domestic saving of an economy is higher than its net investment ($S > I$) the economy is said to run a current account surplus. According to IMF (2008), the top ten current account deficit countries consist of the U.S., Spain, the U.K., France, Italy, Greece, Australia, Turkey, India and Portugal. On the other hand, the top ten current account surplus countries consist of China, Japan, Germany, Saudi Arabia, Russia, Norway, Switzerland, United Arab Emirates, Kuwait and the Netherlands.

2.3 Growth models and the role of saving

The central fact of development is rapid capital accumulation (Lewis, 1954:155).

2.3.1 Capital fundamentalism

The Harrod (1939) and Domar (1946) model laid the basis for capital fundamentalism, which held sway in the 1950s and the 1960s. Easterly (2001:47) defines capital fundamentalism as the belief that the augmentation

of buildings and machinery (through saving) is the principal determinant of growth.

2.3.1.1 The Harrod-Domar growth model

Developed independently by Roy F. Harrod (1939) and Evsey Domar (1946), the model was initially created to help analyse business cycles and was only used to explain economic growth later on. According to Cesaratto (1999:775) the Harrod-Domar model was the first model to attempt to extend the Keynesian model -according to which investment generates saving- to the long-run. However the model had the opposite effect and revived the classical argument that saving is the main determinant of growth.

The Harrod-Domar model argues that high saving lead to higher permanent economic growth through increased physical investment. According to Harrod (1939), the assumptions of the model are the following:

- ❖ Capital stock (K) and labour (L) supply are fixed and therefore the capital-labour (K/L) ratio is constant.
- ❖ Output is a linear function of capital, which means that the capital-output ratio and the labour-output ratios are fixed.

The principal variables in the model are: capital formation and incremental capital output ratio (ICOR). ICOR is the inverse of increase in output to investment. $ICOR = \frac{\Delta K}{\Delta Y} = \frac{I}{\Delta Y}$ since $\Delta K = I$.

With

Y = income

K = capital

I = investment

Domar (1947:34-55) argues that present investment, while contributing to aggregate demand today also provides new productive capacity, which, if not adequately used discourages future investment thus increasing surplus capital and depressing the economy. But if investment increases at the

correct rate, aggregate demand will be sufficient to use fully the newly added capacity.

The Keynesian model argues that for income and output to be in equilibrium, planned investment must equal planned saving. In the search for the income growth rate at which planned investment equals planned saving, Harrod (1939:45) distinguishes three types of growth rates:

- ❖ The natural growth rate (g_n), which is the rate at which labour force expands.
- ❖ The actual growth rate (g), which is the actual aggregate output change.
- ❖ The warranted growth rate (g_w) that Harrod (1939:45) defines as the *rate of growth which, if it occurs, will leave all parties satisfied that they have produced neither more nor less than the right amount. Or, in other words, it will put them into a frame of mind which will cause them to give such orders as will maintain the same rate of growth.*

According to Harrod (1939), for the economy to be in equilibrium, the actual growth rate must equal the warranted growth rate given the formula that is:

$$g = g_w = \frac{s}{v}$$

With

$$s = \text{marginal propensity to save; } s = \frac{\Delta S}{\Delta Y}$$

$$v = \text{incremental capital-output ratio (ICOR); } v = \frac{\Delta K}{\Delta Y} = \frac{I}{\Delta Y}$$

The above equation suggests that for an economy to increase its growth rate, it must first and foremost increase its saving level. Harrod (1939) and Domar (1947) believe economic growth depends on the quantity of labour and capital, given more investment leads to higher capital accumulation, which in turn generates growth. The authors use their model to justify the poor performance of LDCs, suggesting that despite the abundant supply of labour,

these countries are prevented from prospering because they lack physical capital.

According to Easterly (2001:32-33), the Harrod-Domar model was endorsed by other classical fundamentalists such as Lewis (1954) and Rostow (1960). Easterly (*ibid*) contends that the Harrod-Domar was further accredited following the economic boom that took place in the former Soviet Union between the 1950s and the late 1980s. Over that period the economy of the former Soviet Union experienced major developments that resulted from intensive capital accumulation through coerced saving.

Although the Harrod-Domar model was discredited in the 1950s owing to its unrealistic assumptions (Solow, 1956), Easterly (2001:35-36) argues that the model is still a benchmark for international financial institutions (IFIs). The author contends that IFIs recommended on several occasions that developing countries increase their private saving and investment rates in order to achieve growth (Easterly, 2001:48).

2.3.2 Neoclassical theory of exogenous growth

The neoclassical growth theory emerged following the seminal work of the Solow model in the 1950s and was extended in the 1980s with the advent of endogenous growth theories.

The Solow growth model shows how saving, population growth, and technological progress affect the level of an economy's output and its growth over time (Mankiw, 2007:186-187).

2.3.2.1 The Solow-Swan model

Neoclassical growth theory dates back to Solow (1956) and Swan (1956) and has since been revisited by several economists (Mankiw et al., 1992; and Barro & Sala-i-Martin, 1992, 1995). The Solow-Swan model argues that a policy that promotes saving and investment will have only one effect on the

economy: the level effect, which is an increase of output per worker that temporarily increases the growth rate.

Although the Solow-Swan model draws its origins in the Harrod-Domar model, the former exposes and attempts to solve the weaknesses of the latter. The Solow-Swan model differs from the Harrod-Domar model in three aspects (Solow, 1956:65-94):

- ❖ The Solow-Swan model exchanges the fixed-coefficients production function with a neoclassical production function that allows for more flexibility and substitution.
- ❖ The model assumes diminishing returns to labour and capital separately, constant returns to scale for both factors combined and a unitary elasticity of substitution between factors.
- ❖ The Solow-Swan model adds a third factor, known as technology to the production function.

Solow uses the following Cobb-Douglas (1928:139-165) production function to distinguish among the sources of growth (capital (K); labour (L) and technology (T)):

$$Y = T K^{\alpha} L^{\beta}$$

With

α = elasticity (responsiveness) of output with respect to capital (holding labour constant)

β = elasticity of output with respect to labour (holding capital constant)

$$\alpha = (\Delta Y / Y) / (\Delta K / K)$$

$$\beta = (\Delta Y / Y) / (\Delta L / L)$$

$$\alpha + \beta = 1$$

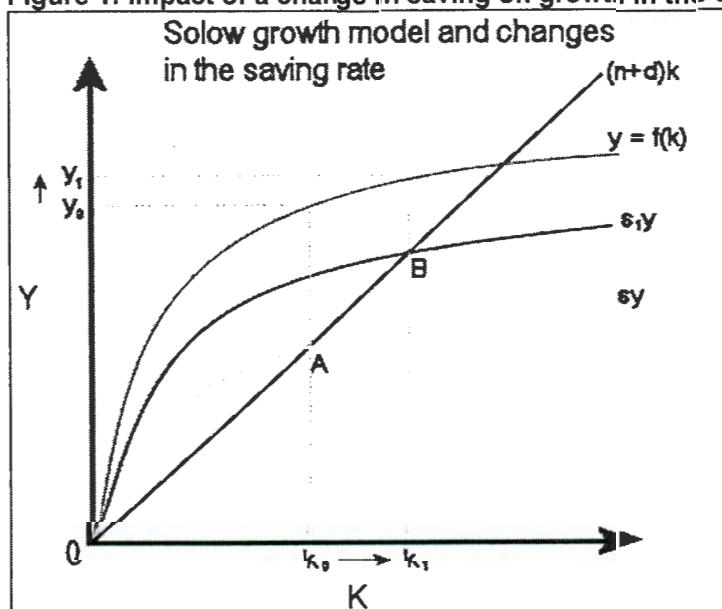
According to Solow (1956), an increase in saving rates fuels investment, which in turn moves the economy to a transition path characterised by higher per capita income and hence higher growth rate. However due to diminishing returns on capital, the economy quickly reaches a point where investment

(and therefore saving) is just enough to cover depreciation and growth in the labour force. The economy then converges to a state of steady growth where per capita income and output, although permanently higher than before the increase in saving occurred, stop increasing.

Solow (1956) contends that the only factor that enables growth to occur on a permanent basis is technical progress. This is done with time, through the improvement labour and capital productivity. According to the author, technical progress cannot be explained by the growth in labour and/or capital: advances in technology are exogenous to economic decisions.

Figure 1 is the representation of the Solow-Swan model and explains the impact of a change in saving levels on the growth rate. An increase in saving shifts the saving function up from sy to s_1y where saving per worker is higher than population growth plus depreciation. Capital accumulation therefore rises from A to B and increases output per worker from y_0 to y_1 . Output per worker reaches a higher path than before the increase in saving occurred. Following the increase in output per worker, the economy expands for a short while, but then goes back to its initial steady rate of growth (n).

Figure 1: Impact of a change in saving on growth in the Solow-Swan model



Source: Wikipedia, 2006

Solow (1956) applies his theory to the U.S. economy and validates it. Similarly in a study of the U.S. economy, Abramowitz (1956) finds that investment accounts for 25 per cent of the growth, leaving the remaining 75 per cent unexplained. The Solow-Swan model received support from several economists at the time, including Domar (1957:8) and was the main cause of the disappearance of the Harrod-Domar model from the academic literature.

2.3.2.2 Other neoclassical models

According to Romer, D. (2006:48), other neoclassical models aroused following the emergence of the Solow-Swan model mainly the Diamond model (Diamond, 1965) and the augmented Ramsey model (Cass, 1965 and Koopmans, 1965). The above models are very similar to the Solow-Swan model as they consider labour and knowledge to be exogenous. However, in contrast to the Solow-Swan model, the Ramsey and the Diamond models assume that the saving decision is endogenous to households as the latter are rational and try to maximise their intertemporal utility relative to the constraints they face. Yet, both models yield the same conclusion as the Solow-Swan model pertaining to the impact of a change in saving on the growth rate; that is, an increase in saving rates results in a temporary level effect rather than a permanent effect on the growth rate.

The Solow-Swan model played a very important role in the development of growth theory and still serves as benchmark for growth models. Nevertheless the Solow-Swan model came under criticism pertaining to the assumption of the exogenous trait of both saving and technological progress rates. Although the Ramsey and Diamond models "endogenised" saving, neoclassical growth models failed to provide an explanation as to the origins of technical progress. This led to the emergence of a new generation of growth models in the 1980s.

2.3.3 New theory of endogenous growth

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 to vary across countries (Romer, P., 1994:3).

Endogenous models aim at explaining long-run growth through the economic process. They argue that permanent growth occurs as a result of decisions and actions by individuals from all the institutional sectors: households, companies and government.

The literature on new growth theories is divided into two main strands, which underscore a different source of long-run economic growth. On the first hand, models of the AK-type led by Romer, P. (1986) go back to the Harrod-Domar model. These models, just like the Harrod-Domar model, argue that capital accumulation is the main contributor to long-run growth. On the other hand, neo-exogenous models developed by Lucas (1988) and Romer, P. (1990) respectively emphasise the critical role of human capital and research and development (Cesaratto, 1999:783-787).

2.3.3.1 The AK model

All that is required to assure the flexibility of perpetual growth is the existence of a 'core' of capital goods that is produced with constant returns technologies and without the direct or indirect use of non reproducible factors (Rebelo, 1991:502).

Inspired by economists such as Abramowitz (1952), Arrow (1962) and Frankel (1962), the AK model gained momentum with the seminal work of Romer, P. (1986). The AK model draws its origins from the Harrod-Domar model. However contrary to the Harrod-Domar model, the AK model considers saving behaviour to be the result of intertemporal optimisation decisions.

The formulation of the AK model is of the type:

$$Y = AK$$

With A = knowledge

K = capital

The AK model is a one sector model and argues that the productive factor, capital, is subject to constant returns to scale. Romer justifies the constant returns to scale by the spill-over effects of knowledge that enhance labour productivity. Romer, P. (1986) believes that every economic agent who is engaged in a productive activity is unintentionally subject to a “learning by doing” process. According to Cesaratto (1999:784) “capital exhibits an externality which gives rise to the production of ‘human capital’”.

The assumption of constant returns to scale of capital implies that individuals will always be motivated to save and invest, because it is a lucrative business. Moreover the spill-over effects of knowledge on labour productivity lead to increasing returns to scale of the production function. Therefore the AK-type models yield the same conclusion as the Harrod-Domar model: increases in saving rates generate a rise in investment, which in turn yield long-run growth rate (Rebelo, 1991).

Jones (1995) tests for the validity of the AK model on the U.S. economy and 14 OECD countries over the period (1950-1988). The author finds that throughout that period, most of the OECD countries depicted increasing investment and that investment in the U.S. was positively and significantly changed with time. However Jones finds that apart from the countries the most stricken by World War II, permanent growth rates did not follow increases in investment. Therefore, the author refutes the belief that an economy can sustain indefinite growth through capital deepening (Jones, 1995, 1998).

2.3.3.2 Neo-exogenous models

What is important for growth is integration not into an economy with a large number of people but rather into one with a large amount of human capital (Romer, P., 1990:S98).

Inspired by Uzawa (1965) and developed by Lucas (1988) and Romer, P., (1990), neo-exogenous models differ from AK-type models in the fact that

they ascribe permanent growth to intentional investment in human capital rather than unintentional spill-over of knowledge. The authors argue that investment in human capital, through education, research and development will lead to permanent economic growth through the development of new forms of technology and efficient means of production. Neo-exogenous models neglect the impact of saving and investment in the long-run growth process.

Endogenous growth models spurred numerous empirical studies throughout the 1980s and 1990s and extended the analysis of economic growth to an international level (Grossman & Helpman, 1991; Barro & Sala-i-Martin, 1995; and Aghion & Howitt, 1998). The first empirical study on endogenous models was done by Jones (1995). The author respectively performs tests on the per capita income growth rate of the U.S. economy over the period 1880-1987 and that of 14 OECD economies over the period 1900-1987. Jones reports that there was no discernible permanent increase in per capita income growth in any of the above-mentioned countries during the above-mentioned period (Jones, 1995).

2.4 Empirics on growth theories

Growth theories have been subject to numerous empirical studies mainly triggered by the East-Asian miracle and the emergence of endogenous growth theories (Cesaratto, 1999:781). The majority of these studies support the idea that increases in saving rates generate increases in investment, which in turn engender temporary increases in the economic growth rate. Therefore most studies endorse the Solow-Swan model, arguing that the model provides a good explanation of the differences in income levels among countries (Mankiw et al., 1992).

In their study of several East-Asian countries, Carroll and Weil (1993) as well as Rodrik (2000) confirm a strong positive relationship between saving and growth and find that higher saving rates are associated with only temporary increases in economic growth. Similarly Easterly and Levine (2000) find that

variations in the growth of physical capital explain only 25 per cent of the variations in growth performance across countries.

Further support for the Solow model comes from Mankiw et al. (1992). The authors analyse the economic growth of 121 OECD countries over the period 1960-1985. The authors initially test the simple Solow model and find that the model's predictions are consistent with observed outcomes: investment accounts for over 18 per cent of the international variation in growth rates. They therefore conclude that although investment contributes to growth, there are other factors that account for over 80 per cent of changes in income growth. High saving rates are necessary but not sufficient to generate high and sustainable economic growth (Mankiw et al., 1992:414-415).

Then Mankiw et al. (1992) extend the simple Solow model by augmenting the aggregate production function with human capital (proxied by educational attainment). The authors find that the inclusion of human capital improves the explanatory power of the Solow model in the explanation of worldwide differences in income levels.

Despite the strong support for the Solow model, most studies performed on the Four Tigers (Kim & Lau, 1994; Young, 1992, 1994; and, Ito & Krueger 1995) ascribe much of the East-Asian economic boom to capital accumulation rather than technical productivity.

Based on the assumptions of the Solow growth model, Young (1992) performs a study on the growth rates of Hong Kong and Singapore. The author finds that between 1970 and 1990, the growth in technical progress contributed to -8 per cent of output growth in Singapore; and that capital accumulation accounted for 117 per cent in the increase in output per worker during that period (Young, 1992:36). In the consideration of the above the author therefore invalidates the Solow model.

Kim and Lau (1994) compare the sources of post war growth in the Four Tiger to those of the Group of Five Industrialised Countries (Germany, France, U.S., U.K. and Japan). The authors find that capital accumulation accounted for between 48 and 72 per cent in the growth rates of the first group. In contrast advances in technology account for 46 and 71 per cent of growth in the second group.

Lau (2000:5) further rejects the validity of the neoclassical theory by showing that technical progress negatively contributed to the income growth rates of some NICs over the period 1960-1995. It is the case of Indonesia, where the share of technical progress in income growth was -27.2 per cent as opposed to 115.7 per cent for capital and 11.5 per cent for labour. Similarly, in the Philippines the contribution of technical progress was -17.5 per cent as opposed to 99.5 per cent for capital and 18 per cent for labour.

Evidence of the crucial role played by saving in the unprecedented growth of East-Asian countries prompted fervent believers of the neoclassical theory such as Krugman (1994) to compare the capital-intensive growth of the Four Tigers to that the Soviet Union before its collapse; implying that such growth rates could not last for long. Nevertheless according to Loayza et al. (1999:1), "Regional saving disparities have been closely matched by diverging growth experiences: across world regions, higher saving rates tend to be correlated with higher income growth."

2.5 Conclusion

Economics has been concerned with the best way of permanently improving economic growth for centuries. Yet, despite centuries of research and the implementation of a wide range of policies, living standards still substantially differ across the globe.

Although the literature formally agrees that the main drivers of growth are capital, labour and technical progress, empirical studies provide mixed results as to which of the above factors is the ultimate contributor to growth. This

chapter paid particular attention to the effect of capital accumulation in long-run growth. Capital accumulation is made possible through saving, which, since the opening of markets following World War II can be obtained from both domestic and foreign sources.

Countries around the world therefore follow different saving patterns and adopt different policies towards saving: whilst some usually record surpluses in the balance of their current account, others experience deficits. As seen earlier, evidence on the causality between saving and growth is at best ambiguous. On the first hand, the spectacular growth of East-Asian countries is mostly ascribed to high saving rates; however the former Soviet Union that adopted similar methods failed to achieve the same results. On the other hand, the pervasiveness of deficits in some of the world's richest countries (U.S., the U.K. and Australia) does not seem to have hindered their growth.

Most theories and empirics agree on the importance of saving for growth. Although increases in saving rates might not yield long-run growth, when invested efficiently high domestic saving rates generate an increase in labour productivity, and, during the transition from a lower investment level to a higher one, the growth rate will increase. It would therefore be helpful if one could put a number of years to the long-run; that is if one could know precisely after how many years the transition period can be considered long-run.

Nevertheless one would argue that from a developing economy's perspective high economic growth rates, even short-lived would be beneficial to the relevant country: half a loaf is better than none after all. Developing economies in general and African countries in particular would therefore gain in succeeding to replicate the Four Tigers' experience. Although East-Asian countries experienced a crisis in the 1990s, and have witnessed a decrease in their growth rates, the latter are still very significant. Since the 1990s they have made considerable advances in technology and their economies are still strong and competitive by any standards.

CHAPTER 3

DETERMINANTS OF SAVING

3.1 Introduction

The question of how people determine their consumption and hence saving levels has received considerable interest in the economic literature (Loayza et al., 1999:1). This is due to the major influence that consumption or saving behaviour has on the rest of the economy. As it was seen in the previous chapter, savings are translated into physical investment, which has been proven to be a critical element in the determination of output. Understanding saving behaviour is therefore helpful in forecasting an economy's prospects and in the formulation of macroeconomic policies. Whilst the previous chapter looked at the effect of saving in the growth process, this chapter is devoted to the assessment of saving determinants in the literature.

The controversy around saving determinants is supported by significant contrasts of saving rates around the globe. On the one hand some countries (net importers of capital) outspend their income and are left to rely on foreign savings to finance their domestic investment. On the other hand, net exporters of capital save more than they spend and hence invest abroad. Strydom (2007:2) distinguishes net exporters of capital -also known as saving surplus countries- such as China, Japan, the European Union and OPEC members from net importers of capital -or saving deficit countries- which include the U.S., the U.K., Australia, most LDCs and South Africa.

3.2 Saving definitions

Understanding saving requires knowing what saving entails. Therefore, this section provides definitions of saving in the general context.

3.2.1 Domestic saving¹

Based on the 1993 System of National Accounts, Prinsloo (2000:1) defines saving as “the amount of resources or income produced within an economy in a given year that is not consumed immediately but is instead put to use in a way that will provide returns to the economy in years to come.”

Gross domestic saving is the sum of the saving of all institutional sectors: personal, corporate and government saving. Gross saving is obtained in the national accounts as the balance of current total income and current total spending by households, companies and general government.

Households saving or personal saving is the share of households' disposable income that is not spent on consumption. Personal saving can be either discretionary that is can emanate from the individual own free will or it can be contractual that is can result from households commitment to regular payments of different nature.

Corporate saving is the retained income of private and public incorporated financial and non-financial enterprises. The sum of saving by households and corporate saving is called private saving.

Government saving is the total of the retained profits of public enterprises and retained taxes and other current receipts not disbursed on current outlays by government.

3.2.2 Foreign saving

As it was highlighted earlier in Chapter 2, economies worldwide support their investment with saving, which can originate either from domestic or foreign sources or both. Just as domestic saving, foreign saving emanates from private and public sources. On the one hand, public foreign saving, also known as foreign official saving consists of loans from multilateral organisations and foreign governments (including concessionary loans),

¹ This section draws on Prinsloo (2000)

official development assistance, and grants. On the other hand, foreign private saving consists of external commercial borrowing (non-concessionary loans), foreign direct investment and foreign portfolio investment (Mason, 2001:188).

Siggel (2005:93-94) reports that the sources of foreign saving have considerably changed over the years. The author contends that in the past decade, most capital flows to developing countries have been generated from private sources, mainly in the form of foreign direct investment and portfolio investment as opposed to the early 1990s where foreign official saving was the dominant component of foreign saving.

3.3 Saving determinants

In their analysis of the motives behind saving, economists have predominantly focused on the household's perspective (Schmidt Hebbel et al., 1992:529) as households ultimately run companies and governments. Throughout the years the literature has suggested several saving determinants which include income, wealth, demographics, the rate of return, fiscal policy, foreign saving and financial deepening. The remainder of this chapter is devoted to the review of the theories and empirical studies around saving determinants.

3.3.1 The classical school and the rate of return

Propounded in 1776 by Adam Smith and developed by renowned economists such as David Ricardo, Thomas Malthus, John Stuart Mill and Jean Baptiste Say, the classical school's main principle is that the economy self-regulates through markets and the private sector. Hence the tenet of classical economics is the 'laissez-faire' approach, as nature will take its course.

In *The Wealth of Nations*, Adam Smith (1776) contends that capital accumulation alongside the division of labour and technical progress is the main engine of economic growth. Saving is crucial for classical economists because they believe saving is the sole determinant of investment: saving and investment are identical. The indisputable contribution of capital accumulation

in the growth rate of output led classical economists to advocate for high saving as the ultimate gateway to growth.

Whatever a person saves from his revenue he adds to his capital, and either employs it himself in maintaining an additional number of productive hands, or enables some other person to do so, by lending it to him for an interest, that is for a share of the profits (Smith, 1776, vol.I:321)

Classical economists perceive saving as postponed consumption; Smith (1776, vol.I:321-322) argues that the desire to save is a direct result of the utility maximising behaviour of the individual: individuals save to better their condition. By saving, individuals give up on an amount of current consumption and hence expect a reward for their parsimony. This reward, the rate of return or rate of interest, will allow individuals to enjoy greater consumption in the future.

Consequently classical economists advocate for high interest rates as the latter will persuade individuals to consume less in the present and save more for the future. In this regard Ricardo (1814, vol.VI:121) argues that if profits and interest were to fall very low, individuals would not have any incentive to save and saving levels would therefore become sluggish.

In the classical doctrine, the interest rate is determined by the interplay of the supply of saving (principally by households) and the demand by the business sector for investment capital. As depicted in Figure 2, equilibrium interest rate is reached at the intersection between the saving curve and the investment curve. With S , I and r^2 representing respectively saving, investment and interest rate, we can write:

² Even though there are various types of interest rates in the financial system, the theory assumes one general interest rate for simplicity purpose. The latter is called the risk-free rate of interest or pure rate of interest and is assumed to be a component of all interest rates. The pure rate of interest can be defined as the opportunity cost of money or the rate of return of a riskless asset.

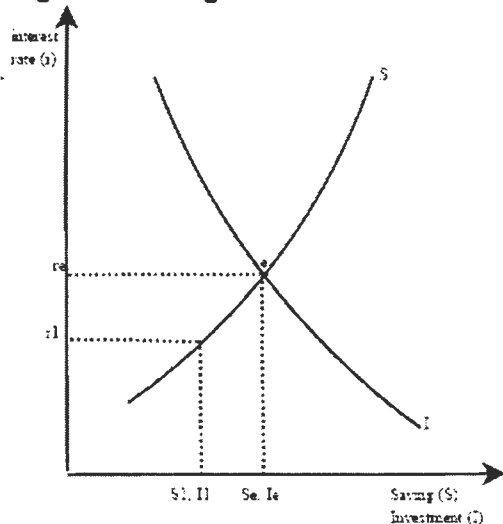
$$S = s(r) \quad \left(\frac{\partial s}{\partial r} > 0 \right)$$

$$I = i(r) \quad \left(\frac{\partial i}{\partial r} < 0 \right)$$

$$S = I$$

Saving is positively related to interest rate. That is a rise in interest rate is followed by a rise in saving, motivated by profit. Investment however is negatively related to interest rate, meaning a rise in interest rate leads to a fall in investment; because the cost of borrowing increases.

Figure 2: Saving in the classical model



Source: Bhaskar and Murray (1976:25)

The classical idea that interest rate is the main determinant of saving is supported by numerous economists. Because interest rate is the price for holding cash, an increase in real interest rate should increase the opportunity cost for. However as discussed by Gordon (1995:121), an increase in real interest rate leads to two opposite effects on saving: the substitution and the income effect that cast ambiguity on the overall relationship between real interest rates and saving/consumption.

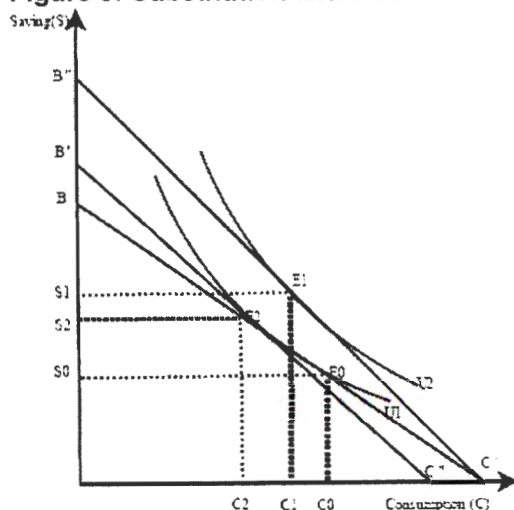
On the one hand a higher real interest rate spawns higher real returns on saving, which in turn spur individuals to consume less and save more of their income; on the other hand, in case individuals are net savers, a higher real

interest rate makes them feel richer than before and prompts them to consume more than prior to the increase in interest rate (Bryant & Zick, 2005:113-115).

According to Schmidt-Hebbel et al. (1992:533) notwithstanding the final outcome of the above two effects, a change in the rate of return has a third effect on saving and consumption: the wealth effect. The authors argue that an increase in the rate of return prompts individuals to decrease their consumption level (hence increase saving) because “a higher real interest rate reduces the present value of future income streams from human capital or fixed-interest financial assets”.

The substitution and income effects of a change of interest rates on consumption and saving are depicted in Figure 3. Initially, the consumer's budget constraint is BC and he is on the indifference curve U1 that allows him to consume C_0 and save S_0 . An increase in the real interest rate shifts him to another budget constraint from BC' to B'C' where he can then decide to stay on the same indifference curve and consumes C_2 and saves S_2 . However, an increase in the interest rate betters his lifestyle and allows him to attain a higher path of consumption than before. Therefore he will move to a higher indifference curve (U2) where he consumes C_1 and saves S_1 .

Figure 3: Substitution and Income effect of an increase in real interest rate on saving



Source: Bryant and Zick (2005:113-115)

3.3.2 The Keynesian absolute-income hypothesis

It should be obvious that the rate of interest cannot be a return to saving or waiting as such. For if a man hoards his savings in cash he earns no interest though he saves just as much as before. The rate of interest is not the price which brings into equilibrium the demand for resources to invest with the readiness to abstain from present consumption (Keynes, 1936:166-167).

The Keynesian school of thought takes its origins in the seminal work of John Maynard Keynes (1936) who in contrast to the classical school argues that the attainment of equilibrium by the private sector is not guaranteed. For this reason the government must intervene given it has the power to regulate the economy through the manipulation of aggregate demand, which is the key element of the economy.

In his 1936 book *The General Theory of Employment, Interest and Money*, Keynes takes opposition with the classical school in several aspects amongst which the importance of saving. Keynes argues that saving plays no significant role in supplying the funds for investment (Keynes, 1937:669). On the contrary he believes that consumption generates investment, which raises incomes and hence saving. "Increased investment will always be accompanied by increased saving, but it can never be preceded by it...It is the parent, not the twin, of increased saving" (Keynes, 1973 [1939]:281).

According to Keynes, income is the main determinant of saving as opposed to interest rates in the classical theory (Keynes, 1938:321). Keynes was the first economist to formulate an equation that expresses the saving-income relationship. He argues that consumption and therefore saving are determined by current disposable income. This is based on the fundamental psychological proposition that the satisfaction of 'immediate primary needs' is a stronger motive for consumption than 'accumulation'.

Keynes' equation, known as the traditional saving equation implies that as their income increases, individuals will increase their consumption but less than proportionally. The marginal propensity to consume, c , which lies between zero and unity, decreases as income increases. Similarly, since saving is the part of income that is not spent on consumption, saving is also positively related to income and increases with the former (Keynes, 1936:96-97).

$$\frac{\partial c}{\partial Y} > 0 \text{ and } \frac{\partial^2 c}{\partial^2 Y} < 0$$

With

c = propensity to consume

Y = income

Keynes believes that although people who earn higher incomes spend more than those who earn less, they are less inclined to spend as much out of a given increase in income than those earning less (Keynes, 1936:97). That is the richer individuals get, the less they spend on consumption and the more they save. Keynes' hypothesis was quickly accepted into the central corpus of economic theory. However, over time, the theory was refuted by economists such as Kuznets (1946) and Duesenberry (1936) and led to the rise of several other theories based on income.

The traditional saving equation can be written:

$$S = a + s Y^d$$

With

S = domestic saving

Y^d = current disposable income

a = a constant (< 0), implying that at low levels of income, saving will be negative

s = marginal propensity to save, with $0 < s < 1$

3.3.3 Relative-income hypothesis

The strength of any individual's desire to increase his consumption expenditure is a function of the ratio of his expenditure to some weighted average of the expenditures of others with whom he comes into contact (Duesenberry, 1948).

Duesenberry (1948) develops the relative income hypothesis and suggests that consumption spending is rooted by status. According to him, current consumption is not only determined by income, but also and foremost by previous levels of consumption, as individuals try to 'keep up with the Joneses'. Thus, as long as their relative income position remains unchanged individuals keep increasing their consumption level with time because they are not willing to return to their previous living standards.

The difference between the absolute-income hypothesis of Keynes and the relative-income hypothesis of Duesenberry is that the latter argues that as their income increases, individuals increase their consumption in the same proportions: that is, their marginal propensity to consume remains constant: their saving level remains unchanged regardless of their income level.

3.3.4 The Kaldor class-saving hypothesis³

Developed by British economist Nicholas Kaldor, the class theory argues that consumption and therefore saving habits differ from an individual to another depending on the economic class they belong to. Kaldor suggests that people who work in the labour market and hence receive a labour income (wage) tend to save less than people who work in the capital market and consequently receive property income (profits, interests, rents).

The following equation represents Kaldor's class-saving hypothesis:

$$S = s_w L + s_c P$$

³ See Deaton 1997.

With

S_w = workers' saving propensities out of labour income

S_c = capitalists' saving propensities out of property income

L = labour income

P = property income

$0 < s_w < s_c < 1$

3.3.5 The neoclassical intertemporal models

Two important models qualified as intertemporal models were derived from the Keynesian model's suggestion that consumption (hence saving) depends on current disposable income. These models are the two standard benchmark models used to explain consumption and saving behaviour in the economic literature. Known as the permanent income hypothesis and the life-cycle hypothesis, these models suggest that individuals are affected by their lifetime income (that is both current and future income), in the decision of their consumption and saving levels.

3.3.5.1 The permanent income hypothesis (PIH)

Developed by Milton Friedman (1957), the permanent income hypothesis (PIH) takes its origins in Irving Fisher's (1907) theory of interest. According to Romer, D. (2006:347), the PIH assumes that:

- ❖ An individual's time horizon is infinite
- ❖ Individuals can save or borrow at an exogenous interest rate and do not face potentially binding borrowing constraints

The PIH argues that people intend to spend all of their income over their lifetime. However they experience good and bad years and therefore save only to smooth out income over their lifetime so as to maintain a steady level of consumption during the bad years. Friedman distinguishes between current and permanent income and calls the difference between the latter and the former transitory income (Romer, D., 2006:348).

Friedman (1957) contends that saving and therefore consumption is not affected by individuals' current income. According to him households are forward-looking economic agents and hence consume and save a steady share of their anticipated income. However the occurrence of unpredicted - therefore temporary- high incomes such as windfalls, inheritances, and lotteries induces households to increase their saving levels.

Friedman argues that there is a negative relationship between income growth and saving. According to him, a permanent increase in income, when predicted by individuals, encourages them to raise their consumption and decrease saving, given future higher incomes will enable both higher consumption and higher saving (Schmidt-Hebbel et al., 1992:531).

The PIH attributes an important role to wealth in the saving behaviour. According to Rousseas (1972:172), Friedman believes wealth to be the determinant of an individual's permanent income. Therefore intertemporal models suggest that there is a negative relationship between wealth growth and saving: an anticipated permanent rise in asset prices will prompt their holders to increase their consumption, thus depressing saving (Schmidt-Hebbel et al., 1992:532).

3.3.5.2 The life cycle hypothesis (LCH)

The life cycle hypothesis (LCH) was developed by Modigliani and Brumberg (1954) and extended by Ando and Modigliani (1963). In contrast to the PIH that assumes an infinitely-lived consumer, the LCH assumes finite lives of agents and argues that people save to smooth out their consumption between active years and retirement years.

The LCH presupposes that individuals' incomes tend to follow a predictable pattern over the course of their lifetimes that is: low levels of income during the initial years of work, increases in income up to retirement, and then a drop in income during retirement. Consequently individuals save little in the early

stages of their active lives whereas their saving rates are relatively high during their peak earning years, this because they prepare for retirement (Ando & Modigliani, 1963).

The LCH has two approaches; the first one assumes that income growth occurs within a specific generation's lifetime. In this case, LCH yields the same conclusion as PIH, that is saving is negatively related to income growth because a permanent increase in growth will increase both consumption and saving in the future.

However the second approach assumes that income growth takes place across different cohorts. In case the incomes of the young are the same as were the incomes of the old, saving and dissaving cancel each other out. However evidence suggests that owing to productivity growth across time and generations, active generations are richer than were the previous generations at the same age. Therefore the active cohorts depict high saving levels that offset the dissaving of the retired cohorts (Deaton, 1992:45).

Several empirical studies have tested the validity of the LCH⁴. Carroll and Summers (1981) and Deaton (1989) invalidate the LCH for respectively three industrial countries and developing countries (Schmidt-Hebbel et al., 1996:90). The positive association between saving growth and income growth predicted by the LCH is also objected by Carroll and Weil (1994). The authors argue that as growth increases *ceteris paribus*, individuals may feel wealthier and may therefore decide to raise their consumption; thus saving less.

3.3.5.3 Extensions of intertemporal models

The failings of permanent income hypothesis and the life cycle hypothesis have motivated a large amount of work on consumption theories. Departures from the PIH and LCH have led to the suggestion numerous other saving determinants amongst which:

⁴ See Poterba (2004) for details on empirical studies on LCH

- ❖ **Bequests.**

Summers (1981) suggests that the saving of the small number of wealthy people is higher than that of the rest of the population. The author argues that saving for leaving bequests is a much stronger motive for saving by households than saving for retirement years. Therefore an increase in wealth encourages their owners to save more.

- ❖ **Habit formation**

Carroll et al. (1994) argue that if consumption is habit based and hence reacts slowly to income changes, an anticipated long-lived income growth can bring about higher saving.

- ❖ **Risk aversion.**

Leland (1968) argues that individuals, especially when young have an increasing risk aversion. They are uncertain about future income and, consequently, increase their saving as their income increases in order to be financially ready in case unexpected events occur. This type of saving is known as precautionary saving (Barsky et al., 1986; Kimball, 1990; Deaton, 1991; and Carroll, 1997).

- ❖ **Borrowing/liquidity constraints.**

According to Romer, D. (2006:375) the PIH assumptions that there is only one interest rate for borrowing and saving purposes and that individuals do not face any borrowing constraints are unrealistic. The interest rates that individuals pay to reimburse their debt are usually higher than the rates they get on their saving. Furthermore households cannot borrow as much as they desire at any interest rate and when they are in debt, their current income is less than their permanent income. Borrowing constraints increase saving because individuals cannot spend as much as they would otherwise.

❖ **Buffer saving.**

Deaton (1991) argues that the majority of wealth is held by a small number of people while others live on their current income. This latter group is risk-averse and faces liquidity constraints. Therefore they tend to increase their saving rates when their incomes increase in order to cushion themselves against future uncertainty.

3.3.6 Other saving determinants

In addition to the determinants that have been discussed prior to this section, the literature suggests other saving determinants amongst which financial deepening, foreign saving, financial liberalisation and public saving.

3.3.6.1 Financial deepening

The importance of the development of the money market and financial deepening is highlighted by several economists in the literature amongst which Lewis (1955); Gurley and Shaw (1960); Tun Wai (1972) and, Shaw (1973). These economists argue that financial deepening enhances the level of saving in an economy. Wikipedia (2008) defines financial deepening as the “increased provision of financial services with a wider choice of services geared to all levels of society”.

Following Shaw (1973), Edwards (1995) suggests that a well-developed financial sector offers a higher rate of return than otherwise and might encourage households saving. However Japelli and Pagano (1994) show that financial deepening inhibits saving by households through the relaxation of borrowing constraints.

3.3.6.2 Foreign saving

According to Schmidt-Hebbel et al. (1992), the rationing of foreign borrowing either by lenders or government regulations in LDCs constrains domestic saving to the amount of available foreign capital, making foreign saving a determinant of domestic saving. However, most studies report a negative

relationship between foreign saving and domestic saving; inflows of foreign saving crowd out domestic saving (Schmidt-Hebbel et al., 1996:99-100).

3.3.6.3 Financial repression: the McKinnon – Shaw hypothesis

When governments tax and otherwise distort their domestic capital markets, the economy is said to be financially 'repressed' (McKinnon, 1989:29).

Prior to the 1970s, it was common practice for most developing governments to financially repress their capital markets. This was done through the imposition of interest rates, credit ceilings and reserve requirements on commercial banks (Warman & Thirlwall, 1994:630). McKinnon (1973) and Shaw (1973) denounced the negative effects of financial repression and advocated for financial liberalisation as a conduit for growth in developing countries.

The authors contradicted the Keynesian credence according to which investment is the parent of saving. Instead, McKinnon (1973) and Shaw (1973) revived the classical belief that saving generates investment and, that a full utilisation of resources is always guaranteed. Hence the authors advocated for the deregulation of interest rates in LDCs. This, because real interest rates, which equate the market demand for and the market supply of saving, will stimulate individuals to save more. More saving will consecutively generate more investment and, more investment will speed up economic growth (Dornbusch & Reynoso, 1989).

McKinnon (1973:63) argues that low or negative interest rates when combined with high inflation generate unattractive real rates of return, which inhibit saving. Individuals resort to spending their money on a lucrative business rather than depositing it in bank accounts. Moreover, since credit allocation is sparse in repressed economies, individuals tend to self-finance and hence need to accumulate money balances before their investment can occur.

According to (Shaw, 1973:121) "scarcity prices for savings increase rates of saving, improve savings allocation, induce some substitution of labour for capital equipment, and assist in income equalisation". The author further adds that high real interest rates cause capital flight to markets that offer more attractive rates of return than those that prevail in repressed economies (Shaw, 1973:94). Therefore not only do higher real interest rates encourage individuals to save more, but they also provide the banking system with more liabilities, hence increasing banks' credit supply of banks, which in turn translates into efficient investment.

Following McKinnon and Shaw's seminal work the financial repression hypothesis gained impetus and received support from numerous economists such as Kapur (1976); Galbis (1977); Mathieson (1980); Fry (1988). However, the paradigm was quickly questioned first of all because as explained in Section 3.3.1, the substitution and income effects are likely to cancel each other out; and, secondly because the theory abstracts from reality.

Van Wijnbergen (1983), Taylor (1983) and, Buffie (1984) criticise the McKinnon-Shaw model for focusing on bank deposits, ignoring other saving options such as gold or currency and loans from informal money markets. The above authors argue that informal money markets are very important in developing market economies. Therefore increases in interest rates on bank deposits will result in a shift of households into the banking system. If this shift happens at the expense of loans from informal money market, the total supply of credit is likely to fall. This, because contrarily to the banking system, informal markets are not subject to interest rates and reserve requirements policies (Van Wijnbergen, 1983:439).

Since the late 1960s LDCs have been subject to a voluminous research on the responsiveness of saving to interest rates. The initial wave of empirical studies (e.g. Williamson, 1968; Gupta, 1970; Galbis, 1977; Fry, 1981; and Giovannini, 1983,1985) used cross-section data and were criticised for not fully accounting for the realities of each country (Balassa, 1989). Owing to

these imperfections, economists started to do case studies in the mid 1980s. Other than the income and substitution effects of interest rates on saving, these studies tested the effects of financial liberalisation.

Table 1 (Page 49) summarises the findings of studies on the relationship between interest rates and saving. These studies, conducted in developing countries between the late 1960s and the mid 2000s yield mixed results. Whilst some studies validate the financial repression hypothesis, others find that saving is negatively related to interest rates. In Table 1, “positive support” means that an increase in real interest rates leads to an increase in domestic saving. On the contrary, “negative support” indicates that an increase in real interest rates generates a drop in domestic saving. It is however worth stressing that negative support does not imply that the financial liberalisation theory is irrelevant for that country.

3.3.6.4 Government saving and the Ricardian equivalence hypothesis⁵

As it was stressed at the beginning of the chapter, domestic saving is the sum of personal saving, corporate and government saving. Government saving is the difference government revenue and government expenditure. When government spending is higher than government revenue, the government records a budget deficit. On the contrary, when government earnings exceed government spending, the government is said to run a budget surplus.

As seen earlier, governments play a non-negligible role in the determination of aggregate saving. In both developed and developing countries budget deficits are more common than budget surpluses. Desroches and Francis (2007:3) remark that world budget deficits seem to be responsible for the sharp decline in world saving through high interest rates in the 1980s. Such a statement is contradictory to the Ricardian equivalence hypothesis.

Developed by Robert Barro (1974), the Ricardian equivalence was proposed by English classical economist David Ricardo as an opposition to Keynes and

⁵ See Lopez, Schmidt-Hebbel, and Servén (2000) for details

his concept of aggregate demand. According to Ricardian equivalence hypothesis, the use of fiscal policy to manipulate aggregate demand is vain because individuals are rational and hence can unravel government policy (Schmidt-Hebbel et al., 1992:533).

Governments usually finance their expenditures either by taxing current generations or by issuing government debt in the form of bonds that have to be paid later. According to Barro (1974), governments' choice to finance their deficit by issuing bonds will not impact aggregate demand at all. This is simply justified by the fact that as rational agents, individuals know that every bond-financed deficit must be met by a future tax increase. Therefore, as forward-looking taxpayers, individuals will prepare themselves for upcoming deficits by lowering their consumption and increasing their saving.

Ricardian equivalence prevails when an increase in government borrowing to finance a deficit causes a sufficient increase in private saving to keep the real interest rate fixed. The idea behind Ricardian equivalence is that the way an increase in government purchases is financed is irrelevant (Barro, 1989). According to Ricardian equivalence hypothesis, the level of government purchases can affect aggregate demand but the way that those purchases (taxes or debt) are financed has no effect on the economy.

However Schmidt-Hebbel et al. (1992:533) contend that the validity of the Ricardian hypothesis is constrained by some conditions, which are:

- ❖ No liquidity constraints
- ❖ Equal discount rates for the public and private sector
- ❖ Certainty of future income, tax and public expenditure flows

Economists have criticised the Ricardian hypothesis, arguing that in real life, individuals hardly think and/or react like in the model. Many taxpayers are clueless as to the real size of the deficit and do not take the consequences of a forthcoming tax increase into consideration; this is known as the public veil.

Most empirical studies reject the Ricardian equivalence both for developed and developing countries, mainly due to the pervasiveness of borrowing constraints in the world. Nonetheless Schmidt-Hebbel et al. (1996:99) contend that studies conducted on LDCs by Haque and Montiel (1989); Corbo and Schmidt-Hebbel (1991); Easterly et al. (1994) and, Edwards (1995) mostly fail to support the Ricardian equivalence hypothesis; however these studies find that private saving offsets some public saving.

3.4 Empirics on saving determinants⁶.

As seen throughout this chapter, the encompassing literature on saving has gathered several determinants of household saving. Amongst these determinants are: income, real interest rates, uncertainty, borrowing constraints, financial depth, fiscal policy, pension systems, demographics, and income and wealth distribution.

Loayza et al. (1999) reveal results from six empirical studies on the determinants of private saving ratio to income, using large panel data samples by (1) Corbo and Schmidt-Hebbel (1991); (2) Masson et al. (1995); (3) Edwards (1996); (4) Dayal-Ghulati and Thimann (1997); and (5) Bailliu and Reisen (1998); (6) Haque et al. (1999). The results of the above empirical studies arrive to the conclusion that of the numerous saving determinants discussed in the literature are significant, the significant variables are: current income, current growth rate, interest rates, domestic and foreign borrowing constraints, fiscal policy variables and demographics (see Table 2, page 50).

3.5 Conclusion

This chapter has reviewed the encompassing literature on saving determinants. The analysis of saving behaviour dates back to the emergence of the classical school of thought, and has since evolved into a voluminous literature, which has been strengthened by the performance of a considerable number of empirical studies across the world. Results of these studies support that among the numerous existing saving determinants in the literature,

⁶ See Table 2, page 50.

income (permanent and/or current) remains the major driver of saving. Nonetheless evidence suggests that other factors such as demographics, real interest rates, foreign savings, liquidity constraints and financial deepening influence every individual, household or nation to a different extent. This further complicates the analysis of saving behaviour and may explain why the topic has received so much attention. The failures of cross-country studies to capture the specificities of every country have led to a preference for case studies. In the background of the above, it appears that the assessment of South African saving behaviour requires a specific study on South Africa; this is done in the next chapter

Table 1: Empirics on the responsiveness of interest rates to saving and growth

Authors	Date	Empirical Tests	Period of test data	Findings
Williamson	1968	Effect of Interest rate saving on saving of six Asian countries		Negative support
Fry, M. J	1979	Application of the McKinnon model to Turkey		Positive support
Galbis, V	1979b	Application of the McKinnon model to 19 Latin American countries	1961-1973 for most countries	Inconclusive
Brodersohn, M.	1981	Impact of 'liberalization' on: saving		Positive support
Leite, S.P	1982	Survey of interest rates in 10 West African countries	1960-1972	Tentative positive support
Giovannini	1983	Effect of interest rates on saving of 8 Asian countries		Negative support
McDonald	1983	Effect of interest rates on 12 Latin American countries		Positive support
Yusuf and Peters	1984	Response of saving to interest rates in South Korea	1965-1981	Positive support
Gupta, K. L	1984	Financial liberalisation in a/12Asian countries b/25Asian countries	1961-1977	Positive effect on financial savings Negative effect on physical savings
Giovannini, A	1985	Response of consumption to real interest rates in 18 Developing countries		Negligible support
Diaz- Alejandro	1985	Financial reforms in Latin American economies	1970s	Negative support
De Melo and Tybout	1985-86	Uruguay		Positive but weak support
Leite and Makonnen	1986	Financial liberalisation in BCEAO countries	1967-1980	Positive support
Gupta, K.L	1987	22 Asian and Latin American countries	1967-1976	Little positive support
Gongales, A	1988	Financial liberalisation in Colombia		Positive but insignificant support
Dornbusch and Reynoso	1989	Impact of real interest rates on saving		Positive support
Cho and Khatkhate	1990	Financial liberalisation of 5 Asian countries		Insignificant support
Nissanke, M	1990	Financial liberalisation in Sub-Saharan African countries		Negligible support
Watson	1991	Financial liberalisation in the Organisation of Eastern Caribbean States		Negative support
Watson	1992	Application of the McKinnon model to Trinidad and Tobago		Positive support
Roubini and Sala-i-Martin	1992	Financial liberalisation in Latin American countries	1960-1985	Positive support
Modeste	1993	Financial liberalisation in Caribbean countries		Positive support
Hussain, M.N	1993	Financial liberalisation in Egypt		Negative support
Warman and Thirwall	1994	Financial liberalisation in Mexico	1960-1990	Negative support
Ogaki et al.	1996	Response of consumption to real interest rates in 18 LDCs		Minor except for households above subsistence levels
Tsikata	1998	Financial liberalisation in South Africa		Negative support
Loayza et al.	2000	Income and substitution effects of real interest rates on saving		Negative support
Kendall, P		Financial repression in Guyana		Positive support
Jonsson and Teferra	2001	Financial liberalisation in South Africa		Negative support
Reinhart and Tokatidis	2001	Financial liberalization on saving in 50 countries (14Dev; 36 LDCs)		mixed effects; little benefits for very low income LDCs
Aron and Muelbauer	2000a	Financial liberalisation in South Africa	1970-1997	Negative support
Odhiambo, N.M	2006	Effect of financial liberalisation on domestic savings in South Africa		Negative support

Source: Various sources

Table 2: Determinants of Private Saving

Variable category	Specific variable	Expected sign	Empirical findings
Income	Income level: actual	0 or +	+ (1,2,3,4) 0 (5,6)
	Transitory/ permanent	+/0 or +	
	Terms of trade: actual	0 or +	+ (2,4,6)
	Transitory/permanent	+/0 or +	
	Growth rate: actual	Ambiguous	+ (2,3) 0 (4,5,6)
Rates of return	Interest rate	Ambiguous	0(1,3,5,6) + (2)
Uncertainty	Variance of innovations to saving determinants	+	- (4) 0 (1,2,3,6)
	Inflation or other measures of macro instability	+	
	Measures of political instability	+	
Domestic borrowing constraints	Private credit flows	-	+ (3)
	Broad money flows	-	
	Income	-	
Foreign borrowing constraints	Foreign lending	-	- (1,2,3)
	Current Account deficit	-	
Financial depth	Private or domestic credit stocks	Ambiguous	- (5)
	Money stocks	Ambiguous	+ (1,3,4)
Fiscal policy	Public saving	-	- (1,3)
	Public surplus	-	- (2,5,6) 0 (4)
	Public consumption	Ambiguous	- (2,6)
Pension system	PAYG transfers to old	0 or -	- (3,4,5)
	Mandatory FF pension system contributions	0 or +	+ (4)
	FF Pension Fund Assets	Ambiguous	0/ + (5)
Demographics	Old and /or young-age population dependency	-	- (2,3,4) 0 (5,6)
	Urbanization	Ambiguous	- (3)
Income and wealth distribution	Income concentration	+	0 (3)
	Wealth concentration	+	
	Capital income share	+	

Source: Loayza et al. (1999), Table 1

Significant coefficient signs are identified by a plus or a minus. Results identified by a zero mean either an insignificant coefficient in the corresponding column of the original study or, when the variable is omitted from the particular specification reported in the column, a significant or insignificant variable in a different column of the same table.

CHAPTER 4

A SOUTH AFRICAN PERSPECTIVE

4.1 Introduction

Chapter 4 concludes the literature survey and as opposed to the previous two chapters, this one moves away from general theories and, focuses on the specific realities of the small open economy of South Africa. The purpose of this chapter is to get a better understanding of the relationship between saving and growth in South Africa. To this end, the chapter reports changes in South Africa's growth trends, monetary system and saving behaviour as observed in the literature. Throughout the chapter some graphs and tables are presented with the aim of illustrating and supporting the literature.

4.2 Growth trends

University of Pretoria (1992:6) and GEAR (1996:7) report that South Africa's potential growth rate lies between 3.5 and 6-7 per cent per annum. However evidence suggests that over the years South Africa's growth rates were often under the lower limit of the above threshold. According to Mohr et al. (2004:585), South Africa has experienced three distinct episodes of growth since 1946. The authors describe these periods as a phase of rapid economic growth until 1974; a phase of lower growth, stagflation and decline between 1975 and 1993 and a phase of sustained though relatively low growth between 1994 and 2004.

According to Mohr et al. (2004:586), the unprecedented high growth rates recorded by the South African economy during the first of the above periods mirrored the global economic performance of the time. Of particular importance were the 1960s, which saw South Africa's growth rates positioned amongst the highest in the world. Houghton (1976:212-213) reports that between 1960 and 1965, South Africa recorded a 140 per cent increase in gross national income and an average growth rate of 5.6 per cent per annum.

In contrast to the 1960s, the 1970s witnessed a decrease in income growth rates in most industrialised countries, which Mohr et al. (2004:586) ascribe to the oil crises that respectively occurred in 1973 and 1979. As an oil-importing country, South Africa was therefore not likely to be exempt from declining growth rates. Furthermore the South African economy was weakened by growing internal political tensions resulting from the Apartheid system.

In addition to the above factors, Truu and Contogiannis (1987:271) highlight the negative effects of the heavy industrialisation process, which took place in the country around the 1970s. The authors contend that the investment projects undertaken during that period by the South African public sector were motivated by strategic and infrastructural reasons rather than economic reasons.

In the same vein, Mohr et al. (2004:587) argue that most of these investment projects were costly and negatively impacted on the country's economic growth. The authors further add that the increasing demand for capital generated a large imbalance between domestic saving and domestic investment. As a result, South Africa had to rely on foreign capital -which was then in the form of foreign direct investment- in order to finance domestic investment.

According to Mohr et al. (2004:89), between 1946 and 1974, South Africa recorded an average annual net inflow of capital equal to about 2.5 per cent of GDP. However inflows of capital to South Africa became sluggish between 1975 and 1984. The decreasing domestic saving rates, combined with a shortage of foreign capital generated a deficit on the current account of the balance of payments. This constrained South Africa to resort to foreign loans to sustain its high domestic investment (Mohr et al., 2004:587).

Despite the difficult times, the South African economy grew at positive rates during the 1970s, with the exception of 1977 (SARB, 2008). This trend, which probably resulted from the rising price of gold, was however reversed after

1981, following a decline in the gold price and mounting political tensions. In reaction to the apartheid system, the international community imposed political and economic sanctions against South Africa in the mid 1980s. These sanctions put the South African economy in an international debt crisis, which was further precipitated by the recall of their loans by U.S. banks in 1985 (Mohr et al., 2004:89).

A debt-standstill agreement was signed in 1985 and put South Africa in the obligation to service its foreign debt according to series of four debt rescheduling agreements. Between 1982 and 1992, the South African economy became familiar with negative growth rates (SARB, 2008); and, according to Smit (2006:83), the country experienced the longest recession since World War II between March 1989 and May 1993.

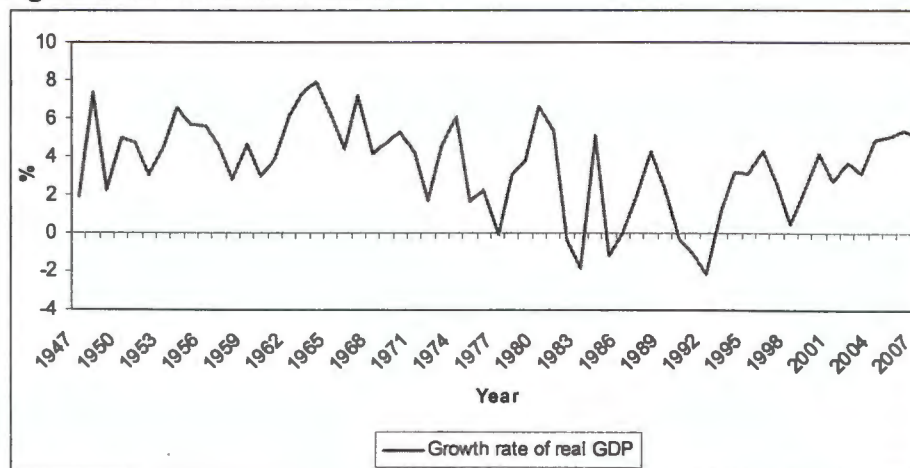
The abolition of sanctions at the dawn of the 1994 democratic elections provided a better scope for higher growth. Prinsloo (2000:9) contends that the renewed interest of foreign investors in South Africa led to the resurgence of inflows of capital. Nevertheless the author stresses that most of these capital imports were of the portfolio type, which are of short-term nature.

The period following 1993 witnessed several changes of different nature in South Africa. In the middle of 1996, the new government implemented a macroeconomic programme named GEAR (Growth Employment and Redistribution). The aim of GEAR was to alleviate the socio-economic problems faced by the country. Of particular importance to this study was the pledge by the new government to improve aggregate saving and reduce fiscal deficits (GEAR, 1996).

The immediate response to the above-mentioned political and socio-economic changes was positive but not significant enough as Mohr et al. (2004:585) report that real GDP grew at an average of 2.8 per cent between 1994 and 2002. However a clear improvement is noticeable since 2004, with annual growth rates of 4 and per cent SARB (2008). Notwithstanding the rise in

growth rates, a comparison with other countries suggests that South Africa's growth rates still lag behind those of average African countries (see Table 3)

Figure 4: Growth rate of real GDP



Source: SARB quarterly bulletin

Table 3: Economic growth in South Africa and other countries (measured by GDP)

Group	Periods			
	1980-1986	1987-1993	1994-2000	2001-2007
Four Tigers (Hong Kong, Taiwan, Singapore, Taiwan)	7.1	8.2	5.8	4.4
Other emerging markets and developing countries	3.7	3.4	4.8	6.8
Africa	2.4	1.6	3.3	5
Africa: Sub-Sahara	2.5	1.6	3.3	5.1
Developing Asia	6.3	7.4	7.4	8.4
South Africa	2	0.92	2.9	4.3

Sources: International Monetary Fund (World Economic Database, October 2007a) and SARB's quarterly bulletin and own calculations.

Other emerging market and developing countries (143 countries): Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, Bahamas, The, Bahrain, Bangladesh, Barbados, Belarus, Belize, Benin, Bhutan, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Chile, China, Colombia, Comoros, Congo, Democratic Republic of, Congo, Republic of, Costa Rica, Côte d'Ivoire, Croatia, Czech Republic, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Estonia, Ethiopia, Fiji, Gabon, Gambia, The, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, India, Indonesia, Iran, Islamic Republic of, Jamaica, Jordan, Kazakhstan, Kenya, Kiribati, Kuwait, Kyrgyz Republic, Lao People's Democratic Republic, Latvia, Lebanon, Lesotho, Libya, Lithuania, Macedonia, Former Yugoslav Republic of, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Qatar, Romania, Russia, Rwanda, Samoa, São Tomé and Príncipe, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Slovak Republic, Solomon Islands, South Africa, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Syrian Arab Republic, Tajikistan, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, Republic of, Zambia, Zimbabwe

Africa (48 countries): Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of, Congo, Republic of, Côte d'Ivoire, Djibouti, Equatorial Guinea, Ethiopia, Gabon, Gambia, The, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé and Príncipe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe

Africa: Sub-Sahara (45 countries): Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of, Congo, Republic of, Côte d'Ivoire, Djibouti, Equatorial Guinea, Ethiopia, Gabon, Gambia, The, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé and Príncipe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe

Developing Asia (23 countries): Bangladesh, Bhutan, Cambodia, China, Fiji, India, Indonesia, Kiribati, Lao People's Democratic Republic, Malaysia, Maldives, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Samoa, Solomon Islands, Sri Lanka, Thailand, Tonga, Vanuatu, Vietnam

4.3 Interest rates⁸

Throughout the years, South Africa's monetary policies have implemented different policies that influenced interest rates. Mohr et al. (2004:373) contend that the South African monetary system has experienced the following phases:

- ❖ The first regime, described as a liquid asset-based system was in place between 1965 and 1980. This system was characterised by quantitative controls of interest rates and credit extension. During that period, the country's monetary authorities imposed on commercial banks to hold a minimum proportion of their total liabilities in liquid financial assets. The role played by interest rates in this liquid asset-based system was minor.

- ❖ In the early 1980s, the South African monetary framework shifted from a highly protected system to a more market-orientated framework. Following the De Kock reports (1978, 1985), South Africa's monetary authorities undertook reforms that led to the initiation of an internal financial liberalisation process, which enabled an easier access to credit. A cost of cash-reserves-based system was implemented wherein a discount rate was set by the SARB. This system therefore enabled the SARB to indirectly control the extension of credit by commercial banks. An increase in the discount rate would generate higher interest rates and hence lower credit and, *vice-versa*.

- ❖ Between 1986 and 1998 the monetary authorities extended the cost of cash-reserves-based system and further improved it with the introduction of pre-announced monetary target. This period witnessed both the imposition and abolition of sanctions against South Africa. Aron and Muellbauer (2000a:12) suggest that the debt crisis faced by the country may have temporary reversed the financial liberalisation process

⁸ This section draws on Mohr et al, 2004:373-374

introduced in 1980. They further contend that between 1994 and the early 2000s, South Africa's financial markets were fully liberalised.

- ❖ The period between 1998 and 2000 witnessed a system of daily tenders for cash reserves (through repurchase transactions) combined with pre-announced monetary targets and informal targets for core inflation.

- ❖ Finally, in 2000 the SARB implemented a formal inflation targeting monetary policy framework wherein the SARB controls fluctuations in inflation through the manipulation of the repo rate (van der Merwe, 2004). As mentioned in Chapter 1, Mohr et al (2004:522) contend that the adjustment of the repo rate indirectly impacts on households' consumption; a raise in the repo rate generates a decrease in investment, consumption spending and aggregate demand respectively and *vice versa*.

4.4 Saving trends⁹

Savings are an integral ingredient in the recipe for a greater South Africa with wealth and opportunity for all (Manuel, 2004).

According to Prinsloo (2000:5), the evolution of South Africa's saving behaviour in the literature can only be traced back to the end of World War II. The author contends that the war positively affected South Africa's domestic saving by curtailing domestic expenditure. During the war, not only did the flow of imported goods to South Africa almost disappear but also, the outflow of local goods to war-affected countries grew significantly. It was therefore with no surprise that the years subsequent to the war witnessed soaring expenditure levels in South Africa. This was further accelerated by the resurgence of inflows of imported goods.

⁹ This section draws on Prinsloo (2000)

As a result of this spending boom the South African government decided to curb private expenditure and to that end, implemented import controls in 1948. The economy experienced rising consumer prices, which not only reversed the downward trend of personal saving but also created favourable conditions for capital accumulation throughout the 1950s.

During the 1960s South Africa's strong economic performance further enhanced domestic saving. Prinsloo (2000:8) reports that when compared to that of some eleven industrialised countries, the gross saving rate of South Africa between 1960 and 1989 was ranked high, sometimes surpassing that of countries like the U.S., the U.K., Canada, France and, Australia. However Prinsloo (2000:9) highlights that these high growth rates were the result of windfalls in corporate profits from the high gold price at the time.

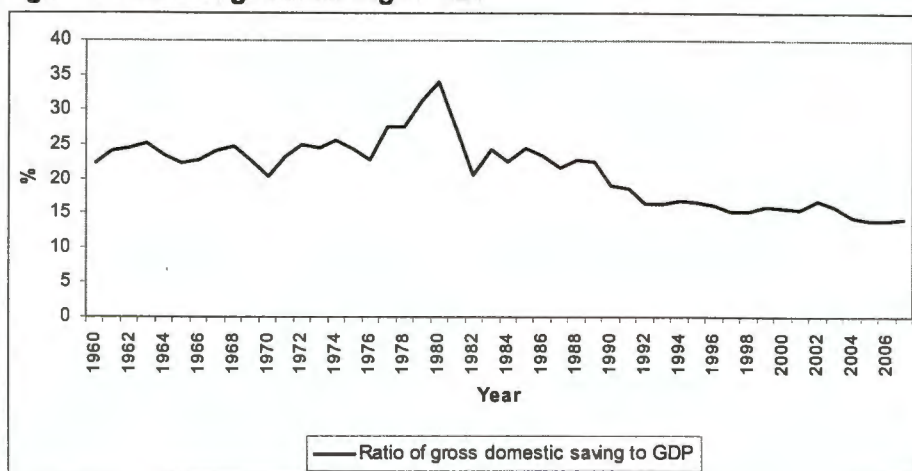
According to Mohr et al. (2004:89), South Africa experienced an average annual outflow of 2.2 per cent of GDP between 1985 and 1993. Furthermore, the debt crisis faced by South Africa between 1985 and the early 1990s constrained the country to be a net exporter of financial capital and to maintain a surplus on the current account rather than merely avoiding a deficit (De Wet, 1995:474).

Prinsloo (2000:9) observes that despite the obligation of South Africa to maintain a surplus on its current account, aggregate saving deteriorated after 1980. Whilst the author remarks that the fall in households' saving coincided with the initiation of the financial liberalisation process, he attributes most of this general decrease to the sharp fall in government saving (see Figure 6).

We have brought the deficit to GDP ratio down to international norms from highs of almost 7 per cent in 1993 to current levels around 3 per cent and we have embarked on much needed investment by the public corporations. The challenge we remain with, is to further improve the quality of the deficit (Manuel, 2004).

As already mentioned in Section 4.2, one of the objectives of the GEAR strategy was to reduce government deficits. Furthermore according to Prinsloo (2000:27), the GEAR strategy suggests that an average growth rate of more than 4 per cent per year in real income requires a ratio of aggregate saving to GDP of 23 per cent. Although government considerably reduced fiscal deficits following 1993, evidence suggests that the decrease in government dissaving was offset by a decrease in private saving (Figure 6). This led to a reverse of South Africa's status from net exporter of capital to net importer of capital (Strydom, 2007:6). Evidence suggests that South Africa's aggregate saving ranks well below that of the average LDC (see Table 4).

Figure 5: Ratio of gross saving to GDP



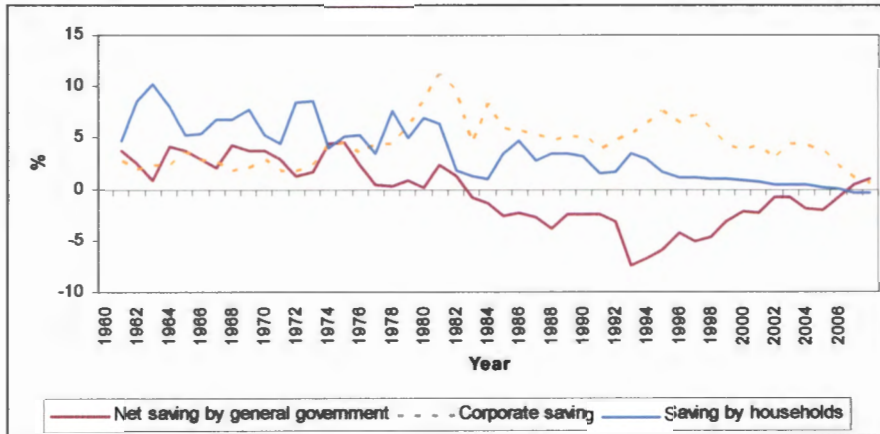
Source: SARB quarterly bulletin

Table 4: Gross National Saving in South Africa and other countries

Groups of countries	Periods			
	1980-1986	1987-1993	1994-2000	2001-2007
Four Tigers: Hong Kong, Korea, Singapore and Taiwan	30.9	35.7	33.4	31.3
Other emerging markets and developing countries	25.02	24.3	24.1	29.4
Africa	18.8	18.1	18.2	22.9
Africa: Sub-Sahara	16.4	15.7	15.7	18.1
Developing Asia	25.3	29.2	33	38.6
South Africa	25.2	19.6	15.9	15

Sources: International Monetary Fund, (World Economic Database, October 2007b), SARB (2008) and, own calculations

Figure 6: Personal, corporate and net saving by general government in per cent of GDP



Source: SARB quarterly bulletin

4.5 Empirical studies

The literature on South Africa's saving behaviour is quite meagre. Aron and Muellbauer (2000b) draw attention to the fact that most studies base their conclusions on hypotheses rather than tests. Nevertheless, most studies argue that throughout the years, the South African saving behaviour has been influenced by the following factors:

- ❖ **Income growth**

As seen in Section 4.2 and Section 4.4, there is causation from income to saving in South Africa. The periods of high saving in the literature coincide with those of high growth.

- ❖ **Real after tax rate of return**

Prinsloo (2000:15-17) and Strydom (2007:5) argue that South Africa's tax system is unfriendly to the personal sector. The latter author argues that marginal income tax on households varies and can reach up to 40 per cent of personal income. In contrast, companies are imposed a fixed rate of 29 per cent. The authors therefore assert that in reaction to that, South Africa's households have resorted to accumulating income in the corporate sector. This may explain the gap between corporate and personal saving throughout the 1980s and 1990s (see Figure 6).

❖ Government deficits

As seen in Figure 6, the South African government has a history of deficits that account for most of the weak performance of aggregate following 1980.

Tsikata (1998), Prinsloo (2000) as well as Jonsson and Teferra (2001) reject the Ricardian equivalence; the authors report suggest that the pervasive low saving by government has only partially been offset by the private sector. The authors therefore suggest that the dissaving of South Africa's government has dampened the country's gross saving. They recommend that policies that aim at rising national saving should focus on increasing government's saving.

On the contrary, Aron and Muellbauer (2002b) argue that in addition to the low rates of government's saving, South Africa's private saving levels are not stable and also need to be improved.

❖ Financial liberalisation.

All of the studies that analyse the South African saving behaviour ascribe an important part of the deterioration of aggregate saving to financial liberalisation (Aron & Muellbauer, 2000; Odhiambo, 2006; Jonsson & Teferra, 2001).

Prinsloo (2000:19-21) remarks that the decline in aggregate saving in the early 1980s coincides with the implementation of financial liberalisation. The author contends that the deregulation of the banking system favoured credit extension, therefore hampering personal saving.

Aron and Muellbauer (2000a) further suggest that the completion of the financial liberalisation process throughout the 1990s alongside the advent of democracy facilitated access to loans to previously disadvantaged people.

In the same vein, Strydom (2007:8) contends that the improvement of credit facilities due to financial liberalisation alongside the unfriendly tax system has encouraged South Africa's households to borrow money from banks and spend that money on assets.

4.6 Conclusion

South Africa's economic growth has experienced three main phases since 1946 owing to international trends and political instability. Although the country's saving rates initially followed variations in economic growth, the situation has reversed since the mid 1990s. Since that period aggregate saving has been on a continuous decline despite renewed high growth rates and a decline in government's deficits. There is little known about the determinants of South Africa's aggregate saving. Nonetheless, most studies report that government deficits, the unfriendly tax system and financial liberalisation are the factors that have contributed the most to the fall in private saving.

CHAPTER 5

RESEARCH METHODOLOGY

5.1 Introduction

The aim of this chapter is to make the methods employed throughout the next chapter known. Chapter 5 discusses the source, construction and definition of the data in order to facilitate the understanding of the results that are obtained in the following chapter.

5.2 Data

5.2.1 Origins of the data

The models formulated are estimated over the sample period 1965-2007, with the use of the R software package. Most of the data were collected on a quarterly basis from the SARB's quarterly bulletin with the exception of a few variables where quarterly data were calculated from monthly collected data. Among the variables, two are expressed in real terms: gross domestic product (rgdp) and growth rate of gross domestic product (rgrowth). The rest of the data were collected in nominal terms and were therefore expressed as a ratio of nominal GDP in order to standardise the variables.

5.2.2 Description of data

Table 5 provides a description of the data used in the study as well as the respective code of each time series in the quarterly bulletin. In addition, the formulae of the variables that have been subject to any transformation from their initial format are also made known.

Table 5: Variables used in the study

Variables	Description	Calculation method	Code ¹⁰ (KBP)
rgdp	Real gross domestic product at market prices (constant 2000 prices)	Provided by SARB	6006C
gdp	Nominal gross domestic product (current prices)	Provided by SARB	6006K
rgrowth	Growth rate of rgdp	$[(rgdp - rgdp_{t-1}) / rgdp] \times 100$	
psav	Ratio of private saving to gdp	(gross saving – net saving by government) / gdp	Gross saving is 6203K Government saving is 6202 K
ryield ¹¹	Real Yield on loan stock traded on the bond exchange: Government stock - 0 to 3 years	$[\ln(1+i) / \ln(1+\pi)] \times 100$	Yield on loan stock traded on the bond exchange: Government stock – 0 to 3 years is 2000M
rprime ¹²	Real Prime overdraft rate	$[\ln(1+i) / \ln(1+\pi)] \times 100$	Prime overdraft rate is 1403M
forsav	Ratio of foreign saving to gdp	(Imports – Exports) / gdp	Imports is 6014K Exports is 6013K
gvt sav	Ratio of net saving by general government to gdp	(Net saving by general government) / gdp	Net saving by general government is 6202K
finsav	Ratio of financial saving to gdp	$(m3 - m1) / gdp$	m3 ¹³ is 1374M m1 ¹⁴ is 1371M
govsav	Ratio of public saving to gdp	(Public investment – Total financing) / gdp	Public investment is gfcfg Total financing is 4071M
cred	Ratio of credit to gdp	credit / gdp	credit is 1368M
gfcfg ¹⁵	Ratio of public investment to gdp	gfcf (Government + Public corporations) / gdp	gfcf government is 6100K gfcf public corporations is 6106K
saflib	South Africa's Financial liberalisation index	Source: Aron and Muellbauer (2000a)	

¹⁰ 'Code' only applies to the series that are used in the study as obtained from the SARB quarterly bulletin

¹¹ i is the yield rate and π is the consumer price inflation (cpi)

¹² i is the prime overdraft rate and π is the consumer price inflation (cpi)

¹³ See definition in Section 5.2.6.9 (page 75)

¹⁴ See definition in Section 5.2.6.9 (page 75)

¹⁵ gfcf is gross fixed capital formation

5.2.3 Dummy variables

The distinction of four breaking points when running the data in the R package led to the creation of four dummy variables: d1, d2, d3 and d4. These dummy variables are added to the variables presented in Table 5. The first dummy extends from the fourth quarter of 1973 to the second quarter of 1982. The second dummy extends from the second quarter of 1982 to the first quarter of 1990. The third dummy goes from the third quarter of 1990 to the first quarter of 1999. Finally, the 4th and last dummy goes from the first quarter of 1999 to the second quarter of 2007.

5.2.4 Omitted variables

5.2.4.1 National data

It would have been more appropriate to use only national data rather than domestic data throughout the study because the former include the contribution of locals that live abroad and the interest payments on foreign debt are not included in domestic data while they are included in domestic data. Unfortunately, the SARB does not always provide national data and sometimes leaves the study relying on domestic data.

5.2.4.2 Wealth

As explained in Chapter 3, some economists have suggested that wealth has an important role in the saving decision of households. Strydom (2007) suggests that many South African households avoid the unfriendly tax system by investing in assets rather than saving. Unfortunately the SARB does not provide data for wealth estimates in South Africa; only Aron and Muellbauer (2004, 2006a) attempt to do it but, the exclusion of several wealth components makes their data not very useful.

5.2.5 Models

The models analysed in the study are based on the non econometric McKinnon-Shaw hypothesis, which argues that:

- ❖ When interest rates are market-determined, they are higher than when imposed by government and lead to higher private saving than otherwise.
- ❖ Higher private saving rates when invested efficiently generate higher investment, which in turn results in higher economic growth.

The study therefore develops two models. In Model 1, the growth rate of real GDP is used as the dependent variable with the purpose of determining which of the variables significantly contribute to the determination of the South African growth rate of real GDP. Model 2 for its share seeks to determine what drives private saving in South Africa; therefore the ratio of private saving to GDP is the dependent variable in this model. The financial liberalisation index for South Africa (saflib) developed by Aron and Muellbauer (2000b) is added to the rest of the explanatory variables in the second model.

The study divides the sample period (1965-2007) into the pre-liberalisation period (1965-1995) and the post liberalisation period (1995-2007). As already shown in Table 5, the study distinguishes between two types of government saving: net saving by general government (gvtsav) and public saving (govsav). Similarly the study distinguishes two types of real interest rates: those calculated from yield (ryield) and those calculated from prime overdraft (rprime). The distinction between gvtsav and govsv as well as ryield and rprime leads to the respective division of Model 1 and Model 2 into four sub models per period. The variables subject to a change are highlighted in each sub model.

5.2.5.1 Model 1

In Model 1, the variable to be explained is economic growth (rgrowth) and the explanatory variables are respectively real GDP, real interest rates (ryield or rprime), foreign saving, government saving (gvtsav or govsv), financial saving, credit and public investment. All of the above-mentioned variables are defined in Table 5.

$$\mathbf{rgrowth} = \beta_0 + \beta_1 \text{rgdp} + \beta_2 \text{rir}_t + \beta_3 \text{forsav} + \beta_4 \text{gsav}_t + \beta_5 \text{finsav}_t + \beta_6 \text{cred}_t + \beta_7 \text{gfcfg}_t + \varepsilon_t$$

t = time period (quarter in this study)

ε = residuals that measure the extent to which every variable is out of equilibrium

In the next four sub models, the relevant measures of real interest rates and government saving are bolded.

1/ Model 1.1

$$\mathbf{rgrowth} = \beta_0 + \beta_1 \text{rgdp} + \beta_2 \mathbf{ryield}_t + \beta_3 \text{forsav} + \beta_4 \mathbf{gvtsav}_t + \beta_5 \text{finsav}_t + \beta_6 \text{cred}_t + \beta_7 \text{gfcfg}_t + \varepsilon_t$$

2/ Model 1.2

$$\mathbf{rgrowth} = \beta_0 + \beta_1 \text{rgdp} + \beta_2 \mathbf{ryield}_t + \beta_3 \text{forsav} + \beta_4 \mathbf{govsav}_t + \beta_5 \text{finsav}_t + \beta_6 \text{cred}_t + \beta_7 \text{gfcfg}_t + \varepsilon_t$$

3/ Model 1.3

$$\mathbf{rgrowth} = \beta_0 + \beta_1 \text{rgdp} + \beta_2 \mathbf{rprime}_t + \beta_3 \text{forsav} + \beta_4 \mathbf{gvtsav}_t + \beta_5 \text{finsav}_t + \beta_6 \text{cred}_t + \beta_7 \text{gfcfg}_t + \varepsilon_t$$

4/ Model 1.4

$$\mathbf{rgrowth} = \beta_0 + \beta_1 \text{rgdp} + \beta_2 \mathbf{rprime}_t + \beta_3 \text{forsav} + \beta_4 \mathbf{govsav}_t + \beta_5 \text{finsav}_t + \beta_6 \text{cred}_t + \beta_7 \text{gfcfg}_t + \varepsilon_t$$

5.2.5.2 Model 2

In Model 2 the dependent variable is private saving and the independent variables are respectively real GDP, real interest rates (ryield or rprime), foreign saving, government saving (gvtsav or govsv), financial saving, credit, public investment and South African liberalisation index.

$$\mathbf{psav}_t = \beta_0 + \beta_1 \text{rgdp} + \beta_2 \text{rir}_t + \beta_3 \text{forsav} + \beta_4 \text{gsav}_t + \beta_5 \text{finsav}_t + \beta_6 \text{cred}_t + \beta_7 \text{gfcfg}_t + \text{safilib} + \varepsilon_t$$

In the next four sub models, the relevant measures of real interest rates and government saving are bolded.

1/ Model 2.1

$$psav_t = \beta_0 + \beta_1 rgdp + \beta_2 \mathbf{ryield}_t + \beta_3 forsav + \beta_4 \mathbf{gvtsav}_t + \beta_5 finsav_t + \beta_6 cred_t + \beta_7 gfcfg_t + safliib + \varepsilon_t$$

2/ Model 2.2

$$psav_t = \beta_0 + \beta_1 rgdp + \beta_2 \mathbf{ryield}_t + \beta_3 forsav + \beta_4 \mathbf{govsav}_t + \beta_5 finsav_t + \beta_6 cred_t + \beta_7 gfcfg_t + safliib + \varepsilon_t$$

3/ Model 2.3

$$psav_t = \beta_0 + \beta_1 rgdp + \beta_2 \mathbf{rprime}_t + \beta_3 forsav + \beta_4 \mathbf{gvtsav}_t + \beta_5 finsav_t + \beta_6 cred_t + \beta_7 gfcfg_t + safliib + \varepsilon_t$$

4/ Model 2.4

$$psav_t = \beta_0 + \beta_1 rgdp + \beta_2 \mathbf{rprime}_t + \beta_3 forsav + \beta_4 \mathbf{govsav}_t + \beta_5 finsav_t + \beta_6 cred_t + \beta_7 gfcfg_t + safliib + \varepsilon_t$$

The above models are estimated and the results are discussed in Chapter 6. Before estimation can be done it is important to get a better understanding of the characteristics of the relevant variables; this is done in the next section.

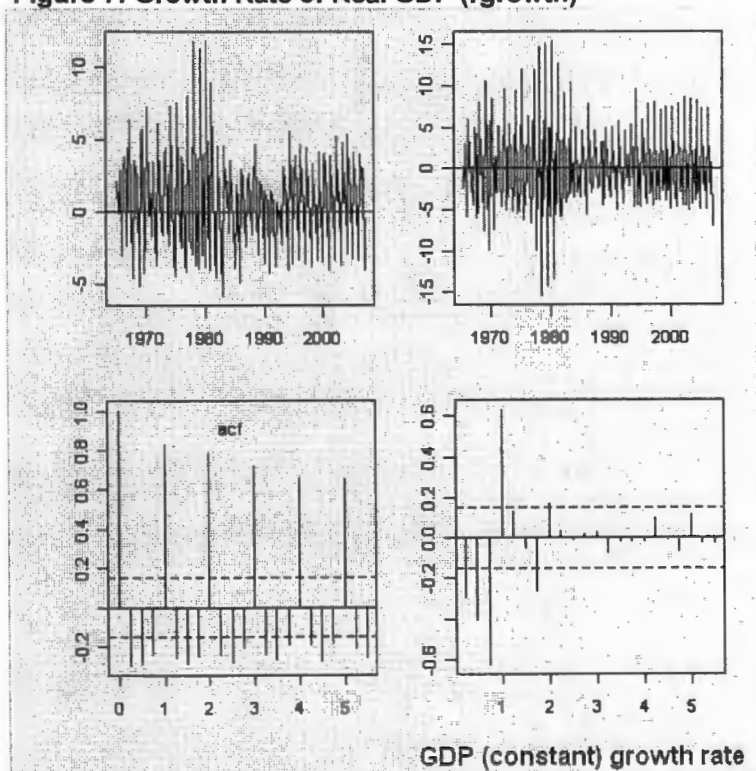
5.2.6 Visual inspection of data

This section of the study provides a depiction of the time series aimed at giving an insight into the existence of stationary property of each time series. The visual inspection consists of a four-plot figure that respectively represents the time series at their original levels, first difference, autocorrelation and partial autocorrelation of data at levels. Prior to each figure a brief summary of the empirical literature is provided as well as the anticipated signs and coefficients of the variables.

5.2.6.1 Growth rate of real GDP (rgrowth)

As already mentioned, the growth rate of real GDP is the dependent variable of the first model of the study. As seen in Chapter 2, the controversial relationship between income growth and saving has been analysed by several growth theories. The Harrod-Domar, Solow-Swan and endogenous models predict that high saving rates lead to high growth rates, albeit some theories stress that growth is just temporary. Both the representations of the variable at levels and first difference in Figure 7 suggest that rgrowth is stationary. A look at the autocorrelation plot shows that the autocorrelations are often irregular and negative. The autocorrelations and partial autocorrelations plots together suggest that the variable does not contain a unit root i.e. is stationary, which is expected from a growth rate.

Figure 7: Growth Rate of Real GDP (rgrowth)



Source: SARB quarterly bulletin

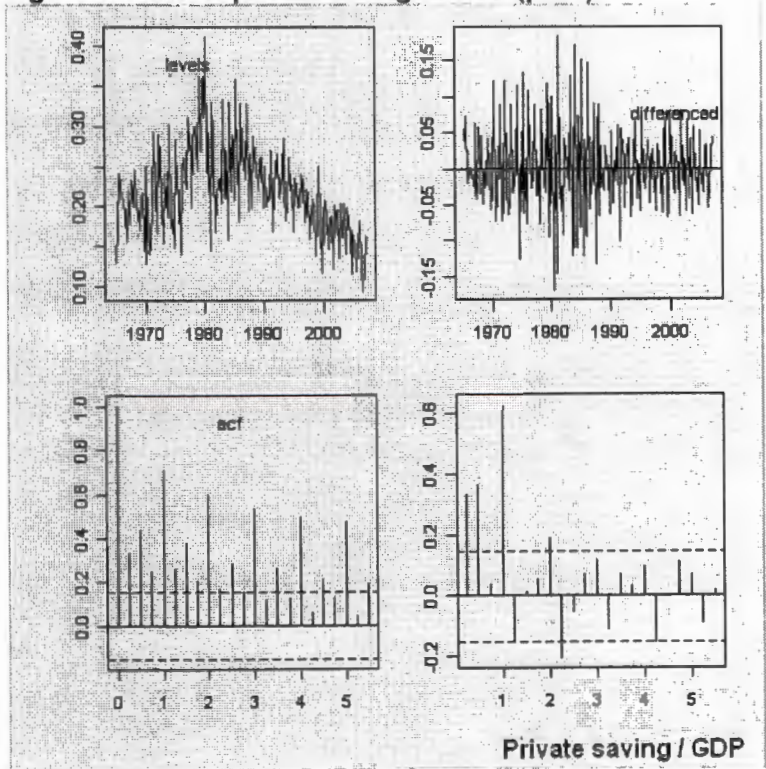
5.2.6.2 Ratio of private saving to GDP (psav)

Private saving is obtained by subtracting net saving by general government (KBP 6202K) from gross saving (KBP 6203K). Naik et al. (2005) argue that gross private saving captures best the flows of saving in the private sector as

a whole given that companies are ultimately owned by individuals. However as opposed to the former authors, this study could not exclude depreciation from private saving because the former variable can only be obtained from the SARB on a yearly basis. Private saving is treated as the dependent variable in the second model to test for the validity of the McKinnon-Shaw model that argues that financial liberalisation is a conduit to higher growth rate through an increase in private saving. Hence the study expects a positive relationship between $rgrowth$ and $psav$.

Figure 8 suggests that the time series at levels follows two trends (upward and downward) whereas the first difference is stationary. The autocorrelation function plot shows that the sample autocorrelations are irregular, do not follow a moving average process and seem to be non-stationary. The interpretation of autocorrelations and partial autocorrelations plots is quite intricate; hence further tests are required in order to find out whether the time series is stationary or not.

Figure 8: Ratio of private saving to GDP (psav)



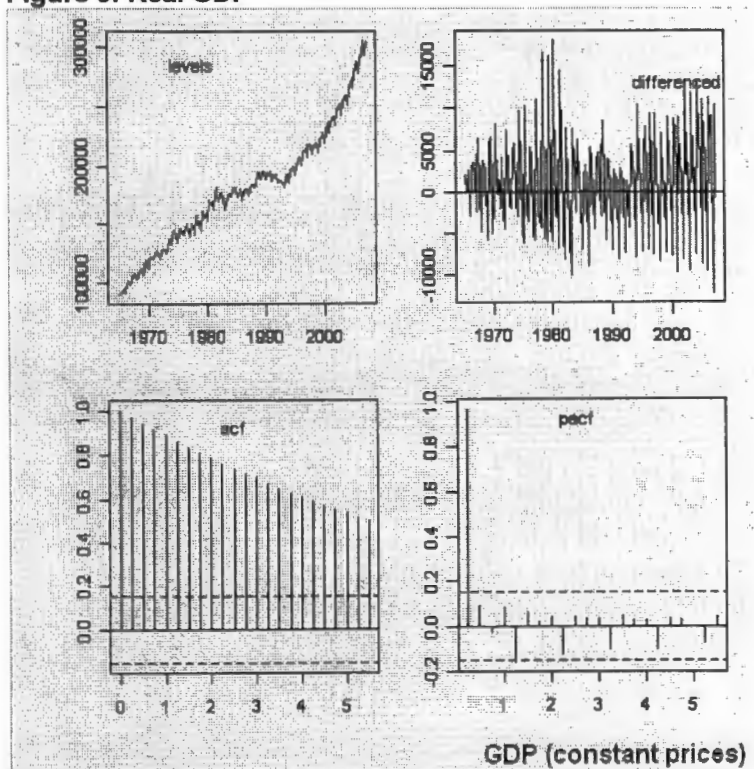
Source: SARB quarterly bulletin

5.2.6.3 Real GDP (rgdp)

The study uses real GDP as the measure of income as opposed to GDP per capita in some empirical studies because South Africa's population and employment figures are unreliable. This is mostly due first of all to a history of break-ups of some provinces and secondly to the prevalence of an informal sector. Most of the consumption/saving theories discussed in Chapter 3 (absolute-income, relative income, PIH and LCH) posit that saving is a function of income. Consequently the coefficient of *rgdp* is expected to be positive in the private saving equation and lie between 0 and 1.

The representation of *rgdp* in Figure 9 clearly suggests that the variable is non-stationary at levels as it follows an upward trend and exhibits significant time dependence. However when differenced once the variable seems stationary. The autocorrelation plot shows that the sample autocorrelations are very strong and positive and decay slowly, which indicates that the process is non-stationary. Furthermore the partial autocorrelation plot shows that only the first lag is significant and suggests an ARIMA model.

Figure 9: Real GDP



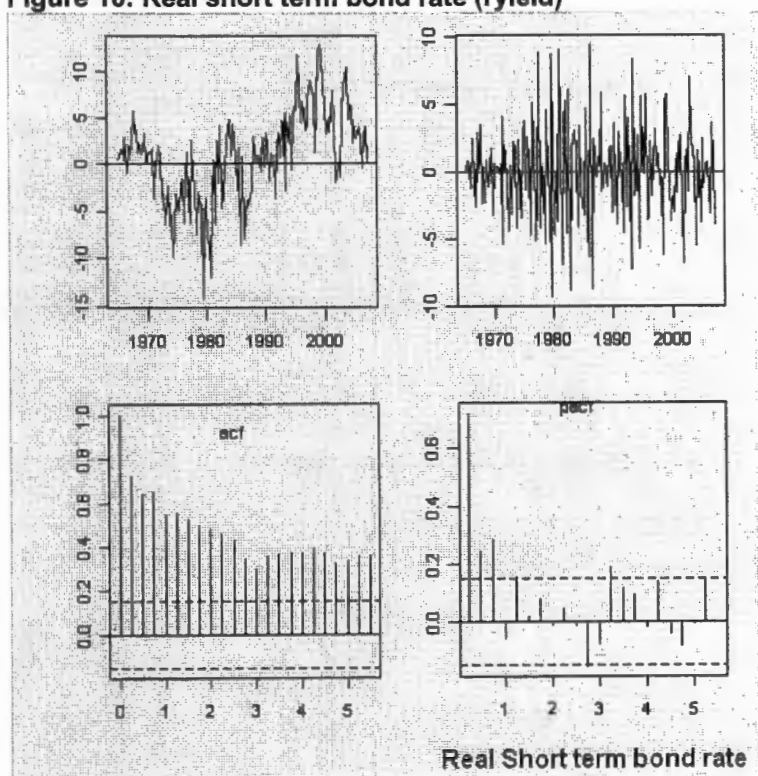
Source: SARB quarterly bulletin

5.2.6.4 Real yield on loan stock traded on the bond exchange (ryield)

ryield is one of the two types of real interest rates used in the study. According to the financial repression hypothesis of McKinnon-Shaw (1973), financially liberalised economies experience higher real interest rates than repressed economies; and higher real interest rates generate higher levels of saving in the private sector. However, as seen earlier in Chapter 3, results from empirical studies are at best ambiguous; but given South Africa's private saving rates have been dwindling since the 1980s, a negative sign is anticipated for ryield in the private saving equation.

Figure 10 suggests that the time series is non-stationary at levels. However when differenced once the variable appears to be stationary and the mean is around zero. The autocorrelation plot shows that the autocorrelations are positive and decay slowly. The autocorrelations plot indicates that the data are non-stationary and suggests an ARIMA model.

Figure 10: Real short term bond rate (ryield)

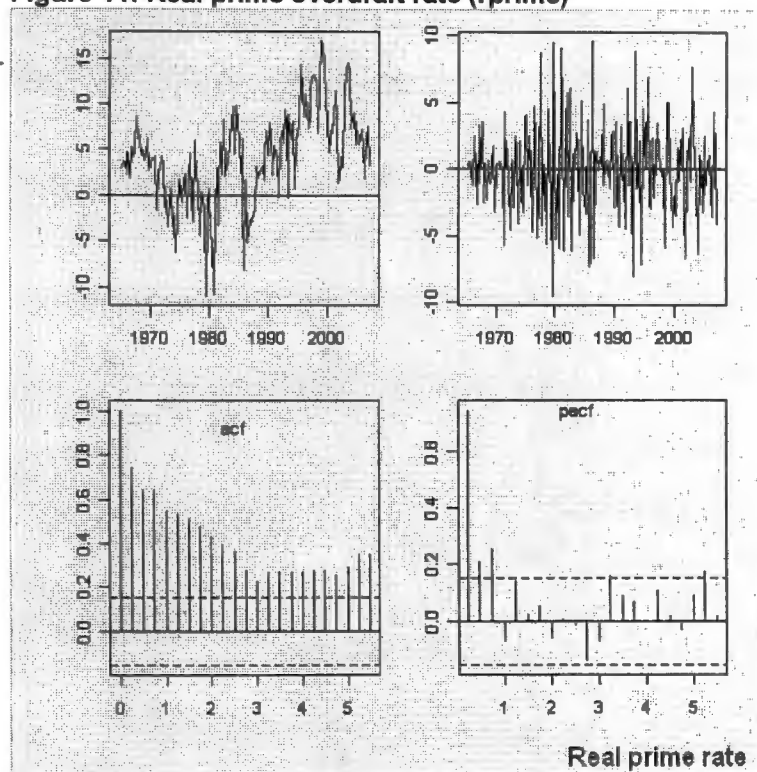


Source: SARB quarterly bulletin

5.2.6.5 Real prime overdraft rate (rprime)

Real prime overdraft rate is the second type of interest rates used in the study. The effect of real prime overdraft rate on saving is expected to be negative for the same reasons as r_{yld} . Figure 11 suggests that the data at levels is non-stationary at levels but stationary at first difference. There is one large autocorrelation, but then the autocorrelations quickly taper off to zero. As for the autocorrelations plot (acf), it shows that only lag 1 is significant and suggests an AR (1). Both the autocorrelation function and the partial autocorrelation function plots suggest the time series does not contain a unit root but further tests need to be performed.

Figure 11: Real prime overdraft rate (rprime)



Source: SARB quarterly bulletin

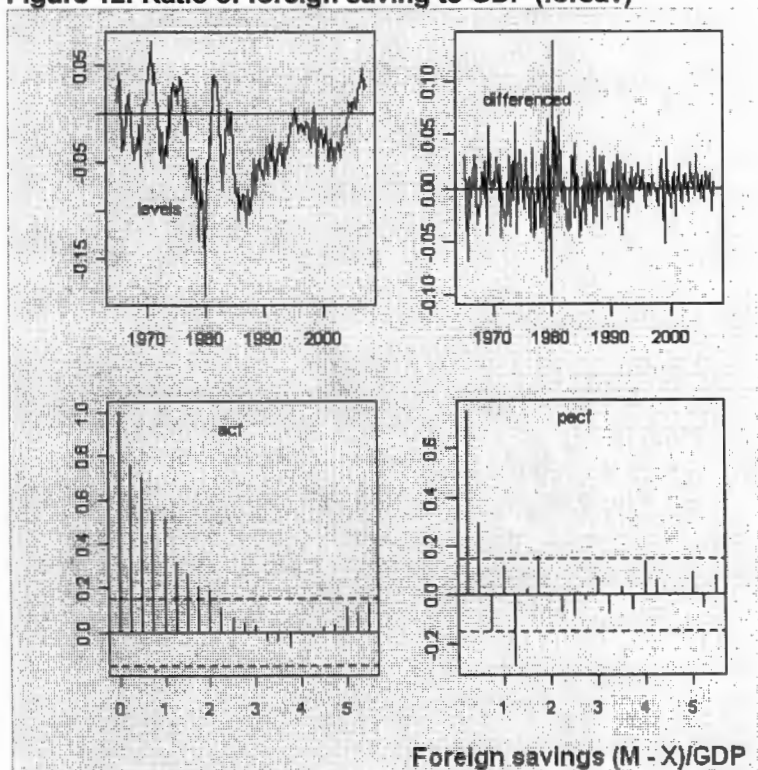
5.2.6.6 Ratio of foreign saving to GDP (forsav)

Following Kendall (2000), foreign saving is calculated as net exports; that is by making the difference between 'imports of goods and services' and 'exports of goods and services'. Then the ratio is obtained by dividing the result by GDP. The empirical literature shows that foreign saving can either be complement to (+) or substitute (-) for domestic saving. Most of the literature

however suggests that the former is substitute for the latter (Kendall, 2000). Current account deficits tend to lead to increased consumption and therefore lower saving. Hence foreign and domestic saving are likely to be substitutes: the time series is expected to depict a negative sign in the private saving equation. On the other hand, as seen in Chapter 4, inflows of foreign saving have significantly contributed to South Africa's growth. Therefore foreign saving is expected to have a positive sign in the growth equation.

In Figure 12 both the plots of the data at levels and at first difference suggest that the time series is stationary. The autocorrelation function plot reveals that the data quickly tapers off to zero as the lags increase although they return positive but insignificant towards the end of the sample period. All of the above suggests that the time series is stationary but further tests must be performed for confirmation.

Figure 12: Ratio of foreign saving to GDP (forsav)

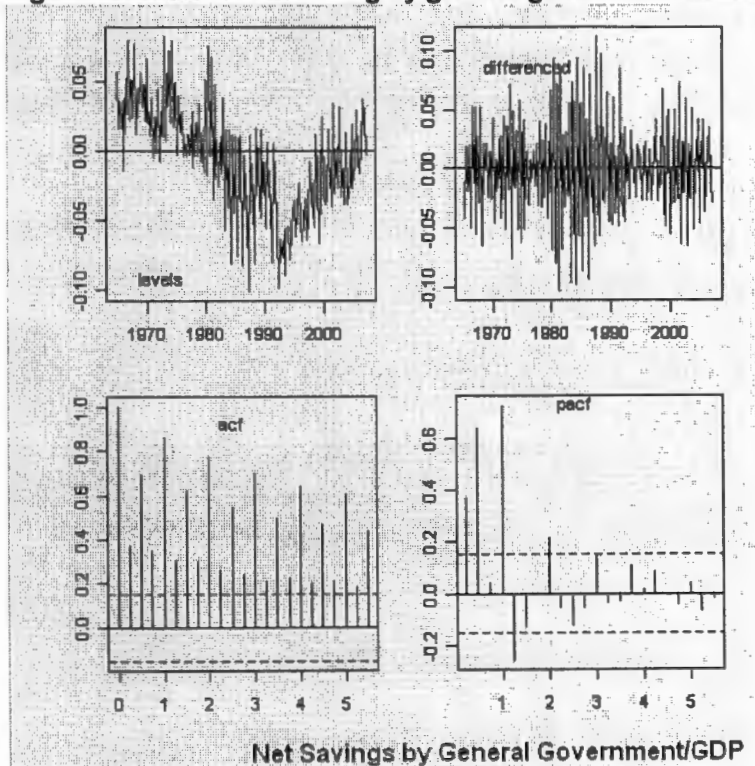


Source: SARB quarterly bulletin

5.2.6.7 Ratio of net saving by general government to GDP (gvtsav)

The inclusion of gvtsav in the study is justified by the history of deficits experienced by South Africa. The variable tests for the validity of the Ricardian equivalence; that is, the extent to which fiscal policy influences private saving. In some studies the coefficient is positive and lies between zero and one ($0 \leq x \leq 1$); whereas in others it is negative and lies between minus one and zero ($-1 \leq x \leq 0$). This study anticipates the latter rather than the former results due to the dissaving of the South African government throughout the years. In Figure 13 the time series appears to be non-stationary at levels and stationary at first difference. The autocorrelation plot indicates that the sample is irregular. Further tests need to be performed to determine the existence of stationarity property of the time series.

Figure 13: Ratio of net saving by general government to GDP (gvtsav)



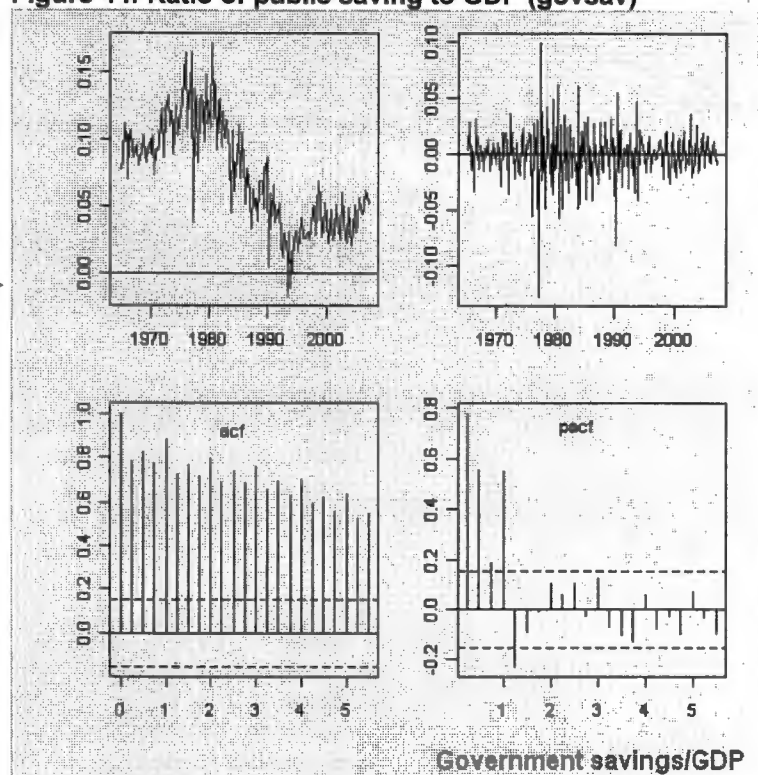
Source: SARB quarterly bulletin

5.2.6.8 Ratio of public saving to GDP (govsav)

govsav differs from gvtsav; whilst the latter is obtained from the SARB quarterly bulletin, the former is calculated by the author as shown in Table 5. The result is then divided by GDP to obtain a ratio.

Figure 14 shows that when at levels, the variable appears to be non-stationary and trends downwards. The plot of the time series at first difference suggests that the data is integrated of order one. The autocorrelation function reveals that the level of one quarter is highly dependent on the ratio of the previous quarters and suggests that the time series non-stationary and follows an ARIMA process.

Figure 44: Ratio of public saving to GDP (govsav)



Source: SARB quarterly bulletin

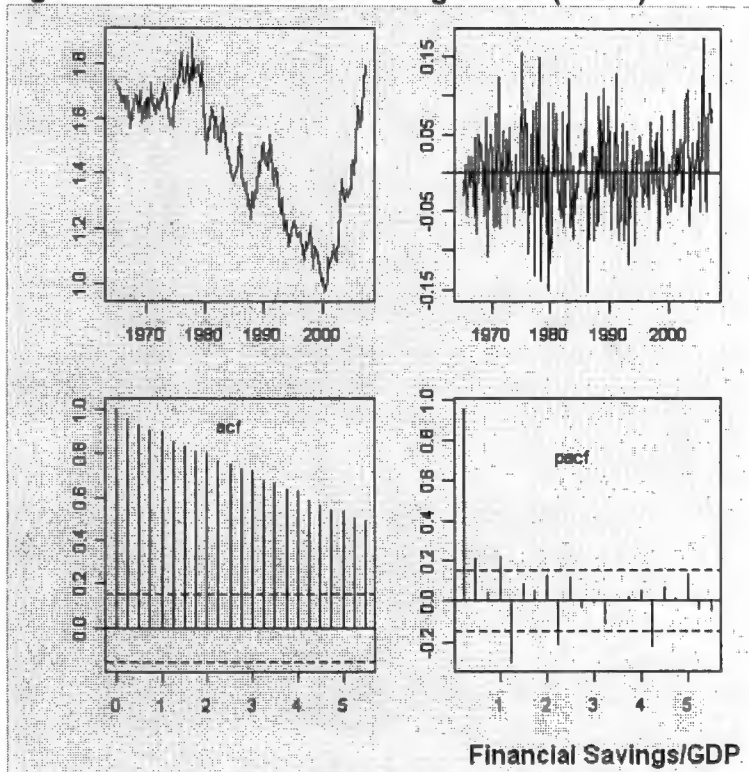
5.2.6.9 Ratio of financial saving to GDP (finsav)

Prema-Chandra (1998) and Warman and Thirlwall (1994) contend that financial saving is a good measure of domestic saving as the former “measures the amount of total saving that is channelled via financial assets” (Warman & Thirlwall, 1994:634). Following the latter authors, financial saving is calculated as the difference between M3 and M1. According to Mohr et al (2004:357-358), M1 includes coins and notes in circulation outside the monetary sector as well as all demand deposits of the domestic private sector with monetary institutions. M2 is equal to M1 plus all other short-term and medium term deposits of the domestic private sector with monetary

institutions. As for M3, it is equal to M2 plus all long-term deposits of the domestic private sector with monetary institutions. McKinnon's virtuous circle of growth suggests that financial saving will grow with income; therefore financial saving is expected to have a positive sign in the growth equation.

Figure 15 shows that the variable appears to follow three trends at its original levels although the downward slope of the period 1970-2000 is quite surprising. However when differenced once the variable seems to be stationary. The autocorrelation plot indicates that the process is non-stationary and the partial autocorrelation plot shows that only the first lag is significant suggesting an ARIMA model.

Figure 15: Ratio of financial saving to GDP (finsav)



Source: SARB quarterly bulletin

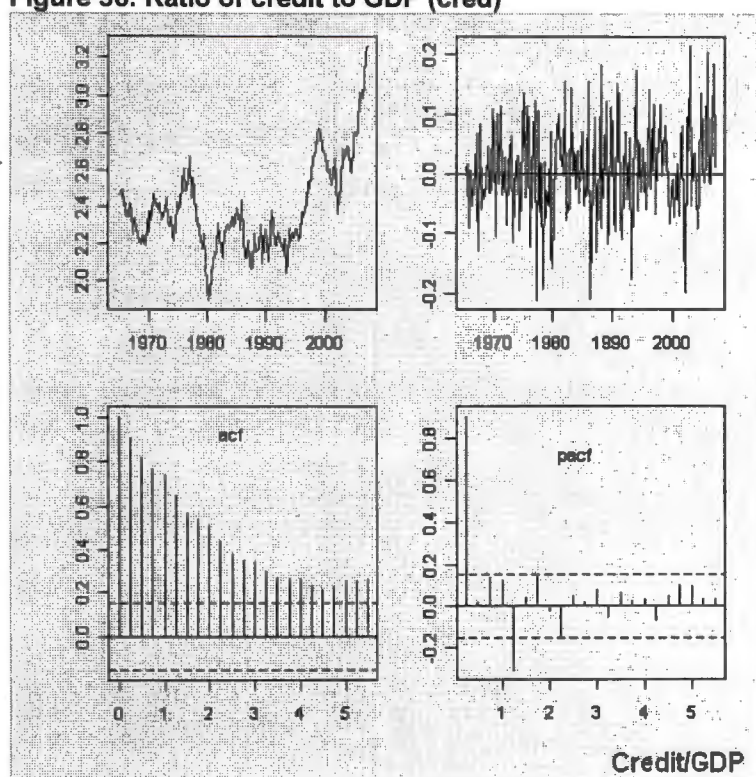
5.2.6.10 Ratio of total domestic credit to GDP (cred)

The ratio of total domestic credit extended by all monetary institutions to GDP is used to capture consumers' access to borrowing as the former is an indicator for financial sector development. According to the Shaw (1973) and his theory of financial deepening, the development of financial sector through

easier access to credit is supposed to be conducive to economic growth: cred is therefore expected to have a positive sign in the growth equation.

Figure 16 shows that the time series is clearly non-stationary at levels but stationary at first difference. A look at the plot of the autocorrelations function shows that the autocorrelations are strong and decay slowly. The autocorrelation plot indicates that the process is non-stationary and suggests an ARIMA model. The plot of the partial autocorrelation shows that after lag one is the most significant and therefore suggests an AR (1).

Figure 56: Ratio of credit to GDP (cred)



Source: SARB quarterly bulletin

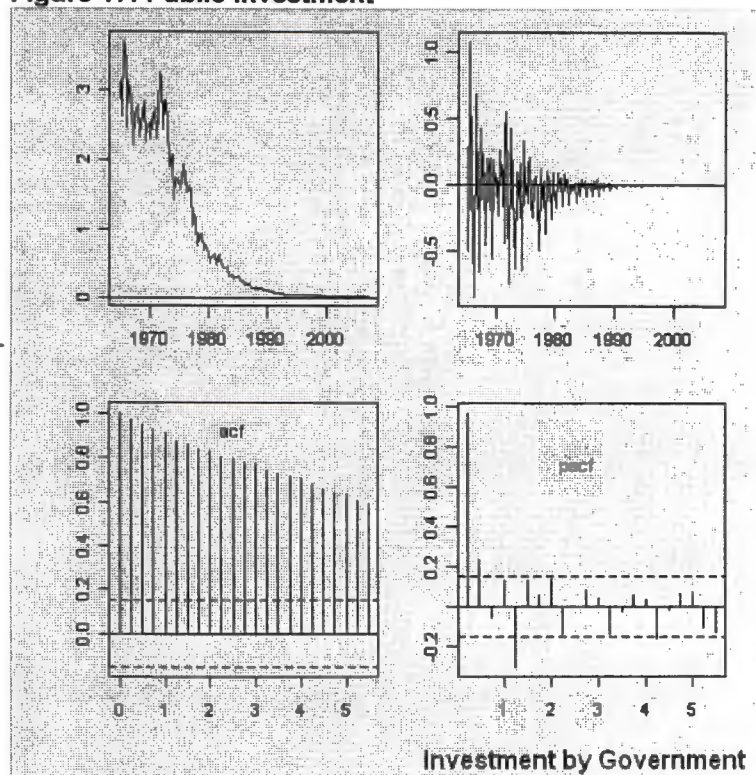
5.2.6.11 Ratio of public investment to GDP (gfcfg)

Public Investment is calculated as shown in Table 5. The study seeks to determine the impact of government deficits on government investment and then on growth.

Figure 17 suggests that the variable is non-stationary as it follows a downward trend throughout the sample period. However, the plot of first difference suggests that the variable is stationary although the data

completely disappears towards the early 1990s. The autocorrelation plot shows that the data are strong and decay slowly, which suggests that the time series is non-stationary and follows an ARIMA process. The partial autocorrelation plot shows that only the first lag is significant and the process 'cuts off'; which suggests a MA (1).

Figure 17: Public Investment



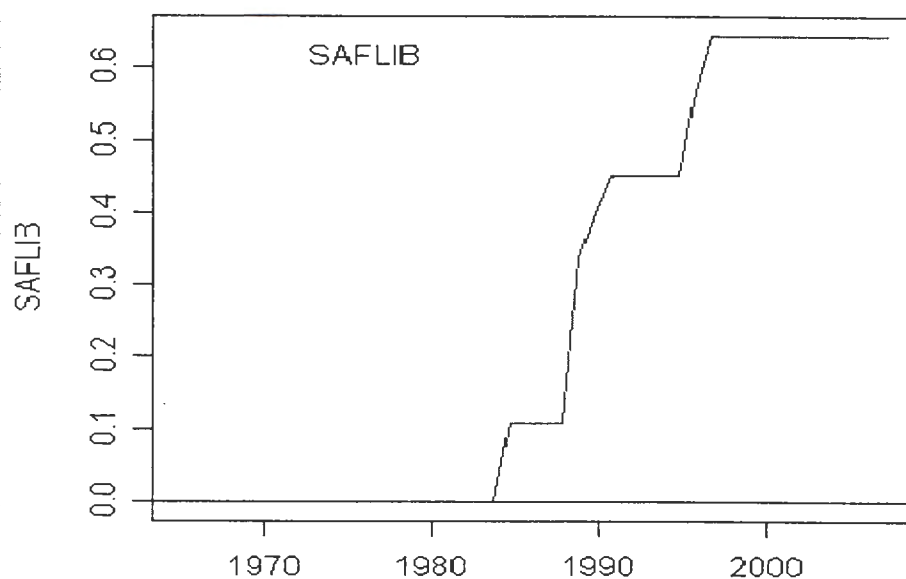
Source: SARB quarterly bulletin

5.2.6.12 South African financial liberalisation index (saflib)

The financial liberalisation index used in the study was developed by Aron and Muellbauer (2000a). The study uses this variable determine the impact of financial liberalisation South Africa's private saving and growth rates. Aron and Muellbauer (2000a) suggest that financial liberalisation played an important role in the drastic and persistent fall of households' saving in South Africa; a negative sign is therefore anticipated.

Figure 18 suggests that financial liberalisation was insignificant in South Africa until 1984. Then the index followed an upward trend and stabilised in the late 1990s.

Figure 18: Financial liberalisation index



Source: Aron and Muellbauer (2000a)

5.2.7 Long-run regressions

The econometric analysis starts off with long-run regressions of the variables at levels in order to find out whether the explanatory variables of the respective models make statistically significant contribution to the relevant dependent variables i.e. growth rate of real GDP and private saving. The signs of the coefficients indicate whether these contributions are positive or negative. The regressions are performed according to the models as explained in section 5.2.3. Due to the distinction of four sub models per period and the existence of three periods, twelve regressions are run for each model. Therefore because there are two models the study runs a total of twenty four long-run regressions.

5.2.8 Residuals tests

Owing to the large number of regressions and the significance of the results of Model 1.1 and Model 2.1, the study performs a series of six tests on the residuals of regressions of the above-mentioned models. The latter models

cover the period 1965-2007. Following Hothorn et al. (2007), the following tests are therefore performed on the residuals of Regression 1 and Regression 13. These tests are:

- ❖ The Durbin Watson test, which tests for the presence of autocorrelated errors.
- ❖ The Breusch-Godfrey test, which tests for higher-order serial correlation.
- ❖ The Breusch-Pagan test: tests for homoscedasticity or against heteroscedasticity
- ❖ The Ramsey RESET test, which tests for functional relation.
- ❖ The Rainbow test, which tests for linearity
- ❖ Harrison-McCabe test, which tests for heteroscedasticity.

5.2.9 Testing for order of integration and cointegration

Given the limitations of visual inspection of the data, the study needs to perform several tests to establish whether the relevant time series are integrated of the same order. The determination of the magnitude of integration of the relevant variables requires putting the series through unit root tests (Pfaff, 2006:76-79).

Unit root test tests for the null of non-stationarity $I(1)$ against the alternative of stationarity $I(0)$, assuming that the dynamics in the data have an ARMA structure. First of all, the study determines if all of the time series at levels are integrated of the same order; if it is verified, there is possibility of cointegration. Then the study tests for stationarity of residuals. In case residuals are found to be stationary, the null of no cointegration must be rejected and an error correction model can be estimated.

5.2.9.1 Unit root tests on variables at levels

Unit root tests are performed for the entire period and the post liberalisation period because of the significance of the results as opposed to the weak results of the pre-liberalisation period. Each variable is subject to three tests:

- ❖ The first test is the augmented Dickey-Fuller (ADF) test on the time series at their original levels with a time trend. When testing for non-stationarity, the value of the ϕ t statistic is compared to the critical t statistic values computed by Mackinnon (MacKinnon, 1991). The study provides the respective 1, 5 and 10 per cent critical values prior to every ADF-test. Given the study chooses a 5 per cent level of significance, the ϕ t statistic must be smaller than the 5 per cent critical value for the null of non-stationarity to be accepted. The result obtained can be confirmed by comparing the value of the τ t statistic to the 5 per cent critical value also provided in the test. In this case, the τ t-statistic must be bigger than the 5 per cent critical value if the null of non-stationarity of the variable is to be accepted.
- ❖ Next, in case the variables are found to be non-stationary, another ADF test is performed to test whether differencing the time series once suffices to achieve stationarity. This is to find out whether the variables are integrated of order one. Again, the values of the relevant t-statistics are compared to the 5 per cent MacKinnon critical values provided in the relevant table so as to draw conclusions as to the stationarity or non-stationarity of each variable.
- ❖ Finally, the Zivot-Andrews test (Pfaff, 2006:76-79) is performed on each variable. This is first of all because ADF tests are unable to discriminate well between non-stationary and stationary series with a high degree of autocorrelation. And, secondly, because ADF tests are sensitive to structural breaks. In the Zivot-Andrews test, the test statistic value must be bigger than the critical 5 per cent value for the hypothesis of the existence of non-stationarity to be validated.

5.2.9.2 Long-run regression tests

The econometric analysis proceeds with the performance of long-run regression tests on the variables of Model 1.1 and Model 2.1 due to the significance of the latter models.

5.2.9.3 Unit root tests on residuals

The Augmented Dickey Fuller (Dickey & Fuller, 1979) test for integration of order one is performed on the residuals of the variables of Model 1.1 and Model 2.1.

5.2.9.4 Cointegration

Cointegration exists when two integrated series maintain an equilibrium, which means they never drift far apart from each other in the long-run. Engle and Granger (1987) demonstrate that in case the variables at levels are found to be non-stationary i.e. $I(1)$ and their residuals are stationary i.e. $I(0)$, time series are cointegrated and depict an error correction mechanism.

5.2.9.5 Error Correction Models

The existence of cointegration of variables leads to the performance of single-equation error correction models (ECM) as suggested by Engle and Granger (1987). An error correction model is a method of combining the long run, cointegrating relationship between the levels variables and the short run relationship between the first differences of the variables. The Granger representation theorem argues that two or more integrated time series that are cointegrated have an error correction representation, and two or more time series that are error correcting are cointegrated. An ECM is estimated for every time series of each model. This is done for the entire period only (1965-2007) and every ECM incorporates the first difference of each of the independent variables. The coefficient of the error correction term (err.ecm) (that measures the short-run adjustment towards the long-run equilibrium position) is expected to be significant and negative; otherwise the hypothesis of a long-run relationship between variables is not stable. Here follow the formulae of the ECM tests that are presented in Chapter 6 as they were run in the R package.

❖ **rgrowth equation**

- **ECM test for rgrowth**

lm(formula = rgrowth.d ~ err.ecm1 + rgdp.d1 + ryield.d1 + forsav.d1 + gvtsav.d1 + finsav.d1 + cred.d1 + gfcfg.d1)

- **ECM test for rgdp**

lm(formula = rgdp.d ~ err.ecm2 + rgrowth.d1 + ryield.d1 + forsav.d1 + gvtsav.d1 + finsav.d1 + cred.d1 + gfcfg.d1)

- **ECM test for ryield**

lm(formula = ryield.d ~ err.ecm3 + rgrowth.d1 + rgdp.d1 + forsav.d1 + gvtsav.d1 + finsav.d1 + cred.d1 + gfcfg.d1)

- **ECM test for forsav**

lm(formula = forsav.d ~ err.ecm4 + rgrowth.d1 + rgdp.d1 + ryield.d1 + gvtsav.d1 + finsav.d1 + cred.d1 + gfcfg.d1)

- **ECM test for gvtsav**

lm(formula = gvtsav.d ~ err.ecm5 + rgrowth.d1 + rgdp.d1 + ryield.d1 + forsav.d1 + finsav.d1 + cred.d1 + gfcfg.d1)

- **ECM test for finsav**

lm(formula = finsav.d ~ err.ecm6 + rgrowth.d1 + rgdp.d1 + ryield.d1 + forsav.d1 + gvtsav.d1 + cred.d1 + gfcfg.d1)

- **ECM test for cred**

lm(formula = cred.d ~ err.ecm7 + rgrowth.d1 + rgdp.d1 + ryield.d1 + forsav.d1 + gvtsav.d1 + finsav.d1 + gfcfg.d1)

- **ECM test for gfcfg**

lm(formula = gfcfg.d ~ err.ecm8 + rgrowth.d1 + rgdp.d1 + ryield.d1 + forsav.d1 + gvtsav.d1 + finsav.d1 + cred.d1)

❖ **psav equation**

- **ECM test for psav**

lm(formula = psav.d ~ err.ecm1 + rgdp.d1 + ryield.d + forsav.d1 + gvtsav.d1 + finsav.d1 + cred.d1 + gfcfg.d1)

- **ECM test for rgdp**

$\text{lm}(\text{formula} = \text{rgdp.d} \sim \text{err.ecm2} + \text{psav.d1} + \text{ryield.d} + \text{forsav.d1} + \text{gvtsav.d1} + \text{finsav.d1} + \text{cred.d1} + \text{gfcfg.d1})$

- **ECM test for ryield**

$\text{lm}(\text{formula} = \text{ryield.d} \sim \text{err.ecm3} + \text{rgdp.d1} + \text{psav.d1} + \text{forsav.d1} + \text{gvtsav.d1} + \text{finsav.d1} + \text{cred.d1} + \text{gfcfg.d1})$

- **ECM test for forsav**

$\text{lm}(\text{formula} = \text{forsav.d} \sim \text{err.ecm4} + \text{rgdp.d1} + \text{ryield.d} + \text{psav.d1} + \text{gvtsav.d1} + \text{finsav.d1} + \text{cred.d1} + \text{gfcfg.d1})$

- **ECM test for gvtsav**

$\text{lm}(\text{formula} = \text{gvtsav.d} \sim \text{err.ecm5} + \text{rgdp.d1} + \text{ryield.d1} + \text{forsav.d1} + \text{psav.d1} + \text{finsav.d1} + \text{cred.d1} + \text{gfcfg.d1})$

- **ECM test for finsav**

$\text{lm}(\text{formula} = \text{finsav.d} \sim \text{err.ecm6} + \text{rgdp.d1} + \text{ryield.d} + \text{forsav.d1} + \text{gvtsav.d1} + \text{psav.d1} + \text{cred.d1} + \text{gfcfg.d1})$

- **ECM test for cred**

$\text{lm}(\text{formula} = \text{cred.d} \sim \text{err.ecm7} + \text{rgdp.d1} + \text{ryield.d} + \text{forsav.d1} + \text{gvtsav.d1} + \text{finsav.d1} + \text{psav.d1} + \text{gfcfg.d1})$

- **ECM for gfcfg**

$\text{lm}(\text{formula} = \text{gfcfg.d} \sim \text{err.ecm8} + \text{rgdp.d1} + \text{ryield.d} + \text{forsav.d1} + \text{gvtsav.d1} + \text{finsav.d1} + \text{psav.d1} + \text{cred.d1})$

5.2.10 Granger causality tests

Developed by Granger (1969), Granger causality tests are performed in the study to ascertain whether variables are causally related to each other. A variable y_t is said to “Granger cause” another variable x_t if current and past information on y_t help improve the forecasts of x_t . Testing for granger causality is made possible through the analysis of the F-test or the p-value ($P > (F)$). The hypothesis to be verified is the null of no granger causality. Given the study opts for $\alpha = 0.05$ level of significance, the null of no Granger causality must be rejected if the p-value is smaller than the level of significance; that is if $(P > (F)) < 0.05$. Granger causality tests are performed on the two

respective models of the study for each of the three periods. This yields a total of six tables for Granger causality tests.

5.3 Conclusion

This chapter has discussed the data, the models as well as the tests used in the econometric analysis and the underlying reasons for their use. Furthermore a visual inspection of the data has been provided in order to get an idea of the characteristics of the data in terms of stationarity. All of the above was done with the purpose of facilitating the understanding of the results that follow in the next chapter.

CHAPTER 6

ECONOMETRIC ANALYSIS

6.1 Introduction

Chapter 6 is the part of the study that empirically tests and estimates hypothetical relationships, causalities and cointegration among the variables. This chapter starts by carrying out long-run regressions for all of the variables at their original levels. A series of tests are performed on the residuals following the most two important models: Model 1.1 and Model 2.1 over the entire period (1965-2007). The purpose of these series of tests on the residuals is to determine if the latter have the desired properties. Next the study proceeds with the testing for the order of integration of the relevant variables at levels by carrying out unit root tests through the Augmented Dickey Fuller and the Zivot-Andrews tests respectively. Then, regressions and unit root tests are performed on the residuals with the aim of checking for cointegration of the variables. Once cointegration is established, the study estimates error correction models to check for the short-run adjustment of the relevant variables to the long-run equilibrium. Finally the chapter ends with the performance of granger causality tests.

6.2 Long-run regression and residuals tests

The study performs long-run regression tests for the variables in levels and divides the regressions into the entire (1965-2007), the pre-liberalisation (1965-1995) and the post liberalisation (1995-2007) periods. As already stressed earlier, residuals tests are only performed on regression 1 and regression 13.

6.2.1 Dependent variable: growth rate of GDP (rgrowth)

6.2.1.1 Entire period: 1965-2007

1. Model 1.1

In Table 6, the adjusted R-squared suggests that the explanatory variables account for less than 20 per cent of the variation in rgrowth. The variables that have significantly contributed to economic growth in South Africa since 1965 are rgdp, forsav, gvtsav, cred and gfcfg. The intercept and dummy variables show a pronounced drop in rgrowth following 1990. gvtsav, cred and gfcfg respectively have a negative sign, implying that over the period 1965-2007 there has been a negative relationship between the above-mentioned variables and rgrowth.

Table 6: Regression 1

Residual standard error: 3.102 on 157 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-Squared: 0.2453; Adjusted R-squared: 0.1924				
F-statistic: 4.638 on 11 and 157 DF				
p-value: 4.120e-06				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	1.380e+01	4.227e+00	3.265	0.001342 **
rgdp	5.875e-05	1.813e-05	3.241	0.001456 **
ryield	1.024e-02	7.879e-02	0.130	0.896717
forsav	1.466e+01	7.387e+00	1.984	0.048987 *
gvtsav	-3.128e+01	8.714e+00	-3.589	0.000443 ***
finsav	-2.557e+00	2.409e+00	-1.062	0.290076
cred	-4.170e+00	2.000e+00	-2.085	0.038694 *
gfcfg	-3.751e+01	2.171e+01	-1.728	0.085960 .
d1	-2.036e+00	1.282e+00	-1.588	0.114353
d2	-7.867e+00	1.785e+00	-4.407	1.94e-05 ***
d3	-1.174e+01	2.446e+00	-4.799	3.68e-06 ***
d4	-1.172e+01	3.263e+00	-3.592	0.000438 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

The residuals tests show that the Durbin-Watson is inconclusive and poses doubts as to the autocorrelation property of residuals.

Table 7: Residuals tests 1

Test	Df	Df1	Df2	T-stat	p-value	Conclusion
Durbin-Watson				2.26	0.858	Inconclusive
Breusch-Godfrey	1			3.42	0.06457	Fails to reject H_0 : evidence of higher-order serial correlation
Stud. Breusch-Pagan	11			30.6	0.00125	Rejects H_0 : errors are heteroscedastic
Reset		1	156	0.38	0.5359	Fails to reject H_0 : evidence of linearity
Rainbow		85	72	0.70	0.9396	Fails to reject H_0 : evidence of linearity
Harrison-McCabe				0.73	0.992	Fails to reject H_0 : errors are heteroscedastic

2. Model 1.2

In Table 8, the value of the adjusted R-squared suggests that the independent variables account for less than 20 per cent of the variation in rgrowth. Of the explanatory variables gross domestic product, foreign saving, public saving and credit are the variables that have significantly impacted on economic growth. With no surprise public saving and credit are negatively related to growth.

Table 8: Regression 2

Residual standard error: 3.094 on 157 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-Squared: 0.2493; Adjusted R-squared: 0.1967				
F-statistic: 4.739 on 11 and 157 DF				
p-value: 2.903e-06				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	1.286e+01	4.245e+00	3.028	0.002876 **
rgdp	6.919e-05	1.847e-05	3.747	0.000251 ***
ryield	2.162e-02	7.850e-02	0.275	0.783351 .
forsav	1.244e+01	7.415e+00	1.677	0.095502 .
govsav	-6.425e+01	1.730e+01	-3.714	0.000283 ***
finsav	-3.507e+00	2.403e+00	-1.460	0.146387
cred	-4.493e+00	1.993e+00	-2.254	0.025583 *
gfcfg	2.987e+01	2.906e+01	1.028	0.305713
d1	-2.270e+00	1.290e+00	-1.760	0.080335 .
d2	-7.329e+00	1.740e+00	-4.211	4.27e-05 ***
d3	-1.091e+01	2.386e+00	-4.574	9.66e-06 ***
d4	-1.149e+01	3.246e+00	-3.540	0.000526 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

3. Model 1.3

The R-squared in Table 9 shows that the independent variables account for less than 20 per cent of rgrowth. rgdp, forsav, gvtsav, cred and gfcfg are significant and once again, government saving, credit and public investment have a negative sign.

Table 9: Regression 3

Residual standard error: 3.101 on 157 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-Squared: 0.2458; Adjusted R-squared: 0.193				
F-statistic: 4.653 on 11 and 157 DF				
p-value: 3.913e-06				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	1.381e+01	4.224e+00	3.269	0.001328 **
rgdp	5.964e-05	1.809e-05	3.296	0.001212 **
rprime	2.653e-02	7.087e-02	0.374	0.708621
forsav	1.432e+01	7.384e+00	1.940	0.054193 .
govtsav	-3.131e+01	8.701e+00	-3.598	0.000429 ***
finsav	-2.484e+00	2.403e+00	-1.034	0.302773
cred	-4.304e+00	1.993e+00	-2.159	0.032371 *
gfcfg	-3.744e+01	2.147e+01	-1.744	0.083198 .
d1	-2.027e+00	1.279e+00	-1.585	0.114984
d2	-7.949e+00	1.799e+00	-4.419	1.84e-05 ***
d3	-1.188e+01	2.475e+00	-4.800	3.68e-06 ***
d4	-1.185e+01	3.280e+00	-3.613	0.000406 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

4. Model 1.4

Table 10 shows that intercept, rgdp, govtsav, cred, and all of the dummy variables are significant. The adjusted R-squared suggests that the independent variables account for less than 20 per cent of the variation in rgrowth. cred and gfcfg are negatively related to rgrowth.

Table 10: Regression 4

Residual standard error: 3.093 on 157 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-Squared: 0.2497; Adjusted R-squared: 0.1971				
F-statistic: 4.75 on 11 and 157 DF				
p-value: 2.797e-06				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	1.288e+01	4.242e+00	3.035	0.002816 **
rgdp	6.964e-05	1.843e-05	3.778	0.000224 ***
rprime	2.871e-02	7.069e-02	0.406	0.685161
forsav	1.226e+01	7.412e+00	1.654	0.100126
govtsav	-6.429e+01	1.730e+01	-3.717	0.000280 ***
finsav	-3.477e+00	2.396e+00	-1.451 .	0.148740
cred	-4.561e+00	1.988e+00	-2.294	0.023089 *
gfcfg	2.952e+01	2.890e+01	1.021	0.308605
d1	-2.273e+00	1.287e+00	-1.765	0.079430 .
d2	-7.393e+00	1.753e+00	-4.217	4.16e-05 ***
d3	-1.102e+01	2.414e+00	-4.567	9.95e-06 ***
d4	-1.159e+01	3.262e+00	-3.553	0.000503 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6.2.1.2 Pre-liberalisation period: 1965-1995

1. Model 1.1

Table 11 shows that Intercept, forsav, gotsav, cred, d2 and d3 are significant. The adjusted R-squared suggests that the independent variables account for 20 per cent of the variation in rgrowth. cred and gotsav negatively respond to changes in rgrowth.

Table 11: Regression 5

Residual standard error: 3.269 on 109 degrees of freedom				
Multiple R-Squared: 0.2714; Adjusted R-squared: 0.2046				
F-statistic: 4.061 on 10 and 109 DF				
p-value: 9.335e-05				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	2.168e+01	9.830e+00	2.205	0.029528 *
rgdp	1.468e-05	3.181e-05	0.461	0.645374
ryield	-4.499e-02	1.027e-01	-0.438	0.662321
forsav	1.588e+01	8.431e+00	1.883	0.062304 .
gotsav	-4.224e+01	1.063e+01	-3.975	0.000127 ***
finsav	1.009e+00	5.117e+00	0.197	0.844009
cred	-7.697e+00	3.507e+00	-2.195	0.030276 *
gfcfg	-3.911e+01	2.508e+01	-1.559	0.121824
d1	-8.865e-01	1.604e+00	-0.553	0.581661
d2	-5.011e+00	2.413e+00	-2.077	0.040175 *
d3	-8.604e+00	2.993e+00	-2.875	0.004866 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

2. Model 1.2

gotsav, cred, d2 and d3 are significant in Table 12. The adjusted R-squared is small and suggests that the independent variables account for less than 20 per cent of the variation in rgrowth. gotsav and cred are negative.

Table 12: Regression 6

Residual standard error: 3.334 on 109 degrees of freedom				
Multiple R-Squared: 0.2424; Adjusted R-squared: 0.1729				
F-statistic: 3.487 on 10 and 109 DF				
p-value: 0.0005172				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	1.637e+01	9.964e+00	1.643	0.10323
rgdp	4.234e-05	3.207e-05	1.320	0.18953
ryield	-3.573e-02	1.047e-01	-0.341	0.73361
forsav	1.366e+01	8.598e+00	1.589	0.11493
gotsav	-6.732e+01	2.029e+01	-3.319	0.00123 **
finsav	5.857e-01	5.217e+00	0.112	0.91083
cred	-7.355e+00	3.577e+00	-2.056	0.04217 *
gfcfg	2.785e+01	3.338e+01	0.834	0.40593
d1	-1.577e+00	1.652e+00	-0.955	0.34194
d2	-4.951e+00	2.461e+00	-2.012	0.04665 *
d3	-8.115e+00	3.045e+00	-2.665	0.00888 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

3. Model 1.3

Table 13 shows that intercept, forsav, gvtsav, cred, d2 and d3 are significant. The R-squared indicates that the independent variables account for 20 per cent of the variation in rgrowth. gvtsav and cred have negative coefficients.

Table 13: Regression 7

Residual standard error: 3.272 on 109 degrees of freedom				
Multiple R-Squared: 0.2703; Adjusted R-squared: 0.2033				
F-statistic: 4.037 on 10 and 109 DF				
p-value: 0.0001001				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	T value	Pr(> t)
Intercept	2.199e+01	9.830e+00	2.237	0.027318 *
rgdp	1.492e-05	3.190e-05	0.468	0.640962
rprime	-1.321e-02	9.308e-02	-0.142	0.887418
forsav	1.539e+01	8.560e+00	1.798	0.075001 .
gvtsav	-4.208e+01	1.063e+01	-3.959	0.000134 ***
finsav	1.002e+00	5.175e+00	0.194	0.846816
cred	-7.920e+00	3.468e+00	-2.283	0.024353 *
gfcfg	-3.728e+01	2.477e+01	-1.505	0.135221
d1	-7.894e-01	1.591e+00	-0.496	0.620746
d2	-4.990e+00	2.446e+00	-2.040	0.043733 *
d3	-8.597e+00	3.050e+00	-2.819	0.005727 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

4. Model 1.4

In Table 14, govsv and cred are significant and negative. The low value of the adjusted R-squared shows that the independent variables account for less than 20 per cent in the variation of rgrowth.

Table 14: Regression 8

Residual standard error: 3.335 on 109 degrees of freedom				
Multiple R-Squared: 0.2419; Adjusted R-squared: 0.1723				
F-statistic: 3.478 on 10 and 109 DF				
p-value: 0.0005317				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	T value	Pr(> t)
Intercept	1.653e+01	9.958e+00	1.660	0.09977 .
rgdp	4.223e-05	3.214e-05	1.314	0.19168
rprime	-2.042e-02	9.494e-02	-0.215	0.83012
forsav	1.353e+01	8.724e+00	1.551	0.12390
govsv	-6.738e+01	2.031e+01	-3.318	0.00123 **
finsav	6.739e-01	5.278e+00	0.128	0.89864
cred	-7.513e+00	3.533e+00	-2.126	0.03575 *
gfcfg	2.901e+01	3.311e+01	0.876	0.38287
d1	-1.519e+00	1.638e+00	-0.927	0.35578
d2	-4.894e+00	2.493e+00	-1.964	0.05213 .
d3	-8.048e+00	3.101e+00	-2.595	0.01075 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6.2.1.3 Post liberalisation period: 1995-2007

1. Model 1.1

The variables that are significant in Table 15 are rgdp, ryield, forsav, and finsav. The adjusted R-squared suggests that the identified variables account for over 40 per cent of the variation in rgrowth.

Table 15: Regression 9

Residual standard error: 2.211 on 40 degrees of freedom				
Multiple R-Squared: 0.5266; Adjusted R-squared: 0.432				
F-statistic: 5.562 on 8 and 40 DF				
p-value: 9.407e-05				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	T value	Pr(> t)
Intercept	1.373e+00	1.028e+01	0.134	0.89446
rgdp	1.497e-04	4.369e-05	3.425	0.00143 **
ryield	3.055e-01	1.158e-01	2.638	0.01183 *
forsav	5.757e+01	2.689e+01	2.141	0.03843 *
gvtsav	-1.106e+01	1.588e+01	-0.697	0.49002
finsav	-1.654e+01	3.773e+00	-4.383	8.26e-05 ***
cred	-5.675e+00	4.263e+00	-1.331	0.19064
gfcfg	-6.989e+01	1.195e+02	-0.585	0.56196
d3	2.451e+00	1.923e+00	1.275	0.20976

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

2. Model 1.2

Table 16 suggests that rgdp, ryield, forsav, govsv and finsav are significant. The medium values of both the multiple and adjusted R-squared suggest that the identified variables account for over 48 per cent of the variation in rgrowth.

Table 16: Regression 10

Residual standard error: 2.126 on 40 degrees of freedom				
Multiple R-Squared: 0.5626; Adjusted R-squared: 0.4752				
F-statistic: 6.432 on 8 and 40 DF				
p-value: 2.316e-05				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	T value	Pr(> t)
Intercept	-2.106e+00	9.645e+00	-0.218	0.828228
rgdp	1.601e-04	3.985e-05	4.018	0.000252 ***
ryield	2.894e-01	1.112e-01	2.603	0.012891 *
forsav	5.209e+01	2.571e+01	2.026	0.049449 *
govsv	-7.479e+01	3.827e+01	-1.954	0.057702 .
finsav	-1.708e+01	3.614e+00	-4.727	2.82e-05 ***
cred	-5.709e+00	4.059e+00	-1.407	0.167253
gfcfg	3.685e+01	1.288e+02	0.286	0.776246
d3	2.379e+00	1.848e+00	1.287	0.205498

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

3. Model 1.3

Table 17 shows that rgdp, rprime, forsav, and finsav are significant. Both the multiple and adjusted R-squared suggest that the identified variables account for over 40 per cent of the variation in rgrowth.

Table 17: Regression 11

Residual standard error: 2.191 on 40 degrees of freedom				
Multiple R-Squared: 0.5353; Adjusted R-squared: 0.4424				
F-statistic: 5.76 on 8 and 40 DF				
p-value: 6.793e-05				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	6.227e+00	9.782e+00	0.637	0.52803
rgdp	1.302e-04	3.973e-05	3.276	0.00218 **
rprime	2.880e-01	1.029e-01	2.799	0.00785 **
forsav	7.190e+01	2.617e+01	2.747	0.00897 **
govsav	-6.682e+00	1.569e+01	-0.426	0.67255
finsav	-1.600e+01	3.692e+00	-4.333	9.63e-05 ***
cred	-5.555e+00	4.198e+00	-1.323	0.19333
gfcfg	-1.042e+02	1.168e+02	-0.892	0.37763
d3	1.735e+00	1.879e+00	0.923	0.36134

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

4. Model 1.4

Table 18 shows that rgdp, rprime, forsav, govsv and finsav are significant and that the explanatory variables account for 48 per cent in the variation of rgrowth. finsav and govsv have negative coefficients.

Table 18: Regression 12

Residual standard error: 2.116 on 40 degrees of freedom				
Multiple R-Squared: 0.5665; Adjusted R-squared: 0.4798				
F-statistic: 6.534 on 8 and 40 DF				
p-value: 1.977e-05				
Dependent variable: rgrowth				
Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	2.214e+00	9.296e+00	0.238	0.813002
rgdp	1.429e-04	3.672e-05	3.892	0.000368 ***
rprime	2.683e-01	1.001e-01	2.682	0.010584 *
forsav	6.524e+01	2.526e+01	2.583	0.013567 *
govsav	-6.718e+01	3.833e+01	-1.753	0.087338 .
finsav	-1.658e+01	3.560e+00	-4.657	3.50e-05 ***
cred	-5.637e+00	4.028e+00	-1.400	0.169351
gfcfg	-9.644e-01	1.274e+02	-0.008	0.993997
d3	1.690e+00	1.814e+00	0.931	0.357305

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6.2.2 Dependent variable: private saving

6.2.2.1 Entire period: 1965-2007

1. Model 2.1

In Table 19 most of the variables are significant with the exception of ryield, finsav, gfcfg and d1. The adjusted R-squared suggests that this is a good model as the explanatory variables account for 74 per cent in the variation of private saving. Residual tests are only performed for Model 2.1, which the study has selected to perform further tests.

Table 19: Regression 13

Residual standard error: 0.02865 on 157 degrees of freedom				
Multiple R-Squared: 0.7565; Adjusted R-squared: 0.7379				
F-statistic: 40.64 on 12 and 157 DF				
p-value: < 2.2e-16				
Dependent variable: psav				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	2.845e-01	3.938e-02	7.223	2.07e-11 ***
rgdp	7.350e-07	1.777e-07	4.135	5.76e-05 ***
ryield	5.163e-04	7.333e-04	0.704	0.4824
forsav	-4.145e-01	6.923e-02	-5.988	1.40e-08 ***
gvtsav	-1.083e+00	8.022e-02	-13.498	< 2e-16 ***
finsav	-3.321e-02	2.301e-02	-1.443	0.1509
cred	-4.156e-02	2.017e-02	-2.060	0.0410 *
gfcfg	1.762e-01	2.242e-01	0.786	0.4331
d1	-4.914e-03	1.181e-02	-0.416	0.6779
d2	-8.117e-02	1.648e-02	-4.926	2.11e-06 ***
d3	-1.089e-01	2.273e-02	-4.790	3.83e-06 ***
d4	-1.215e-01	3.005e-02	-4.041	8.31e-05 ***
saffib	-9.038e-02	3.532e-02	-2.559	0.0115 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 20: Residuals tests 2

Test	Df	Df1	Df2	T-stat	p-value	Conclusion
Durbin-Watson				1.8354	0.03542	Inconclusive
Breusch-Godfrey	1			1.1753	0.2783	Fails to reject H_0 : evidence of higher-order serial correlation
Stud. Breusch-Pagan	12			29.2645	0.003599	Rejects H_0 : errors are heteroscedastic
Reset 1		1	156	3.0257	0.08393	Fails to reject H_0 : evidence of linearity
Rainbow		85	72	0.8097	0.8257	Fails to reject H_0 : evidence of linearity
Harrison-McCabe				0.8714	1	Fails to reject H_0 : errors are heteroscedastic

Source: own calculations.

2. Model 2.2

In Table 21 ryield, d1 and saffib are the non significant variables and the R-squared has a value of 54 per cent.

Table 21: Regression 14

Residual standard error: 0.03791 on 157 degrees of freedom				
Multiple R-Squared: 0.5737; Adjusted R-squared: 0.5411				
F-statistic: 17.61 on 12 and 157 DF				
p-value: < 2.2e-16				
Dependent variable: psav				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	2.890e-01	5.241e-02	5.514	1.41e-07 ***
rgdp	8.799e-07	2.386e-07	3.687	0.000312 ***
ryield	9.304e-04	9.691e-04	0.960	0.338490
forsav	-4.399e-01	9.206e-02	-4.779	4.03e-06 ***
govsav	-1.289e+00	2.126e-01	-6.062	9.64e-09 ***
finsav	-5.730e-02	3.041e-02	-1.884	0.061378 .
cred	-5.894e-02	2.669e-02	-2.209	0.028648 *
gfcfg	1.553e+00	3.880e-01	4.003	9.64e-05 ***
d1	4.262e-04	1.580e-02	0.027	0.978511
d2	-4.382e-02	2.133e-02	-2.054	0.041613 *
d3	-6.150e-02	2.953e-02	-2.083	0.038905 *
d4	-9.774e-02	3.970e-02	-2.462	0.014886 *
saflib	-6.915e-02	4.688e-02	-1.475	0.142216

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

3. Model 2.3

In Table 22 most of the variables are significant with the exception of rprime, finsav, gfcfg and d1. The adjusted R-squared suggests that the explanatory variables account for 74 per cent in the variation of private saving.

Table 22: Regression 15

Residual standard error: 0.02852 on 157 degrees of freedom				
Multiple R-Squared: 0.7586; Adjusted R-squared: 0.7402				
F-statistic: 41.12 on 12 and 157 DF				
p-value: < 2.2e-16				
Dependent variable: psav				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	2.838e-01	3.920e-02	7.240	1.88e-11 ***
rgdp	7.690e-07	1.780e-07	4.320	2.75e-05 ***
rprime	9.143e-04	6.661e-04	1.373	0.172
forsav	-4.252e-01	6.914e-02	-6.149	6.20e-09 ***
gvsav	-1.085e+00	7.977e-02	-13.596	< 2e-16 ***
finsav	-3.267e-02	2.283e-02	-1.431	0.154
cred	-4.310e-02	1.992e-02	-2.163	0.032 *
gfcfg	1.485e-01	2.230e-01	0.666	0.506
d1	-4.675e-03	1.173e-02	-0.398	0.691
d2	-8.389e-02	1.657e-02	-5.064	1.14e-06 ***
d3	-1.125e-01	2.283e-02	-4.925	2.12e-06 ***
d4	-1.251e-01	3.008e-02	-4.160	5.22e-05 ***
saflib	-9.747e-02	3.567e-02	-2.733	0.007 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

4. Model 2.4

In Table 23, ryield, d1 and saflib are the non significant variables and the R-squared has a value of 54 per cent.

Table 23: Regression 16

Residual standard error: 0.03788 on 157 degrees of freedom				
Multiple R-Squared: 0.5742; Adjusted R-squared: 0.5417				
F-statistic: 17.65 on 12 and 157 DF				
p-value: < 2.2e-16				
Dependent variable: psav				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	2.893e-01	5.235e-02	5.527	1.33e-07 ***
rgdp	8.909e-07	2.397e-07	3.716	0.000281 ***
rprime	9.377e-04	8.846e-04	1.060	0.290795
forsav	-4.431e-01	9.227e-02	-4.802	3.63e-06 ***
govsav	-1.289e+00	2.124e-01	-6.067	9.41e-09 ***
finsav	-5.818e-02	3.028e-02	-1.921	0.056538 .
cred	-5.831e-02	2.647e-02	-2.203	0.029058 *
gfcfg	1.516e+00	3.878e-01	3.908	0.000138 ***
d1	1.850e-04	1.576e-02	0.012	0.990650
d2	-4.556e-02	2.152e-02	-2.117	0.035797 *
d3	-6.378e-02	2.976e-02	-2.143	0.033621 *
d4	-9.998e-02	3.987e-02	-2.508	0.013162 *
safliib	-7.381e-02	4.752e-02	-1.553	0.122367

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6.2.2.2 Pre-liberalisation period: 1965-1995

1. Model 2.1

Table 24 shows that ryield, finsav and d1 are the only variables that are not significant. The adjusted R-squared has a value of 62 per cent.

Table 24: Regression 17

Residual standard error: 0.0331 on 108 degrees of freedom				
Multiple R-Squared: 0.6543; Adjusted R-squared: 0.6191				
F-statistic: 18.58 on 11 and 108 DF				
p-value: < 2.2e-16				
Dependent variable: psav				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	3.359e-01	1.131e-01	2.970	0.00367 **
rgdp	6.528e-07	3.778e-07	1.728	0.08686 .
ryield	2.279e-05	1.041e-03	0.022	0.98257
forsav	-3.693e-01	8.567e-02	-4.311	3.6e-05 ***
gvtsav	-1.075e+00	1.077e-01	-9.984	< 2e-16 ***
finsav	-2.791e-04	5.428e-02	-0.005	0.99591
cred	-8.038e-02	3.739e-02	-2.150	0.03382 *
gfcfg	1.297e-01	3.288e-01	0.395	0.69393
d1	-4.665e-03	1.644e-02	-0.284	0.77714
d2	-7.016e-02	2.487e-02	-2.821	0.00570 **
d3	-9.757e-02	3.036e-02	-3.214	0.00173 **
safliib	-9.596e-02	4.928e-02	-1.947	0.05409 .

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

2. Model 2.2

Table 25 shows that rgdp, forsav, govsav, gfcfg, d2 and d3 are significant. The adjusted R-squared suggests that the explanatory variables account for 38 per cent in the variation of private saving.

Table 25: Regression 18

Residual standard error: 0.04217 on 108 degrees of freedom				
Multiple R-Squared: 0.4389; Adjusted R-squared: 0.3817				
F-statistic: 7.678 on 11 and 108 DF				
p-value: 1.15e-09				
Dependent variable: psav				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	2.053e-01	1.431e-01	1.434	0.154372
rgdp	1.310e-06	4.756e-07	2.754	0.006913 **
ryield	3.167e-04	1.325e-03	0.239	0.811577
forsav	-4.175e-01	1.091e-01	-3.825	0.000219 ***
govsav	-1.147e+00	2.569e-01	-4.467	1.96e-05 ***
finsav	-2.992e-02	6.912e-02	-0.433	0.665916
cred	-5.281e-02	4.770e-02	-1.107	0.270625
gfcfg	1.222e+00	5.057e-01	2.416	0.017378 *
d1	-1.589e-02	2.113e-02	-0.752	0.453727
d2	-6.589e-02	3.168e-02	-2.080	0.039930 *
d3	-8.067e-02	3.859e-02	-2.091	0.038908 *
safib	-9.908e-02	6.281e-02	-1.577	0.117627

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

3. Model 2.3

The variables that are not significant are rprime, finsav, gfcfg and d1.

Table 26: Regression 19

Residual standard error: 0.03304 on 108 degrees of freedom				
Multiple R-Squared: 0.6555; Adjusted R-squared: 0.6204				
F-statistic: 18.68 on 11 and 108 DF				
p-value: < 2.2e-16				
Dependent variable: psav				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	3.384e-01	1.127e-01	3.004	0.00332 **
rgdp	6.795e-07	3.791e-07	1.793	0.07585 .
rprime	5.874e-04	9.446e-04	0.622	0.53535
forsav	-3.843e-01	8.691e-02	-4.422	2.34e-05 ***
gvt sav	-1.074e+00	1.074e-01	-9.997	< 2e-16 ***
finsav	-4.263e-03	5.453e-02	-0.078	0.93782
cred	-8.110e-02	3.694e-02	-2.196	0.03026 *
gfcfg	1.370e-01	3.253e-01	0.421	0.67436
d1	-3.779e-03	1.626e-02	-0.232	0.81663
d2	-7.293e-02	2.521e-02	-2.893	0.00461 **
d3	-1.012e-01	3.083e-02	-3.283	0.00138 **
safib	-9.895e-02	4.940e-02	-2.003	0.04768 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

4. Model 2.4

Table 27 shows that rprime, finsav, cred, d1 and saflib are not significant. The adjusted R-squared has a small value of 38 per cent.

Table 27: Regression 20

Residual standard error: 0.04214 on 108 degrees of freedom				
Multiple R-Squared: 0.4395; Adjusted R-squared: 0.3824				
F-statistic: 7.699 on 11 and 108 DF				
p-value: 1.085e-09				
Dependent variable: psav				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	2.051e-01	1.427e-01	1.437	0.153613
rgdp	1.328e-06	4.778e-07	2.778	0.006445 **
rprime	5.205e-04	1.206e-03	0.432	0.666857
forsav	-4.252e-01	1.108e-01	-3.836	0.000210 ***
govsav	-1.144e+00	2.570e-01	-4.451	2.09e-05 ***
finsav	-3.296e-02	6.955e-02	-0.474	0.636533
cred	-5.173e-02	4.714e-02	-1.097	0.274950
gfcfg	1.211e+00	5.026e-01	2.409	0.017688 *
d1	-1.584e-02	2.093e-02	-0.757	0.450685
d2	-6.804e-02	3.215e-02	-2.117	0.036596 *
d3	-8.336e-02	3.922e-02	-2.125	0.035831 *
saflib	-1.013e-01	6.305e-02	-1.606	0.111133

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6.2.2.3 Post liberalisation period: 1995-2007

1. Model 2.1

In Table 21, only intercept, forsav and gvt sav saving are significant. The value of the adjusted R-squared suggests that the independent variables account for almost 90 per cent in the variation of private saving.

Table 28: Regression 21

Residual standard error: 0.01181 on 39 degrees of freedom				
Multiple R-Squared: 0.9145; Adjusted R-squared: 0.8948				
F-statistic: 46.35 on 9 and 39 DF				
p-value: < 2.2e-16				
Dependent variable: psav				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	1.446e-01	5.564e-02	2.600	0.0131 *
rgdp	4.188e-07	3.747e-07	1.118	0.2706
ryield	8.596e-04	6.357e-04	1.352	0.1841
forsav	-4.421e-01	1.947e-01	-2.271	0.0287 *
gvt sav	-1.213e+00	9.906e-02	-12.249	6.08e-15 ***
finsav	-1.160e-02	3.234e-02	-0.359	0.7218
cred	-2.277e-02	2.724e-02	-0.836	0.4083
gfcfg	5.336e-01	6.392e-01	0.835	0.4089
d3	3.214e-03	1.285e-02	0.250	0.8038
saflib	-8.988e-02	1.227e-01	-0.732	0.4682

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

2. Model 2.2

In Table 29, only intercept, rgdp, forsav, govsv and gfcfg are significant.

Table 29: Regression 22

Residual standard error: 0.01842 on 39 degrees of freedom				
Multiple R-Squared: 0.7922; Adjusted R-squared: 0.7442				
F-statistic: 16.52 on 9 and 39 DF				
p-value: 9.43e-11				
Dependent variable: psav				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	2.523e-01	8.379e-02	3.011	0.00455 **
rgdp	-9.298e-07	5.168e-07	-1.799	0.07977 .
ryield	-4.159e-04	9.753e-04	-0.426	0.67209
forsav	1.907e-02	2.880e-01	0.066	0.94754
govsv	-2.252e+00	3.617e-01	-6.226	2.51e-07 ***
finsav	6.878e-02	4.760e-02	1.445	0.15645
cred	-3.457e-02	4.248e-02	-0.814	0.42074
gfcfg	2.083e+00	1.125e+00	1.853	0.07153 .
d3	-1.798e-02	1.956e-02	-0.919	0.36362
safib	2.426e-01	1.786e-01	1.358	0.18231

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

3. Model 2.3

In Table 30 only intercept, forsav and gvtsav are significant. The adjusted R-squared is quite high (90 per cent).

Table 30: Regression 23

Residual standard error: 0.01176 on 39 degrees of freedom				
Multiple R-Squared: 0.9152; Adjusted R-squared: 0.8957				
F-statistic: 46.78 on 9 and 39 DF				
p-value: < 2.2e-16				
Dependent variable: psav				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	1.571e-01	5.298e-02	2.965	0.00514 **
rgdp	4.073e-07	3.627e-07	1.123	0.26832
rprime	8.537e-04	5.795e-04	1.473	0.14872
forsav	-4.192e-01	1.890e-01	-2.218	0.03247 *
gvtsav	-1.208e+00	9.786e-02	-12.343	4.79e-15 ***
finsav	-1.375e-02	3.242e-02	-0.424	0.67384
cred	-2.055e-02	2.702e-02	-0.761	0.45145
gfcfg	4.410e-01	6.273e-01	0.703	0.48626
d3	2.251e-03	1.258e-02	0.179	0.85890
safib	-1.072e-01	1.247e-01	-0.859	0.39543

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

4. Model 2.4

Table 31 shows that only intercept, rgdp, govsv and gfcfg are significant. The independent variables account for 74 per cent of the variations in psav.

Table 31: Regression 24

Residual standard error: 0.01846 on 39 degrees of freedom
Multiple R-Squared: 0.7913; Adjusted R-squared: 0.7431
F-statistic: 16.43 on 9 and 39 DF
p-value: 1.020e-10

Dependent variable: psav

Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	2.436e-01	8.120e-02	3.001	0.00468 **
rgdp	-8.592e-07	5.080e-07	-1.691	0.09873 .
rprime	-1.206e-04	9.016e-04	-0.134	0.89427
forsav	-3.476e-03	2.837e-01	-0.012	0.99029
govsav	-2.256e+00	3.624e-01	-6.224	2.53e-07 ***
finsav	6.544e-02	4.817e-02	1.358	0.18216
cred	-3.645e-02	4.232e-02	-0.861	0.39434
gfcfg	2.142e+00	1.118e+00	1.917	0.06257 .
d3	-1.651e-02	1.936e-02	-0.853	0.39876
safib	2.367e-01	1.827e-01	1.296	0.20262

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6.2.3 Summary of long-run regression tests

Given the significance of their results, Model 1.1 and Model 2.1 are the only models that will be used in the rest of the study. Similarly, the study will leave out the pre-liberalisation period and focus on the other two periods. Table 32 summarises the results of the growth equation, Model 1.1 over the entire and the post liberalisation periods. Table 32 shows that rgdp and forsav are the only statistically significant drivers of rgrowth in both periods of the study. forsav seems to have contributed more in the post liberalisation period than in the entire period. ryield however is not significant in the entire period but significant and positive in the post liberalisation period. gvtsav is negatively related to rgrowth, although not significantly over the period 1995-2007. finsav is not significant in the entire period but significant and negative in the post liberalisation period. cred and gfcfg are always negatively related to rgrowth but are only statistically significant in the entire period.

Table 32: Growth equation, Model 1.1

Variables	Expected sign	1965-2007			1995-2007		
		Result		5%	Result		5%
		Sign	Coefficient	Cv	Sign	Coefficient	cv
rgdp	+	+	0.00006	S	+	0.00015	S
ryield	+	+	0	NS	+	0.31	S
forsav	+	+	14.7	S	+	57.6	S
gvtsav	-	-	31.3	S	-	11.1	NS
finsav	+	-	2	NS	-	16.5	S
cred	-	-	4.17	S	-	5.7	NS
gfcfg	+	-	37.5	S	-	70	NS

Cv: critical value; S: significant; Ns: not significant

Table 33 summarises the results of the private saving's equation over the entire and the post liberalisation periods (Model 2.1). Table 33 shows that income has statistically positively contributed to private saving in the entire period only. Private saving does not respond to real interest rates. In both periods foreign saving are substitutes for rather than complements to private saving. Private saving does not respond to financial saving. Credit is negatively related to private saving but the former is only significant in the entire period. Public investment is not a driver of private saving and liberalisation has had a statistically significant and negative impact on private saving in the entire period.

Table 33: Private saving equation, Model 2.1

Variables	Expected sign	1965-2007			1995-2007		
		Result		5% Cv	Result		5% Cv
		Sign	Coefficient		Sign	Coefficient	
rgdp	+	+	0.00000073	S	+	0.0000004	NS
ryield	+ / -	+	0.00051	NS	+	0.00086	NS
forsav	-	-	0.41	S	-	0.44	S
gvtsav	-	-	1.1	S	-	1.21	S
finsav	+	-	0.03	NS	-	0.012	NS
cred	-	-	0.042	S	-	0.022	NS
gfcfg	+	-	0.18	NS	+	0.5	NS
saflib	+	-	0.09	S	-	0.09	NS

Cv : critical value; S: significant; Ns: not significant

6.3 Unit root tests

Unit root tests are performed in this section through the Augmented Dickey Fuller and the Zivot-Andrews tests respectively. However, these tests are only performed over the entire period (1965-2007) and the post liberalisation period (1995-2007) because the above regressions have depicted the most significant results as opposed to the pre-liberalisation period (1965-1995).

6.3.1 Augmented Dickey Fuller test I (0): testing for non-stationarity of variables at levels

Table 35 presents the results of the tests for the null of non-stationarity of all the variables at their original levels both over the entire period (1965-2007) and the post liberalisation period (1995-2007). Table 35 shows that over the entire period of the study, the null of non-stationarity must be rejected for only

two variables out of eight: rgrowth and forsav are stationary given both the coefficients of their respective phi3 (7.76 and 7.1) are bigger than the 5 per cent critical value 6.49 (Table 34).

However when the same test is conducted on the same variables over the post liberalisation period (1995-2007), the null of non-stationarity cannot be rejected for any of the variables given all of the phi3 test statistic values are smaller than the 5 per cent critical value 6.73 (Table 34); All of the eight variables contain at least a unit root and are therefore non-stationary.

Table 34: MacKinnon Critical values for variables at levels I (0)

	1965-2007			1995-2007		
	1%	5%	10%	1%	5%	10%
tau3	-3.99	-3.43	-3.13	-4.15	-3.50	-3.18
phi2	6.22	4.75	4.07	7.02	5.13	4.31
phi3	8.43	6.49	5.47	9.31	6.73	5.61

Table 35: Augmented Dickey Fuller test for variables at levels I (0)

Entire period (1965-2007)	Post liberalisation period (1995-2007)
rgrowth Residual standard error: 1.803 on 157 degrees of freedom Multiple R-Squared: 0.9001; Adjusted R-squared: 0.8962 F-statistic: 235.6 on 6 and 157 DF; p-value: < 2.2e-16 tau 3: -3.9366; phi2: 5.1795; phi3: 7.7622	rgrowth Residual standard error: 0.8869 on 38 degrees of freedom Multiple R-Squared: 0.9723; Adjusted R-squared: 0.9679 F-statistic: 222.1 on 6 and 38 DF; p-value: < 2.2e-16 tau 3: -2.613; phi2: 2.3486; phi3: 3.5046
rgdp Residual standard error: 2875 on 157 degrees of freedom Multiple R-Squared: 0.7824; Adjusted R-squared: 0.7741 F-statistic: 94.09 on 6 and 157 DF; p-value: < 2.2e-16 tau 3: -0.0276; phi2: 3.6788; phi3: 1.011	rgdp Residual standard error: 2078 on 38 degrees of freedom Multiple R-Squared: 0.9271; Adjusted R-squared: 0.9156 F-statistic: 80.54 on 6 and 38 DF; p-value: < 2.2e-16 tau 3: -0.4664; phi2: 2.2821; phi3: 2.3475
ryield Residual standard error: 3.075 on 157 degrees of freedom Multiple R-Squared: 0.2913; Adjusted R-squared: 0.2642 F-statistic: 10.75 on 6 and 157 DF; p-value: 5.292e-10 tau 3: -2.943; phi2: 2.8962; phi3: 4.3442	ryield Residual standard error: 2.586 on 37 degrees of freedom Multiple R-Squared: 0.3353; Adjusted R-squared: 0.2275 F-statistic: 3.111 on 6 and 37 DF; p-value: 0.01437 tau 3: -2.9623; phi2: 3.072; phi3: 4.4712
forsav Residual standard error: 0.02378 on 157 degrees of freedom Multiple R-Squared: 0.3062; Adjusted R-squared: 0.2797 F-statistic: 11.55 on 6 and 157 DF; p-value: 1.096e-10 tau 3: -3.7616; phi2: 4.764; phi3: 7.1044	forsav Residual standard error: 0.01299 on 38 degrees of freedom Multiple R-Squared: 0.4415; Adjusted R-squared: 0.3533 F-statistic: 5.007 on 6 and 38 DF; p-value: 0.0007244 tau 3: -0.4287; phi2: 2.3386; phi3: 3.0028
gvtsav Residual standard error: 0.01846 on 157 degrees of freedom Multiple R-Squared: 0.8392; Adjusted R-squared: 0.8331 F-statistic: 136.6 on 6 and 157 DF; p-value: < 2.2e-16 tau 3: -1.0026; phi2: 0.6166; phi3: 0.9247	gvtsav Residual standard error: 0.0151 on 37 degrees of freedom Multiple R-Squared: 0.8503; Adjusted R-squared: 0.826 F-statistic: 35.02 on 6 and 37 DF; p-value: 8.153e-14 tau 3: -1.3706; phi2: 2.3112; phi3: 1.1192
finsav Residual standard error: 0.05679 on 157 degrees of freedom Multiple R-Squared: 0.2305; Adjusted R-squared: 0.2011 F-statistic: 7.837 on 6 and 157 DF; p-value: 2.162e-07 tau 3: -0.42; phi2: 0.6801; phi3: 0.9985	finsav Residual standard error: 0.05028 on 38 degrees of freedom Multiple R-Squared: 0.334; Adjusted R-squared: 0.2289 F-statistic: 3.176 on 6 and 38 DF; p-value: 0.01263 tau 3: -0.4406; phi2: 3.3243; phi3: 3.9499
cred Residual standard error: 0.0709 on 157 degrees of freedom Multiple R-Squared: 0.3041; Adjusted R-squared: 0.2775 F-statistic: 11.43 on 6 and 157 DF; p-value: 1.375e-10 tau 3: -1.5691; phi2: 1.7514; phi3: 2.2201	cred Residual standard error: 0.07649 on 37 degrees of freedom Multiple R-Squared: 0.2296; Adjusted R-squared: 0.1046 F-statistic: 1.837 on 6 and 37 DF; p-value: 0.1184 tau 3: -1.5609; phi2: 1.5733; phi3: 1.4414
gfcfg Residual standard error: 0.007689 on 157 degrees of freedom Multiple R-Squared: 0.3876; Adjusted R-squared: 0.3642 F-statistic: 16.56 on 6 and 157 DF; p-value: 9.611e-15 tau 3: -2.0763; phi2: 1.5749; phi3: 2.1903	gfcfg Residual standard error: 0.003307 on 38 degrees of freedom Multiple R-Squared: 0.3884; Adjusted R-squared: 0.2919 F-statistic: 4.023 on 6 and 38 DF; p-value: 0.003245 tau 3: -2.3538; phi2: 2.1697; phi3: 3.1644

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6.3.2 Augmented Dickey Fuller test I (1): testing for non-stationarity of variables at first difference

Table 36 shows that the ADF test performed on the first difference of all the variables shows that over the entire period (1965-2007), the null of non-stationarity cannot be accepted for any of the eight variables: variables are integrated of order one. However over the post liberalisation period (1995-2007), the null of non-stationarity cannot be rejected for forsav, gvtsav, finsav, cred and gfcfg.

Table 36: Augmented Dickey Fuller test for variables at first difference I (1)

Entire period 1965-2007	Post liberalisation period 1995-2007
rgrowth Residual standard error: 1.869 on 156 degrees of freedom Multiple R-Squared: 0.9643; Adjusted R-squared: 0.9629 F-statistic: 702.5 on 6 and 156 DF; p-value: < 2.2e-16 tau 3: -10.3192; phi2: 35.5264; phi3: 53.2681	rgrowth Residual standard error: 0.8847 on 37 degrees of freedom Multiple R-Squared: 0.9912; Adjusted R-squared: 0.9898 F-statistic: 694.4 on 6 and 37 DF; p-value: < 2.2e-16 tau 3: -4.7515; phi2: 7.6797; phi3: 11.3766
rgdp Residual standard error: 2861 on 156 degrees of freedom Multiple R-Squared: 0.9181, Adjusted R-squared: 0.915 F-statistic: 291.5 on 6 and 156 DF; p-value: < 2.2e-16 tau 3: -3.584 ; phi2: 4.4103 ; phi3: 6.5781	rgdp Residual standard error: 1807 on 37 degrees of freedom Multiple R-Squared: 0.9805, Adjusted R-squared: 0.9773 F-statistic: 309.4 on 6 and 37 DF; p-value: < 2.2e-16 tau 3: -3.6028; phi2: 4.9993; phi3: 7.4807
ryield Residual standard error: 3.165 on 156 degrees of freedom Multiple R-Squared: 0.7225; Adjusted R-squared: 0.7118 F-statistic: 67.68 on 6 and 156 DF; p-value: < 2.2e-16 tau 3: -7.7315; phi2: 19.9265; phi3: 29.8886	ryield Residual standard error: 2.841 on 36 degrees of freedom Multiple R-Squared: 0.5898; Adjusted R-squared: 0.5214 F-statistic: 8.625 on 6 and 36 DF; p-value: 7.701e-06 tau 3: -4.6921; phi2: 7.366; phi3: 11.0478
forsav Residual standard error: 0.02479 on 156 degrees of freedom Multiple R-Squared: 0.7355; Adjusted R-squared: 0.7254 F-statistic: 72.31 on 6 and 156 DF; p-value: < 2.2e-16 tau 3: -5.8452; phi2: 11.4099; phi3: 11.4099	forsav Residual standard error: 0.01297 on 37 degrees of freedom Multiple R-Squared: 0.7886; Adjusted R-squared: 0.7543 F-statistic: 23.01 on 6 and 37 DF; p-value: 4.168e-11 tau 3: -3.0295; phi2: 3.1294 ; phi3: 4.6735
gvtsav Residual standard error: 0.01829 on 156 degrees of freedom Multiple R-Squared: 0.9551; Adjusted R-squared: 0.9534 F-statistic: 553.2 on 6 and 156 DF; p-value: < 2.2e-16 tau 3: -6.0916; phi2: 12.3842; phi3: 18.5622	gvtsav Residual standard error: 0.01553 on 36 degrees of freedom Multiple R-Squared: 0.9477; Adjusted R-squared: 0.939 F-statistic: 108.8 on 6 and 36 DF; p-value: < 2.2e-16 tau 3: -3.5614; phi2: 4.2886; phi3: 6.3495
finsav Residual standard error: 0.05658 on 156 degrees of freedom Multiple R-Squared: 0.693; Adjusted R-squared: 0.6812 F-statistic: 58.68 on 6 and 156 DF; p-value: < 2.2e-16 tau 3: -5.496; phi2: 10.1367; phi3: 15.1705	finsav Residual standard error: 0.05086 on 37 degrees of freedom Multiple R-Squared: 0.6203; Adjusted R-squared: 0.5587 F-statistic: 10.07 on 6 and 37 DF; p-value: 1.360e-06 tau 3: -3.4994; phi2: 4.2037; phi3: 6.1381
cred Residual standard error: 0.07118 on 156 degrees of freedom Multiple R-Squared: 0.6823; Adjusted R-squared: 0.6701 F-statistic: 55.84 on 6 and 156 DF; p-value: < 2.2e-16 tau 3: -5.0133; phi2: 8.4329; phi3: 12.5763	cred Residual standard error: 0.07901 on 36 degrees of freedom Multiple R-Squared: 0.5773; Adjusted R-squared: 0.5068 F-statistic: 8.193 on 6 and 36 DF; p-value: 1.271e-05 tau 3: -2.345; phi2: 1.9863; phi3: 2.9682
gfcfg Residual standard error: 0.007721 on 156 degrees of freedom Multiple R-Squared: 0.74; Adjusted R-squared: 0.73 F-statistic: 74.01 on 6 and 156 DF; p-value: < 2.2e-16 tau 3: -4.5439; phi2: 6.8997; phi3: 10.33	gfcfg Residual standard error: 0.003258 on 37 degrees of freedom Multiple R-Squared: 0.6781; Adjusted R-squared: 0.6259 F-statistic: 12.99 on 6 and 37 DF; p-value: 7.553e-08 tau 3: -3.3999; phi2: 3.8993; phi3: 5.8253

6.3.3 Zivot-Andrews test for non-stationarity of variables at levels I (0)

Table 37 presents the Zivot-Andrews critical values for variables at levels that must be used to determine the stationarity or non-stationarity of the variables. Table 38 shows that the Zivot-Andrews tests confirm that over the entire period, all of the variables are non-stationary (with the exception of rgrowth), with their respective t statistic higher than that of the 5% critical value. However over the post liberalisation all of the t statistic are higher than the 5% critical value and are therefore non-stationary.

Table 37: Zivot-Andrews critical values for variables at levels

	1%	5%	10%
Critical values	-5.34	-4.8	-4.58

Table 38: Zivot-Andrews test for variables at levels I (0)

Entire period 1965-2007	Post liberalisation period 1995-2007
rgrowth Residual standard error: 1.63 on 150 degrees of freedom Multiple R-Squared: 0.7962; Adjusted R-squared: 0.7826 F-statistic: 58.58 on 10 and 150 DF; p-value: < 2.2e-16 t statistic: -5.3216	rgrowth Residual standard error: 0.6933 on 31 degrees of freedom Multiple R-Squared: 0.9583; Adjusted R-squared: 0.9449 F-statistic: 71.28 on 10 and 31 DF; p-value: < 2.2e-16 t statistic: -4.1895
rgdp Residual standard error: 2704 on 150 degrees of freedom Multiple R-Squared: 0.997; Adjusted R-squared: 0.9968 F-statistic: 5033 on 10 and 150 DF; p-value: < 2.2e-16 t statistic: -1.4179	rgdp Residual standard error: 1776 on 31 degrees of freedom Multiple R-Squared: 0.9971, Adjusted R-squared: 0.9961 F-statistic: 1053 on 10 and 31 DF; p-value: < 2.2e-16 t statistic: -1.0272
ryield Residual standard error: 3.07 on 150 degrees of freedom Multiple R-Squared: 0.623; Adjusted R-squared: 0.5979 F-statistic: 24.79 on 10 and 150 DF; p-value: < 2.2e-16 t statistic: -3.6392	ryield Residual standard error: 2.541 on 30 degrees of freedom Multiple R-Squared: 0.6425; Adjusted R-squared: 0.5233 F-statistic: 5.391 on 10 and 30 DF; p-value: 0.000152 t statistic: -3.0721
forsav Residual standard error: 0.02263 on 150 degrees of freedom Multiple R-Squared: 0.7189; Adjusted R-squared: 0.7002 F-statistic: 38.37 on 10 and 150 DF; p-value: < 2.2e-16 t statistic: -4.1521	forsav Residual standard error: 0.01218 on 31 degrees of freedom Multiple R-Squared: 0.8341; Adjusted R-squared: 0.7805 F-statistic: 15.58 on 10 and 31 DF; p-value: 1.788e-09 t statistic: -2.105
gvtsav Residual standard error: 0.01702 on 150 degrees of freedom Multiple R-Squared: 0.8271; Adjusted R-squared: 0.8156 F-statistic: 71.75 on 10 and 150 DF; p-value: < 2.2e-16 t statistic: -2.6939	gvtsav Residual standard error: 0.01276 on 30 degrees of freedom Multiple R-Squared: 0.8353; Adjusted R-squared: 0.7804 F-statistic: 15.21 on 10 and 30 DF; p-value: 3.541e-09 t statistic: -3.7529
finsav Residual standard error: 0.05501 on 150 degrees of freedom Multiple R-Squared: 0.9464; Adjusted R-squared: 0.9429 F-statistic: 265 on 10 and 150 DF; p-value: < 2.2e-16 t statistic: -1.7398	finsav Residual standard error: 0.04862 on 31 degrees of freedom Multiple R-Squared: 0.9621; Adjusted R-squared: 0.9499 F-statistic: 78.7 on 10 and 31 DF; p-value: < 2.2e-16 t statistic: -1.6479
cred Residual standard error: 0.06829 on 150 degrees of freedom Multiple R-Squared: 0.9278; Adjusted R-squared: 0.923 F-statistic: 192.7 on 10 and 150 DF; p-value: < 2.2e-16 t statistic: -2.8583	cred Residual standard error: 0.07321 on 30 degrees of freedom Multiple R-Squared: 0.8965; Adjusted R-squared: 0.862 F-statistic: 25.99 on 10 and 30 DF; p-value: 4.31e-12 t statistic: -2.2836
Gfcfg Residual standard error: 0.007369 on 150 degrees of freedom Multiple R-Squared: 0.9645; Adjusted R-squared: 0.9621 F-statistic: 407.3 on 10 and 150 DF; p-value: < 2.2e-16 t statistic: -3.1067	gfcfg Residual standard error: 0.002703 on 31 degrees of freedom Multiple R-Squared: 0.862; Adjusted R-squared: 0.8174 F-statistic: 19.36 on 10 and 31 DF; p-value: 1.166e-10 t statistic: -3.7578

6.3.4 Cointegration and error correction models over entire period (1965-2007)

The unit root and Zivot-Andrews tests performed earlier on the variables at levels show that the latter are integrated of order one. Now the null of non-stationarity of the residuals of the variables of both models (Model 1.1 and Model 2.1) is tested over the entire period only. For each relevant variable the

long-run regression is presented, followed by the ADF test on the residuals of that variable. Because the variables at levels are integrated of order one, over the entire period, the residuals of these variables must be found to be integrated of order zero (i.e. stationary) if cointegration of variables is to be established. If residuals are stationary, an error correction model is estimated.

6.3.4.1 Growth equation (1965-2007)

$$\text{Model 1.1 } \text{rgrowth}_t = \beta_0 + \beta_1 \text{rgdp}_t + \beta_2 \text{ryield}_t + \beta_3 \text{forsav}_t + \beta_4 \text{gvtsav}_t + \beta_5 \text{finsav}_t + \beta_6 \text{cred}_t + \beta_7 \text{gfcfg}_t + \varepsilon_t$$

Table 39 shows the MacKinnon critical values that determine whether the residuals are stationary or not. The residual of a variable is stationary if the value of its tau1 is smaller than that of the 5 per cent MacKinnon critical value.

Table 39: MacKinnon critical values for residuals

Critical values	1%	5%	10%
tau1	-2.58	-1.95	-1.62

1. rgrowth

a. Long-run regression

Table 40 shows that the independent variables account for 19 per cent in the variation of rgrowth. Only ryield and finsav are not significant.

Table 40: Long-run regression test for rgrowth

Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	1.380e+01	4.227e+00	3.265	0.001342 **
rgdp	5.875e-05	1.813e-05	3.241	0.001456 **
ryield	.1024e-02	7.879e-02	0.130	0.896717
forsav	1.466e+01	7.387e+00	1.984	0.048987 *
gvtsav	-3.128e+01	8.714e+00	-3.589	0.000443 ***
finsav	-2.557e+00	2.409e+00	-1.062	0.290076
cred	-4.170e+00	2.000e+00	-2.085	0.038694 *
gfcfg	-3.751e+01	2.171e+01	-1.728	0.085960 .
d1	-2.036e+00	1.282e+00	-1.588	0.114353
d2	-7.867e+00	1.785e+00	-4.407	1.94e-05 ***
d3	-1.174e+01	2.446e+00	-4.799	3.68e-06 ***
d4	-1.172e+01	3.263e+00	-3.592	0.000438 ***

Residual standard error: 3.102 on 157 degrees of freedom (1 observation deleted due to missingness)
 Multiple R-Squared: 0.2453; Adjusted R-squared: 0.1924
 F-statistic: 4.638 on 11 and 157 DF; p-value: 4.120e-06
 Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

The ADF test in Table 41 shows that the residual of rgrowth is stationary given its tau1 value (-12.24) is smaller than the 5 per cent critical value -1.95.

Table 41: ADF test for the residual of rgrowth

Residual standard error: 2.915 on 165 degrees of freedom
 Multiple R-Squared: 0.5893; Adjusted R-squared: 0.5844 ; F-statistic: 118.4 on 2 and 165 DF
 p-value: < 2.2e-16; tau 1: -12.241

c. Error correction model

In Table 42 the error correction term of the growth equation enters significantly (t= 9.8), but has the wrong sign. The long-run relationship between rgrowth and the explanatory variables is therefore unstable.

Table 42: ECM test for rgrowth

Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	7.553e-01	2.017e-01	3.745	0.000254 ***
err.ecm1	7.119e-01	7.237e-02	9.837	< 2e-16 ***
rgdp.d1	-6.390e-04	4.894e-05	-13.057	< 2e-16 ***
ryield.d	8.720e-02	5.588e-02	1.561	0.120673
forsav.d1	4.429e+00	7.986e+00	0.555	0.579994
gvtsav.d1	1.479e+01	4.822e+00	3.068	0.002545 **
finsav.d1	1.314e+01	4.935e+00	2.662	0.008584 **
cred.d1	-3.072e+00	3.737e+00	-0.822	0.412337
gfcfg.d1	-8.451e+01	2.300e+01	-3.675	0.000327 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

2. rgdp

a. Long-run regression

Table 43 shows that the adjusted R-squared depicts a very high value, which suggests that the rest of the variables play a significant role in the variation of rgdp. It appears that only gvtsav has an insignificant value.

Table 43: Long-run regression test for rgdp

Residual standard error: 13220 on 157 degrees of freedom (1 observation deleted due to missingness)
Multiple R-Squared: 0.9361; Adjusted R-squared: 0.9316
F-statistic: 209.1 on 11 and 157 DF ; p-value: < 2.2e-16

Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	32152.0	18436.7	1.744	0.08313 .
rgrowth	1067.1	329.3	3.241	0.00146 **
ryield	-878.0	328.4	-2.674	0.00830 **
forsav	80872.8	31212.6	2.591	0.01047 *
gvt sav	62045.1	38312.8	1.619	0.10736
finsav	41200.7	9762.8	4.220	4.12e-05 ***
cred	17261.7	8530.8	2.023	0.04472 *
gfcfg	-275918.9	90742.8	-3.041	0.00277 **
d1	44689.0	4197.3	10.647	< 2e-16 ***
d2	82514.8	4656.6	17.720	< 2e-16 ***
d3	100479.8	7763.9	12.942	< 2e-16 ***
d4	140899.1	9103.7	15.477	< 2e-16 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

As seen in Table 44 the residual of real gross domestic product is stationary with a tau1 value (- 4.3109) smaller than the 5 per cent critical value (-1.95).

Table 44: ADF test for the residual of rgdp

Residual standard error: 7820 on 165 degrees of freedom
Multiple R-Squared: 0.1207; Adjusted R-squared: 0.11; F-statistic: 11.32 on 2 and 165 DF ;
p-value: 2.465e-05; tau 1: - 4.3109

c. Error correction model

In Table 45 the coefficient of the error correction term in the income function does not enter significantly ($t= 1.022$) and has the wrong sign ($3.526e-02$); which suggests that the long-run relationship between rgdp and the rest of the variables is unstable.

Table 45: ECM test for rgdp

Residual standard error: 5344 on 154 degrees of freedom (1 observation deleted due to missingness)
Multiple R-Squared: 0.2191; Adjusted R-squared: 0.1785
F-statistic: 5.4 on 8 and 154 DF; p-value: 5.353e-06

Variables	Estimate	Std. Error	T value	Pr(> t)
Intercept	1.153e+03	4.208e+02	2.739	0.00689 **
err.ecm2	3.526e-02	3.450e-02	1.022	0.30839
rgrowth.d1	-3.905e+01	1.105e+02	-0.353	0.72431
ryield.d	-1.492e+01	1.193e+02	-0.125	0.90064
forsav.d1	-1.838e+04	1.675e+04	-1.097	0.27441
gvt sav.d1	-1.873e+04	1.047e+04	-1.789	0.07559 .
finsav.d1	4.405e+04	1.027e+04	4.290	3.14e-05 ***
cred.d1	-6.602e+03	8.087e+03	-0.816	0.41554
gfcfg.d1	-2.172e+05	5.117e+04	-4.245	3.76e-05 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

3. ryield

a. Long-run regression

Table 46 shows that the adjusted R-squared has a medium value of 0.55 and suggests that the rest of the variables play a non negligible role in the variation of ryield. The variables that are significant are rgrowth, forsav, finsav, cred and gfcfg.

Table 46: Long-run regression test for ryield

Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	1.136e+00	4.423e+00	0.257	0.797616
rgdp	-4.959e-05	1.855e-05	+2.674	0.008299 **
rgrowth	1.051e-02	8.083e-02	0.130	0.896717
forsav	1.706e+01	7.452e+00	2.289	0.023421 *
gvtsav	-4.896e+00	9.173e+00	-0.534	0.594254
finsav	-4.423e+00	2.423e+00	-1.826	0.069779 .
cred	7.391e+00	1.967e+00	3.757	0.000242 ***
gfcfg	-4.269e+01	2.193e+01	-1.947	0.053347 .
d1	-1.246e+00	1.305e+00	-0.955	0.341149
d2	1.980e+00	1.910e+00	1.037	0.301476
d3	3.550e+00	2.638e+00	1.346	0.180258
d4	3.763e+00	3.425e+00	1.098	0.273669

Residual standard error: 3.142 on 157 degrees of freedom (1 observation deleted due to missingness)
Multiple R-Squared: 0.5876; Adjusted R-squared: 0.5587
F-statistic: 20.34 on 11 and 157 DF; p-value: < 2.2e-16
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 47 suggests that the residual of real interest rates is stationary given its tau1 value is smaller than the 5 per cent critical value of -1.95.

Table 47: ADF test for the residual of ryield

Residual standard error: 2.905 on 165 degrees of freedom
Multiple R-Squared: 0.3484; Adjusted R-squared: 0.3405; F-statistic: 44.11 on 2 and 165 DF
p-value: 4.498e-16; tau 1: -7.1001

c. Error correction model

The adjusted R-squared is very low and suggest that the explanatory variables account for 1 per cent in the variation of ryield. The error correction term, despite having the right sign, does not enter significantly. The long-run relationship between ryield and the rest of the variables is not stable.

Table 48: ECM test for ryield

Residual standard error: 3.601 on 154 degrees of freedom (1 observation deleted due to missingness)
Multiple R-Squared: 0.03179; Adjusted R-squared: -0.01851
F-statistic: 0.6321 on 8 and 154 DF; p-value: 0.7499

Variables	Estimate	Std. Error	T value	Pr(> t)
Intercept	3.704e-02	3.054e-01	0.121	0.904
err.ecm3	-6.289e-02	9.288e-02	-0.677	0.499
rgdp.d1	-3.556e-05	9.423e-05	-0.377	0.706
rgrowth.d1	-8.601e-02	1.003e-01	-0.858	0.392
forsav.d1	3.099e+00	1.172e+01	0.264	0.792
gvtsav.d1	-7.411e+00	7.641e+00	-0.970	0.334
finsav.d1	-6.820e+00	7.189e+00	-0.949	0.344
cred.d1	1.689e+00	5.510e+00	0.306	0.760
gfcfg.d1	4.237e-01	3.506e+01	0.012	0.990

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

4. forsav

a. Long-run regression

In Table 49 the adjusted R-squared shows that the independent variables account for 35 per cent in the variation of foreign saving. gvtsav, finsav and gfcfg are the only variables that are not significant.

Table 49: Long-run regression test for forsav

Residual standard error: 0.03311 on 157 degrees of freedom (1 observation deleted due to missingness)
Multiple R-Squared: 0.394; Adjusted R-squared: 0.3515
F-statistic: 9.278 on 11 and 157 DF; p-value: 1.045e-12

Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	-2.369e-01	4.260e-02	-5.561	1.13e-07 ***
rgdp	5.071e-07	1.957e-07	2.591	0.010471 *
ryield	1.893e-03	8.272e-04	2.289	0.023421 *
rgrowth	1.669e-03	8.412e-04	1.984	0.048987 *
gvtsav	3.864e-03	9.673e-02	0.040	0.968189
finsav	-7.962e-03	2.579e-02	-0.309	0.757915
cred	6.788e-02	2.095e-02	3.240	0.001458 **
gfcfg	2.391e-01	2.330e-01	1.026	0.306363
d1	-3.483e-02	1.351e-02	-2.578	0.010843 *
d2	-7.364e-02	1.932e-02	-3.811	0.000198 ***
d3	-5.828e-02	2.756e-02	-2.115	0.036044 *
d4	-1.011e-01	3.532e-02	-2.863	0.004769 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 50 shows that the residual of foreign saving is stationary with its tau 1 value (- 4.2999) smaller than the 5 per cent critical value (-1.95).

Table 50: ADF test for the residual of forsav

Residual standard error: 0.02353 on 165 degrees of freedom
Multiple R-Squared: 0.2238; Adjusted R-squared: 0.2144; F-statistic: 23.79 on 2 and 165 DF ;
p-value: 8.352e-10; tau 1: - 4.2999

c. Error correction model

In Table 51 the error correction term is significant ($t= 3.909$) but has the wrong sign ($2.588e-01$). The long-run relationship between *forsav* and the rest of variables is not stable.

Table 51: ECM test for *forsav*

Residual standard error: 0.02627 on 154 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-Squared: 0.1961; Adjusted R-squared: 0.1543				
F-statistic: 4.694 on 8 and 154 DF; p-value: 3.667e-05				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	-7.673e-05	2.218e-03	-0.035	0.972449
err.ecm4	2.588e-01	6.621e-02	3.909	0.000138 ***
rgdp.d1	-1.466e-07	6.688e-07	-0.219	0.826791
ryield.d	3.215e-06	5.905e-04	0.005	0.995663
rgrowth.d1	-1.076e-03	7.357e-04	-1.462	0.145730
gvtsav.d1	1.770e-02	5.446e-02	0.325	0.745579
finsav.d1	6.551e-02	5.224e-02	1.254	0.211673
cred.d1	-9.784e-03	3.922e-02	-0.249	0.803322
gfcfg.d1	-8.805e-01	2.530e-01	-3.480	0.000653 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

5. *gvtsav*

a. Long-run regression

Among the independent variables, only *rgrowth* and dummy variables significantly contribute to variations in *gvtsav*.

Table 52: Long-run regression test for *gvtsav*

Residual standard error: 0.02731 on 157 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-Squared: 0.5616; Adjusted R-squared: 0.5309				
F-statistic: 18.28 on 11 and 157 DF; p-value: < 2.2e-16				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	-8.851e-03	3.845e-02	-0.230	0.818232
rgdp	2.648e-07	1.635e-07	1.619	0.107361
ryield	-3.700e-04	6.931e-04	-0.534	0.594254
<i>forsav</i>	2.630e-03	6.585e-02	0.040	0.968189
<i>rgrowth</i>	-2.424e-03	6.755e-04	-3.589	0.000443 ***
<i>finsav</i>	7.017e-03	2.127e-02	0.330	0.741958
<i>cred</i>	-1.936e-03	1.785e-02	-0.108	0.913798
<i>gfcfg</i>	5.148e-02	1.929e-01	0.267	0.789885
<i>d1</i>	-2.836e-02	1.115e-02	-2.543	0.011944 *
<i>d2</i>	-7.431e-02	1.557e-02	-4.772	4.14e-06 ***
<i>d3</i>	-9.765e-02	2.170e-02	-4.500	1.32e-05 ***
<i>d4</i>	-7.213e-02	2.933e-02	-2.459	0.015004 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 53 shows that the residual of government saving is stationary given the variable's τ_1 value is smaller than the 5 per cent critical value -1.95.

Table 53: ADF test for the residual of gvtsav

Residual standard error: 0.02494 on 165 degrees of freedom
Multiple R-Squared: 0.6538; Adjusted R-squared: 0.6496; F-statistic: 155.8 on 2 and 165 DF
p-value: < 2.2e-16; tau 1: -8.0343

c. Error correction model

The coefficient of the error correction term in the government saving’s function (9.382e-01) has the wrong sign although it enters significantly (t= 9.31). The existence of a stable long-run relationship between gvtsav and the rest of the variables must be rejected.

Table 54: ECM test for gvtsav

Residual standard error: 0.03074 on 154 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-Squared: 0.5638; Adjusted R-squared: 0.5411				
F-statistic: 24.88 on 8 and 154 DF; p-value: < 2.2e-16				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	3.490e-04	2.581e-03	0.135	0.8926
err.ecm5	9.382e-01	1.007e-01	9.317	<2e-16 ***
rgdp.d1	-6.987e-07	7.396e-07	-0.945	0.3463
ryield.d	6.036e-04	6.858e-04	0.880	0.3802
forsav.d1	2.408e-01	9.936e-02	2.423	0.0165 *
rgrowth.d1	1.723e-03	7.749e-04	2.224	0.0276 *
finsav.d1	-1.531e-01	5.957e-02	-2.570	0.0111 *
cred.d1	2.273e-02	4.682e-02	0.485	0.6281
gfcfg.d1	9.706e-02	2.991e-01	0.324	0.7460

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6. finsav

a. Long-run regression

Table 55 shows that the majority of the independent variables seem to have a fairly high participation in the variation of finsav. Of all the variables, only forsav, gvtsav and rgrowth seem not to have an impact on finsav.

Table 55: Long-run regression test for finsav

Residual standard error: 0.1024 on 157 degrees of freedom (1 observation deleted due to missingness)
Multiple R-Squared: 0.8146; Adjusted R-squared: 0.8016
F-statistic: 62.72 on 11 and 157 DF; p-value: < 2.2e-16

Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	4.870e-01	1.389e-01	3.507	0.000591 ***
rgdp	2.473e-06	5.859e-07	4.220	4.12e-05 ***
ryield	-4.700e-03	2.574e-03	-1.826	0.069779 .
forsav	-7.622e-02	2.469e-01	-0.309	0.757915
gvtsav	9.868e-02	2.992e-01	0.330	0.741958
rgrowth	-2.787e-03	2.626e-03	-1.062	0.290076
cred	2.883e-01	6.287e-02	4.586	9.17e-06 ***
gfcfg	1.976e+00	7.060e-01	2.799	0.005770 **
d1	-1.327e-01	4.134e-02	-3.211	0.001605 **
d2	-3.305e-01	5.665e-02	-5.834	3.00e-08 ***
d3	-5.204e-01	7.584e-02	-6.862	1.48e-10 ***
d4	-6.934e-01	9.747e-02	-7.114	3.76e-11 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

As shown in Table 56 the residual of financial saving is stationary, as its tau1 value (-3.38) is smaller than the 5 per cent critical value (-1.95).

Table 56: ADF test for the residual of finsav

Residual standard error: 0.0552 on 165 degrees of freedom
Multiple R-Squared: 0.07329; Adjusted R-squared: 0.06206; F-statistic: 6.525 on 2 and 165 DF
p-value: 0.001874; tau 1: -3.388

c. Error correction model

In Table 57 although the error term in the equation of finsav is significant (t= 2.05), it has the wrong sign (9.485e-02). The existence of a stable long-run relationship between finsav and the other variables must be rejected.

Table 57: ECM test for finsav

Residual standard error: 0.05747 on 154 degrees of freedom (1 observation deleted due to missingness)
Multiple R-Squared: 0.2075; Adjusted R-squared: 0.1663
F-statistic: 5.039 on 8 and 154 DF; p-value: 1.430e-05

Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	-7.064e-03	4.867e-03	-1.451	0.148738
err.ecm6	9.485e-02	4.622e-02	2.052	0.041830 *
rgdp.d1	6.040e-06	1.467e-06	4.116	6.27e-05 ***
ryield.d	1.533e-03	1.282e-03	1.196	0.233386
forsav.d1	-4.008e-02	1.868e-01	-0.215	0.830415
gvtsav.d1	-4.539e-01	1.170e-01	-3.881	0.000154 ***
rgrowth.d1	-4.616e-03	1.592e-03	-2.900	0.004279 **
cred.d1	-4.736e-02	7.370e-02	-0.643	0.521405
gfcfg.d1	9.000e-01	5.537e-01	1.626	0.106084

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

7. cred

a. Long-run regression

Table 58 shows that the independent variables, with the exception of gvt sav, play a fairly high role (74 per cent) in the variation of cred.

Table 58: Long-run regression test for cred

Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	1.150e+00	1.454e-01	7.911	4.28e-13 ***
rgdp	1.472e-06	7.277e-07	2.023	0.044723 *
ryield	1.116e-02	2.971e-03	3.757	0.000242 ***
forsav	9.234e-01	2.850e-01	3.240	0.001458 **
gvt sav	-3.868e-02	3.568e-01	-0.108	0.913798
finsav	4.098e-01	8.935e-02	4.586	9.17e-06 ***
rgrowth	-6.461e-03	3.099e-03	-2.085	0.038694 *
gfcfg	3.208e+00	8.235e-01	3.896	0.000144 ***
D1	-1.163e-01	5.002e-02	-2.325	0.021369 *
D2	5.896e-03	7.449e-02	0.079	0.937009
D3	2.155e-01	1.016e-01	2.120	0.035563 *
D4	5.040e-01	1.274e-01	3.955	0.000116 ***

Residual standard error: 0.1221 on 157 degrees of freedom (1 observation deleted due to missingness)
Multiple R-Squared: 0.759; Adjusted R-squared: 0.7421
F-statistic: 44.95 on 11 and 157 DF; p-value: < 2.2e-16
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 59 shows that the residual of cred is stationary given its tau1 value (-3.56) is smaller than the 5 per cent critical value of -1.95.

Table 59: ADF test for the residual of cred

Residual standard error: 0.07291 on 165 degrees of freedom Multiple R-Squared: 0.1091; Adjusted R-squared: 0.0983; F-statistic: 10.1 on 2 and 165 DF; p-value: 7.261e-05; tau 1: -3.5596
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c. Error correction model

Table 60 the error term enter significantly at 5 per cent critical value (t= 1.9) but has the wrong sign (9.166e-02) and suggests that the long-run relationship between cred and the rest of the variables is unstable.

Table 60: ECM test for cred

Residual standard error: 0.07311 on 154 degrees of freedom (1 observation deleted due to missingness)
 Multiple R-Squared: 0.2574; Adjusted R-squared: 0.2188
 F-statistic: 6.671 on 8 and 154 DF; p-value: 1.759e-07

Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	-7.971e-03	6.155e-03	-1.295	0.197237
err.ecm7	9.166e-02	4.934e-02	1.858	0.065107 .
rgdp.d1	9.961e-06	1.893e-06	5.263	4.68e-07 ***
ryield.d	1.687e-03	1.634e-03	1.032	0.303532
forsav.d1	-5.592e-03	2.331e-01	-0.024	0.980892
gvt sav.d1	-2.254e-01	1.545e-01	-1.459	0.146635
finsav.d1	-1.562e-01	1.225e-01	-1.275	0.204135
rgrowth.d1	-7.864e-03	2.026e-03	-3.881	0.000154 ***
gfcfg.d1	1.124e+00	7.114e-01	1.580	0.116249

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

8. gfcfg

a. Long-run regression

It appears from Table 61 that forsav and gvt sav are the only variables that do not seem to play a role in the variation of gfcfg.

Table 61: Long-run regression test for gfcfg

Residual standard error: 0.0113 on 157 degrees of freedom (1 observation deleted due to missingness)
 Multiple R-Squared: 0.9143; Adjusted R-squared: 0.9083
 F-statistic: 152.3 on 11 and 157 DF ; p-value: < 2.2e-16

Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	2.983e-02	1.573e-02	1.896	0.059772 .
rgdp	-2.016e-07	6.629e-08	-3.041	0.002767 **
ryield	-5.521e-04	2.836e-04	-1.947	0.053347 .
forsav	2.786e-02	2.715e-02	1.026	0.306363
gvt sav	8.811e-03	3.301e-02	0.267	0.789885
finsav	2.405e-02	8.593e-03	2.799	0.005770 **
cred	2.748e-02	7.053e-03	3.896	0.000144 ***
rgrowth	-4.976e-04	2.880e-04	-1.728	0.085960 .
d1	3.090e-02	4.010e-03	7.705	1.39e-12 ***
d2	8.121e-04	6.893e-03	0.118	0.906367
d3	-3.088e-02	9.216e-03	-3.351	0.001008 **
d4	-3.593e-02	1.203e-02	-2.987	0.003272 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 62 shows that the residual of gfcfg is stationary given its tau1 (-4.99) value is smaller than the 5 per cent value of -1.95.

Table 62: ADF test for the residual of gfcfg

Residual standard error: 0.008295 on 165 degrees of freedom
 Multiple R-Squared: 0.1875; Adjusted R-squared: 0.1777; F-statistic: 19.04 on 2 and 165 DF
 p-value: 3.617e-08; tau 1: -4.9877

c. Error correction model

In Table 63 the coefficient of the error correction term in the equation of gfcfg enters significantly ($t= 2.453$) but has the wrong sign ($1.558e-01$). The long-run relationship between gfcfg and the rest of the variables is unstable.

Table 63: ECM test for gfcfg

Residual standard error: 0.008548 on 154 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-Squared: 0.2792; Adjusted R-squared: 0.2418				
F-statistic: 7.458 on 8 and 154 DF; p-value: 2.219e-08				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	-1.885e-03	7.211e-04	-2.615	0.009823 **
err.ecm8	1.558e-01	6.353e-02	2.453	0.015295 *
rgdp.d1	1.189e-06	2.219e-07	5.357	3.02e-07 ***
ryield.d	-1.892e-04	1.914e-04	-0.989	0.324388
forsav.d1	-1.174e-02	2.735e-02	-0.429	0.668219
gvtsav.d1	-3.015e-02	1.819e-02	-1.658	0.099426 .
finsav.d1	-1.388e-02	1.687e-02	-0.823	0.411946
cred.d1	3.564e-03	1.306e-02	0.273	0.785347
rgrowth.d1	-7.958e-04	2.219e-04	-3.587	0.000449 ***

* Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6.3.4.1 Private saving equation (1965-2007)

$$\text{Model 2.1 } psav_t = \beta_0 + \beta_1 rgdp + \beta_2 ryield_t + \beta_3 forsav + \beta_4 gvtsav_t + \beta_5 finsav_t + \beta_6 cred_t + \beta_7 gfcfg_t + saflib + \varepsilon_t$$

1. psav

a. Long-run regression

In Table 64, the independent variables account for over 74 per cent in the variation of psav. Only ryield, finsav and gfcfg are not significant.

Table 64: Long-run regression test for psav

Residual standard error: 0.02865 on 157 degrees of freedom				
Multiple R-squared: 0.7565, Adjusted R-squared: 0.7379				
F-statistic: 40.64 on 12 and 157 DF, p-value: < 2.2e-16				
Variables	Estimate	Std. Error	t value	Pr(> t)
Intercept	2.845e-01	3.938e-02	7.223	2.07e-11 ***
rgdp	7.350e-07	1.777e-07	4.135	5.76e-05 ***
ryield	5.163e-04	7.333e-04	0.704	0.4824
forsav	-4.145e-01	6.923e-02	-5.988	1.40e-08 ***
gvtsav	-1.083e+00	8.022e-02	-13.498	< 2e-16 ***
finsav	-3.321e-02	2.301e-02	-1.443	0.1509
cred	-4.156e-02	2.017e-02	-2.060	0.0410 *
gfcfg	1.762e-01	2.242e-01	0.786	0.4331
d1	-4.914e-03	1.181e-02	-0.416	0.6779
d2	-8.117e-02	1.648e-02	-4.926	2.11e-06 ***
d3	-1.089e-01	2.273e-02	-4.790	3.83e-06 ***
d4	-1.215e-01	3.005e-02	-4.041	8.31e-05 ***
saflib	-9.038e-02	3.532e-02	-2.559	0.0115 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

As seen in Table 65, the residual of psav is stationary at 5 per cent given the value of tau 1 (-11.28) is smaller than the 5 per cent critical value (- 1.95).

Table 65: ADF test for residual of psav

Residual standard error: 0.02686 on 166 degrees of freedom
Multiple R-squared: 0.4936, Adjusted R-squared: 0.4875; F-statistic: 80.9 on 2 and 166 DF, p-value: < 2.2e-16; tau 1: -11.2821

c. Error correction model

In Table 66 the coefficient of the error correction term in the private saving function has the right sign (-1.488) but does not enter significantly (t= -1.488). The long-run relationship between psav and the explanatory variables is unstable.

Table 66: ECM test for psav

Residual standard error: 3.116 on 155 degrees of freedom				
Multiple R-squared: 0.7038, Adjusted R-squared: 0.6886				
F-statistic: 46.05 on 8 and 155 DF, p-value: < 2.2e-16				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	8.173e-01	2.562e-01	3.191	0.001719 **
err.ecm1	-1.428e+01	9.598e+00	-1.488	0.138880
rgdp.d1	-7.218e-04	6.248e-05	-11.552	< 2e-16 ***
ryield.d	-1.835e-02	6.946e-02	-0.264	0.792009
forsav.d1	4.434e-01	1.011e+01	0.044	0.965085
gvt sav.d1	5.211e+00	5.992e+00	0.870	0.385796
finsav.d1	2.273e+01	6.152e+00	3.695	0.000304 ***
cred.d1	-6.797e+00	4.704e+00	-1.445	0.150475
gfcfg.d1	-1.464e+02	2.807e+01	-5.218	5.73e-07 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

2. rgdp

a. Long-run regression

It appears from Table 67 that the independent variables account for 94 per cent in the variation of rgdp. Out of the independent variables, only cred and gfcfg depict insignificant values.

Table 67: Long-run regression test for rgdp

Residual standard error: 12220 on 157 degrees of freedom				
Multiple R-squared: 0.9464, Adjusted R-squared: 0.9424				
F-statistic: 231.2 on 12 and 157 DF, p-value: < 2.2e-16				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	11498.7	19362.7	0.594	0.553462
psav	133639.3	32316.3	4.135	5.76e-05 ***
ryield	-964.7	303.6	-3.178	0.001787 **
forsav	158149.2	30184.1	5.239	5.11e-07 ***
gvtsav	163312.1	48561.6	3.363	0.000969 ***
finsav	47498.5	9117.9	5.209	5.87e-07 ***
cred	-623.4	8715.7	-0.072	0.943074
gfcfg	-69112.7	95628.8	-0.723	0.470928
d1	34764.4	4204.9	8.268	5.43e-14 ***
d2	75797.9	4516.9	16.781	< 2e-16 ***
d3	82329.7	8032.3	10.250	< 2e-16 ***
d4	123502.4	9174.1	13.462	< 2e-16 ***
saflib	79684.5	13995.4	5.694	5.96e-08 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 68 shows that the residual of rgdp is stationary at 5 per cent given the value of tau 1 (-4.2961) is smaller than the 5 per cent critical value (-1.95).

Table 68: ADF test for the residual of rgdp

Residual standard error: 8202 on 166 degrees of freedom	
Multiple R-squared: 0.1975, Adjusted R-squared: 0.1878; F-statistic: 20.43 on 2 and 166 DF	
p-value: 1.173e-08; Tau1: -4.2961	

c. Error correction model

Table 69 shows that although the error correction term has the right sign, it does not enter significantly (t= -1.080) and therefore suggests that the long-run relationship between rgdp and the rest of variables in unstable.

Table 69: ECM test for rgdp

Residual standard error: 5342 on 154 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-squared: 0.2197, Adjusted R-squared: 0.1791				
F-statistic: 5.419 on 8 and 154 DF, p-value: 5.078e-06				
Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	1.209e+03	4.204e+02	2.875	0.00461 **
err.ecm2	-4.073e-02	3.771e-02	-1.080	0.28179
psav.d1	-3.735e+01	1.104e+02	-0.338	0.73565
ryield.d	-2.069e-01	1.201e+02	-0.002	0.99863
forsav.d1	-1.668e+04	1.667e+04	-1.000	0.31869
gvtsav.d1	-1.706e+04	1.048e+04	-1.628	0.10563
finsav.d1	4.432e+04	1.025e+04	4.325	2.73e-05 ***
cred.d1	-7.662e+03	8.050e+03	-0.952	0.34266
gfcfg.d1	-2.153e+05	5.115e+04	-4.209	4.34e-05 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

3. ryield

a. Long-run regression

In Table 70 amongst all of the variables, only rgdp, forsav and cred seem to play a crucial role in the variation of ryield.

Table 70: Long-run regression test for ryield

Residual standard error: 3.113 on 157 degrees of freedom Multiple R-squared: 0.5952, Adjusted R-squared: 0.5643 F-statistic: 19.24 on 12 and 157 DF, p-value: < 2.2e-16				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	4.430e-01	4.940e+00	0.090	0.92865
rgdp	-6.265e-05	1.971e-05	-3.178	0.00179 **
psav	6.097e+00	8.659e+00	0.704	0.48240
forsav	2.142e+01	8.160e+00	2.625	0.00953 **
gvtsav	9.814e-01	1.281e+01	0.077	0.93904
finsav	-3.166e+00	2.504e+00	-1.265	0.20785
cred	5.841e+00	2.172e+00	2.690	0.00793 **
gfcfg	-2.218e+01	2.435e+01	-0.911	0.36361
d1	-1.412e+00	1.279e+00	-1.104	0.27126
d2	2.538e+00	1.913e+00	1.327	0.18652
d3	3.345e+00	2.631e+00	1.271	0.20546
d4	4.114e+00	3.416e+00	1.205	0.23020
saflib	7.036e+00	3.877e+00	1.815	0.07147 .

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 71 shows that the residual of rgdp is stationary at 5 per cent given the value of tau 1 (-7.31) is smaller than the 5 per cent critical value (- 1.95).

Table 71: ADF test for the residual of ryield

Residual standard error: 2.889 on 166 degrees of freedom Multiple R-squared: 0.3597, Adjusted R-squared: 0.352 ; F-statistic: 46.64 on 2 and 166 DF p-value: < 2.2e-16; Test-statistic: -7.3105	
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c. Error correction model

Table 72 shows that although the coefficient of the error term in the yield function is significant (t= 3.189) it has the wrong sign (2.915e-01). The long-run relationship between ryield and the rest of the variables is unstable.

Table 72: ECM test for ryield

Residual standard error: 3.493 on 154 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-squared: 0.08905, Adjusted R-squared: 0.04173				
F-statistic: 1.882 on 8 and 154 DF, p-value: 0.06654				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	3.032e-02	2.962e-01	0.102	0.91861
err.ecm3	2.915e-01	9.142e-02	3.189	0.00173 **
rgdp.d1	-4.330e-05	9.143e-05	-0.474	0.63643
psav.d1	-8.694e-02	9.725e-02	-0.894	0.37276
forsav.d1	2.560e+00	1.136e+01	0.225	0.82198
gvtsav.d1	-9.452e+00	7.441e+00	-1.270	0.20586
finsav.d1	-7.104e+00	6.940e+00	-1.024	0.30758
cred.d1	7.829e-01	5.328e+00	0.147	0.88337
gfcfg.d1	4.956e+00	3.404e+01	0.146	0.88444

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

4. forsav

a. Long-run regression

In Table 73 apart from finsav and gfcfg, the independent variables are mostly significant and appear to account for over 47 per cent in the variation of forsav.

Table 73: Long-run regression test for forsav

Residual standard error: 0.0298 on 157 degrees of freedom				
Multiple R-squared: 0.5114, Adjusted R-squared: 0.474				
F-statistic: 13.69 on 12 and 157 DF, p-value: < 2.2e-16				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	-5.643e-02	4.707e-02	-1.199	0.23238
rgdp	9.411e-07	1.796e-07	5.239	5.11e-07 ***
ryield	1.963e-03	7.477e-04	2.625	0.00953 **
psav	-4.485e-01	7.490e-02	-5.988	1.40e-08 ***
gvtsav	-5.201e-01	1.154e-01	-4.506	1.28e-05 ***
finsav	-3.660e-02	2.391e-02	-1.531	0.12785
cred	4.924e-02	2.089e-02	2.356	0.01969 *
gfcfg	-1.816e-02	2.337e-01	-0.078	0.93814
d1	-3.106e-02	1.204e-02	-2.581	0.01077 *
d2	-1.091e-01	1.623e-02	-6.720	3.17e-10 ***
d3	-1.043e-01	2.391e-02	-4.363	2.32e-05 ***
d4	-1.503e-01	3.058e-02	-4.915	2.21e-06 ***
saffib	-1.154e-01	3.635e-02	-3.174	0.00181 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 74 shows that the residual of forsav is stationary at 5 per cent given the value of tau 1 (-5.16) is smaller than the 5 per cent critical value (- 1.95).

Table 74: ADF test for the residual of forsav

Residual standard error: 0.02491 on 166 degrees of freedom
 Multiple R-squared: 0.3524, Adjusted R-squared: 0.3446; F-statistic: 45.16 on 2 and 166 DF,
 p-value: < 2.2e-16; Test-statistic: -5.1614

c. Error correction model

In Table 75, the sign of the coefficient of the error correction term and the t value suggest that the long-run relationship between forsav and the other variables is unstable.

Table 75: ECM test for forsav

Residual standard error: 0.02749 on 154 degrees of freedom (1 observation deleted due to missingness)
 Multiple R-squared: 0.1193, Adjusted R-squared: 0.07358
 F-statistic: 2.608 on 8 and 154 DF, p-value: 0.01055

Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	-4.413e-04	2.333e-03	-0.189	0.850223
err.ecm4	5.971e-02	8.172e-02	0.731	0.466084
rgdp.d1	1.383e-07	7.178e-07	0.193	0.847520
ryield.d	2.880e-04	6.152e-04	0.468	0.640343
psav.d1	-1.338e-03	7.678e-04	-1.742	0.083424
gvtsav.d1	2.080e-02	5.723e-02	0.363	0.716790
finsav.d1	7.169e-02	5.476e-02	1.309	0.192422
cred.d1	1.778e-03	4.134e-02	0.043	0.965743
gfcfg.d1	-9.941e-01	2.633e-01	-3.775	0.000228 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

5. gvtsav

a. Long-run regression

Table 76: Long-run regression test for gvtsav

Residual standard error: 0.01954 on 158 degrees of freedom
 Multiple R-Squared: 0.7777, Adjusted R-squared: 0.7622
 F-statistic: 50.25 on 11 and 158 DF, p-value: < 2.2e-16

Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	1.237e-01	2.939e-02	4.207	4.33e-05 ***
rgdp	3.230e-07	1.133e-07	2.850	0.004954 **
ryield	-9.346e-05	4.956e-04	-0.189	0.850664
forsav	-2.013e-01	4.812e-02	-4.182	4.78e-05 ***
psav	-4.866e-01	3.666e-02	-13.273	< 2e-16 ***
finsav	-9.411e-04	1.515e-02	-0.062	0.950550
cred	-2.557e-02	1.283e-02	-1.993	0.047962 *
gfcfg	2.759e-01	1.356e-01	2.034	0.043601 *
d1	-1.475e-02	7.961e-03	-1.853	0.065747 .
d2	-6.502e-02	1.072e-02	-6.063	9.45e-09 ***
d3	-9.165e-02	1.488e-02	-6.158	5.84e-09 ***
d4	-8.082e-02	2.052e-02	-3.939	0.000122 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 77 shows that the residual of *gvtsav* is stationary at 5 per cent given the value of tau 1 (-8.86) is smaller than the 5 per cent critical value (- 1.95).

Table 77: ADF test for the residual of *gvtsav*

Residual standard error: 0.01904 on 166 degrees of freedom
Multiple R-Squared: 0.4901, Adjusted R-squared: 0.484; F-statistic: 79.79 on 2 and 166 DF
p-value: < 2.2e-16; Value of test-statistic is: -8.8624

c. Error correction model

Table 78 shows that the coefficient of the error correction term both enters significantly ($t= 5.32$) and has the right sign (-4.479e-01). This suggests that *gvtsav* adjusts to correct about 45 per cent of any disequilibrium in the long-run relationship per quarter.

Table 78: ECM test for *gvtsav*

Residual standard error: 0.03106 on 155 degrees of freedom				
Multiple R-Squared: 0.5521, Adjusted R-squared: 0.5289				
F-statistic: 23.88 on 8 and 155 DF, p-value: < 2.2e-16				
Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	-6.544e-04	2.551e-03	-0.256	0.797912
Err.ecm5	-4.479e-01	1.407e-01	-3.183	0.001759 **
rgdp.d1	3.168e-07	6.164e-07	0.514	0.607959
ryield.d1	-4.148e-04	6.971e-04	-0.595	0.552692
forsav.d1	3.301e-01	9.793e-02	3.371	0.000947 ***
psav.d1	3.255e-01	4.428e-02	7.352	1.06e-11 ***
finsav.d1	-1.285e-01	6.067e-02	-2.119	0.035705 *
cred.d1	-2.877e-02	4.689e-02	-0.613	0.540447
gfcfg.d1	2.122e-01	2.854e-01	0.743	0.458335

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6. *finsav*

a. Long-run regression

The independent variables account for over 80 per cent in the variation of *finsav*.

Table 79: Long-run regression test for finsav

Residual standard error: 0.09873 on 157 degrees of freedom				
Multiple R-squared: 0.8292, Adjusted R-squared: 0.8161				
F-statistic: 63.52 on 12 and 157 DF, p-value: < 2.2e-16				
Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	4.708e-01	1.521e-01	3.095	0.00233 **
rgdp	3.103e-06	5.956e-07	5.209	5.87e-07 ***
ryield	-3.185e-03	2.518e-03	-1.265	0.20785
forsav	-4.018e-01	2.625e-01	-1.531	0.12785
gvt sav	-2.321e-01	4.060e-01	-0.572	0.56826
psav	-3.944e-01	2.732e-01	-1.443	0.15087
cred	3.613e-01	6.427e-02	5.621	8.47e-08 ***
gfcfg	7.228e-01	7.720e-01	0.936	0.35057
d1	-1.091e-01	3.977e-02	-2.744	0.00678 **
d2	-3.323e-01	5.496e-02	-6.046	1.04e-08 ***
d3	-4.559e-01	7.557e-02	-6.032	1.12e-08 ***
d4	-6.524e-01	9.557e-02	-6.827	1.79e-10 ***
saffib	-4.387e-01	1.192e-01	-3.680	0.00032 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 80 shows that the residual of rgdp is stationary at 5 per cent given the value of tau 1 (-3.3) is smaller than the 5 per cent critical value (- 1.95).

Table 80: ADF test for the residual of finsav

Residual standard error: 0.05302 on 166 degrees of freedom	
Multiple R-squared: 0.0821, Adjusted R-squared: 0.07104 ; F-statistic: 7.424 on 2 and 166 DF	
p-value: 0.0008166; Test-statistic: -3.3065	

c. Error correction model

Table 81 shows that the long-run relationship between finsav and the other variables is unstable.

Table 81: ECM test for finsav

Residual standard error: 0.05824 on 154 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-squared: 0.1862, Adjusted R-squared: 0.1439				
F-statistic: 4.403 on 8 and 154 DF, p-value: 8.14e-05				
Variables	Estimate	Std. Error	T value	Pr(> t)
Intercept	-6.770e-03	4.931e-03	-1.373	0.171721
err.ecm6	1.294e-02	4.860e-02	0.266	0.790447
rgdp.d1	5.624e-06	1.485e-06	3.787	0.000218 ***
ryield.d	1.443e-03	1.298e-03	1.112	0.267907
forsav.d1	-2.943e-02	1.893e-01	-0.155	0.876688
gvt sav.d1	-4.621e-01	1.185e-01	-3.901	0.000143 ***
psav.d1	-4.435e-03	1.620e-03	-2.738	0.006902 **
cred.d1	-4.580e-02	7.470e-02	-0.613	0.540711
gfcfg.d1	8.703e-01	5.609e-01	1.552	0.122825

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

7. cred

a. Long-run regression

Table 82 shows that rgdp, ryield, forsav, finsav, psav, gfcfg and saflib explain up to 78 per cent in the variation of cred.

Table 82: Long-run regression test for cred

Residual standard error: 0.1119 on 157 degrees of freedom Multiple R-squared: 0.7979, Adjusted R-squared: 0.7825 F-statistic: 51.65 on 12 and 157 DF, p-value: < 2.2e-16				
Variables	Estimate	Std. Error	t value	Pr(> t)
Intercept	1.178e+00	1.505e-01	7.828	6.89e-13 ***
rgdp	-5.227e-08	7.308e-07	-0.072	0.943074
ryield	7.541e-03	2.804e-03	2.690	0.007928 **
forsav	6.938e-01	2.944e-01	2.356	0.019689 *
gvsav	-5.294e-01	4.585e-01	-1.155	0.249995
finsav	4.637e-01	8.250e-02	5.621	8.47e-08 ***
ppav	-6.335e-01	3.075e-01	-2.060	0.041013 *
gfcfg	4.963e+00	7.826e-01	6.342	2.31e-09 ***
d1	-9.845e-02	4.546e-02	-2.166	0.031833 *
d2	3.588e-02	6.907e-02	0.519	0.604154
d3	1.211e-01	9.453e-02	1.281	0.202115
d4	4.137e-01	1.188e-01	3.482	0.000644 ***
Saflib	6.398e-01	1.312e-01	4.877	2.62e-06 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 83 shows that the residual of cred is stationary at 5 per cent given the value of tau 1 (-3.78) is smaller than the 5 per cent critical value (- 1.95).

Table 83: ADF test for the residual of cred

Residual standard error: 0.07177 on 166 degrees of freedom Multiple R-squared: 0.1354, Adjusted R-squared: 0.125; F-statistic: 13 on 2 and 166 DF p-value: 5.693e-06; Test-statistic: -3.7784	
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c. Error correction model

Table 84 shows that the coefficient of the error correction term in the credit function neither enters significantly ($t= 0.556$) nor has the right sign ($3.057e-02$). The existence of a stable long-run relationship between cred and the other variables is therefore invalidated.

Table 84: ECM test for cred

Residual standard error: 0.07385 on 154 degrees of freedom (1 observation deleted due to missingness)				
Multiple R-squared: 0.2422, Adjusted R-squared: 0.2029				
F-statistic: 6.154 on 8 and 154 DF, p-value: 6.995e-07				
Variables	Estimate	Std. Error	T value	Pr(> t)
Intercept	-7.963e-03	6.221e-03	-1.280	0.202454
err.ecm7	3.057e-02	5.498e-02	0.556	0.579058
rgdp.d1	9.830e-06	1.911e-06	5.145	8.04e-07 ***
ryield.d	1.820e-03	1.652e-03	1.102	0.272062
forsav.d1	-4.643e-02	2.345e-01	-0.198	0.843283
gvtsav.d1	-2.206e-01	1.563e-01	-1.411	0.160163
finsav.d1	-1.507e-01	1.238e-01	-1.217	0.225457
psav.d1	-7.631e-03	2.043e-03	-3.735	0.000264 ***
gfcfg.d1	1.282e+00	7.163e-01	1.789	0.075578

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

8. gfcfg

a. Long-run regression

As seen in Table 85, the value of the adjusted R-squared is fairly high and suggests that the independent variables account for over 90 per cent in the variation of gfcfg; only cred, d1, d4 and saflib are significant.

Table 85: Long-run regression test for gfcfg

Residual standard error: 0.01018 on 157 degrees of freedom				
Multiple R-squared: 0.9306, Adjusted R-squared: 0.9253				
F-statistic: 175.4 on 12 and 157 DF, p-value: < 2.2e-16				
Variables	Estimate	Std. Error	T value	Pr(> t)
intercept	8.562e-04	1.615e-02	0.053	0.9578
rgdp	-4.798e-08	6.638e-08	-0.723	0.4709
ryield	-2.371e-04	2.602e-04	-0.911	0.3636
forsav	-2.119e-03	2.726e-02	-0.078	0.9381
gvtsav	4.071e-02	4.177e-02	0.975	0.3312
finsav	7.682e-03	8.204e-03	0.936	0.3506
cred	4.109e-02	6.479e-03	6.342	2.31e-09 ***
psav	2.224e-02	2.830e-02	0.786	0.4331
d1	2.673e-02	3.615e-03	7.395	7.96e-12 ***
d2	1.174e-03	6.289e-03	0.187	0.8522
d3	-1.248e-02	8.589e-03	-1.453	0.1481
d4	-2.254e-02	1.107e-02	-2.035	0.0435 *
saflib	-7.100e-02	1.149e-02	-6.181	5.27e-09 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

b. Order of integration of residuals

Table 86 shows that the residual of gfcfg is stationary at 5 per cent given the value of tau 1 (-6.41) is smaller than the 5 per cent critical value (- 1.95).

Table 86: ADF test for the residual of gfcfg

Residual standard error: 0.008089 on 166 degrees of freedom
 Multiple R-squared: 0.2326, Adjusted R-squared: 0.2234; F-statistic: 25.16 on 2 and 166 DF
 p-value: 2.855e-10; Test-statistic: -6.4196

c. Error correction model

Table 87 shows that the coefficient of the error correction term does not enter significantly ($t = 1.297$) and has the wrong sign ($9.448e-02$). The long-run relationship between gfcfg and the other variables is unstable.

Table 87: ECM test for gfcfg

Residual standard error: 0.008666 on 154 degrees of freedom (1 observation deleted due to missingness)
 Multiple R-squared: 0.2592, Adjusted R-squared: 0.2207
 F-statistic: 6.735 on 8 and 154 DF, p-value: 1.485e-07

Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	-1.947e-03	7.310e-04	-2.663	0.008557 **
err.ecm8	9.448e-02	7.282e-02	1.297	0.196404
rgdp.d1	1.250e-06	2.232e-07	5.598	9.69e-08 ***
ryield.d	-2.149e-04	1.937e-04	-1.109	0.268948
forsav.d1	-1.306e-02	2.772e-02	-0.471	0.638317
gvtsav.d1	-3.036e-02	1.845e-02	-1.645	0.101928
finsav.d1	-1.548e-02	1.708e-02	-0.906	0.366302
cred.d1	5.349e-03	1.325e-02	0.404	0.686985
psav.d1	-8.150e-04	2.251e-04	-3.620	0.000399 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6.4 Granger causality tests

In this section Granger causality tests are performed and include all of the variables used in the study. This is done over the entire, pre-liberalisation and post liberalisation periods. The performance of granger causality tests is necessary because granger causality tests enable to ascertain whether past information on a variable helps forecast variations in other variables.

6.4.1 Growth equation**6.4.1.1 Entire period: 1965-2007**

It appears from Table 88 that forsav and gvtsav are the only variables that granger-cause the rgrowth throughout the entire period of the study.

6.4.1.2 Pre-liberalisation period (1965-1995)

The results of Table 89 show that during the pre-liberalisation period, forsav, gvtsav, govsv, finsav and gfcfg appear to granger-cause rgrowth.

6.4.1.3 Post liberalisation period (1995-2007)

It appears from Table 90 that ryield, rprime, forsav, gvtsav, govsv, finsav and, gfcfg respectively granger-cause rgrowth in the post liberalisation period.

Table 88: Granger causality rgrowth equation (1965-2007)

Dep. Variable	Indep. Variable	Lag 1	Res. Df	Df	F	Pr (>F)	Conclusion
rgrowth	ryield	1	162	-3	0.0509	0.9848	The null of no granger causality cannot be rejected
ryield	rgrowth	1	162	-3	0.7693	0.5128	The null of no granger causality cannot be rejected
rgrowth	rprime	1	162	-3	0.5485	0.6499	The null of no granger causality cannot be rejected
rprime	rgrowth	1	162	-3	0.7292	0.536	The null of no granger causality cannot be rejected
rgrowth	forsav	1	162	-3	3.3045	0.02182 *	The null of no granger causality must be rejected
rgrowth	gvtsav	1	162	-3	8.7033	2.215e-05 ***	The null of no granger causality must be rejected
rgrowth	govsv	1	162	-3	1.9745	0.1200	The null of no granger causality cannot be rejected
rgrowth	finsav	1	162	-3	2.077	0.1054	The null of no granger causality cannot be rejected
rgrowth	cred	1	162	-3	0.8952	0.4451	The null of no granger causality cannot be rejected
rgrowth	gfcfg	1	162	-3	1.3095	0.2733	The null of no granger causality cannot be rejected

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 89: Granger causality rgrowth equation (1965-1995)

Dep. Variable	Indep. Variable	Lag 1	Res. Df	Df	F	Pr (>F)	Conclusion
rgrowth	ryield	1	113	-3	0.6563	0.5807	The null of no granger causality cannot be rejected
ryield	rgrowth	1	113	-3	1.0246	0.3847	The null of no granger causality cannot be rejected
rgrowth	rprime	1	113	-3	1.8264	0.1466	The null of no granger causality cannot be rejected
rprime	rgrowth	1	113	-3	0.9761	0.4068	The null of no granger causality cannot be rejected
rgrowth	forsav	1	113	-3	2.8692	0.03976 *	The null of no granger causality must be rejected
rgrowth	gvtsav	1	113	-3	10.765	2.934e-06 ***	The null of no granger causality must be rejected
rgrowth	govsv	1	113	-3	3.5223	0.01745 *	The null of no granger causality must be rejected
rgrowth	finsav	1	113	-3	3.7392	0.01328 *	The null of no granger causality must be rejected
rgrowth	cred	1	113	-3	0.4283	0.7331	The null of no granger causality cannot be rejected
rgrowth	gfcfg	1	113	-3	2.5964	0.05605 .	The null of no granger causality must be rejected

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 90: Granger causality rgrowth equation (1995-2007)

Dep. Variable	Indep. Variable	Lag 1	Res. Df	Df	F	Pr (>F)	Conclusion
rgrowth	ryield	1	42	-3	2.2619	0.09644 .	The null of no granger causality must be rejected
ryield	rgrowth	1	42	-3	0.5244	0.6681	The null of no granger causality cannot be rejected
rgrowth	rprime	1	42	-3	4.6499	0.007138 **	The null of no granger causality must be rejected
rprime	rgrowth	1	42	-3	0.3911	0.76	The null of no granger causality cannot be rejected
rgrowth	forsav	1	42	-3	2.5538	0.06933 .	The null of no granger causality must be rejected
rgrowth	gvtsav	1	42	-3	8.4699	0.0001864 ***	The null of no granger causality must be rejected
rgrowth	govsav	1	42	-3	5.5362	0.002896 **	The null of no granger causality must be rejected
rgrowth	finsav	1	42	-3	3.1482	0.0357 *	The null of no granger causality must be rejected
rgrowth	cred	1	42	-3	0.7037	0.5556	The null of no granger causality cannot be rejected
rgrowth	gfcfg	1	42	-3	3.6336	0.02099 *	The null of no granger causality must be rejected

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

6.4.2 Private saving equation

6.4.2.1 Entire period (1965-2007)

The results of Table 91 show that all of the explanatory variables granger-cause psav throughout the entire period covered by the study.

6.4.2.2 Pre-liberalisation period (1965-1995)

As shown in Table 92 of during the pre-liberalisation period all the explanatory variables of the model granger-cause psav. forsav, rgdp, gvtsav, govsv and gfcfg granger-cause psav in the pre-liberalisation period.

6.4.2.3 Post liberalisation period (1995-2007)

Table 93 shows that during the post liberalisation period the first lag of rgdp, forsav, govsv, finsav, cred and gfcfg are the variables that granger-cause psav.

Table 91: Granger causality psav (1965-2007)

Dep. Variable	Indep. Variable	Lag 1	Res. Df	Df	F	Pr (>F)	Conclusion
psav	rgdp	1	163	-3	18.891	1.539e-10 ***	The null of no granger causality must be rejected
psav	ryield	1	163	-3	2.8453	0.03945 *	The null of no granger causality must be rejected
ryield	psav	1	163	-3	0.8372	0.4753	The null of no granger causality cannot be rejected
psav	rprime	1	163	-3	2.2955	0.07983 .	The null of no granger causality must be rejected
rprime	psav	1	163	-3	1.0738	0.3619	The null of no granger causality cannot be rejected
psav	forsav	1	163	-3	13.945	4.017e-08 ***	The null of no granger causality must be rejected
psav	gvtsav	1	163	-3	12.290	2.809e-07 ***	The null of no granger causality must be rejected
psav	govsv	1	163	-3	5.0671	0.002227 **	The null of no granger causality must be rejected
psav	finsav	1	163	-3	4.0628	0.008166 **	The null of no granger causality must be rejected
psav	cred	1	163	-3	5.4552	0.001350 **	The null of no granger causality must be rejected
psav	gfcfg	1	163	-3	6.2913	0.0004621 ***	The null of no granger causality must be rejected
psav	safilib	1	163	-3	4.4477	0.004959 **	The null of no granger causality must be rejected

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 92: Granger causality psav equation (1965-1995)

Dep. Variable	Indep. Variable	Lag 1	Res. Df	Df	F	Pr (>F)	Conclusion
psav	rgdp	1	113	-3	7.722	9.957e-05 ***	The null of no granger causality must be rejected
psav	ryield	1	113	-3	1.1818	0.3201	The null of no granger causality cannot be rejected
ryield	psav	1	113	-3	0.6211	0.6028	The null of no granger causality cannot be rejected
psav	rprime	1	113	-3	0.7712	0.5125	The null of no granger causality cannot be rejected
rprime	psav	1	113	-3	0.8248	0.4829	The null of no granger causality cannot be rejected
psav	forsav	1	113	-3	11.700	1.033e-06 ***	The null of no granger causality must be rejected
psav	gvt sav	1	113	-3	10.130	6.024e-06 ***	The null of no granger causality must be rejected
psav	gov sav	1	113	-3	2.9243	0.03709 *	The null of no granger causality must be rejected
psav	finsav	1	113	-3	1.1466	0.3336	The null of no granger causality cannot be rejected
psav	cred	1	113	-3	1.3398	0.2652	The null of no granger causality cannot be rejected
psav	gfcfg	1	113	-3	2.8678	0.03983 *	The null of no granger causality must be rejected
psav	saffib	1	113	-3	0.319	0.8116	The null of no granger causality cannot be rejected

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 93: Granger causality psav equation (1995-2007)

Dep. Variable	Indep. Variable	Lag 1	Res. Df	Df	F	Pr (>F)	Conclusion
psav	rgdp	1	42	-3	28.379	6.657e-10 ***	The null of no granger causality must be rejected
psav	ryield	1	42	-3	0.35	0.7863	The null of no granger causality cannot be rejected
ryield	psav	1	42	-3	0.73	0.5399	The null of no granger causality cannot be rejected
psav	rprime	1	42	-3	0.53	0.6642	The null of no granger causality cannot be rejected
rprime	psav	1	42	-3	0.86	0.4679	The null of no granger causality cannot be rejected
psav	forsav	1	42	-3	8.84	0.0001343 ***	The null of no granger causality must be rejected
psav	gvt sav	1	42	-3	1.88	0.1477	The null of no granger causality cannot be rejected
psav	gov sav	1	42	-3	3.24	0.03223 *	The null of no granger causality must be rejected
psav	finsav	1	42	-3	3.74	0.01862 *	The null of no granger causality must be rejected
psav	cred	1	42	-3	10.0	4.962e-05 ***	The null of no granger causality must be rejected
psav	gfcfg	1	42	-3	18.8	1.016e-07 ***	The null of no granger causality must be rejected
psav	saffib	1	42	-3	1.38	0.2619	The null of no granger causality cannot be rejected

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

CHAPTER 7

DISCUSSION AND INTERPRETATION OF RESULTS

7.1 Introduction

Chapter 7 is devoted to the interpretation of the results obtained in the previous chapter. Chapter 7 starts by reiterating the hypotheses submitted in Chapter 1, based on the theories that were discussed earlier in the literature survey. Next the results that are obtained in the econometric analysis are analysed and compared to the hypotheses suggested in Chapter 5 and the results suggested by most empirical studies. Then the chapter provides a summary of all the findings of the study.

7.2 Interpretation of results

7.2.1 Long-run regression tests

The long-regression tests were divided with regards to three aspects:

- ❖ First of all the dependent variable (rgrowth or psav).
- ❖ Next the relevant real interest rate (ryield or rprime) and government saving (gvtsav or govsv).
- ❖ Finally the period covered by the study (entire period, pre-liberalisation or post liberalisation periods).

The above distinction of variables led to the performance of 24 long-run regression tests.

Results show that in the growth equation (rgrowth), the adjusted R-squared is usually low and lies between 17 and 47 per cent. This implies that the explanatory variables (real gross domestic product, real interest rates, foreign saving, government saving, financial saving, credit and investment by government) account for less than 50 per cent in the total variation of the dependent variable, which is real growth rate. The long-regressions suggest that over the period 1965-2007, the variables that have a statistical significant

influence on South Africa's economic growth rate are real gross domestic product, foreign saving, government saving and credit. However in the private saving equation, the majority of regressions depict high adjusted R-squared well above 50 per cent, which means that the above-mentioned explanatory variables along with the South Africa's liberalisation index have a significant influence on the variation in the level of private saving in South Africa.

Given the sub-division of the two initial models into so many sub-models, and the time available for this study, tests could not be carried out for all of the above variables. Therefore only the regressions that depicted the most significant results were used in the remainder of the econometric analysis. This is why the models that contain the variables r_{prime} and $govsav$ were dropped as well as the pre-liberalisation period. The residuals tests and unit root tests therefore were performed on Model 1.1 and Model 2.1 only over the entire (1965-2007) and post liberalisation (1995-2007) periods.

7.2.2 Residuals tests

The results of the Durbin-Watson test, which tests for autocorrelation of residuals, are mostly inconclusive. Both the Reset and the Rainbow tests suggest that both regression equations are approximately linear. The Breusch-Pagan and the Harrison-McCabe tests suggest that the residuals are heteroscedastic; which means that the variance is not constant over time.

7.2.3 Unit root tests

Unit root tests were performed on the variables at their original levels and first difference through the ADF and the Zivot-Andrews tests. The results of unit root tests over the entire period covered by the study (1965-2007) confirm the suggestions of the visual inspection that all of the time series are integrated of order one i.e. $I(1)$. Indeed, with the exception of growth rate and foreign saving, all of the time series are non-stationary at their original levels. However when differenced once, all of the time series are stationary.

The performance of ADF test the residuals of the time series shows that all of the residuals are stationary i.e. $I(0)$. The prevalence of non-stationary variables at levels combined with stationary residuals therefore led to the conclusion of a long-run relationship among variables. This in turn led to the estimation of an error correction model for each time series in each of the two models.

7.2.4 Error correction models

Because there are 8 time series in each model, 8 error correction models were estimated per dependent variable¹⁶. In the growth equation none of the eight functions has a coefficient that both enters significantly and has the right sign. Hence, none of the time series depicts an error correcting behaviour. However in the private saving equation, out of the eight functions, only the error correction term of the government saving's function is both significant and negative. This suggests that net saving by government adjusts to correct about 45 per cent of any disequilibrium in the long-run relationship with the rest of the variables each quarter. Given the above-mentioned results, it appears that apart from government saving, the time series do not exhibit a stable long-run relationship.

7.3 Verification of hypotheses

The purpose of this section is to use the results obtained in Chapter 6 to validate or invalidate the hypotheses proposed in Chapter 1. The latter hypotheses are the following:

H1: High saving (financial, public and foreign) rates are necessary for long-run growth: low saving rates constrain growth.

H2: Private saving is positively related to income

H3: Private and financial savings are positively related to real interest rates: higher real interest rates lead to higher private saving and financial saving (McKinnon-Shaw's model).

¹⁶ saflib is not included in the error correction models of psav equation because it is an index rather than a time series.

H4: Budget deficits are offset by private saving: Ricardian equivalence.

H5: Foreign saving crowds out private saving.

H1: High saving rates are necessary for higher economic growth: low saving rates constrain growth.

The Harrod-Domar, the Solow-Swan and the endogenous models all argue that saving is a conduit to growth even if it is only temporary. Financial saving was used in this study following Prema-Chandra (1998) and Warman and Thirlwall (1994), who suggest that it is a good measure of domestic saving. The McKinnon-Shaw financial repression hypothesis suggests that financial saving will grow with income. Therefore a positive sign was expected in the equation of growth rate to confirm that income growth and financial saving are complements. However results show that in the growth equation, financial saving is only significant and negative (around -17) in the post liberalisation period (1995-2007). The results of the Granger causality tests show that financial saving granger-cause growth in the pre-liberalisation (1965-1995) and post liberalisation periods (1995-2007) separately but not in the entire period.

In the private saving equation, financial saving is never statistically significant, which suggests that finsav was not a significant determinant of private saving in South Africa. The results of the granger causality tests show that financial saving granger-cause private saving in the entire period (1965-2007) and in the post liberalisation period (1995-2007) but not in the pre-liberalisation period.

Conclusion: The results of the analysis suggest that the significant inflows of financial saving post 1995 depressed South Africa's economic growth. Over the latter period a 1 per cent rise in financial saving was likely to result in a 17 per cent decrease in the growth rate of gross domestic product. The negative signs of financial saving's coefficients coincide with the declining phase between 1992 and 2000 of the variable when at levels as depicted in Figure 15 in Chapter 5. A plausible explanation for that decline is that the large flows of money that followed financial deepening were outweighed by the outflows

of money designated to repay the country's debt. Therefore, the overall effect on financial saving was negative.

H2: Private saving positively respond to income (psav = f (rgdp))

As discussed in Chapter 3, the existing literature on income, consumption and saving agrees that saving is a function of income whether it is current, past or anticipated (the absolute-income hypothesis, relative-income hypothesis, PIH and LCH). Most empirical studies find the income coefficient relative to private saving to be null or positive.

The exclusion of personal saving and demographics from the data prevents the study from drawing conclusions on the role of income in the determination of personal saving in South Africa. Regardless this study reveals a null coefficient for income relative to private saving. Real gross domestic product is significant throughout the entire period and the pre-liberalisation period but not always during the post liberalisation period. Furthermore results from the Granger causality tests show that real gross domestic product granger-causes private saving in every period covered by the study: income of period $t-1$ helps predict the private rate saving of period t .

Conclusion: Although there are two cases in the post liberalisation period where gross domestic product is not statistically significant, the overall results seem to suggest that income is a driver -albeit minor- of South Africa's private saving. Moreover real income has a strong predictive power for private saving.

H3: Private saving positively responds to real interest rates: higher real interest rates generate higher private saving.

The classical theory and the McKinnon-Shaw hypothesis contend that higher real interest rates will generate higher growth rates through higher saving and more efficient investment. This suggests a positive sign for r_{yield} and r_{prime} in both the income and the private saving equations. Nevertheless as highlighted in the literature survey, the results of empirical studies are ambiguous.

The study shows that in the private saving equation the coefficients of real interest rates are never significant, suggesting that private saving is not significantly responsive to real interest rate in South Africa as opposed to the arguments of the McKinnon-Shaw hypothesis. Nevertheless, results of the Granger causality tests show that real interest rates granger-cause private saving in the entire period (1965-2007). These results are supported by those of South Africa's financial liberalisation index which show that the variable is mostly negative and granger-cause private saving in the entire period (1965-2007). Therefore real interest rates are helpful in the prediction of private saving's rates.

As for the growth's equation, real interest rates are significant in the post liberalisation period only. In the latter period they are positive and approximate 0.3 per cent, suggesting that a 1 per cent rise in real interest rates is likely to scale up economic growth by 0.3 per cent. Real interest rates have therefore had a positive impact on economic growth since 1995. Granger causality tests show that both measures of real interest rates granger-cause growth between 1995 and 2007. This suggests that since the post liberalisation period real interest rates have been good predictors of economic growth in South Africa.

Conclusion: Although real interest rates do not statistically drive South Africa's private saving, they help forecast private saving rates. Further the growth rate of real income has increased with higher real interest rates during the post liberalisation period. Even though financial liberalisation has not improved the level of private saving, the overall effect of financial liberalisation on the economy has been positive. The financial repression hypothesis can therefore not be rejected.

H4: Budget deficits are offset by private saving:: testing for Ricardian equivalence.

As explained in Chapter 5, the inclusion of government and public saving is crucial when trying to understand the private sector's saving behaviour. If the

Ricardian equivalence is validated for an economy, it means that government need not to increase its saving rate in order to boost domestic saving.

The empirical results show that both variables that measure government's saving, that is *gvt sav* and *gov sav* are always significant in the private saving equations and depict negative signs as expected regardless of the period analysed. Moreover the coefficients of the variables lie between 2.3 and 1 that is $(-2.3 < x < -1)$. This suggests that the private sector responds negatively and more than proportionately to changes in government's saving. That is a 1 per cent rise in government saving reduces private saving by more than 1 per cent and *vice versa*.

The validity of the Ricardian Equivalence implies that the deficits recorded by the South African government throughout the period covered by the study have not hampered the country's domestic saving. Furthermore, the results of the Granger causality tests show that most of the time government saving/public saving granger-cause private saving: that is the saving rates of the government help forecast the saving rates of the private sector. The ECM results of the private saving' equation suggest that net saving by government adjusts to correct about 45 per cent of any disequilibrium in the long-run relationship with private saving each quarter.

As for the growth equation, government saving and public saving mostly depict significant and high negative coefficients, comprised between 30 and 75 per cent: that is a 1 per cent rise in government's saving would tend to result in a 30 to 75 per cent decrease in growth rate. The Granger causality tests show that government and public saving always do granger-cause growth.

Conclusion: The results, although difficult to believe, suggest that private saving more than offsets government saving. This suggests that the Ricardian equivalence be validated for South Africa and is in contrast with Tsikata (1998) and, Jonsson and Teferra (2001) that argue that 'private saving only

partially offsets changes in public saving'. Moreover, government/public saving are good predictors of private saving and economic growth.

H5: Foreign saving crowds out private saving

The long-run regressions show that foreign saving mostly is null and negative in the private saving's equation. Foreign saving is significant throughout the regressions with the exception of the two following equations: Model 2.2 (1995-2007) and Model 2.4 (1995-2007). The negative signs suggest that there is a negative relationship between foreign and private saving: private savings are crowded out by foreign saving. Moreover the results of Granger causality tests suggest that variations in foreign saving help predict private saving throughout all of the periods covered by the study.

Conclusion: The rates of foreign saving are definitely a significant determinant and predictor of private saving in South Africa. However the negative signs of the coefficients suggest that foreign saving are a substitute for rather than a complement to private saving.

7.4 Summary

This study has analysed the South African saving behaviour relative to the country's economic growth. This is a quite intricate task due to the fact that the South African economy does not seem to fall into any of the traditional patterns analysed in mainstream economics. Furthermore the South African economy has experienced factors such as the debt settlement, which appears to have negatively affected financial saving between 1992 and 2000. Finally the measurement of saving in the national accounts does not correspond to the definition and is likely to be flawed. Nevertheless the results of the econometric analysis have led to the following findings:

- ❖ Income is a driver albeit minor of private saving in South Africa. In the post liberalisation period (1995 – 2007), the growth rate of income positively responds to liberalised real interest rates. Therefore financial

liberalisation, with special attention to the deregulation of interest rates has encouraged South Africa's economic growth.

- ❖ Although real interest rates help forecast private saving, the private sector's saving behaviour does not seem to be influenced by real interest rates.
- ❖ The higher flows of financial saving following the completion of the financial liberalisation process in the late 1990s seem to have inhibited economic growth.
- ❖ Credit appears to be one of the main deterrents of economic growth as results suggest that credit is negatively related to income growth over the entire and the pre-liberalisation periods respectively. It appears that in the former period a 1 per cent rise is likely to result in a 4 per cent decrease in economic growth whereas in the latter period a 1 per cent rise in credit allocation is likely to reduce growth by 7 per cent.
- ❖ Of all the time series analysed in the study, foreign saving is the one that contributes the most to economic growth, both positively and statistically.

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

This study investigates the saving-growth nexus in South Africa. This, in view of the continuously decreasing domestic saving levels recorded by the said country, contrasted with renewed economic growth recorded since the early 2000s. Saving theories all agree that there is a positive relation between saving and growth albeit most of these theories argue that the impact of saving on growth is short lived. However most studies performed on East-Asian miraculous growth ascribe a good share of that growth to high saving rates. Similarly neither theories nor empirical studies agree on saving determinants. Amongst these determinants, real interest rates have particularly received attention and once again, findings diverge.

The study confirms that South Africa's domestic saving levels are low by any standards and that the financial liberalisation process has not helped improve them. South Africa's saving behaviour does not seem to be influenced by real interest rates. Whilst financial liberalisation has dampened private saving by facilitating access to credit, the implementation of inflation targeting has not been followed by any significant sign of slowdown in consumer spending prior to 2006. This can be justified by the fact that although the South African economy was fully liberalised in the late 1990s, the country experienced low interest rates and low inflation rates between 2000 and 2006. Therefore the impact on consumers spending was minor.

A surprising finding of this study is that it appears that throughout the years, credit extension has been a deterrent to rather than a driver of South Africa's economic growth. Similarly, the renewed availability of financial saving following 1995 does not seem to have had a positive impact on the country's

economic performance; this may be the result of a heavy outflow of money to repay the international loans acquired prior to and in the early 1980s.

Despite the difficult times experienced between the late 1980s and 1990s, the South African economy has witnessed a resurgence of positive and significant economic growth rates since the early 2000s. The study suggests that the latter growth seems to have been financed to a great extent with foreign funds, which, one must stress again are mostly of the portfolio type and are therefore reversible. Nonetheless, as it was mentioned in Chapter 4, the South African economy owes the resurgence of inflows of foreign funds not only to the end of sanctions but also to political stability and the completion of the financial liberalisation process, which enabled better capital mobility. In the background of the above, the study can therefore not invalidate the financial liberalisation hypothesis, as the financial process has proven to be growth enhancing for South Africa.

It is a fact that the prevalence of liberalised markets combined with the prevalence of low inflation and low interest rates as well as soaring housing prices between 2000 and 2006 have all favoured a boom in credit-financed consumer spending. However, even though South Africa managed to attract sufficient foreign funds in the past decade, such financing methods have been claimed not to be sustainable. The complaints of South Africa's monetary authorities with regard to the country's low aggregate saving rates appear to be pertinent in view of the current (2008) global financial crisis.

The U.S. economy, which is at the origin of this global financial crisis, is similar with the South African economy in many aspects. Although the former is a big open economy, just like the latter, the U.S. economy is a net importer of capital and experienced in the past years low inflation, low interest rates and rising asset prices. All of the above factors favoured a glowing consumer confidence, which yielded a boom in consumption and credit levels, financed mostly by saving inflows from Asia (Greenspan, 2007). Just like South Africa's, the U.S. economy appeared to do well until the credit crunch occurred in 2007.

The rest is history... Worldwide markets are plunged in a crisis never seen since the 1929 depression. Numerous U.S. families have lost their houses, several financial institutions have gone bankrupt worldwide and banks are plagued by paranoia due to uncertainty of solvency. This has caused people to resort to hoarding and even to revert to holding gold. Despite the numerous efforts undertaken by governments, to date no economist has been able to find a cure to the problem or even to predict when things will go back to normal.

8.2 Recommendations

In the backdrop of the foregoing, one can unhesitatingly assert that any open economy that does not save enough and finances credit with foreign funds is in the long-run exposed to major crises considering the volatile character of foreign funds. Given the current global financial state, it would be advisable for the South African monetary authorities to take appropriate precautionary measures to boost aggregate saving rather than just call on the population to save more. The South African government can look to the Orient- more specifically the East-Asian experience- for inspiration, and introduce measures to mobilise savings.

- ❖ First of all, as it was seen in Chapter 4, South Africa's households react to the unfriendly tax system by accumulating income in the corporate sector. The South African banking sector must therefore make the tax system more flexible in order to attract more personal saving, which in turn will bolster private saving.
- ❖ The government should opt for a prudent credit policy. This can be done through a restrained credit extension to individuals who possess substantial collaterals.
- ❖ Although the study does not look at the factor unemployment, it is well-known that South Africa's level of unemployment is extremely high.

Individuals who do not have jobs cannot save; therefore the South African government should make further efforts to increase the labour force.

Although the study shows that the private sector more than offsets the changes in government's saving (Ricardian equivalence), it also shows that government dissaving has severely hampered South Africa's economic growth throughout the years. Prinsloo (1994) suggests that policies aimed at improving national saving should be focused on raising government saving. Figures show that the South African government has for the past two years recorded budget balances. This must be maintained and even improved with budget surpluses as Stiglitz and Uy (1996) contend that budget surpluses were a significant driver of the East-Asian miraculous growth; this is further necessary in the view that current account balances usually mirror economic performances around the globe.

Notwithstanding the above suggestions, the derivation of saving aggregates as balancing items in the use of disposable income does not comply with the definition of saving in the literature. Therefore the data may be flawed and, consequently, may lead researchers to draw conclusions that are debatable. Therefore the definition of saving must be revisited and new data must be developed from there. Then a benchmark should be developed that specifies the warranted or optimal saving rate for South Africa. A comparison between the national rate and the optimal rate should therefore give a better assessment of the real situation and it would provide a platform for action. With regard to that, the SARB should develop data for household wealth as the literature argues that although many South African households do not save, they purchase assets thanks to their credit facilities. The inclusion of wealth stocks in personal saving data would therefore provide a completely different outlook on the saving-nexus in South Africa.

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