

**DISSERTATION**

**MONETARY POLICY IN A COMMODITY BASED ECONOMY: THE CASE OF  
SOUTH AFRICA**

Submitted by

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In partial fulfillment of the requirements

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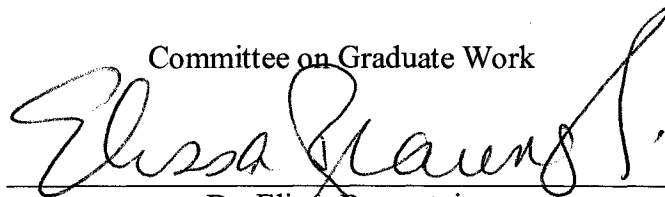
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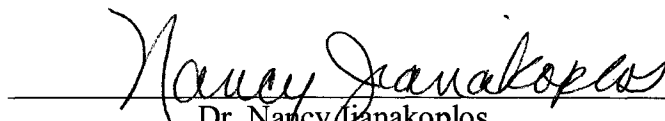
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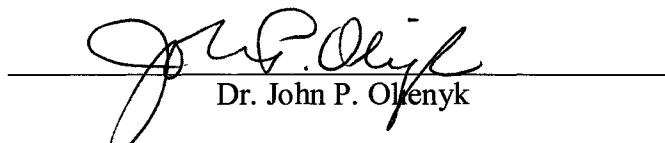
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## ABSTRACT OF DISSERTATION

### MONETARY POLICY IN A COMMODITY BASED ECONOMY: THE CASE OF SOUTH AFRICA

There are many studies done on monetary economics by scholars and central bankers around the world. Most studies cover areas such as inflation, money demand stability, interest rates, credit controls and the effectiveness of different monetary policy approaches. But of these studies, fewer used multi-equation models that included the monetary as well as the real sectors of the economy. A well-specified multi-equation model is the focus of this study when looking at what the monetary authorities in South Africa have been doing.

The South African Reserve Bank has over the decades sought of better monetary policy mechanisms to help the Bank, and ultimately the South African economy. Hence, there have been a lot of changes by the Reserve Bank over the years as the monetary authorities responded to changing economic conditions in South Africa and around the world. The South African Reserve Bank was not immune from socio-political issues facing the country. A classic example was how the Bank responded to trade and economic sanctions applied against South Africa by the international countries.

South Africa has been a commodity-based economy. For decades it led the world in the production of gold, and it played a major role in the production of other minerals as well. Hence, investments in the mining industry were of great importance. The industry was a backbone for the South African economy. Therefore, it matters that the Reserve Bank should pursue policies that would include encouraging growth in the mining sector.

The need for a macroeconomic model that included both the monetary and real sectors of the economy is obvious in a situation where monetary policy variables affect investment, economic growth and consumption. The approach in this study is the use of cointegration in a multi-equations model that includes both the monetary and the real sector of the economy. Real consumption and real investment equations will be the real sector part of the model whereas the monetary sector will be represented by the money demand and money supply equations. The inclusion of the money supply vector in the model brings with it the monetary base variable. This is one of the most important variables in that the monetary authorities have direct control over it. Hence, it becomes an effective policy variable.

The biggest single change in ways that the South African Reserve Bank conducted monetary policy was a switch from non-market policy instruments to the use of market oriented policy instruments. So, this study analyses the effectiveness of monetary policy under the two regimes – the non-market and the market approaches.

The robustness of the estimated model is analyzed starting from tests for the number of vectors predicted by the theory, the speed of adjustment parameters, correlation coefficients and persistent profiles.

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DEDICATION

To  
Rendani Rorisang Connie

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## **Chapter 1**

### **INTRODUCTION**

Studies on monetary policy in South Africa have mostly been done following the single-equation money demand system. In most cases, focus has been on the stability of money growth and prices. This study proposes the use of multiple-equation model that incorporates money market and real sector. The money market will include both money demand and money supply as a way of improving from models that only used the money demand equations. The inclusion of the money supply equation provides an important choice variable for the central bank.

Central Banks perform a critical role in the macroeconomic stability of countries around the world. Through the use of monetary variables central bankers are accredited for promoting stability in prices as well as real economic variables such as income, consumption and investments. Hence, there are studies dedicated to studying Central Bank's performance in their quests for laying good foundations for economic growth and development.

Achieving and maintaining money market stability is a noble goal. But this should be looked at hand in hand with stability in real output growth, consumption and investments. A four vector system is used to analyze the money market and the real

sector market. The four vectors represent money supply, money demand, real consumption, and real investment markets. Investment vector in this study represents the commodity market due to greater percentage of investments in that market. Seven variables in the four vectors are real consumption, real investment, real income, monetary aggregates, prices, monetary base and interest rates. A cointegration method will be used to estimate the four vectors since the variables used are cointegrated.

This approach is useful in tying the money market to the real sector of the economy. Hence, the roles of the central banks should be seen as directly incorporating the real sector as well. In cases where these markets are looked at separately, there may be a risk of limiting policy goals to maintaining the internal and external value of the currency. For example, the South African Reserve Bank receives credits for keeping inflation at desirable levels, but the growth in output and investments are accredited to sound fiscal policy by the government.

Monetary policy in South Africa is conducted by the South African Reserve Bank. This role was assigned to the South African Reserve Bank in the 1940s following the Bank Act of 1942 and since then, there have been several changes to the ways in which policy makers conduct monetary policies, (Jones and Muller, 1992). The South African Reserve Bank, as the nation's central banker, operates to serve the needs of the people of South Africa. Hence, the benefits derived from the policies enacted by the Reserve Bank should benefit the country both at macroeconomic and microeconomic levels. With the birth of a new society after the dearth of apartheid, there is a need for the policies to be more inclusive in terms of positively affecting even those who were previously alienated from the banking and financial system.

This study focuses on two monetary regimes between 1960 and 2004. There were changes in monetary policies in reaction to domestic and international economic and social changes over these years. The major change was a shift from non-market oriented monetary policies to the use of market oriented policies in the early 1980s. The success of policies is analyzed in the four proposed markets under the two regimes. This is done considering the economic difficulties that South Africa went through as a result of apartheid policies.

Despite the non-market policy instruments approach, the first regime was characterized by years of consecutive economic growth that averaged above four percent. There were massive investments in the country's urban infrastructures that went together with the development of the manufacturing sector. Mining and agricultural sectors thrived during this period. The second regime witnessed different impediments to economic growth. In the 1980s South Africa experienced trade and economic sanctions. There were disinvestments by most of the international companies as the world protested against the abhorred apartheid policies. There were civilian unrests as South Africans fought for justice in working places and schools. These were part of the factors that forced the National Party government to change policies and this led to South Africa's acceptance to the international world. Transition in the early 1990s was characterized by uncertainties as some feared that civil war could erupt. When transition proved to be peaceful, now the economy was exposed to the global financial challenges such as the Asian crises in the late 1990s.

The study also considers the contribution made by commodities to the South African economy. Commodities continue to play a major role in South Africa's

economy, though economic diversification over the past decades has reduced the country's dependence on the production of minerals. That being said, South Africa is still the world's largest producer of platinum, gold, and chromium. Also, the country is the world's fourth largest producer of diamond by value. In such economic situation, productivity is enhanced by investment in physical infrastructure and human capital. Hence, formulation and implementation of monetary policy would affect investments in the country's leading economic sectors by both domestic and foreign investors.

The bulk of consumption of the minerals (in their raw form) is the foreign market, traditionally the developed country. In recent years the emerging market has begun to tap into this commodity market, with the People's Republic of China being the fastest growing market as their economy continues to grow at a faster rate. For the simple reason that consumption of raw minerals is largely by the foreign market, this brings the question of exposure to the shocks in the global economy. The global oil crises of the early 1970s slowed down growth in most countries. As a result demand for South Africa's gold declining. The decline in gold prices in 1981 resulted in a slow down in economic growth (Franzsen, 1983).

Despite being Africa's largest economy, South Africa remains a third world country with her unique problems. In terms of infrastructure the country ranks well amongst the developed nations. The well developed infrastructure includes a highly sophisticated banking and financial system, with the stock market (that is, the Johannesburg Stock Exchange) ranked in the top 20 in terms of capitalization and accounting for more than 75 percent of African stock market capitalization (Smith, Jefferis and Ryoo, 2002). On the other hand, problems associated with the third world

manifest in the form of higher unemployment rates, high unskilled labor force, and about fifty percent of the population living below poverty line. Also, there is a very big gap in income inequality which resulted in the wealth of the country remaining in the hands of a smaller percentage of the population.

There remain still a large number of South Africans who are un-banked, though the initiatives by the banking sector to set special accounts (Mzansi project) for those with low income – including those without any form of continuous flow of income – helped to reduce the number of the un-banked. But with high unemployment levels, it remains a challenge to attract more deposits from individuals. Access to banking and financial institutions would mean that most individuals could react to monetary policy changes. For example, a fall in interest rates may encourage individuals to borrow money for consumption or investment. Through banks deposits and lending system, money circulates more when there are more lenders and borrowers involved.

Over the years, income inequality affected consumption and investments levels. A high percentage of the population living below poverty line meant that the wealth of Africa's richest economy was concentrated in hands of the few individuals. As a result, real consumption could be lower than it would be the case with equitable distribution of wealth. Equitable distribution of wealth may increase consumption, thereby stimulating growth. This is the case with the rising black middle class whose spending power has been increasingly felt starting from the late 1990s (Burger, Van der Berg and Nieftagodien, 2004).

Due to the fact that economic and trade sanctions applied against South Africa, as well as other factors affected economic growth, intervention policies were necessary.

Monetary policies implemented by the South African Reserve Bank had to consider disinvestments and trade sanctions. A fully specified model helps to analyze the effectiveness of monetary policy during this period.

Despite the above mentioned challenges facing the country, the economy seems to be taking a good shape. The economic indicators such as growth, investment, inflation are moving towards the right directions. The country is in a modest but stable rate of economic growth. There is a noticeable rise in the number of economic players in the economy. The consumer confidence in South Africa has been on the rise for months. This is due to higher demand for money (or credit) as a result of reduced cost of borrowing. The examples for rising demand can be seen in the change in demand for new cars, and the increase in the percentage of other durable goods in the market. It is a complete turn around from the 1990's where interest rates were very high - discouraging borrowers.

For countries that need foreign investments, it is recommended that they should have sound macroeconomic fundamentals. These include balanced national budget (or small deficits), lower inflation rates, stable currency, and a free market system. Van Den Heever (2001) maintains that mainstream economists and analysts buy the idea that monetary policy could best serve economic growth and development by providing a stable financial environment within which optimal economic processes can take place. From a general point of view, the South African Reserve Bank has an important role for the overall economic growth and development. Prudential monetary policy by the monetary authorities is as important as the fiscal policy for the country's economic

growth and development. In fact, the two can be looked at as complementary, though this will not be the focus for discussion for this research.

Chapter 2 provides a summary of monetary policy and economic performance literature. The focus is on the evolution of monetary policy from the 1960s and the progress made by the Reserve Bank in addressing economic issues. The goals of the South African Reserve Bank are presented as well. Other literatures on the South African monetary policy are reviewed and evaluated based on the techniques used. Having considered other studies, this study will provide a full system model that captures main macroeconomic activities in South Africa.

The third chapter presents data and empirical techniques used in the study. The first section will discuss sources of data as well as the reasons for choosing the variables to be used in the estimation of the model. This section will also give the definitions of the variables to be used in the model. A summary of descriptive data will also be presented. Section 2 provides the mathematical approach to cointegration analysis. The approach outlines the usefulness of the multiple-equations model in providing a full model that encompasses the money market as well as the real side of the economy such as output, consumption and investment.

Chapter 4 presents the argument for dividing the sampled period into two monetary regimes despite the fact that there were four Reserve Bank governors over the four decades. Changes in monetary policies during the era of these governors are discussed. Then, a detailed discussion of major economic sectors will follow. There are also domestic and international factors that affected the economy, and policy responses from authorities at the times will be discussed.

In chapter 5 the results of the estimated model are presented. First, the theoretical framework of the expected vectors is given. This is followed by the unit root tests and the estimation of vectors using the exact identified as well as the over identified system matrix. Once the exact number of vectors is found for the two regimes, the speeds of adjustment parameters are presented. Speed of adjustment parameters provide insights into what variables are responsible for bringing equilibrium in the four system equations. The robustness of the estimated model is evaluated using correlation coefficients and persistent profiles. The results in this chapter are compared with other studies done in South Africa and those done in the United States.

Chapter 6 concludes by giving a summary of the study. Based on the empirical results obtained, policy recommendations will be given. Since the study estimated a full system model the success of the approach used will be evaluated as compared to other studies. This should open ways for future researches in this field of study.

## **Chapter 2**

### **LITERATURE REVIEW**

#### **2.1. Introduction**

This chapter reviews studies done on monetary economics in South Africa. It shows different monetary policy approaches and how such approaches affect the economy as a whole. In the second section, a general background on the South African Reserve Bank's evolution over the past four decades is given. This is done with reference to how the Reserve Bank reacted to domestic as well as international changes in macroeconomics.

The third section gives the Reserve Bank's major concerns and the policies that can be employed to reach their goals. It is noted that sometimes monetary authorities set goals that conflict with those of other economic players. For example, when the South African Reserve Bank pursued policies aimed at achieving a stronger rand relative to other currencies, those in the export sectors protest about losing out on competitiveness in the export market.

In section 4, procedures on how monetary policy committee goes about their business are given. Section 5 gives details of selected studies done on South Africa's

monetary economy, and this is compare with studies done in the United States using United States data. Section 6 concludes with explanation of economic trends in selected economic variables.

## **2.2. Historical Background**

Many authors have echoed the changes that monetary policy in South Africa has undergone in the past four decades. Jones and Muller (1992) write that between 1961 and 1990 the South African banking and financial institutions experienced a revolution, and that the banking system had not significantly changed for a century before 1961. The Bank Act of 1965 was passed to give more power to the South African reserve Bank into the money supply by getting all the banking institutions under the regulatory controls of the Reserve Bank. This Act came at a time when money was increasing rapidly in the possession of institutions such as merchant banks, discount houses and general banks. Before 1965 banks did not have to meet reserve and the liquid asset requirements, as they were later to be imposed by the reserve Bank. Jones and Muller (1992) write that the 1965 Bank Act brought the following changes:

“It increased the power of the Reserve Bank to impose credit ceilings and to increase the liquid asset requirements of the commercial banks, it recognized the existence of near-money as adding to the total stock of money and this could be created by deposit-taking institutions other than the commercial banks, and it brought (all) banks into the jurisdiction of the Registrar of Financial Institutions.”  
(Jones and Muller 1992, p326)

Strydom noted that from the 1970s until the submission of the De Kock Commission in 1985, monetary policy consisted of direct controls<sup>1</sup>. Measures such as controls implemented in the form of credit ceiling were taken with the purpose of controlling monetary growth in the monetary aggregate, hence, the tool to maintain price stability. Strydom has also noted how the controls were used:

The cash reserve requirement was a variable deposit of banking institutions with the (South African) Reserve Bank. The liquid asset requirement forced banks to invest in liquid assets that the Reserve Bank could alter from time to time. These assets comprised Reserve Bank notes, coin, gold coin, cash balances with the Reserve Bank and a larger number of financial assets such as Treasury Bills, government stocks, bankers' acceptances and trade bills. (Jones and Elgar, 2002).

In total, there have been five monetary policy regimes from the 1960 to the present (Aron and Muellbauer, 2001). Though the regimes are listed as five, there is an economic argument to divide them into two<sup>2</sup>. The regimes are summarized in Table 3 as follows;

Table 2.1: Monetary Policy Regimes

Years	Monetary Policy Regime
1960-1982	Liquid asset ratio-based system with quantitative controls on interest rates and credit
1983-1985	Mixed system during transition
1986-1998	Cost of cash reserves-based system with pre-announced monetary targets (M3)
1998-1999	Daily tenders of liquidity through repurchase transactions (repo system), plus pre-announced M3 targets and targets for core inflation
2000-	Repo system with inflation targeting (CPI-X)

Source: Aron and Muellbauer (2001) with some modifications

<sup>1</sup> This is the section on monetary policy written by Strydom and published in Jones and Elgar (2002).

<sup>2</sup> Chapter four gives details for the argument in support of categorizing the regimes into two.

In the 1960-1982 regime, liquid-asset ratio-based system meant that banks could lend to borrowers based on the ratio of liquid assets to required liquid assets. If there was an increase in the bank liquid assets relative to required liquid assets it meant that the bank could exchange their liquid assets for cash so that they could extend credit to borrowers. Under this practice, to reduce credit lending by banks (that is, reducing money supply) the Reserve Bank would have to increase the required liquid assets. This would force banks to reduce their lending in order to meet the required liquid assets set by the authorities.

Quantitative controls on interest rates and credit meant that banks could not set their own lending rate, and therefore the entire interest formation was directly controlled by the Reserve Bank. Also, The Reserve Bank could place a cap on the maximum amount that banks could lend. Such a practice constituted what is referred to as non-market monetary policy instruments in macroeconomic literature.

Botha (1997) argues that most controls were introduced by Dr. De Jongh who was the governor of the South African Reserve Bank from 1967 to 1980. That was done as an effort to contain the relentless increase in money supply. Botha summarizes the events surrounding controls as follows;

[de Jongh] implemented a series of additional direct controls such as ceiling to advances, deposit rate controls, exchange control, import deposits – the latter two being especially important in an import prone country – and some direct consumer credit controls. This had been done to contain the increase in the money supply and was naturally resented by the banking sector and all that were affected by one or other of these measures (Botha, 1997).

In the 1960's the amount of money in the possession of the banking sector (that is, the merchant banks, discount houses and general banks) was growing at an

unprecedented rate. The monetary authority was in no way able to deal with the challenges of the rapid growth in money. By introducing the asset ratio-based system the authority wanted to reduce the ability of the commercial banks to gather together resources and increase the supply of money to the non-bank public. Jones and Muller (1992: 326) write that “direct controls were used until the end of the decade (1970s), without satisfactory results, as the banking sector kept on finding ways around the controls”. Hence, the monetary authority had to come with a different policy action.

It was not until 1985 that the De Kock commission submitted their findings and recommendations about monetary policy in South Africa. The recommendations could be justifiably summed as a move towards the use of market oriented policy instruments. Recommendations by the De Kock commission were implemented as from 1982, but the controls of the first regime were not yet completely faced out. It was for this reason why the period 1982 – 1985 is referred to a mixed system regime.

Based on the first report of Dr. Gerhard de Kock Commission of Inquiry into the Monetary System and Monetary Policy in South Africa, the authority introduced a mixed system. During this period (1981-1985) the authority removed some direct controls, as well as bank credit ceiling. A cash reserves-based system was introduced as some of the controls were being removed. The success of the system (if ever it was to succeed) was interrupted by political instability and the reaction of the international communities in dealing with the South African governments. Economic sanctions were intensified and the exchange controls were introduced to counter disinvestment from South Africa. The goal was to tackle the balance of payments problems at the cost of addressing inflation that was running in the double digits.

From 1986 to 1998 cost of cash reserves-based system with pre-announced monetary targets (M3) was introduced. This period covers the part of the apartheid regime and the democratic government era that started in 1994. Under both regimes, the M3 targets were rarely met and as such no conclusions could be made on the success of monetary aggregates targeting policy. However in 1998 the policy shifted to “Daily tenders of liquidity through repurchase transactions (repo system), plus pre-announced M3 targets and targets for core inflation”. This was just a transition period before the introduction of the repo system with inflation targeting in 2000.

For decades the South African Reserve Bank maintained that its role would be to protect the internal and the external value of the currency. Hence, lower inflation rates and a stable rand exchange rate were more desirable for the Reserve Bank. This is the duty that the Reserve Bank has to perform independent of the government influence. Since its establishment in 1921, the South African Reserve Bank has always been independent. It is the fourth central bank outside Europe and by the turn of the century it had more than 700 shareholders. Its shares are listed in the Johannesburg Stock Exchange and there is a restriction that no individual shareholder can hold more than half percent of the capital of the Reserve Bank. The Reserve Bank has a board of 14 directors where seven are appointed by shareholders to represent them in the board. The remaining seven, including the governor, three deputy governors and three part-time directors are appointed by the president (Stals, 1997).

The mission statement to protect the internal and external value of the rand (as stated by the South African Reserve Bank in 1989) was later enhanced by adopting an

inflation targeting regime in 2000 (Moolman and Du Toit, 2004)<sup>3</sup>. The target was initially to mean the annual average inflation. But in November 2003 amendments were made to keep inflation target month to month, leaving no room for inflation to deviate from the target in any given quarter. From September 2003 to December 2004 the CPIX inflation remained within the target range.

Why should central banks dedicate much of their effort to studying inflation? The main reason should be the destabilizing effects of high inflation in the economy. The effects translate to undesirable effects on real variables such as output growth, consumption and investments. There is a general consensus in most economic literature on the fact that high inflation erodes the purchasing power of the currency. Countries that have experienced hyperinflation have also suffered from significant reduction in the value of money held by their people. Higher levels of inflation turn to have negative effects on consumption and national income. This should be one of the reasons why some economists devote much of their time to the study of the causes and effects of inflation.

Barro (1998) found a very strong relationship between money growth and inflation when using a cross-sectional data for selected developed and developing countries. His findings can be true also for a South Africa's time-series data. Inflation – a continuous rising price level – cannot take place without a continuous rising money supply (Ekelund & Tollison: 1994).

Historical economic events also show that rising oil prices is likely to lead to rising inflation. “OPEC raised oil prices in the mid-1970s, pushing the inflation rate (in

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<sup>3</sup> When the inflation regime was announced in 2000, inflation was still averaging above 8 percent. The target of between 3 and 6 percent inflation was not met until 2003 due to external shocks such as the worst depreciation of the rand in 2001 and 2002.

the United States) up to about 10 percent (Mankiw, 1999). Hence, any oil-importing country will be susceptible to such shocks. The rising inflation was accompanied by high unemployment that reached its highest level in 40 years by 1982 and 1987.

Not much evidence in economic literature suggesting that a particular country's inflation will follow the pattern of its major trading partners. Even if its inflation may follow the trends of its major trading partners, we could not conclude anything about causality. Gujarati (1999) maintains that statistical relationship, however strong and however suggestive, can never establish causal connection. However, for a country that depends much on foreign capital goods, substantial rise in their prices may lead to a rise in the domestic prices.

Zimbabwe is one of South Africa's major trading partners in the region. But the countries have of late grown more widely apart as far as their inflation levels are concerned. Reserve Bank of Zimbabwe has raised the overnight interest rate to 850 percent to try to reduce inflation which has reached a record high of 1043 percent in April 2006 (Sguazzin, 2006). Meanwhile inflation in South Africa has fallen and the CPIX remained well between 3 and 6 percent South African Reserve Bank target since 2002.

### **2.3. Reserve Bank's main concerns**

The South African Reserve Bank is concerned about price stability in the economy. There seems to be an agreement in macroeconomic and monetary economic literature that inflation is costly. What may not be very clear is the level at which inflation becomes more costly or "really bad" for the economy. Studies in monetary

economics do not advocate for zero inflation rates, but they indicate the importance of keeping inflation low.

Some economists argue that a single digit inflation target for a developing country might not be appropriate, let alone the three to six percent target by South Africa. According to United Nations Development Program (2006) on South Africa, a higher, but stable inflation would be good for growth and to deal with the problem of unemployment. The report further argues that “demand-pull inflation, resulting from a process of economic expansion, was positively associated with growth as long as the inflation rate remained moderate”. This sub-section will briefly discuss the costs of inflation and also how the South African economy is affected by this inflation levels.

There are a number of easily identifiable costs of inflation and their severity in terms of how they affect individual and business economic agents differs. First, is the shoe-leather cost of inflation where individual consumers and businesses face the cost of making frequent trips to the banks when trying to holding significant amount of currency or shifting their funds from interest-bearing assets into money (Hubbard, 2000). The shoe-leather cost is regarded to be very small in the literature. However, in an historically polarized economy like South Africa, the shoe-leather cost may be substantially high to some segments of the society. As stated in the introduction chapter, there remains a large segment of the population without access to the banks. In such cases money will lose its value in the non-bank hands since those who do not have access to banks will just keep cash in their hands. Those who are willing to “walk” the distance to the far away bank will literary have to face a higher shoe-leather cost.

Secondly, Romer (2001) argues that the other “readily identifiable cost of inflation is that nominal prices and wages must be changed more often, or indexing schemes must be adopted”. This is what is commonly known as the menu cost where the prices are rising more often and the restaurants incur the costs of printing new menus time and again (Abel and Bernanke, 2001; and Mankiew, 2000). This kind of cost is almost certainly small, especially in this era of much advanced technology used in all forms of business transactions. A classic example is the changing of price tags on a newspaper print or magazine which requires very minimal effort to do.

The third cost is with regard to tax system. Inflation distorts the tax system and it is agreed that the cost of inflation due to tax distortion is noticeably large (Hubbard, 2000 and Romer, 2001). In economies where personal income and company tax systems are progressive, inflation accompanied by a rise in nominal incomes earned by individuals and business may push some groups of individuals and businesses to a higher income bracket level. Based on the increase on their nominal income earnings they may be expected to pay higher taxes though their purchasing power (or real income) has not risen. South Africa has adopted a progressive income tax, and as such periods of high inflation accompanied by increase in nominal wages would result in some income groups pushed to the higher income tax bracket.

There is also the effect of expected inflation that South Africa is concerned about. If people expect prices to be too high in future they may decide to spend most of their income now when prices are still low. This will have bearings on the country’s private savings relative to their incomes. Future consumption suffers and current investments level may be affected due to low savings rates. However, with inflation expected to be

low and stable, prices are fairly predictable and this helps consumers in their planning for future consumption. It may be good for them to delay some purchases knowing that prices will not be too difficult from their present state. In situations faced with hyper inflation, wages are spent almost entirely on the day they are earned because prices changes significantly from day to day.

Those with fixed salaries suffer more than those whose salaries are adjusted to inflation changes if the country is faced with high inflation rates. In most cases it is the low-income groups and pensioners whose income are low and mostly fixed.

The South African Reserve Bank summarizes the disadvantages of inflation as follows<sup>4</sup>;

- (i) distorting the allocation of resources and often directs the efforts of entrepreneurs and investors into hedging operations instead of productive activity;
- (ii) discouraging saving: people spend money now rather than save for investment and future consumption if the expected value is much less;
- (iii) discriminating against fixed salaried workers, pensioners and low-income earners who cannot protect themselves against the impact of inflation; and
- (iv) usually leading to an even more unequal distribution of income and wealth.

## **2.4. Monetary policy operation procedures in South Africa**

Just like in any branch of economics, in monetary economics objectives are set with the aim of achieving specific economic goals. There is however, a difference in how directly such goals are achieved in the monetary policy arena as compared to the fiscal policy field. With the implementation of fiscal policy, the authorities may simply implement public spending in the economy by directly increasing financial resources, or

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<sup>4</sup> See the Statement to Monetary Policy by Governor T. T. Mboweni: April 6, 2000 (<http://www.reservebank.co.za/>)

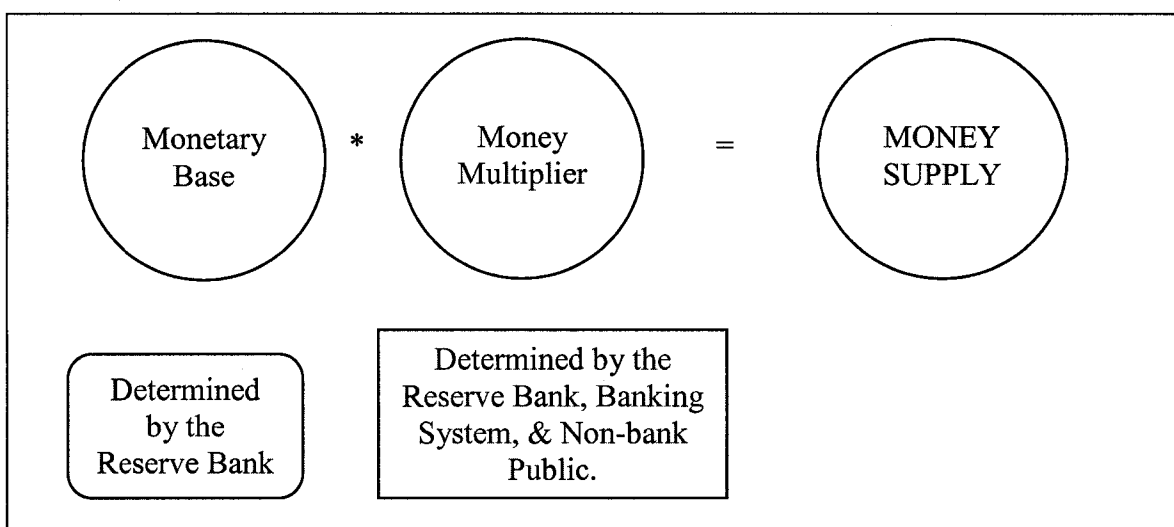
may decide to redistribute wealth from one economic sector to the other by increasing taxes in one sector and giving tax breaks to the other.

While taxes and government spending can be directly controlled by the authorities, the South African Reserve bank cannot directly control the variables considered for policy making. Walsh (2003:429) writes that “central banks do not directly control the nominal money supply, inflation, or long-term interest rates... Instead, narrow reserve aggregates, such as the monetary base or the federal funds rate in the United States, are the variables over which the central bank can exercise close control”. An understanding of what instruments are directly under the control of the Reserve Bank will help the Bank to optimally choose the targets that will ultimately lead to achieving policy goals.

The South African Reserve Bank rarely mentioned policies aimed at addressing deviations of unemployment from its natural rate. Their main concern remained keeping inflation under control. It is their policy goal. The Reserve Bank operating targets (as a link between targets and goals) would be to achieve a measurable level of bank reserves, a monetary index that includes an interest rate and the exchange rate, or the interest rate on over-night loans that commercial banks charge each other. The instruments of choice would be the interest rate that the Reserve Bank charges on reserves borrowed by the commercial banks (known as the repo rate in South Africa), the level of reserve requirement ratios determining the reserves commercial banks must hold against their deposits liabilities, and the composition of the Reserve Bank’s balance sheet (Walsh 2000).

It is important to note that there are three noticeable players in the supply of money in the economy (Hubbard, 2000). In this case the players are the South African Reserve Bank, the banking system and the non-bank public (see figure 2.1 on the role they each play).

Figure 2.1: Money Supply process



Source: Hubbard (2000) and Walsh (2003)

Although the Reserve Bank does not have the full control over the supply of money, it surely has the greater impact as compared to the other two players – the banking system and the non-bank public. Note that the Reserve Bank has the direct control over the monetary base. Monetary base is here defined as the sum of money in the non-bank public plus the reserve money held by the central bank (Hubbard, 3001 and Walsh, 2003). It is the sum of currency in circulation plus reserves. In South Africa it

equals notes and coin in circulation outside the South African Reserve Bank plus required reserve balances and deposits of banks with the Reserve Bank (Mollentze, 2006)

Given the above analysis, what follows here is how the Reserve Bank operates in recent years. The Reserve Bank's Monetary Policy Committee (MPC) meets and after their discussions they release a monetary policy statement. MPC meetings are shown in table 2.2 below.

Table 2.2: Monetary Policy Committee Meetings and Announced Interest Rates

<b>MPC Meeting</b>	<b>Repo rate</b>	<b>Prime rate</b>
January 13, 2000	11.75	14.5
March 2, 2000	11.75	14.5
April 6, 2000	11.75	14.5
May 19, 2000	11.75	14.5
June 16, 2000	11.75	14.5
August 11, 2000	11.75	14.5
September 21, 2000	11.75	14.5
October 16, 2000**	12	14.5
November 16, 2000	12	14.5
January 19, 2001	12	14.5
March 16, 2001	12	14.5
April 25, 2001	12	14.5
June 14, 2001	11	13.75
July 26, 2001	11	13.5
September 4, 2001	10	13
September 20, 2001	9.5	13
November 15, 2001	9.5	13
January 15, 2002**	10.5	14
March 14, 2002	11.5	15
June 13, 2002	12.5	16
September 12, 2002	13.5	17
November 20, 2002	13.5	17

<b>MPC Meeting</b>	<b>Repo rate</b>	<b>Prime rate</b>
March 20, 2003	13.5	17
June 12, 2003	12	15.5
August 14, 2003	11	14.5
September 10, 2003**	10	13.5
October 16, 2003	8.5	12
December 8, 2003	8	11.5
February 26, 2004	8	11.5
April 22, 2004	8	11.5
June 10, 2004	8	11.5
August 12, 2004	7.5	11
October 1, 2004	7.5	11
December 9, 2004	7.5	11
February 10, 2005	7.5	11
April 14, 2005	7	10.5
June 9, 2005	7	10.5
August 11, 2005	7	10.5
October 13, 2005	7	10.5
December 8, 2005	7	10.5

*Source: South African Reserve Bank website and the MPC statements*

At the end of their meetings, the MPC announces the repo rates (one of the instruments that they have direct control over) effective the following day, and the commercial banks adjust their prime lending rates at the end of the month (see Table 4).

The MPC meeting dates are announced for the whole year before the start of the new calendar year. But there are special meetings that the MPC can be called for and for the period observed, such meetings always brought changes in the repo rates. The special MPC meetings were first, on the 16<sup>th</sup> of October 2000 when the repo rate increased by 25 basis points from 11.75 to 12. The second special meeting was on the 15<sup>th</sup> of January 2002 and the repo rate increased significantly from 9.5 to 10.5. Finally, on the 10<sup>th</sup> of September the meeting resulted in a fall of the repo rate from 12 percent to

11 percent. There were no reported special MPC meetings in 2004 and 2005. Also, in the last two years the repo rate has fallen from 8 to 7 percent.

The announced meetings and the publicly declared inflation rate targets by the Reserve Bank authorities have earned them credibility with the public.

## **2.5. Approaches to monetary policy studies in South Africa**

Most of the studies done in the past followed the structural single-equation models in their design for monetary policy, and this includes empirical works done to show the important role played by money demand stability in macroeconomics models. This sub-section will present the works done by Moll (2000), Moolman and Du Toit (2004), Van den Heever (2001), Wesso (2002), De Wet, Jonkergouw and Koekemoer (1995) and Van der Merve (1999). For the purpose of comparing South Africa's monetary policy with that of the United States, reviews of the studies done by Cutler, Davies, and Schmidt (1997) and Schmidt (2003) will be given. The following main points will be considered: objectives of the studies, data, econometric techniques, and the authors' respective results and implications.

Moll (1999) conducted an empirical study on broad monetary aggregate (M3) targeting by the South African Reserve Bank, and how M3 targeting is connected to prices and other real economic activities. This study tested for cointegration in the data used. He wanted to test the prediction that there exists a relationship between money

demand and variables such as nominal and real income, real consumption and real investment. This was done by examining the rationale behind M3 targeting in South Africa.

Moll's study was conducted using the single equation models. First, he tested the stationarity between money demand and real output by using cointegration. The following two equations were constructed:

$$m - \beta_1 y - B_2 r = \varepsilon$$

$$(m-p) - \beta_1 (y-p) - B_2 r = \varepsilon$$

where  $m$  is monetary aggregate,  $p$  is price level,  $y$  is GDP,  $r$  is the interest rate,  $\beta_1$  and  $B_2$  are coefficients, and  $\varepsilon$  is the disturbance term. He says that all the variables are in natural logarithms. Having rejected the null hypothesis for cointegration, the study opted for first differencing of the data. Moll used the "St Louis" formulation;

$$\Delta y_t = \alpha + \sum_{i=1}^8 \beta_i \Delta y_{t-i} + \sum_{i=1}^8 \gamma_i \Delta f_{t-i} + \sum_{i=1}^8 \delta_i \Delta g_{t-i} + u_t$$

where  $y$ ,  $f$  and  $g$  are the natural logarithms of real/nominal activity variable, financial variable and government expenditures';  $B$ ,  $\gamma$  and  $\delta$  are the coefficients to be tested; and  $u_t$  is the error term.

The paper used quarterly data from 1960 to 1996. The source of the data was the South African Reserve Bank Quarterly Bulletin published by the South African Reserve Bank. Variables used in the model were: currency, M1, M3, credit, nominal and real income, real consumption, real investment, inflation, interest rate, and real exchange rate.

The following conclusions were arrived at;

- "monetary aggregates have little or no influence over future real activities"

- “changes in monetary aggregates have no impact upon private consumption, gross investment, or private business investment”
- “the Reserve Bank determined discount rate and other interest rates contained information about future real income and other measures of real activity in South Africa”

Moolman and du Toit (2004) gave an analysis of the influence that monetary policy has on inflation, and also suggested optional policy instruments that could be used to deal with inflation problems. They summarized the objectives on their study as;

- (i) to analyse the influence of monetary policy on inflation, (ii) to suggest alternative policy instruments with which inflation can be addressed, (iii) to analyse the influence of foreign prices and the exchange rate on inflation, (iv) to determine the role of the labor market on inflation, especially through wage-push dynamics and (v) to determine the role of demand-pull factors on inflation.

They used annual data from 1975 to 2000 and applied the Layard-Nickel, mark-up pricing in their South African based price-setting to model. The variables used were: consumer price index, production price index, user cost of capital, wage productivity, price of imports, capacity utilization, excess demand, international position, and Rand-US\$ exchange rate.

The study applied the Johansen’s cointegration technique to determine the number of cointegrating relationships and to estimate the following equations;

$$P^p = f((W/product), r)$$

where  $P^p$  is producer price,  $W$  represents nominal wage rate, product represents labor productivity and  $r$  is nominal user-cost-of-capital.

$$P^c = f(p^p, p^m, GDE/GDP)$$

The above equation is based on theoretical exposition that stated that  $P^c = f(p^p, t^i, p^m)$  where  $P^c$  is consumer prices,  $t^i$  is indirect taxes and  $p^m$  is import prices on consumption goods. GDE/GDP (gross domestic expenditure relative to gross domestic production in nominal terms) captures the demand pressure effects in the economy (Moolman and Du Toit, 2004).

They found that “the long-run equilibrium level of consumer prices in South Africa is determined by domestic production prices as well as the prices of imported goods”.

The authors concluded that the monetary authorities can be successfully used to curb inflation if there is disciplined monetary policy. Also, they found that there are other ways (for example, tax policies) that can be used to reduce inflation. Their other findings were: “Wage increases, relative to productivity growth, exert the most pressure on production prices, and consumer price inflation is primarily driven by increases in the production prices, which has a larger influence on consumer prices than the imported prices of consumer goods”. Finally, high degree of openness contributes to inflation in South Africa.

In a non-technical paper Van den Heever (2000) gave background to and the rationale for inflation targeting in South Africa. He sited the need for price stability and that inflation in South Africa should be brought down to the level of the major trading partners. Inflation targeting would enhance the credibility of the Reserve Bank if the monetary authorities remain accountable to their targets. The inflation target of 3 to 6 percent was announced on February 23, 2000. South Africa’s major trading partners have been the European Union, Japan and the United States, and all these countries have

relatively low inflation compared to South Africa. It would be quite a task to achieve their level of inflation rates, given the different economic conditions such as unemployment rate that is above twenty percent in South Africa.

Van den Heever (2001, p176) concluded that “economic policymaking is becoming more transparent and subject to more accountability and technical rules, and less susceptible to discretionary actions”. The government and the Reserve Bank can publicly commit to same inflation target. The main cost of this program may be that the monetary authority risks overlooking other important role they are to play, namely, to stabilize output.

A study by Wesso (2002) used a fixed-coefficient error-correction representation and the varying parameter regression approach. The study used the following variables: money stock ( $m$ ) data which are the weighted averages of monthly observations, real GDP, real prices, consumer price index which excludes mortgage interest rates and interest rates. He also performed the unit root test to provide some guidance on whether the variables in the analysis were stationary or non-stationary. Like most of the macroeconomic time series data, the data was found to be non-stationary according to the ADF tests.

A single-equation error correction method was used and the representation of the M3 money demand equation was as follows:

$$(m-p)_t = 1.84y_{t-1} - 2.84I_t - 5.11(s-own)_t$$

where  $m$  is weighted averages of the monthly M3 demand,  $p$  is consumer price index, excluding mortgage interest rates,  $y$  is gross domestic product,  $I$  is long-term nominal interest rate (ten-year government bond yield),  $s$  is short-term nominal interest rate, and

finally, *own* is a weighted average of short-term, medium-term and long-term deposit rates (own rate of return on M3 holdings).

From the results of this single-equation estimate, Wesso concludes that:

... there is considerable variation in the income coefficients, reflecting the declining income velocity of money, the interest rate coefficients of the demand for M3 are remarkably stable. Even though the relationships investigated were not completely stable, much of the instability seemed to be evolving over time. That is, the changes in the long-run income coefficient appear to occur gradually. This observation suggests that the modeling strategy that allows the parameters to vary over time (rather than holding them constant) would better explain a money demand equation and therefore improve its forecasting ability... The nexus between monetary policy and the stability of money demand has not been removed by the switch to inflation targeting, and the debate about the stability of the South African money demand remains relevant. Long-run causality from money growth to price inflation may exist due to an accommodating monetary policy or the use of inflation targeting by the monetary authority, but the long-run stability of money demand may be affected by the changes and turbulence evident in the financial sector since the 1990s. (Wesso: 2002).

These conclusions highlight the importance of finding the stability of money demand even when the monetary policy's position is to focus on inflation targeting. However, there should be improvements on the estimation methods, and this can be done by using the multivariate equation that do not just estimate money demand, but includes money supply and the real sector equations in their estimations.

De Wet, Jonkergouw and Koekemoer (1995) did a study on the impact of monetary policy instruments changes on the money supply. Their study showed a move from the use of liquid-asset as policy instruments to the use of bank rates. Though liquid-asset ratios are no longer used for policy instruments, they are still important to ensure that banks do not become insolvent.

The authors developed a model that shows "how the various market-oriented policy instruments can be applied to influence the ability of the banking sector's extended

credit and eventually the supply of money, given the various reserve requirements and the demand for money". They evaluated the effectiveness of the policy instruments and provided empirical results on the success of the policies.

Their paper indicated that there are two main factors determining the supply of credit and money. The first one is the level of economic activity which is measured by gross domestic product. There is a positive relationship between money supply (and credit) growth and increase in economic activities. The other factor is the profit that commercial banks make when they extend credit to the borrowers.

How much banks can lend is limited by the amount of free liquid assets which can be exchanged for cash at the Reserve Banks' discount window. This is measured by the ratio of liquid assets to required liquid assets, such that an increase in liquid assets relative to required liquid assets means that banks can use the discount window to exchange their liquid assets for cash, and lend to borrowers. On the contrary, an increase in required liquid assets relative to liquid assets means that banks will have to reduce their lending activities in order to meet the required liquid assets.

The liquid assets requirements, open-market operations and public debt management are not really the controls of the credit and money supply. De Wet, Jonkergouw and Koekemoer (1995) say that this is because the Reserve Bank is always ready to lend to commercial banks should the need arise. For example, as a lender of last resort, the Reserve Bank will lend money to banks regardless of their liquid asset status. Therefore, the bank rate is the only control (brake) on the money creation process. The bank rate is the cost of borrowing money from the Reserve Bank by the commercial banks. So, if the cost of borrowing is too high, banks will pass the cost to the borrowers

through the lending process in order to be able to make positive profits. It is the increase in the bank's lending rates that raise the whole interest rate composition, thereby reducing the demand for credit and money.

De Wet, Jonkergouw and Koekemoer summarize the process as follows;

The economic agents who have a demand for credit and money, will demand less money to hold and therefore less credit as a means to obtain money as a store of value, when they expected economic conditions to improve, and more when they expect economic condition to slow down. When they expect economic conditions to improve, economic agents will dispose of money (liquid assets) in order to obtain the non-liquid assets needed to profit from the expected more buoyant economic environment before the prices of the non-liquid assets increase substantially, (De Wet, Jonkergouw and Koekemoer, 1995).

On the empirical side, the study employed a single equation technique using the ordinary least square method. They used data from 1986 to 1992 to estimate their model. In their policy reaction tests they found that "a sustained one percentage point increase in the bank rate lowered the level of the time-path of the money supply and that this reduction reached about one percent after six years". Their finding supports the theory regarding the expected direction of influence of increase in bank rates.

Van der Merwe (1999) researched on monetary policy operating procedures in South Africa. His paper maintains that the ultimate goal of monetary policy in South Africa is to create sound financial environment as a requirement for sustainable real economic growth. There is continual observation on the economy since real economic growth in this case is measured over the medium and long term. Stable financial system, for example, is when the economy has a low inflation rate that has little weight on the decisions made by economic players in terms of investments, production, consumption and trade.

Money supply is used as an intermediate objective of monetary policy by the Reserve Bank. Van der Merwe (1999) argues that “[t]he rationale for using money supply as an intermediate objective of monetary policy is that the growth in money supply is a vital process in the process of inflation, the greater predictability of monetary policy assists the private-sector enterprises in reaching business decisions and it provides a yardstick against which the actual performance of monetary policy can be judged”.

His study indicated that the bank’s liquid asset requirements were the basis of monetary policy in South Africa from mid 1960s to the early 1980s. But later bank rates were introduced. This is in accord with the study by De Wet, Jonkergouw and Koekemoer (1995). Some of the benefits of the market approach used by the Reserve Bank now are “a quicker response in shorter-term interest rates to changed liquidity conditions and an improvement in the transmission process of monetary policy; and greater flexibility in money market interest rates with enough safety valves to prevent undue volatility in interest rates”.

Given the approaches used on studies done on the South African economy, a brief review on the studies done on the United States economy would help in terms of comparison and improving the estimated models.

There have been reasons given on the lack of cointegrating relation between money aggregates, real income and interest rates in the United States economy. Hence there have been ongoing studies using improved methods in an attempt to get better results. There are studies that used M1 where the money market is imbedded in a system that has consumption, and investment markets (Cutler, Davies, Rhodd and Schwarm, 1997; and Schmidt, 2001). These approaches carried on from earlier works developed by

King, Plosser, Stock and Watson (1991) where their model included real GDP, consumption, investment, real money balances, nominal interest rates and inflation.

Cutler et al (1997) included consumption, investment, ex-post real interest rates and imports in their estimated system that had seven cointegrating variables. Schmidt (2001) and Schmidt (2003) introduced money supply vector into the system. He finally had four cointegrating vectors. The real sector side of the model had consumption and investment vectors and the money market had money supply and money demand vectors. This was significant in that money supply enters the system with a unique variable (monetary base) which is an important variable choice for monetary policy.

The developments mentioned here enabled Cutler et al (1997) and Schmidt (2001) to construct a more complete system on their separate works. The former had the following vectors; consumption, investment, real money demand and imports. The four vectors represent separate markets, which are however cointegrated.

The empirical work done for these papers included testing for the cointegrating vectors and parameter values. The cointegrating vectors are those listed above. This way of estimating money models improved the results. For example, Schmidt (2001) found results that supported the relations between money market and the real sector. As the theory predicted, the real income coefficients in his model were much closer to one.

This study will follow the approach used by Schmidt in constructing a complete money market system for the South African economy.

## 2.6. The long-run economic trends

Economic growth in South Africa has been characterized by upwards and downwards swings over the past five decades. On the other hand, population has been growing at a somewhat constant rate. This meant that the periods of economic slow down saw declining GDP per capita. Table 2.3 gives five year averages for population and gross domestic product (GDP). The table shows that the total population has more than doubled, from an average of 18, 426 418 in 1960-1964 to an average of 45, 114 022 in 2000-2004. From 1960 to 1999 the population grew at a rate above 2 percent, but it started declining significantly in the beginning of the 21<sup>st</sup> century.

Table 2.3: Some Social and Economic Indicators

Year	Total Population	Population growth (annual %)	GDP (constant 2000 US\$ml.)	GDP growth (annual %)	GDP per capita (constant 2000 US\$)	GDP per capita, PPP (constant 2000 international \$)
1960-1964	18426418	2.71	43029.27	6.33	2330.78	..
1965-1969	20714818	2.17	59226.94	5.84	2855.56	..
1970-1974	23132280	2.25	73873.16	4.37	3191.19	..
1975-1979	25819556	2.15	85102.60	2.13	3296.16	10563.02
1980-1984	29006370	2.49	99629.82	2.97	3436.78	10996.40
1985-1989	32916260	2.46	105725.02	1.50	3212.09	10257.23
1990-1994	36716174	2.09	109866.86	0.20	2994.78	9427.80
1995-1999	40973894	2.29	122564.68	2.59	2991.41	9384.55
2000-2004	45114022	1.64	141368.32	3.39	3132.44	9864.33

Source: Averages were obtained using data from World Development Indicators 2005

.. Data is not available.

Table 2.3 also indicates that by 2000-2004, GDP had grown more than three times from its 1960-1964 levels. However, there were years of serious recession, to be

specific, from 1990 to 1992. But the economy bounced back in 1993 with a growth rate of 1.23 percent and a significant growth of 3.23 percent in 1994. Hence, the five year average growth in the early 1990s was a scanty one-fifth of a percentage. The slowdown in economic growth in the early 1990's is reflected in the GDP per capita as well. GDP per capita fell on average for the 1990-1994 and 1995-1999 periods. Taking into consideration that the late 1990's and the early 2000's witnessed a rapid weakening of the rand, the table includes GDP per capita in purchasing power parity (PPP). Still, the data support the fall in GDP per capita which shows that the fall was not just to the dollar denominated income. GDP per capita grew by an impressive average of 3.39 in the period 2000-2004. This coincided with the slowdown in population growth which remained below the 1985-1989.

#### Growth patterns for selected variables:

This subsection gives graphical presentations of growth patterns for real growth domestic product (GDP), real investment, real consumption, monetary aggregates (M1 and M2), and consumer price index (CPI) using annual data for the period 1960 to 2004. The data has been differentiated to see how the above variables revert to their mean over time. A brief description of the monetary policy actions taken in different periods will be given.

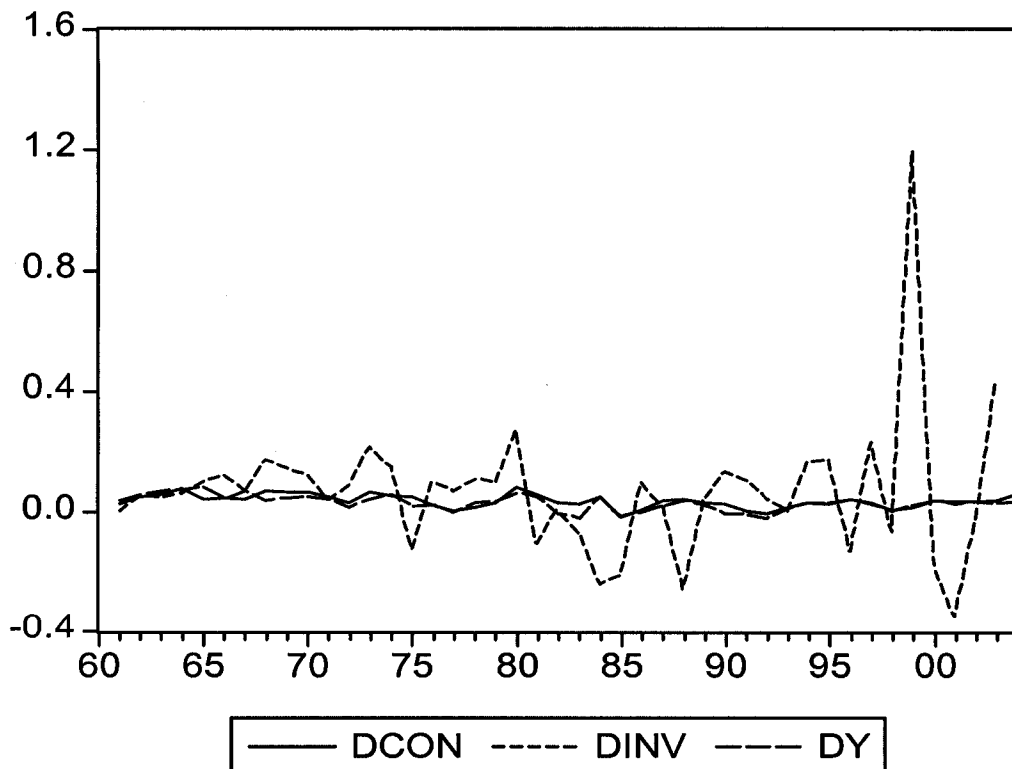
The following are the names of the abbreviations of the variables used:

DY = Gross Domestic Product (GDP), DCON = Consumption, DINV = Investment, CPI = Consumer Price Index, DM1 and DM2 = Monetary Aggregates

GDP and final consumption of goods and services move together for the sampled period. It is a steady growth pattern although there are periods decline in both economic growth and consumption. This is shown in figure 2.2 below.

Consumption followed income pattern which might be an indication of how South African consumers adjusted to changes in income growth. This is important to note since the country had to rely mainly on goods and services produced domestically, in particular, during the years of trade and economic sanctions.

Figure 2.2: Growth, Consumption and Investment Pattern



One important note to make is that the South African economy indirectly hit by oil shocks of the early 1970s experienced by the world economies. A decline in global demand affected South Africa's exports, and therefore some minor effect on real income. Hence, there are no noticeable shocks in consumption and national output during that period. The GDP grew at a steady rate and so did consumption. There was less dependence on foreign sources of oil by South Africa. The country used synthetic fuel processed from coal. Since South Africa was one of the leading producers of coal, there was no major effect on the oil used in the country. The gas-to-liquid technology that originated in Germany in the 1920's benefited South Africa in terms of transfer of technology. This technology was developed much further in South Africa to meet the rising fuel demand by the time when sanctions were imposed to South Africa (Voss, 2006).

The 1980s witnessed a decline in investment in the economy. It was the longest decline in investment, covering the period from 1980 to 1989. It was during this period when the international business community withdrew their capital from South Africa, and foreign investment stopped. As an attempt to minimize the effect of disinvestment by the international business community, South African Reserve Bank introduced a mixed system to control capital. It was a dual exchange rate system meant to encourage investment in the country while discouraging disinvestment.

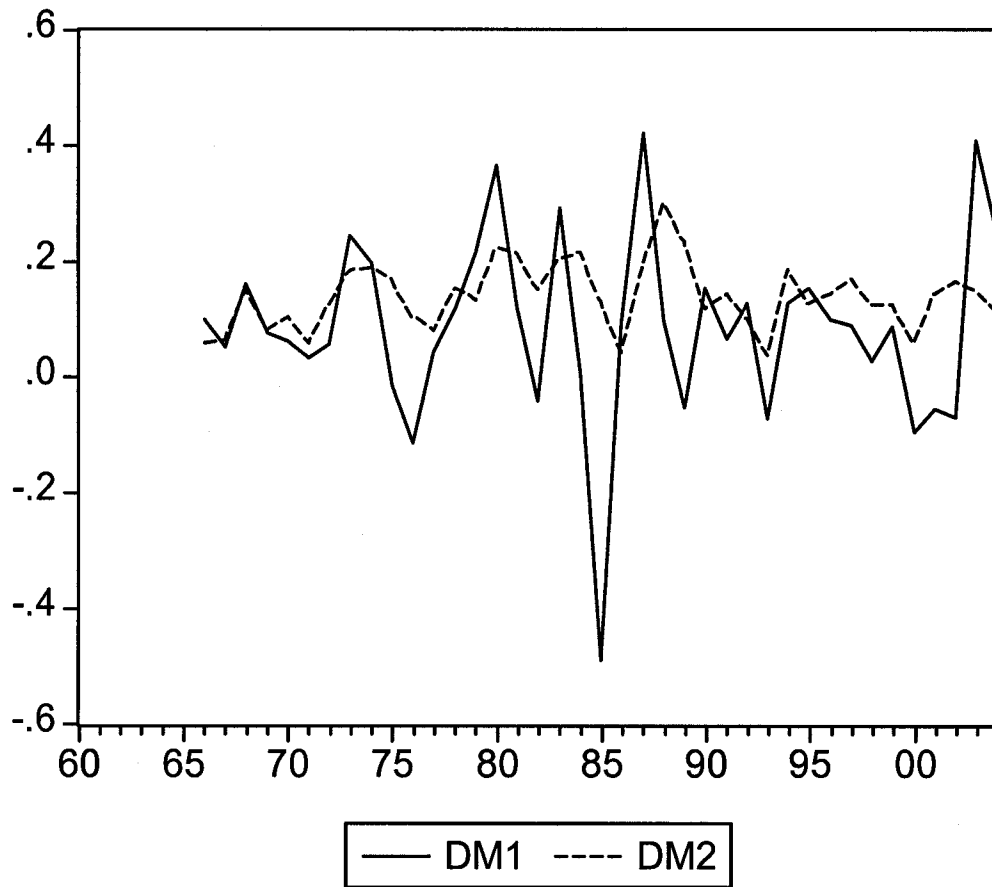
The brighter part of South Africa came in the mid 1990s following President F W De Klerk's initial announcement in 1990 that all banned political organizations would be allowed to operate freely as the country moved to be democratic government. He also promised to release political prisoners. With the prospects of a new multi-party, non-

racial South Africa, the international community started to welcome the country into the international arena. Hence, early 1990s witnessed a slow but steady increase in investment. A sharp rise in investment was seen in 1996-7, and there was a decline in 2000. However, the level of investment is still above the 1996 level.

Figure 2.2 shows the growth patterns for both M1 and M2. Data for the period 1960 to 1964 was not available. As a result, the pattern is considered for the period from 1965 to 2004. When compared to M1, M2 seems to follow a more stable pattern, especially for the period 1973 to 1989.

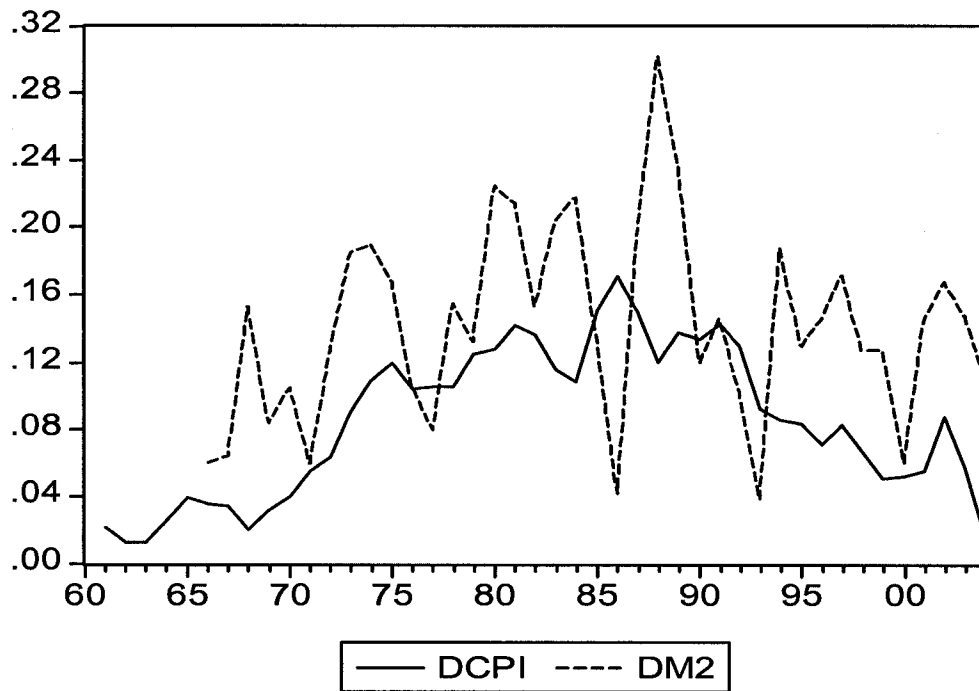
South Africa adopted a policy of targeting M3 for the period 1985 to 1999 (see table 2.3 below). But the targets were met in four of the eleven years. It was only in 1986 where the actual money growth fell below the target band. Predicting money growth would be almost impossible considering the rate of change in money growth from year to year, in particular between 1986 and 1992.

Figure 2.3: M1 and M2 Patterns



Consumer inflation (here indicated by consumer price index) and money growth hardly followed similar pattern over the sampled period. Figure 2.4 plots the relationship between M2 growth and consumer price index. This makes one to cast a doubt on how monetary policy was used to stabilize prices. However, from 1997, there seems to be a procyclical pattern between prices and m2 aggregates.

Figure 2.4: M2 and CPI



Even when considering money growth and total inflation (which includes consumer price index and producer price index) in table 2.4, there is no evidence that money growth targeting succeeded in lowering inflation. Although inflation fell from 18.6 in 1986 to 7.4 in 1996, it happened in spite of the monetary authority's failure to meet the money growth targets in more than half of the sampled period.

Table 2.4: M3 Growth targets and Inflation

Year	Money Growth Guidelines (%)	Money Growth Actual (%)	Inflation Total
1986	16 - 20	9.3	18.6
<b>1987</b>	<b>14 - 18</b>	<b>17.6**</b>	16.1
1988	12 - 16	27.3	12.2
1989	14 - 18	22.3	14.7
<b>1990</b>	<b>11 - 15</b>	<b>12.0**</b>	14.4
1991	8 - 12	12.3	15.3
<b>1992</b>	<b>7 - 10</b>	<b>8.0**</b>	13.9
<b>1993</b>	<b>6 - 9</b>	<b>7.0**</b>	9.7
1994	6 - 9	15.7	9.0
1995	6 - 10	15.2	8.7
1996	6 - 10	13.6	7.4

Source: Aron and Maullbauer (2000)

Figures 2.5 and 2.6 show inflation pattern and rand-US dollar exchange rate respectively. Inflation reached its highest point in 1979. It was in double digits for the 1980s and most part of the 1990s. It however declined to single digit rates, averaging less than five percent in 2004. On the other hand, the rand shows continuous depreciation pattern (with the exception of few years where it gained) until 2001. A rise in inflation rate in 2000 and 2001 is associated with a dramatic fall in the exchange rate value of the rand during the same period.

Figure 2.5: Inflation Pattern

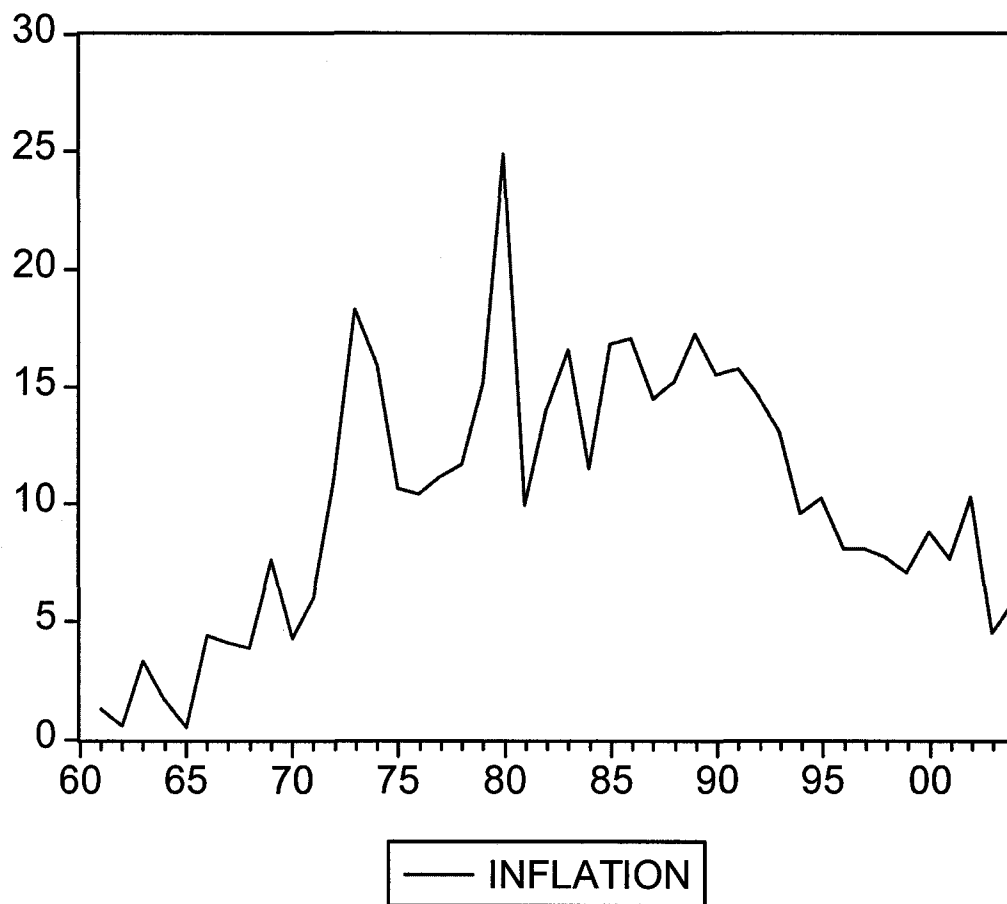
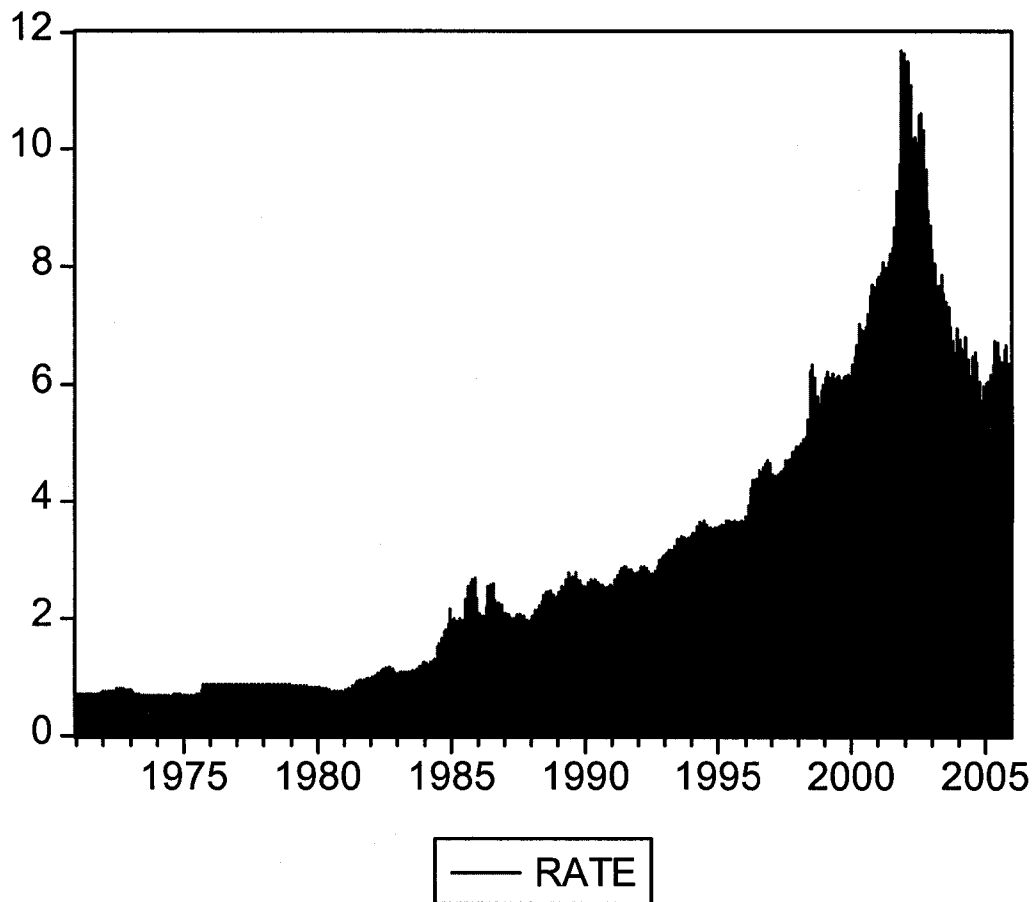


Figure 2.6: Rand – US dollar Exchange Rate Pattern



Different studies reviewed in this chapter revealed the methods used at different times as the South African money and banking sector evolved. Economic performance over the decades was also reviewed. There is a need for improving methods used in getting empirical results. That can be done by employing models that are used in developed countries such as the United States.

## **Chapter 3**

### **DATA AND THE EMPIRICAL TECHNIQUES**

#### **3.1. Data**

The study uses secondary macroeconomic data acquired from the International Monetary Fund (IMF)'s International Financial Statistics (IFS), the World Bank's World Development Indicators, the South African Reserve Bank and Statistics South Africa. It is a time series data. This data covers the period from 1960 to 2004 for most of the variables used. However, data for some variables is available from 1965, and this will call for the sample to be reduced to forty years of quarterly data.

The data expressed in monetary value will be in constant 2000 prices and will be in South African rand unless stated. Other form of data will be in US dollars as it is usually reported in international data sources. Where necessary, both the rand and the US dollar will be used. This will help to identify changes that may be due to rand depreciation or appreciation against the US dollar

Table 3.1: Variable Descriptions

Acronyms	Full names
CONS	Real Consumption
INV	Real Investment
M3	M3 Money Aggregates
MB	Monetary Base
P	Consumer Price Index (CPI)
R	Interest Rates
Y	Real gross domestic product (real income)
$\epsilon_{CONST}$	Consumption Vector Residuals
$\epsilon_{INVt}$	Investment Vector Residuals
$\epsilon_{MSt}$	Money Supply Vector Residuals
$\epsilon_{MDt}$	Money Demand Vector Residuals

Real consumption and real investment refer to private as opposed to total consumption and total investment. The study uses CPI (consumer price index) and not CPIX (consumer price index less interest on mortgages because data for the later is available under the first regime).

As indicated in the literature review, most studies in monetary policy in South Africa used a broader definition of money. This study will make use of M3. It is therefore important to define the monetary aggregates (M1, M2 and M3). The definition of these monetary aggregates is given for both the South African and the United State economies. The reason is that different countries use different measures of monetary aggregates, and this study will compare results on South Africa to those in the United States.

M1, by definition, is the narrowest monetary aggregate. In the United States it includes currency, traveler's checks, and checkable deposits. It is money used as a medium of exchange. In South Africa, narrow money (M1) is the sum of currency in circulation and demand deposits at monetary institutions. The next level in monetary

aggregate is M2. Hubbard (2000) defines M2 as a monetary aggregate that have components of M1 plus short-term investments accounts that are convertible to definitive money. However, their convertibility is not as easy as in the components of M1. The definition of M2 has been modified as there continues to be financial innovations. Hence, money market deposit accounts, non-institutional money market mutual fund shares, overnight purchase agreements and overnight Eurodollars. According to the South African Reserve Bank “Monetary aggregate (M2) comprises M1 and short-term deposits (other than demand deposits) and medium-term deposits (including all saving deposits) of the domestic private sector with monetary institutions, including saving deposits with and savings bank certificates issued by the Postbank”.<sup>1</sup>

Finally, M3 in the United States is monetary aggregation that includes M2 plus assets such as large-denomination time deposits, institutional money market mutual fund balances, term purchase agreements, and term Eurodollars. In South Africa, M3 consists of long-term deposits of the domestic private sector with monetary institutions, including national savings certificates issued by the Postbank. As of March 2004, M3 in South Africa has been modified to include negotiable certificates of deposits (NCDs) that are issued by banks and held by non-bank domestic private-sector parties, but does not include negotiable promissory notes (NPNs) since the focus is on deposits (South African Reserve Bank Quarterly Bulletin).

Consumer price index is seasonally adjusted and has 2000 as the base year. Interest rate refers to the ten year and over government bond and the data is available from the South African Reserve Bank.

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<sup>1</sup> The definitions are from the South African reserve Bank’s website ([www.resbank.co.za](http://www.resbank.co.za))

### 3.2. Empirical technique

This section presents a mathematical approach to cointegration and persistent profiles.

Cointegration can be defined as one of the techniques used for testing the correlation between non-stationary time series variables in econometric modeling. Cointegration is increasingly becoming a more reliable tool in macroeconomic analysis due to the nature of most of the time series data in macroeconomic and monetary fields. Green (2003: 649) made the following observation;

Studies in Macroeconomics almost always involve nonstationary and trending variables, such as income, consumption, money demand, the price level, trade flows, and exchange rates. Accumulated wisdom ... suggest(s) that the appropriate way to manipulate such series is to use differencing and other transformations (such as seasonal adjustment) to reduce the stationarity and then to analyze the resulting series as VARs or with the methods of Box and Jenkins. But recent research and a growing literature has shown that there are more interesting, appropriate ways to analyze trending variables, (Green, 2003)

In case one had the macroeconomics data described above the conventional way used to be to detrend data in order to reduce them to stationary form. Then the data could be used in the analysis in the form of VARs. But such a system may have its flaws, as will be discussed below. Important to note is that when purging non-stationary data using differencing method, and then estimating the differenced variables, some valuable information from econometric theory regarding the long-run equilibrium properties of the data can be lost (Kennedy: 1998). However, cointegration is one of the more interesting and appropriate ways to be used in the short-run and long-run relationships between two or more non-stationary time series variables with infinite means and variances. The

series may be non-stationary on its own, but a linear combination of these series may be stationary.

There are three ways used to test whether the data is stationary or non-stationary (tests for unit root). First, one can plot the data to observe changes over time. For example, data shows that gross domestic product has been increasing over the years. Its mean keeps changing. The mean is non-reverting and this suggests that the series is non-stationary. The other way can be to apply test for autocorrelation (ACF) and correlogram.

A stationary series can be represented by this equation;

$$X_t = \delta + X_{t-1} + \varepsilon_t$$

And this is represented in figure 3.1(a). The figure shows that the series is non-mean reverting. The non-stationary series is converted into stationary through the use of first difference. The series becomes mean reverting as shown by figure 3.1(b).

Figure 3.1(a) Stationary series ( $X_t$ )

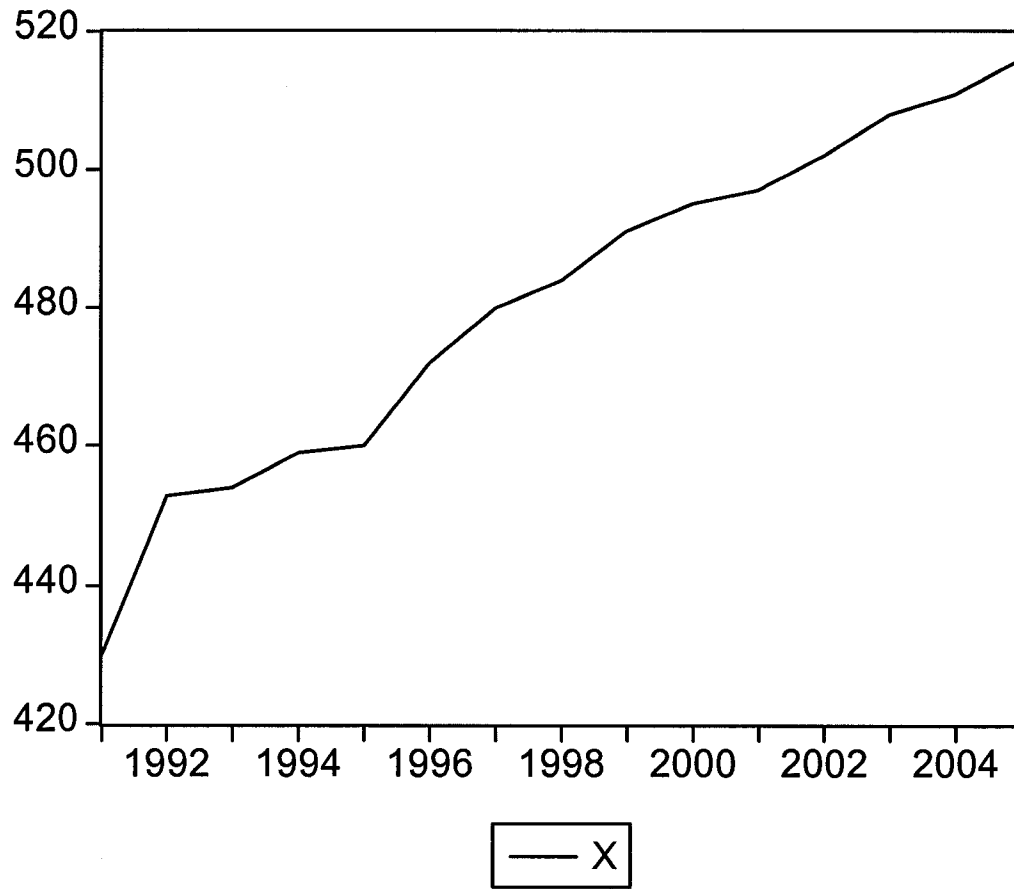
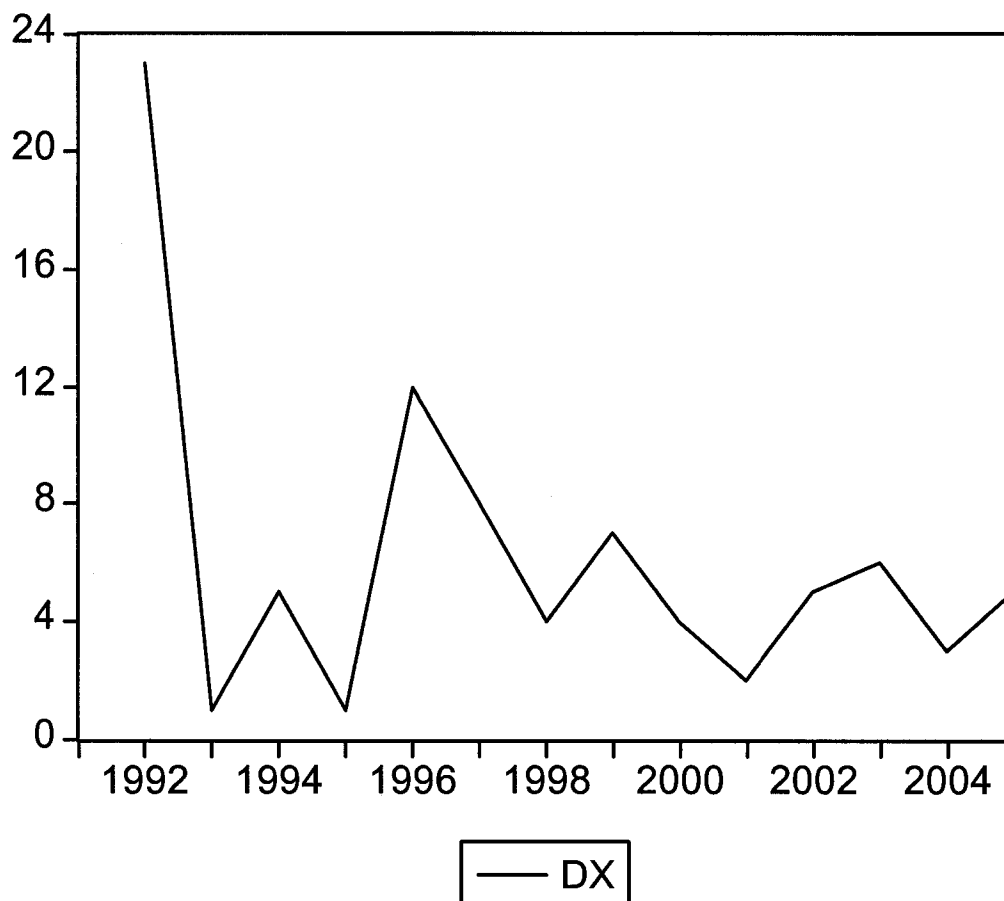


Figure 3.1(b) Non-stationary series (DX<sub>t</sub>)



Following Green's (2003) fully specified (but simplified) regression model, consider this equation

$$y_t = \beta x_t + \varepsilon_t$$

where  $y_t$  and  $x_t$  are integrated series.  $\varepsilon_t$  is the residual sequence. Now, when do we have cointegrated variables? According to Murray (1994), "if there exist a stationary linear combination of nonstationary random variables, the variables combined are said to be

cointegrated”. The nonstationary  $y_t$  and  $x_t$  series are assumed to be integrated to the same order, and  $\varepsilon_t$  is stationary. Therefore,  $y_t$  and  $x_t$  are cointegrated.

The model to be used here considers a linear combination of integrated variables. Enders (2004) says that “it is quite possible for there to be a linear combination of integrated variables that is stationary”. Such variables may be nonstationary when considered individually. Therefore, it is the linear combination of these variables that is stationary, and this is referred to as cointegrated variables. This brings in the issue of equilibrium relationships in macroeconomic models. The argument here is that a combination of nonstationary variables in an equilibrium setting means that the stochastic trends of these variables should be connected. It is this connection among the trends that requires that the nonstationary variables be cointegrated. Hence, in an equilibrium situation no variables can move independent of each other.

What follows here is a mathematical exposition of linear combination of integrated variables. Consider the following equation;

$$e_t = m_t - \beta_0 - \beta_1 p_t - \beta_2 y_t - \beta_3 r_t$$

where  $m_t$  is demand for money,  $p_t$  is price level,  $y_t$  is real income,  $r_t$  is interest rate,  $e_t$  is an error term, and  $\beta_i$  represents parameters to be estimated. From the above equation,  $e_t$  (the left hand side of the equation) is stationary. Therefore, the right hand side must be stationary too. For example, prices and real income when considered separately will each have a non-reverting mean which means that they are nonstationary when considered

individually. However, a linear combination of the right hand side variables is stationary since  $e_t$  is stationary.

There is a formal study developed by Engle and Granger (1987) to demonstrate the concept of cointegration in macroeconomics variables. It is based on this long-run equilibrium equation;

$$\beta_1 X_{1t} + \beta_2 X_{2t} + \dots + \beta_n X_{nt} = 0$$

where  $\beta$  stands for the vector  $(\beta_1, \beta_2, \dots, \beta_n)$  and stands for the vector  $(X_{1t}, X_{2t}, \dots, X_{nt})$ . Long-run equilibrium requires that  $\beta X_t$  be equal to zero. The deviation from long-run equilibrium is denoted by  $e_t$  such that  $e_t = \beta X_t$ .

Note that equilibrium in this case is different from what most economic theorists refer to in that it does not stand for equality as in the case of desired investments equal the actual investments. Enders (2004) writes;

“The econometric use of the term (equilibrium) makes reference to any long-run relationship among nonstationary variables. [But] cointegration does not require that the long-run relationship be generated by market forces or by the behavioral rules of individuals. In Engle and Granger’s use of the term, the equilibrium relationship may be casual, behavioral, or simply a reduced-form relationship among similarly trending variables. Engle and Granger (1987) provide the following definition of cointegration: The components of the vector  $X_t = (X_{1t}, X_{2t}, \dots, X_{nt})'$  are said to be cointegrated of order  $d, b$ , denoted by  $X_t \approx CI(d, b)$  if (1) all components of  $X_t$  are integrated of order  $d$ , [and] (2) there exist a vector  $\beta = (\beta_1, \beta_2, \dots, \beta_n)$  such that the linear combination  $\beta_t = \beta_1 X_{1t} + \beta_2 X_{2t} + \dots + \beta_n X_{nt}$  is integrated of order  $(d - b)$  where  $b > 0$ . The vector  $\beta$  is called the cointegrating vector.” (Enders, 2004)

Now that the long-run equilibrium has been clearly defined, the next step is to explain what happens when the disturbance terms moves out of equilibrium. This is

explained by the error correction models. The main attribute of cointegrated variables according to Enders (2004) is that “their time paths are influenced by the extent of any deviation from long-run equilibrium. ...if the system is to return to long-run equilibrium, the movements of at least some of the variables must respond to the magnitude of the disequilibrium.” An example of the term structure interest rates is given where the short-run and the long-run equations are considered. In case there is a gap between the short-term and the long-term rates, long-run equilibrium can be achieved either of the following: “(1) an increase in the short-term rate and/or a decrease in the long-term rate, (2) an increase in the long-term rate but a commensurately larger rise in the short-term rate, or (3) a fall in the long-term rate but a smaller fall in the short-term rate.”

This analysis can be applied also in multi-equation models where equations can be individually considered. For example, the two equations below are assumed to be in the long-run equilibrium.

$$C_t - g_0 - g_1 Y_t - g_2 R_t = \varepsilon_{Ct}$$

$$I_t - d_0 - d_1 Y_t - d_2 R_t = \varepsilon_{It}$$

where the equations are the consumption and investments vectors respectively.  $C_t$  represents real consumption,  $Y_t$  is real income,  $R_t$  is interest rates and  $I_t$  is real investment.  $\varepsilon_{Ct}$  and  $\varepsilon_{It}$  are the error terms for consumption equation and investment equation respectively.

Suppose there is deviation from long-run equilibrium in the consumption equation, what should happen to the variables in the equation? Recall that long-run equilibrium requires that  $\varepsilon_{Ct}$  be equal to zero. So if deviation is in the form of  $\varepsilon_{Ct}$  being

greater than zero, the following should happen to bring the system back to equilibrium: (1) consumption should fall, (2) real output should increase, (3) interest rates should rise, (4) or any combination of the above should happen. The same analogy can be applied for the investment equation. Therefore, movements in these variables would bring the system back to long-run equilibrium. What the discussion above implies is that the short-term dynamics (when the system deviates from long-run equilibrium) it can be corrected, and the process is what is called error correction.

After considering the dynamics of the equations above, it is now necessary to discuss how one arrives at the number of vectors to be used in the model. Then, the Johansen maximum likelihood approach will be discussed briefly. This approach has become more popular in estimating more than one cointegrating relationship in macroeconomic empirical analysis<sup>2</sup>. The following vector error correction (VEC) representation as used by Schmidt (2003) is considered;

$$\Delta X_t = \mu + \sum_{i=1}^{k-1} \Gamma X_{t-i} + \Pi X_{t-k} + \varepsilon_t$$

where  $\Delta X_t$  represents a p-element vector of observations on all variables in the system at time t. The term  $\sum_{i=1}^{k-1} \Gamma X_{t-i}$  account for stationary variation which is related to the past history of system variables, and the  $\Pi$  (defined as  $\alpha\beta'$ ) matrix contains the cointegration relationships in the model. The  $\beta'$  contains the cointegrating parameters and  $\alpha$  gives the descriptions of the weights with which each variable enters into the model. In this case, cointegration will require the  $\beta'$  matrix contains stationary parameters.

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<sup>2</sup> Details are in Johansen (1988)

The estimated parameter values using Johansen and Juselius' H6 test provides useful information in the estimated model. One would use the information to determine whether the unconstrained vectors reduce the system to reasonable economic relations. It then provides one with information to examine whether the time series data are consistent with the proposed economic model. There are two further restrictions that can be applied to the model: (1) to normalize the coefficients around a particular variable, (2) or to zero out particular variables from the particular vector.

The empirical techniques discussed here will be applied for this study, and the results are presented in chapter 5.

## **Chapter 4**

### **TWO REGIMES: POLICIES AND ECONOMIC PERFORMANCE**

#### **4.1. Introduction**

This section discusses the rationale for dividing the sampled period (1966 to 2004) into two regimes. It further summarizes the social, political and economic events that characterized the two periods. The South African reserve governors in the two periods formulated their policies and implemented them responding to economic shocks of their times. The major factors that affected the economy at macroeconomic level over the past four decades are discussed.

#### **4.2. Monetary policies in two regimes**

The first and second regimes refer to the periods (1966q1 - 1982q4) and (1983q1 - 2004q4) respectively. The first regime covers the non-market oriented policy instruments whereas the second regime covers the market oriented policy instruments. In this era Dr. De Jongh (South African Reserve Bank governor) was responsible for the implementation of additional direct controls which included deposits rate controls, direct consumer credit controls and ceiling on advances (Moolman and Du Toit, 2004). This

was in line with Prime Minister Hendrik Frensch Verwoerd's quest to increase the power of the South African Reserve Bank. That was to be done through direct, non-market controls of the money supply such as the imposing credit ceiling and increasing the liquid asset requirements of the commercial banks (Jones and Muller, 1992).

Goedhuys refers to this non-market policy options as the administrative controls by the Reserve Bank. He summarizes the controls as follows;

an upper limit on the rates banks could pay on deposits; an upper limit on the amount of credit that could be granted by each bank; a requirement for banks to hold liquid assets in an unnaturally high ratio to their deposit liabilities (Goedhuys, 1994).

Under the circumstances described by Goedhuys the commercial banks were denied the opportunity to freely play their role as intermediaries – to match the willing lenders to the willing borrowers – as the terms of lending and borrowing did not reflect the demand and supply conditions in the money market. Interest rates would generally be restricted to be below the market rates. With regard to bank liquid assets ration, the ratio went as high as 58 percent of short term deposits.

The setting of the upper limit on rates paid on deposits by the Reserve Bank had the unintended possibility of encouraging potential depositors with the commercial banks to look for other options where they could lend their money. If the Reserve Bank was to set the upper limit very low, other non-bank financial institutions would be attractive to net savers, and the consequences would be the reduction in potential lenders to the banks. Commercial banks would lose on the deposits which are the basis for their lending to net borrowers.

If South Africa was entirely dependent on traditional commercial banks for individual people and firms, the outcome of setting upper limit on rates paid to deposits would be very severe. Unlike in most developing countries in Africa, South Africa had a more sophisticated financial system which included the Johannesburg Stock Exchange that helped to facilitate lending and borrowing. Merchant banks, building societies as well as hire-purchase and general banks also competed for deposits with the commercial banks.

In spite of the competition in the financial market in terms of attaining more assets, commercial banks in South Africa remains the main institution in mediating between lenders and borrowers. Small companies and most individuals put their assets with the commercial banks. This helps their credibility, and increases their chances of getting loans from banks that it would be the case with other form of financial intermediaries. Commercial banks are easily accessible in compared with non-bank financial institutions. Commercial banks are found even in small towns whereas non-bank institutions are usually in big cities. The effectiveness of deposits controls was much in doubt. Deposits with the commercial banks grew from R3 308 million in 1970 to R 64 413 million in 1979.

The controls were not only going to help curb inflation, but to reduce other risks associated with commercial banks. Higher rates paid on deposits would attract more deposits, but speculations about future rates cut might result in a bank rush, which could end up destabilizing the whole financial sector. If credit lending was not properly controlled the fear would be that the borrowers might not be able to honor their debts with the bank, and that could result in a bank run. Such arguments were echoed by critics

of the Asian boom after the 1997 economic crisis. Eichengreen (1999) writes that “bank crisis have typically occurred in the wake of financial liberalization that ignites a credit boom in which the banks significantly expand their lending activities”.

In addition to the above controls there were different price controls on products exchanged in the home market. There was also import control as well as exchange control.<sup>1</sup>

The second regime spans the governorship of three Reserve Bank governors, namely, De Kock (from 1980 to 1989), Chris Stals (from 1989 to 1999) Tito Mboweni (from 1999 - present). Stals was the governor under the National Party government through out the transition to the non-racial democratic elections in 1994 and the first term of the government of national unity which was led by the African National Congress (ANC). There is a reason to justify considering the eras by the above three governors as one regime. Several authors agree on the fact that the policies applied since the early 1980s to present remain largely the same, perhaps the difference being the intensity at which such policies are applied.<sup>2</sup> Schoombee summarizes this period as follows;

“The main elements of the South African monetary control system, recommended by the De Kock Commission and introduced in the early 1980’s, remained largely unchanged during the decade of the 1990s. Market-oriented monetary policy instruments were used to ensure a continuous shortage of cash reserves in the money market, forcing the banking system to seek accommodation from the Reserve Bank which it provided automatically and unconditionally, thus making effective the impact of a change in bank’s lending rate on market interest rates. The resultant change in short-term market rates affected the quantity of money demanded and in that way pursued the monetary growth targets, the intermediate objective of the monetary authorities.” Schoombee (2003, p39)

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<sup>1</sup> This came as a result of the Bank Act of 1965 that thought to increase power in the hands of the South African Reserve Bank. See Jones and Muller (1992).

<sup>2</sup> Bell (2001), Hodge (2001), Rangasamy, Swanepoel and Visser (2005) highlighted the similarities in these years.

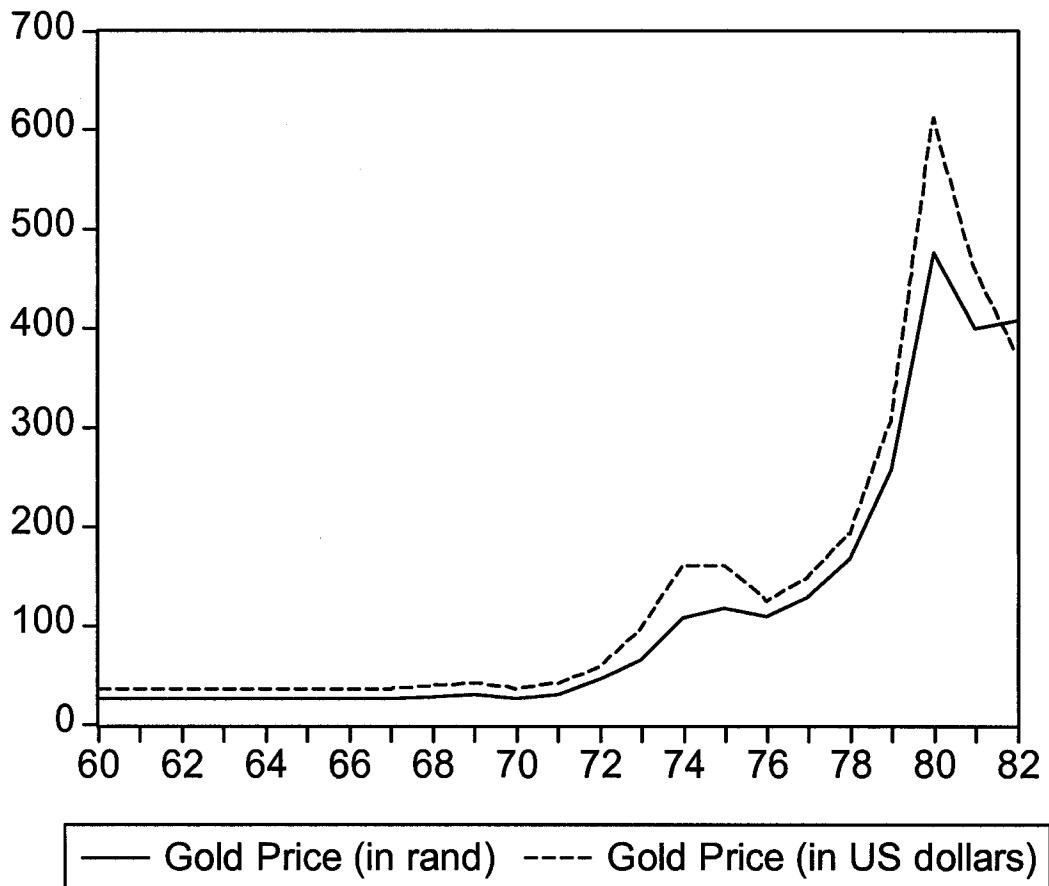
The market-oriented policy instruments involved the relaxation of most of the controls that were there in the 1960s and 1970s. Credit ceiling on what commercial banks could lend were removed and the Reserve Bank allowed for the bank lending rates to be used in controlling the amount of credit given.

#### **4.3. Other economic sectors and challenges faced**

There is more work recorded on the economic progress made by South Africa since the first decade of the 20<sup>th</sup> century. For the purpose of this study, the period from the 1960s to 2004 will be considered. During the first period the economy grew significantly to match that of the developed world in terms of industrial transformation, banking and financial institutions, transportation and communications (Bell, 2001; Hodge, 2001; Jones and Muller, 1992; and Mokoena et al, 2005). The mining sector, in particular gold mining, became the cornerstone of the South African economy. Gold price per fine ounce increased from US\$ 35.17 in 1966 to US\$ 612.94 in 1980.

Despite this huge price increase in a decade and half, gold price could be unpredictable in the 1970 and early 1980s. Figure 4.1 shows changes from one year to the other. Gold price increased by about 39 percent from 1973 to 1974, and it fell by about 23 percent between 1975 and 1976. When gold price was at its highest level (in 1980) under the first regime, the economy was also performing well as depicted by figure 4.1. But a fall in gold prices from US\$ 612.94 in 1980 to US\$ 375 in 1983 decline in the rate of economic growth that was followed two years of economic recession.

Figure 4.1: Changes in gold prices

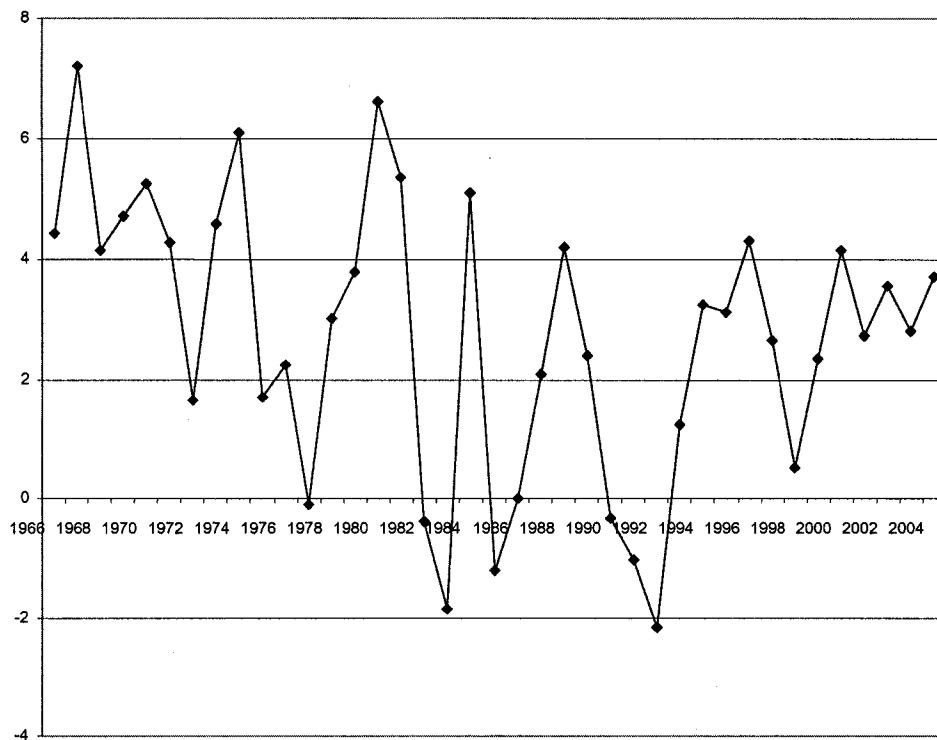


Source: South African Reserve Bank and Franzsen (1983)

The boom in the sector was good enough to lift many of the country's poor from poverty and invest on human capital. But the wealth of the country was unfairly distributed. The white minority rule favored whites on the expense of blacks when distributing the national income. The state legislated policies that put blacks on the disadvantage, not only on the government sectors, but even on the private sectors of the economy. This alienation of blacks from their country's wealth contributed to civil unrest.

The economy experienced many years of economic growth under the first regime. Recession was only experienced in 1978 in the first regime (see figure 4.2). A growth rate of more than six percent was recorded in three years. But by the beginning of the 1980s there were many challenges that started to slow the growth. The economy slowed down significantly in the early 1990s. The country was in a transition period to a multi-party, non-racial government. There was a degree of uncertainty that affected productivity.

Figure 4.2: Growth in National Output



The 1960s were characterized by economic growth that averaged 5.8 percent and changes in the pattern of industrialization. South Africa started to process raw materials to produce semi-finished products, capital goods, and machines that were mostly imported in previous times. The motor, engineering and chemical industries took off and the manufacturing sector grew to contribute to at least twenty percent of the GDP. The goal here was to make the country self-sufficient by strengthening their industries. For example, the automobile assembly plants were required to increase the value of the domestic produced parts used in the cars. But this protectionist step by the South African government came at a cost to the consumers. It resulted in higher prices for the automobiles in South Africa, since the locally produced components of the automobiles were always higher than they would be if imported from those countries that had comparative advantage.

The rapid expansion in the manufacturing sector of the economy increased the availability of goods as well as jobs in the market. With this economic expansion followed the expanding money in the economy. Money demand increased as real income and consumption increased. As a result, the economy experienced double digit inflation in the 1970s. However, inflation could not be entirely blamed on domestic economic expansion. There were other factors contributing to this increase in inflation. International gold price was on the rise, as it increased by about seventy percent between 1973 and 1974. Mokoena (2005) maintains that “(t)he boom in the gold price coupled with monetary stance of the time, resulted in a 19 percent increase in money supply in 1973/74, which was higher than the annual average of around six percent in the previous two years”.

Some authors argue that the global oil crisis of the 1970s also contributed to higher inflation rates in South Africa. South Africa was a net importer of oil. The imported oil was paid for with gold revenues. The short-lived gold price boom did not give South Africa a chance to be prepared for the aftermath of the global oil shock. But others view the oil shocks as having effects through the decline in South Africa's value of exports. The indirect effects of the world oil price increase on South Africa took the following sequence: world economic growth declined as a result of oil shocks, then the world demand for South African minerals fell, and as a result of that the price of commodities fell. Since South Africa's main exports were mineral resources, the decline in their prices placed the country's balance of payments on the deficit by the mid-1970s.

The 1960s and the 1970's saw major investments in the mining and agricultural sector. Production in the mining sector increased over the 1960s and early 1970s, but fell in 1975. Table 4.1 gives the changes in gold output.

Table 4.1: Changes in gold output for selected years, 1960-1975

Year	Tons treated (million metric)	Fine gold (kilograms)	Realized value of output (R million)
1960	67.0	665 086	536
1965	75.4	950 332	767
1970	80.0	1 000 447	831
1975	75.1	713 447	2 560

Source: Jones and Muller (1992)

Production growth was not limited to gold mining only. Coal, diamonds as well as other minerals experienced increase in production. But the increase in coal was not of great benefit because of the low quality as it had more ash and therefore, required

complex techniques to clean. Coal export to the European countries benefited from the oil crisis of the early 1970s, as the European countries increased demand for coal for their power stations. Diamonds production increased over the same period, although it remained a very small proportion of the total mining sector. Other minerals, excluding gold, coal and diamonds contributed 27 percent in 1960 and their share fell to a low of 17 percent in 1980 (see the table 4.2 below).

Table 4.2: Relative share of minerals in total value of mining output, 1960-1985 (percent)

Year	Gold	Coal	Diamonds	Other	Total
1960	63	6	4	27	100
1970	53	7	5	35	100
1980	69	10	4	17	100
1985	59	20	3	18	100

Source: Jones and Muller (1992)

South Africa still maintained its dominance in the share of mineral production by 1980. Gold and platinum group metals were amongst the leading minerals in terms world production share. Table 4.3 shows how South Africa ranked in the world, and the percentage share in total estimated world production.

Table 4.3: South Africa's estimated share of minerals production, 1980

	World ranking	Percentage
Platinum group metals	1	48
Gold	1	55
Vanadium	1	34
Chrome ore	1	39
Andalusite/sillimanite	1	39
Manganese ore	2	22
Vermiculite	2	31
Antimony	3	20
Diamonds	3	18
Asbestos	3	6
Zirconium	3	17
Fluorspar	3	11
Titanium	5	20
Coal	7	4
Phosphate	7	3
Nickel	8	4
Iron ore	10	3
Lead	10	2
Tin	11	1
Copper	13	3
Uranium oxide	-	-

Source: SA Mineral Bureau

Apart from the oil shocks and the falling of commodity prices, there were other factor that affected the economy over this period. There were problems regarding the much needed labor in the mining industry. Black South Africans were not the only source of cheap labor in mining industry. Mine workers were recruited from other countries in Southern Africa. A greater number of mine laborers came from Malawi and Mozambique, though countries such as Botswana, Lesotho and Swaziland had noticeable number of workers in South Africa too. The decline in foreign mine workers started when an aircraft that was carrying Malawians crashed and killed the passengers, the Malawian government restricted the South African companies from recruiting mine

workers in Malawi. The Malawian government withdrew more than 100 000 of its citizens who were working in South African mines. When Mozambique attained independence from Portugal in 1975, the South African mining industries reduced the number of mine worker recruits from Mozambique.

For a while the decline in the number of immigrant workers in the mines resulted in the increase in wages in order to attract South African workers. But the wage increase was still very low and could not stop massive protests by black mine workers. Black mine workers were given better job security than in the 1960s and early 1970s. By 1980 black mine unions were legally recognized by the National Party government. That was a long way of gradual progress since before 1973 blacks did not even have any form of bargaining power. All strikes by black workers were declared illegal. But rising prices of goods and services, inadequate housing for mine workers, coupled with low wages resulted in massive riots in most of the country.

The 1970s witnessed a massive investment in physical infrastructure throughout the country. This was financed by revenues from the mining industries. Tax paid by the mines increased by 285% in the 1970s leaving the government with enough resources to fund their socialist system that was meant to profit the few. No effort was made to invest in the education of the blacks. The government upheld the principle of "Bantu Education" that was designed to make blacks better servants but lacking in modern skills. Universities and other institutions of higher learning were racially segregated. But the government remained committed to total eradication of poverty in the white communities.

The second period was characterized by several civil unrests in the 1980s, negotiations for transition into non-racial government in the early 1990s, to the ANC-led government under Mr. Nelson Mandela from 1994 to 1999 and Mr. Thabo Mbeki from 1999. There was pressure from the international community for the white minority government to allow for a true democratic government with equal participation by all citizens. Domestically, pressure was applied by workers' unions and political organizations.

Problems or difficulties in the second period included sanctions, strikes and riots in the 1980s, uncertainty regarding transition to first non-racial democratic government, uncertainty about the newly elected ANC led government, the Asian economic crisis, and perceptions about the appointment of the ANC's political heavy-weight as Reserve Bank governor in the 1990s. In the 1990s, it was mainly the problem of perception of South Africa's future by the international communities rather than judging the country on path agreed upon.

As early as 1980, South Africa was increasingly becoming aware of the growing problems of political unrest in the country and of the fact that the world was assessing the situation with much interest. The black communities were becoming uncontrollable. It had been always a situation that could potentially get out of hand like the student protests that culminated into what is commonly known as the "Soweto Riots". The international community was concerned by abuse of human rights in South Africa. So, sanctions by the concerned international organizations and governments to punish the South African government were inevitable. Jones and Muller indicated that the economic stagnation of the 1980s was inevitable;

International pressure on South Africa multiplied rapidly from 1980, after Zimbabwe had become independent and South Africa had become the only remaining White-ruled state on the continent. As in the case of Rhodesia, increased efforts were made to impose economic and trade sanctions against South Africa, and to persuade foreign companies to disinvest. Under these circumstances very little foreign capital was invested in manufacturing. In addition, the fall in the gold price from its peak reached in January 1980, and the steady depreciation of the Rand, which started soon thereafter, reduced the attractiveness of South Africa to foreign investors (Jones and Muller, 1992)

Bell (2001) writes that “(b)y 1986 the United States decided to enact sanctions against South Africa, (which) meant that the United States would no longer buy South African goods, including metals, minerals and gold”. That was a major blow to South Africa considering that disinvestment had started in 1984 before sanctions were officially enacted by the United States in 1986. United States firms that disinvested between 1984 and 1989 were more than 192<sup>3</sup>. More than 160 companies from other countries disinvested too. Ford and General Motors were amongst the United States companies who disinvested as a result of American pressure groups in 1985. Barclays Bank was one of the major non-U.S. companies to disinvest. During the second half of the 1980s, South Africa experienced capital outflow of more than R24 billion. In terms of employment opportunities lost as a result of sanctions some economists estimated the number to be half a million jobs<sup>4</sup>.

During the 1980s South Africa felt the effects of poorly skilled labor (that was deliberately done through Bantu education curriculum in black universities as part of apartheid policies) supplied by the blacks to the industries that were already affected by disinvestments. Coupled with strikes by black workers, lack of properly skilled labor

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<sup>3</sup> Details on success of the sanctions by the United States are found on “Report on Anti-Apartheid Act of 1986 – Ronald Reagan’s report to Congress – transcript” (US Department of State Bulletin, December 1987)

<sup>4</sup> See Jones and Muller (1992) for more details.

resulted in lower productivity in the industrial sectors. South Africa started to seriously fall behind the industrialized countries.

Inflation remained very high in South Africa in the 1980s though the advanced economies had inflation rates averaging below 10 percent. For the past three decades consumer inflation in South Africa had been following the inflation rate pattern of the advanced economies. The table 4.4 below gives the averages of consumer inflation for advanced economies, selected emerging economies and South Africa.

Table 4.4: Average inflation rates compared to emerging and advanced economies

	1951-1960	1961-1970	1971-1980	1981-1990	1991-1995	1996-2000
Advanced economies	4.3	4.0	10.8	8.1	3.9	2.0
Selected developing economies*	15.2	18.3	29.8	139.7	94.4	23.4
South Africa	3.6	2.7	10.6	14.7	11.3	6.7

\*Countries included are Argentina, Brazil, Bulgaria, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Pakistan, Peru, Poland, South Africa, Thailand, Turkey and Venezuela.

Source: IMF, *World Economic Outlook and Mokoena et al (2005)*

For the three decades before the 1980's consumer inflation in South Africa averaged less than the average in both the selected developing economies and the advanced economies as well. Between 1981 and 1990 consumer inflation in South Africa averaged 14.7 percent and this was 6.6 percent higher than the average in the advanced economies. Throughout the five decades South Africa had always had inflation rates averaging less than that of the selected emerging economies. In relative terms, average inflation in 1991 to 2000 was still much greater in South Africa than in the developed world, and the ratio was about three to one.

The economic difficulties of the 1980s played a role in pushing the National Party government towards the negotiation table. In 1990 President De Klerk took unprecedented step towards ending apartheid and this included the release of Mr. Nelson Mandela from jail. Political parties that were previously banned by the National Party government were allowed to meet freely. The organized working class in South Africa began to see the fruits of their tireless struggle against the apartheid system. Their efforts were even greatly appreciated by political prisoners as well as political refugees who were returning to South Africa. In his speech when he was released from prison Mr. Mandela paid special tribute to working class;

I extend my greetings to the working class of our country. Your organized strength is the pride of our movement: You remain the most dependable force in the struggle to end exploitation and oppression (Mandela, 1990).

Transition to the non-racial, government of national unity went smooth, much of a surprise to those who expected more violence or even a civil war. This did nothing to restore the lost confidence on South Africa by the outside world. There were also fears of the likelihood of a socialist type of government by the ANC and its alliance. During transition time there was less confidence on the country to stabilize, hence foreign investors were not swift in taking opportunities in South Africa. Under the ANC led government, the economy started growing and consumer inflation averaged less than 10 percent in the second half of the 1990s. Contrary to the fears of the foreign investors, the ANC opened dialogs on privatization of some of the state assets despite the opposition from the labor unions.

The Asian crisis in 1997 did affect the prospects of the South African economy since the country is regarded as one of the emerging economies. By that time the

government had already started implementing the Growth, Employment and Redistribution (GEAR) that aimed to build a strong economy. Amongst other things, the policy regarded sound macroeconomic fundamentals as maintaining low interest rates, low budget deficits and achieving high employment levels<sup>5</sup>. The Asian crisis was viewed as a major force in destabilizing the economy that was already taking good shape. The South African Reserve Bank responded to the Asian crisis by raising interest rates, and this discouraged borrowing for investment in the local economy.

South Africa still had to prove its credibility as an attractive destination for foreign investments. Being on the world spotlight meant that every economic and political decision taken by South Africa would be assessed and evaluated in terms of future political and economic stability in the country. The news that ANC political heavy weight Mr. Tito Mboweni would be the next governor was not well taken by the markets. This worsened the value of the rand which was already depreciating against the United State dollar and the European currencies.

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<sup>5</sup> The policies are written in details in Growth, Employment and Redistribution published by the South African government (June 1996).

## **Chapter 5**

### **EMPIRICAL RESULTS**

#### **5.1. Introduction**

This chapter presents the estimated results of the model and compares the findings with related studies. Section 2 outlines the theoretical rationale of the model. It also gives insight into the number of expected vectors and how they are expected to behave. Section 3 computes the four vectors from the over-identifying restrictions of the restricted values of the multiple-equation cointegrating system using the Johansen and Juselius's H6 test. Section 4 presents the results of the computed speed of adjustments and the variables responsible for clearing the vectors. Section 5 gives further economic importance of this model based on the covariance matrix and the correlation coefficients signs. And this is concluded by a section on persistent profiles.

#### **5.2. Theoretical Framework on Expected Vectors**

This section presents the theoretical framework of the model used. It is a theoretical discussion regarding money demand, money supply, consumption and investment functions. First, consider the money market equations for the economic interpretation of money demand and money supply. The theory states that the demand

for real money balances as a function of income and interest rate. Mathematically, this is stated as

$$(M/P) = L(Y, R)^1$$

where  $L$  is a function relating money demand to real income and the nominal interest rate.  $M/P$ ,  $Y_t$  and  $R_t$  are defined as real money balances, real output and nominal interest rates respectively.

This equation can be expressed in log form as

$$\ln M = a_0 - a_1 \ln Y_t + a_2 \ln R_t - a_3 \ln P_t - \varepsilon_{MDt}$$

In nominal terms the money demand equation can be expressed as;

$$M_t^D - a_0 - a_1 Y_t - a_3 P_t + a_2 R_t = \varepsilon_{MDt}$$

where  $M_t^D$  is represents the demand for nominal money balances and  $P_t$  is the aggregate price level.

Now consider the money supply function:

$$M_t^S - b_0 - MB_t + b_2 R_t = \varepsilon_{MS_t}$$

The unique variable in the money supply vector is the monetary base ( $MB_t$ ). This variable is of great significance since it is the policy variable choice by the central bank authorities.

The consumption and investment equations in the four economic relationships represent the real side of this model, namely,  $CONS_t - d_1 Y_t - d_2 R_t = \varepsilon_{Ct}$  and  $INV_t - g_1 Y_t - g_2 R_t = \varepsilon_{It}$  respectively.

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<sup>1</sup> This is in line with theoretical derivation as in Abel and Bernanke (2001), Branson (1989) and Hubbard (2000).

Combined with the money market the four vectors will represent the real consumption, real investment, money supply and money demand. The vectors are shown in the box below.

$$\begin{aligned} \text{CONS}_t - g_0 - g_1 Y_t - g_2 R_t &= \varepsilon_{\text{CONS}t} \\ \text{INV}_t - d_0 - d_1 Y_t - d_2 R_t &= \varepsilon_{\text{INV}t} \\ M_t^S - b_0 - b_1 \text{MB}_t + b_2 R_t &= \varepsilon_{\text{MS}t} \\ M_t^D - a_1 Y_t - a_3 P_t + a_2 R_t &= \varepsilon_{\text{MD}t} \end{aligned}$$

where  $\text{CONS}_t$  is real consumption,  $Y_t$  is real gross domestic product (GDP),  $\text{INV}_t$  is real investment,  $R_t$  interest rate,  $M_t^S$  is nominal money supply and  $M_t^D$  is demand for money.  $\varepsilon_{\text{C}t}$ ,  $\varepsilon_{\text{I}t}$ ,  $\varepsilon_{\text{MD}t}$  and  $\varepsilon_{\text{MS}t}$  are the error terms for consumption, investment, money demand and money supply vectors respectively.

The variables ( $C_t$ ,  $I_t$ ,  $Y_t$ ,  $M_t^S$ ,  $M_t^D$ ,  $P_t$ ,  $\text{MB}_t$ ,  $R_t$ ) in the four equations above are assumed to be cointegrated. Therefore, the relationships of the four vectors represented by the above equations can be analyzed together based on the macroeconomic theory.

According to monetary and macroeconomic theory, the “great ratio” for money demand, one should expect  $a_1$  and  $a_3$  to have their mean fluctuating around one. Also, it is expected that  $a_2$  will be less than zero, and this is in line with the long-run elasticity of the interest rate<sup>2</sup>. The great ratio helps to link the real consumption, real investment and money markets, as the money demand equation has the real income as one of its variables. This is based on the analysis that for forward-looking consumers that follow permanent income hypothesis, movements in consumption will give insights about the

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<sup>2</sup> See Schmidt (2001)

position of output in relation to its trend (Attfield and Temple, 2003). For example, an economy experiencing a fall in output while consumption remains the same, it would be safe to conclude that the fall in income is not permanent, but transitory. The same analogy is true for a fall in output while investment remains the same. Hence, Attfield and Temple (2003) conclude that “the balanced growth hypothesis implies that log consumption and log investment should each be cointegrated with output, with unit cointegrating vectors”. The relationships amongst the variables discussed above are expected to yield the four long-run relationships.

The first two equations relations in the box are called the great ratio. Pesaran and Pesaran (1997) say that “the balanced growth literature, and the more recent real business cycle literature both predict [CONS – Y] and [INV – Y] as the two cointegrating relations”. Since we have four cointegrating vectors in total, the remaining two equations in the box, namely, the long-run money demand and money supply respectively will complete the hypothesized vectors.

The two money market equations represent equilibrium in the money demand and money supply market. The money demand error term and the money supply error term are stationary with a zero mean. This means that each of these residuals will fluctuate around zero as a condition for long-term equilibrium. But in the short-run these markets do deviate from equilibrium from time to time. If the market is in disequilibrium a variable or a combination of variables will have to adjust to re-attain equilibrium.

Now the question is what happens when  $\varepsilon_{MDt}$  is greater than zero? Before answering this question, note that an important aspect of the cointegration analysis entails the evaluation of the short-run properties of cointegrating vectors. That is, if there is any

deviation from the long-run equilibrium, there should be adjustment in variable(s) to achieve the defined long-run equilibrium. And this adjustment takes place on the short-run basis. So, in case  $\varepsilon_{MD_t}$  is greater than zero, the expectation is that either  $M_t^D$ ,  $P_t$ ,  $Y_t$ ,  $R_t$  or some combination of these four variables should adjust to get the system back to equilibrium. The theory suggests that in this case equilibrium can be reached again by having either  $M_t^D$  or  $R_t$  decreasing or either by  $Y_t$  or  $P_t$  increasing<sup>3</sup>. Following the initial assumption of  $a_1$  and  $a_3$  to each equal one, and  $a_2$  to be less than zero, the money demand equation will be as follows;

$$M_t^D - a_0 - Y_t - P_t + R_t = \varepsilon_{MD_t}$$

The adjustments in  $M_t^D$ ,  $P_t$ ,  $Y_t$  and  $R_t$  are based on money demand equation where  $M_t^D$  and  $R_t$  have positive coefficients, while  $P_t$  and  $Y_t$  have negative coefficients. Also, there can be any combination of these four adjusting to re-attain equilibrium. If  $M_t^D$  is greater than zero it means that people are holding too much money. Therefore, money demand or interest rate should fall, or income or prices will increase to bring equilibrium in the money demand market.

Similar to what is done in case  $\varepsilon_{MD_t}$  is greater than zero, there are adjustments needed in case the money supply function is not in equilibrium. What happens when  $\varepsilon_{MS_t}$  is greater than zero? Equilibrium is re-attained by having either  $M_t^S$ ,  $MB_t$  or  $R_t$  responding to this disequilibrium.

Following the “great ratio” assumption, one would predict that both  $d_1$  and  $g_1$  will be equal or at least closer to one. The sign for  $d_2$  is sometimes ambiguous, but mostly

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<sup>3</sup> See Schmidt (2003) for other empirical studies done on the adjustment of variables in order to re-attain equilibrium.

estimated to be greater than zero (Schmidt, 2001). Based on monetary theory one would predict it to be less than zero.

If  $\varepsilon_{\text{CONST}}$  is greater than zero, the consumption vector can be re-equilibrated by changes in either real consumption, real income or interest rates. Also, if  $\varepsilon_{\text{INV}_t}$  is greater than zero the investment vector can be re-equilibrated by changes in real investment, real income or interest rates. The theoretical analysis will be applied on the empirical results based on the South African macroeconomic and monetary economic data in the next sections.

### **5.3. Computing vectors**

This section deals with the empirical tests for unit roots and testing for the appropriate number of vectors. It explains how one arrives at the results for four equations. The multivariate model was run for different sample periods. For most of the periods, four vectors were found, but in other periods less than four vectors were found. Base on the economic theory assumptions we expect to have four vectors.

*Unit root tests.* The Augmented Dickey-Fuller (ADF) test was performed to test for the unit root in the system. The ADF test indicates that the seven variables fail to reject the presence of a single unit root as in table 5.1. The tests are based on the empirical techniques outlined in chapter 3. The assumption was that by nature, most macroeconomic data are non-stationary. Hence, the first step would be to test for the condition that the data is non-stationary, and not just carry on with the estimation by simply assuming that condition.

Table 5.1: Unit root tests for variables

Variable	ADF statistics with no trend*	ADF statistics with trend**
LCONS	-1.2715	-3.0892
LINV	-2.0167	-2.4460
LMB	.055658	-2.2640
LP	-.92018	-.95744
LM3	-.040609	-2.8324
LY	-1.2133	-2.4089
R	-1.6153	-.33585

\* 95% critical value for the augmented Dickey-Fuller statistic (with no trend) = -2.8806

\*\* 95% critical value for the augmented Dickey-Fuller statistic (with trend) = -3.4401

Now that the unit root tests are done, the next step is to test for the number of vectors using the eigenvalue and the trace tests.

*The eigenvalue tests.* The maximum eigenvalue and trace tests are necessary steps used to determine the number of cointegrating relationships that the seven variables are expected to give. So, in each of the regime results for the maximum eigenvalue and trace tests are presented to show the number of cointegrating vectors. The unrestricted matrix by Johansen's maximum likelihood system was estimated and the number of significant cointegrating vectors is reported in the table below. The results are reported within the vector error-correction equations for the seven variables.

Table 5.2(a)

Sample: 1967:1 – 1982:4

Multiple-equation long-run tests based on maximum eigenvalue and trace test of the stochastic matrix

<b>Maximum Eigenvalue</b>					
Eigenvalue	Ho:	Ha:	Statistic	95 % Critical Value	90 % Critical Value
0.64227	$r = 0$	$r = 1$	65.7911	46.4700	43.4400
0.53415	$r \leq 1$	$r = 2$	48.8893	40.5300	37.6500
0.48494	$r \leq 2$	$r = 3$	42.4627	34.4000	31.7000
<b>0.30563</b>	<b><math>r \leq 3</math></b>	<b><math>r = 4</math></b>	<b>23.3445**</b>	<b>28.2700</b>	<b>25.8000</b>
0.20651	$r \leq 4$	$r = 5$	14.8042	22.0400	29.6800
0.20485	$r \leq 5$	$r = 6$	14.6706	15.8700	13.8100
0.17973	$r \leq 6$	$r = 7$	12.6800	12.3900	10.5500
<b>Trace</b>					
Eigenvalue	Ho:	Ha:	Statistic	95 % Critical Value	90 % Critical Value
0.64227	$r = 0$	$r \geq 1$	222.6423	147.2700	141.8200
0.53415	$r \leq 1$	$r \geq 2$	156.8513	115.8500	110.6000
0.48494	$r \leq 2$	$r \geq 3$	107.9620	87.1700	82.8800
0.30563	$r \leq 3$	$r \geq 4$	65.4993	63.0000	59.1600
<b>0.20651</b>	<b><math>r \leq 4</math></b>	<b><math>r \geq 5</math></b>	<b>42.1548**</b>	<b>42.3400</b>	<b>39.3400</b>
0.20485	$r \leq 5$	$r \geq 6$	27.3506	25.7700	23.0800
0.17973	$r \leq 6$	$r \geq 7$	12.6800	12.3900	10.5500

\*\*\*, \*\*, \* Significant at the 99%, 95% and 90% critical levels respectively.

Table 5.2(b)

Sample: 1983:1 – 2004:4

Multiple-equation long-run tests based on maximum eigenvalue and trace test of the stochastic matrix

Maximum Eigenvalue					
Eigenvalue	Ho:	Ha:	Statistic	95 % Critical Value	90 % Critical Value
0.83925	r = 0	r = 1	87.7383	49.3200	46.5400
0.71578	r ≤ 1	r = 2	60.3851	43.6100	40.7600
0.62556	r ≤ 2	r = 3	47.1510	37.8600	35.0400
<b>0.47836</b>	<b>r ≤ 3</b>	<b>r = 4</b>	<b>31.2372**</b>	<b>31.7900</b>	29.1300
0.3845	r ≤ 4	r = 5	23.2953	25.4200	23.1000
0.24555	r ≤ 5	r = 6	13.5245	19.2200	17.1800
0.10441	r ≤ 6	r = 7	5.2930	12.3900	10.5500
Trace					
Eigenvalue	Ho:	Ha:	Statistic	95 % Critical Value	90 % Critical Value
0.83925	r = 0	r ≥ 1	268.6245	147.2700	141.8200
0.71578	r ≤ 1	r ≥ 2	180.8862	115.8500	110.6000
0.62556	r ≤ 2	r ≥ 3	120.5011	87.1700	82.8800
<b>0.47836</b>	<b>r ≤ 3</b>	<b>r ≥ 4</b>	<b>73.35**</b>	<b>63.0000</b>	59.1600
0.3845	r ≤ 4	r ≥ 5	42.1128	42.3400	39.3400
0.24555	r ≤ 5	r ≥ 6	18.8175	25.7700	23.0800
0.10441	r ≤ 6	r ≥ 7	5.2930	12.3900	10.5500

\*\*\*, \*\*, \* Significant at the 99%, 95% and 90% critical levels respectively.

In both periods, the maximum eigenvalue tests suggest a cointegrating rank of  $r = 4$ . But the trace test confirms the existence of  $r = 4$  in the second period and  $r = 5$  in the first period. The eigenvalue test results are in support of the four vectors and this is good for this estimated system of equations where the theory predicted the existence of four vectors.

The four cointegrating vectors are denoted by  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$  and  $\beta_4$ . In each of these four vectors there are eight elements. The first seven elements are the coefficients of the I(1) variables are CONS, INV, MB, P, M3, Y and R. The eighth element is the trend

Table 5.3: Theoretical Presentation of Vectors

	Vector 1	Vector 2	Vector 3	Vector 4
Cons	$\beta_{11}$	$B_{21}$	$B_{31}$	$B_{41}$
Inv	$\beta_{12}$	$B_{22}$	$B_{32}$	$B_{42}$
MB	$\beta_{13}$	$B_{23}$	$B_{33}$	$B_{43}$
P	$\beta_{14}$	$B_{24}$	$B_{34}$	$B_{44}$
M3	$\beta_{15}$	$B_{25}$	$B_{35}$	$B_{45}$
Y	$\beta_{16}$	$B_{26}$	$\beta_{16}$	$B_{46}$
R	$\beta_{17}$	$B_{27}$	$\beta_{17}$	$B_{47}$
Trend	$\beta_{18}$	$B_{28}$	$\beta_{18}$	$B_{48}$

In order to get the estimated vectors, the system is further restricted. The box below shows the imposed exactly identified restriction.

Mathematically, the four vectors can be presented in this form;

$\beta_{11} = 1;$	$\beta_{12} = 0;$	$\beta_{13} = 0;$	$\beta_{14} = 0;$
$\beta_{21} = 0;$	$\beta_{22} = 1;$	$\beta_{23} = 0;$	$\beta_{24} = 0;$
$\beta_{31} = 0;$	$\beta_{32} = 0;$	$\beta_{33} = 1;$	$\beta_{34} = 0;$
$\beta_{41} = 0;$	$\beta_{42} = 0;$	$\beta_{43} = 0;$	$\beta_{44} = 1;$

The model is estimated for both the exact-identifying and the over-identifying restriction for restricted values of the multiple-equation cointegrating system. But only the results of the over-identified restrictions will be used in constructing the four system equations.

The over-identifying restrictions help in terms of removing some of the variables in the vectors where they are not required for economic interpretation reasons. Tables 5.4(a) and 5.4(b) are estimated with exact identifying restrictions for regimes I and II

respectively, while tables 5.4(c) and 5.4(d) are estimated with over identifying restrictions for the two regimes.

Table 5.4(a): Regime I - ML estimates subject to exactly identifying restriction(s)  
Estimates of Restricted Cointegrating Relations (SE's in Brackets)

Variables	Consumption Vector	Investment Vector	Money Supply Vector	Money Demand Vector
LCONS	1.0000 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)
LINV	0.00 (*NONE*)	1.0000 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)
LMB	0.00 (*NONE*)	0.00 (*NONE*)	1.0000 (*NONE*)	-0.00 (*NONE*)
LP	0.00 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)	1.0000 (*NONE*)
LM3	-.051204 (.10813)	.24911 (.34845)	-1.3793 (.40115)	-1.1502 (.22375)
LY	-3.1599 (.90195)	-2.0924 (3.5263)	-4.7195 (3.7390)	.77686 (2.1788)
R	-.011806 (.012482)	-.052465 (.050446)	-.083252 (.052836)	-.040734 (.031002)
Trend	.0088537 (.0045165)	.0075338 (.016473)	.032036 (.017953)	.0087769 (.010306)

LL subject to exactly identifying restrictions= 1529.4

The numbers in parenthesis show that most of the variables are significant. For example, M3 is significant for the Money Supply and Money Demand vectors, but not for the Consumption and Investment vectors. However, the fact that M3 is not significant for Consumption and Investment vectors is okay for this model. With additional restrictions M3 will be zeroed out from the two vectors.

Table 5.4(b): Regime II - ML estimates subject to exactly identifying restriction(s)  
Estimates of Restricted Cointegrating Relations (SE's in Brackets)

Variables	Consumption Vector	Investment Vector	Money Supply Vector	Money Demand Vector
LCONS	1.0000 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)
LINV	0.00 (*NONE*)	1.0000 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)
LMB	0.00 (*NONE*)	0.00 (*NONE*)	1.0000 (*NONE*)	-0.00 (*NONE*)
LP	0.00 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)	1.0000 (*NONE*)
LM3	.086006 (.097951)	.91920 (.40852)	-.89089 (.21135)	-.80780 (.095600)
LY	-.67233 (.20191)	-.67586 (.85885)	.60069 (.43306)	2.3972 (.20168)
R	-.0019831 (.0019400)	.0098539 (.0081497)	-.0021809 (.0041761)	-.0064855 (.0019093)
Trend	-.0031235 (.0014155)	-.011710 (.0059851)	-.0033623 (.0030414)	-.0040683 (.0014040)

LL subject to exactly identifying restrictions= 2056.8

Table 5.4(c): Regime I - ML estimates subject to over identifying restriction(s)  
Estimates of Restricted Cointegrating Relations (SE's in Brackets)

Variables	Consumption Vector	Investment Vector	Money Supply Vector	Money Demand Vector
LCONS	1.0000 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)
LINV	0.00 (*NONE*)	1.0000 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)
LMB	0.00 (*NONE*)	0.00 (*NONE*)	1.0000 (*NONE*)	-0.00 (*NONE*)
LP	0.00 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)	1.0000 (*NONE*)
LM3	-.13305 (.13272)	0.00 (*NONE*)	-2.0242 (.45167)	-1.4096 (.48228)
LY	-3.2639 (.85037)	-3.1843 (1.3426)	0.0000 (*NONE*)	4.7857 (1.5266)
R	-.0092967 (.068148)	.15122 (.23046)	.38203 (.46708)	.29928 (.36216)
Trend	.0099860 (.0056980)	.0012455 (.016249)	-.0041497 (.026364)	-.022767 (.020306)

LL subject to over-identifying restrictions= 2054.6

Table 5.4(d): Regime II - ML estimates subject to over identifying restriction(s)  
 Estimates of Restricted Cointegrating Relations (SE's in Brackets)

Variables	Consumption Vector	Investment Vector	Money Supply Vector	Money Demand Vector
LCONS	1.0000 (*NONE*)	-0.000 (*NONE*)	0.000 (*NONE*)	-0.000 (*NONE*)
LINV	-0.000 (*NONE*)	1.0000 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)
LMB	0.00 (*NONE*)	-0.000 (*NONE*)	1.0000 (*NONE*)	-0.00 (*NONE*)
LP	0.000 (*NONE*)	0.00 (*NONE*)	0.00 (*NONE*)	1.0000 (*NONE*)
LM3	0.000 (*NONE*)	1.1608 (.31573)	-1.0017 (.14741)	-.77646 (.081900)
LY	-.97655 (.24354)	-1.6093 (.31533)	-0.000 (*NONE*)	2.5806 (.28607)
R	-.0044778 (.0024449)	-.0000 (*NONE*)	-.0072447 (.0022276)	-.0048653 (.0026314)
Trend	-.0017067 (.3959E-3)	-.014710 (.0047112)	-.0014014 (.0021129)	-.0046206 (.0012188)

LL subject to over-identifying restrictions= 2054.6

From the over-identifying restrictions of the multiple-equation cointegrating model the four economic relationships are constructed for each regime. Also, note that the results are based on over-identifying restrictions.<sup>4</sup> The four vectors from the over-identified restriction model are as follows;

#### REGIME I

$$1.00\text{CONS} - 3.263Y_t - 0.009R_t = \varepsilon_{\text{CONST}} \quad (5.1)$$

$$1.00\text{INV} - 3.184Y_t = \varepsilon_{\text{INV}_t} \quad (5.2)$$

$$-2.024M_t + 1.00\text{MB} - 0.382R_t = \varepsilon_{\text{MST}} \quad (5.3)$$

$$-1.409M_t + P + 4.78Y_t + 0.299R_t = \varepsilon_{\text{MD}_t} \quad (5.4)$$

<sup>4</sup> With over-identifying restrictions, variables are removed from the vectors where they are not important for the economic relationships.

## REGIME II

$$1.00\text{CONS}_t - 0.977Y_t - 0.004R_t = \varepsilon_{\text{CONST}} \quad (5.5)$$

$$1.00\text{INV}_t - 1.609Y_t = \varepsilon_{\text{INV}_t} \quad (5.6)$$

$$-1.002M_t + 1.00MB - 0.007R_t = \varepsilon_{\text{MS}_t} \quad (5.7)$$

$$-0.776M_t + P + 2.581Y_t + 0.004R_t = \varepsilon_{\text{MD}_t} \quad (5.8)$$

Notice that from equations (5.1), (5.2), (5.5) and (5.6) that the income coefficients in the consumption and investment vectors are greater in the first regime than in the second regime. In the first regime, the income coefficients are much greater than one, which is contrary to what the economic theory suggested in the previous section. But in the second regime, the income coefficients are much closer to one. These income coefficients in the second regime are nearer to what Schmidt (2001) found when using the United States data. In his exact-identifying restrictions model Schmidt found the income coefficients for consumption and investment vectors to be -1.011 (0.083) and -1.216 (0.279) respectively. With the over-identifying restrictions his model had the income coefficients of -0.900 (0.071) and -1.565 (0.317) for income and investment vectors respectively. The second regime model have income coefficients for consumption and investments vectors as -0.977 (0.243) and 1.609 (0.315). The numbers in the parenthesis represents the standard errors. The behavior of the model under the second regime is much related to the model on the U.S. by Schmidt (2001).

Now consider the two long-run money demand equations in both regime I and regime II above. Recall also that any deviation from the long-run money demand equilibrium will require adjustment in order to bring the system back to equilibrium. Given these equations, if  $\varepsilon_{\text{MD}_t}$  is greater than zero, there should be a response by either  $M_t^D$ ,  $Y$ ,  $P$ ,  $R$  or some combination of the four variables. So, to go back to equilibrium

$M_t^D$  or R should decrease or either Y or P should increase. In other words, any combination of the above should help attain equilibrium, and therefore, the stability of money demand in the economy.

Wesso (2002) echoes the importance of the stability of money demand relationships. He argues that this is important for the economy's monetary policy and specifically for forecasting purposes. Wesso's long-run money demand relationship is based on real money demand ( $m - p_t$ ), real GDP ( $y_{t-1}$ ), long-term nominal interest rate ( $i_t$ ) and short-term nominal interest rate ( $s-own_t$ ). All variables are in logarithms except for the two interest rate variables. From his results obtained when using data from 1971Q1 to 2000Q4 he came out with this long-run money demand equation:

$$(m - p_t) = 1.84y_{t-1} - 2.76i_t - 5.11(s-own)_t$$

From this equation Wesso noted that “[t]he long-run income elasticity suggests that a 1 per cent increase in income will lead to a 1.84 per cent increase in real M3 money demand”. The same argument is inferred for changes in short-term interest rate spread and long-run interest rate.

What Wesso's approach lacks is the incorporation of long-run money supply equation and the inclusion of other significant real economic variables such as consumption and investment. So, this paper introduced real consumption, real investment and long-run money supply in the system. As stated earlier, the South African Reserve Bank has greater influence on the money supply through the manipulation of monetary base and interest rates. The Reserve Bank plays a significant

role in the stability in the money market and we therefore the importance of money supply equation should be unquestionable.

In Wesso's results, the parameters on the two interest rates are much larger than in the results of the model run here. In the first and second regimes the parameters for interest rate are 0.299 and 0.004 respectively. For interest rates to be effectively used to move the long-run money demand equation into equilibrium, there should be a very big rise or fall when other variables remain constant. In 1998 and 1999 the Reserve Bank increased the bank lending rate from 16 percent to record high of 24.

A more complete and detailed analysis of these four vectors are given in the next section where "speed of adjustment" analysis are given.

#### **5.4. The 'speed of adjustment' parameters**

As mentioned earlier, the estimated results are based on two sample periods representing two different regimes. The first regime is from 1966q1 to 1982q4 and the second regime is from 1983q1 to 2004q4. The two regimes are compared and monetary policy variables that bring the four systems back to equilibrium are considered.

This section discusses the secondary aspect of cointegration analysis where short-run properties of the cointegrated vectors are examined. As Schmidt (2001) has stated, "the existence of cointegration requires that any deviation from long-run equilibrium must produce adjustment(s) to re-attain the defined equilibrium". So, this section looks at the variables in the model that bring the system back to equilibrium as well as those variables that derive the system out of equilibrium under the two regimes. Put

differently, one should be able to observe the effectiveness of monetary policy instruments used based on the variables restoring equilibrium in the real and nominal relationship in the two regimes.

The results of the seven variables and the four vectors are presented in tables 5.5(a) and 5.5(b) for the first and second regime respectively. Deviations from equilibrium are illustrated by a case such as having  $\epsilon_{\text{CONST}t}$  greater than zero. Note that from the associated  $\alpha$  matrix the estimated responses are obtained.  $\alpha$  is obtained from  $\Pi$  matrix where  $\Pi$  equals  $\alpha\beta'$ . Tables 5.1(a) and 5.1(b) represent the estimated  $\alpha$  matrix. These results show how each of the seven variables responds to past disturbances to the cointegrating vectors.

Table 5.5(a): Estimated Speed of Adjustment in Regime I  
Sample: 1966:1 – 1982:4

Variables	$\epsilon_{\text{CONST}t}$	$\epsilon_{\text{INV}t}$	$\epsilon_{\text{MS}t}$	$\epsilon_{\text{MD}t}$
Income (LY)	<b>0.424***</b> (0.114)	0.018 (0.025)	<b>-0.146***</b> (0.037)	<b>0.193***</b> (0.057)
Consumption (LCONS)	-0.060 (0.136)	0.011 (0.037)	0.0002 (0.0431)	-0.004 (0.069)
Investment (LINV)	<b>-0.942***</b> (0.281)	<b>-0.282***</b> (0.090)	<b>0.286***</b> (0.090)	<b>0.574***</b> (0.144)
Money (LM3)	0.037 (0.079)	<b>0.053**</b> (0.021)	-0.008 (0.025)	0.0412 (0.040)
Price (LP)	-0.093 (0.015)	0.028 (0.013)	0.009 (0.014)	-0.003 (0.024)
Monetary base (LMB)	<b>0.544***</b> (0.163)	<b>0.109**</b> (0.047)	<b>-0.268***</b> (0.053)	<b>0.356***</b> (0.083)
Interest rate (INTB)	<b>-12.104*</b> (6.054)	1.344 (1.489)	2.016 (1.840)	-3.132 (2.885)

\*\*\* Significant at the 1 percent level

\*\* Significant at 5 percent level

\* Significant at 10 percent level

Table 5.5(b): Estimated Speed of Adjustment in Regime II  
Sample: 1982:1 – 2004:4

Variables	$\varepsilon_{\text{CONS}t}$	$\varepsilon_{\text{INV}t}$	$\varepsilon_{\text{MS}t}$	$\varepsilon_{\text{MD}t}$
Income (LY)	0.044 (0.061)	-0.023 (0.015)	-0.036 (0.04)	<b>-0.037**</b> <b>(0.02)</b>
Consumption (LCONS)	-0.089 (0.128)	0.005 (0.033)	<b>0.052*</b> <b>(0.037)</b>	0.025 (0.022)
Investment (LINV)	<b>0.520***</b> <b>(0.175)</b>	<b>-0.465***</b> <b>(0.164)</b>	<b>-0.126**</b> <b>(0.07)</b>	-0.066 (0.08)
Money (LM3)	0.042 (0.052)	<b>0.032**</b> <b>(0.013)</b>	-0.007 (0.015)	0.008 (0.011)
Price (LP)	-0.032 (0.044)	<b>0.022**</b> <b>(0.011)</b>	<b>-0.026**</b> <b>(0.013)</b>	<b>0.016**</b> <b>(0.008)</b>
Monetary base (LMB)	-0.003 (0.002)	0.021 (0.031)	<b>-0.131***</b> <b>(0.033)</b>	<b>-0.039**</b> <b>(0.021)</b>
Interest rate (INTB)	<b>19.934***</b> <b>(6.420)</b>	1.305 (1.371)	2.5253 (1.847)	0.626 (0.021)

\*\*\* Significant at the 1 percent level

\*\* Significant at 5 percent level

\* Significant at 10 percent level

As stated earlier, the consumption and the investment vectors represent the real sector of the model. The money supply and money demand vectors represent the money market. Following Schmidt (2001), further restrictions are made in the four vectors. First, investment and monetary base are eliminated from the consumption vector though investment is significant in both regimes and monetary base is significant only in the first regime. Second, restrictions are put on investment sector by omitting money and prices. Third, according to Schmidt (2001)'s analogy, "consumption and investment are restricted to be zero within the hypothesized money supply vector and the monetary base is removed from the consumption and investment vectors". Fourth, a distinction between the money supply vector and money demand vector in the money market is made by removing monetary base from the money demand vector and by removing prices from the money supply vector. These further restrictions give rise to equations (5.1) to (5.8).

From the tables 5.5(a) and 5.5(b) consider the variables that clear the system and those that drive the system out of equilibrium. So, the four vectors are examined individually under the two regimes. For example, if there is a positive value of  $\epsilon_{MDt}$ , it means that money demand is above the long-run equilibrium and therefore, there should be adjustment either in price, money demand, income or interest rate to bring the system back to equilibrium. But not all the required variables are significant. Moreover, some variables may be significant, but responsible for further driving the system out of long-run equilibrium rather than equilibrating it.

The consumption relationship has real consumption, real income and interest rates available to correct the disequilibrium. In the first regime both real income and interest rate are significant at 99 percent and 90 percent levels respectively. But of the two, only income comes with the right sign. Hence, the conclusion is that income clears the consumption vector under the first regime. In the second regime income is insignificant though it comes with the right sign. However, interest rate is significant at the 99 percent level and it comes with the right sign. Therefore, interest rates clear the consumption vector in the second regime. It is here concluded that in case  $\epsilon_{CONST}$  is greater than zero, income will have to rise to re-attain equilibrium in the first regime, and in the second regime interest rates should rise to bring the system back to equilibrium.

As in the consumption relationship, three variables are responsible for equilibrating the investment relationship. Real income, real investment and interest rates are the choice variables. From the two tables above, neither real income nor interest rates are significant to clear the investment vectors in the two regimes. But real investment comes with the right sign and is significant at 99 percent level in both regimes.

Disequilibrium in the investment vector may be the situation where  $\varepsilon_{it}$  is greater than zero and in both regimes real investment would be the choice variable to move in order to bring the system back to equilibrium.

The money market has interesting features under the two regimes. These features will be analyzed in the money supply and money demand relationships. For the money supply relationship the variables required to bring the system back to equilibrium are nominal money supply, monetary base and interest rates. For money demand relationship, real income, nominal money demand prices and interest rates are the variables required to re-attain equilibrium.

Now consider the money supply vector. Here the nominal money supply and interest rates variables are insignificant in both regimes. But monetary base comes with the right sign and is significant at the 99 percent level in both regimes. Therefore, in case  $\varepsilon_{MSt}$  is greater than zero, monetary base will have to increase in order to re-attain long-run equilibrium in the money supply relationship.

Some of the money demand relationship's clearing variables show mixed signals in the two regimes. Of all the variables required to clear the money demand vector, interest rate was insignificant at 99 percent level in both regimes. It, however, comes with a negative sign in the first regime and a positive sign in the second regime. Real income is significant in both regimes, but it comes with the positive sign in the first regime and a negative sign in the second regime. This means that real income drives money demand relationship out of equilibrium in the first regime, but it clears the money demand relationship under the second regime. In the first regime, price comes with the right sign but it is statistically insignificant. Note that this finding about price is in line

with the monetary policy regime under this period where policies were non-market oriented in approach. In the second regime price comes with a positive sign and it is significant at the 95 percent confident level. Therefore, one would conclude that prices drive the money demand system out of equilibrium in the second regime.

A further discussion on prices driving the money demand system out of equilibrium is important given that in most cases prices are expected to be positive. To put this in a different way one would say that there are more cases in general of the economies facing rising prices than falling prices. So, why should one expect price to come with a negative sign in order to for it to re-attain equilibrium in this estimated systems? The answer can found in the statement by Abel and Bernanke (2001);

“...if we say something like ‘the price level falls to restore general equilibrium’, we do not mean that the price level literally falls but only that it rises by less than its trend or expected rate of growth would suggest.”

Now that the variables responsible for re-attaining long-run equilibrium in this estimated system have been identified for each of the four vector relationships, the next step would be to compare the results with other research done on macroeconomics and monetary economics in South Africa. As stated earlier (in the literature review section), not much work has been done in this field of study using the cointegration methods where real consumption and real investment are estimated together with the money market vectors. Moreover, studies done on the money market did not estimate the money supply and money demand as two separate vectors. These limitations necessitate the idea of comparing the results of this study with some literature on economic history in South Africa. A section on the two regimes and their economic performance gives insight into the nature of economic development over the past four decades.

It has been mentioned above that real investment had to increase to clear the investment relationship. The main sector where much of the investments were needed over the decades was in the mining industry, especially in gold mining. South Africa has been known for more than four decades to be the major supplier of gold. The mining industry has always been in the private hands in South Africa. Hence, private companies have been largely responsible for investments in this sector. The motivation was for increased profits as investments (especially in modernized technology) would bring efficiency and increase productivity. The industry also benefited from cheap black labor as the government allowed for the practice of paying blacks lower wages than their white counterparts regardless of their skill levels or number of years spent serving the companies.

But the government was not always helpful to this sector over the years. Taxes were increased on the net profits in the gold industry. In the 1980s the Mineral Bill came up with the policy of taxing the gold mines at a higher rate than other companies. But this did not discourage investments since the gold mine companies found a way to beat the system. Conglomeration became the order of the day as the gold mining teamed with companies providing services to the gold mines. Bell (2000) argues that “this often led to price distortions, as industrial companies belonging to the mining houses charged exorbitantly high prices to the mines, so that profits were earned in the companies that would attract the lowest rate of tax”.

Another sector that encouraged much investment was the Agriculture from the early 1960s to the late 1980s. Investment in machinery and other equipments used in the agricultural sector increased from 48.6 million rand in 1961 to 369.9 million rand in

1987. During this period the total capital assets, that is, investment in machinery plus value of machinery and equipments in agricultural sector, increased from 4 845.8 million rand in 1961 to 48 048.7 million rand in 1987. This is in line with the increase in investment in the South African economy.

The expectations would be that real income should clear the investment vector. But under the first regime investment is the one that reacts to income. The reason for this might be that high tax rates that targeted the mining sector. When taxes on the mining proceeds were too high, one way to avoid tax would be to re-invest the profits, and this would stimulate economic growth. Companies that invested more of their profits would leave less of their financial resources available for government taxing. Therefore, if there was hope for a cut in mine tax in the following years, then mining companies would consider not investing much of their profits in those years.

The other question is on how this study compares with other South African studies where financial variables and real economic variables were simultaneously estimated? Moll (1999) estimated the model with financial variables, consumption and investment. The financial variables included by Moll were currency, M1, M3 and currency and he found that “changes in monetary aggregates have no impact upon private consumption, gross investment, or private business investment”. He also found the demand for money to be less stable in the 1980’s and the reason was that there was financial innovation, liberalization of financial system, and change towards indirect policy measures that were used in the past decades. He also found strong effects of interest rates on real variables. Compared with the model used in this paper, interest rates have effects on real consumption, where they derive the consumption system out of

equilibrium in the first regime, but clear the system in the second regime. Also, in this model, real income was found to clear the money demand market in the second regime whereas Moll did not find any tangible relationship between monetary aggregates and nominal or real income in the two periods.

Finding of better results in the relationship between nominal money demand and income in the money demand vector can be attributed to better estimating methods. First, the inclusion of both the money demand vector and the money supply vector was important for proper estimation of the model. The inclusion of money supply vector brings with it the monetary base, which is one of the important monetary variables used by the Reserve Bank. But Moll used the money demand vector plus income and investment vectors, leaving out the money supply vector. Second, the model differentiated between the two periods that are entirely distinct in terms of the monetary policy applied.

### **5.5. Reflection on Monetary Economic Issues**

The two tables on estimated speed of adjustment show the similarities and differences on how policy variables responded to disequilibrium in the four markets under the two regimes. An attempt is made to show if the change in policy applied by the Reserve Bank in the two periods were of any importance for stability and growth. Success or failure will be based on the responsiveness of relevant variables and on whether there is any improvement on the variables that move to clear the markets when going from the first regime to the second regime.

The approach here will be to analyze changes in variances as well as correlation coefficients in the two regimes. Then a discussion on the meaning of residual disequilibrium in each vector is given, and this will be followed by economic analysis of correlation coefficients. First consider the changes in the variances of the residuals in table 5.6.

Table 5.6: Covariance Matrix

Regime I				
	$\epsilon_{CONST}$	$\epsilon_{INVt}$	$\epsilon_{MSt}$	$\epsilon_{MDt}$
$\epsilon_{CONST}$	0.116829631	0.121335664	0.107060944	-0.069333573
$\epsilon_{INVt}$	0.121335664	0.126640948	0.110821209	-0.072313891
$\epsilon_{MSt}$	0.107060944	0.110821209	0.136516955	-0.093824048
$\epsilon_{MDt}$	-0.069333573	-0.072313891	-0.093824048	0.067718713

Regime II				
	$\epsilon_{CONST}$	$\epsilon_{INVt}$	$\epsilon_{MSt}$	$\epsilon_{MDt}$
$\epsilon_{CONST}$	0.000435371	-0.000586106	-0.0011912	0.003166015
$\epsilon_{INVt}$	-0.000586106	0.004323794	0.003664471	-0.007768097
$\epsilon_{MSt}$	-0.0011912	0.003664471	0.006320575	-0.012231844
$\epsilon_{MDt}$	0.003166015	-0.007768097	-0.012231844	0.032938281

The computed variances for  $\epsilon_{CONST}$ ,  $\epsilon_{INVt}$ ,  $\epsilon_{MSt}$  and  $\epsilon_{MDt}$  were 0.1168, 0.1266, 0.1365 and 0.0677 respectively for regime I. For regime II the computed variances were 0.0004, 0.0043, 0.0063 and 0.0329 for  $\epsilon_{CONST}$ ,  $\epsilon_{INVt}$ ,  $\epsilon_{MSt}$  and  $\epsilon_{MDt}$  respectively. During regime II the variances were smaller compared to those in regime I. The relevance of this finding is that the smaller variance signifies the smaller deviation from the long-run disequilibrium, and the more strongly the monetary theory in question is reflected in the

data<sup>5</sup>. Therefore, the findings here reflect improvements in policy responsiveness under the second regime.

Smaller variances mean that the four markets do not deviate much from their long-run equilibrium. This can be attributed to the use of market oriented policy instruments allowing the system to adjust back to equilibrium faster, or variables integrating relatively freely for the equilibration of the systems. But in the first regime, variables were mostly controlled and this could affect equilibrium process.

Correlation coefficients allow one to evaluate the relationships between the vectors. Table 5.7 gives the correlation coefficient signs for the different pairs of residuals.

Table 5.7 Correlation Coefficients

Regime I				
	$\varepsilon_{CONST}$	$\varepsilon_{INVt}$	$\varepsilon_{MSt}$	$\varepsilon_{MDt}$
$\varepsilon_{CONST}$	1	0.997527539	0.847737253	-0.779493917
$\varepsilon_{INVt}$	0.997527539	1	0.842834904	-0.780872822
$\varepsilon_{MSt}$	0.847737253	0.842834904	1	-0.97581282
$\varepsilon_{MDt}$	-0.779493917	-0.780872822	-0.97581282	1

Regime II				
	$\varepsilon_{CONST}$	$\varepsilon_{INVt}$	$\varepsilon_{MSt}$	$\varepsilon_{MDt}$
$\varepsilon_{CONST}$	1	-0.42718272	-0.718086038	0.836050919
$\varepsilon_{INVt}$	-0.42718272	1	0.700971703	-0.650926108
$\varepsilon_{MSt}$	-0.718086038	0.700971703	1	-0.847740965
$\varepsilon_{MDt}$	0.836050919	-0.650926108	-0.847740965	1

The vector combinations under consideration are  $(\varepsilon_{MSt}, \varepsilon_{MDt})$ ,  $(\varepsilon_{MSt}, \varepsilon_{CONST})$ ,  $(\varepsilon_{MDt}, \varepsilon_{CONST})$ ,  $(\varepsilon_{MSt}, \varepsilon_{INVSt})$  and  $(\varepsilon_{MDt}, \varepsilon_{INVSt})$ . It is important to remember that the four

<sup>5</sup> This was illustrated by Cutler, Berri and Ozawa (2002) for the flying-geese theory.

estimated vectors are linked such that changes in one vector have the potential to affect the other vector. For example, an expansionary monetary policy that increases money supply have the potential to increase real output in the short run, as well as causing prices to increase. So, the question is what is the economic significance or implications of having the covariance of  $\epsilon_{MS_t}$  and  $\epsilon_{MD_t}$  greater or less than zero?

Now that the covariance matrix support the fact that monetary policy's responsiveness is evident in the second regime than in the first regime, further analysis are made using correlation coefficients.

It is important to re-visit the disequilibrium in residuals in more details. This is because the markets are discussed in pairs. Hence, the need to give details on what is theoretically expected and what the data says when the disequilibrium in residuals are analyzed in pairs.

*Disequilibrium residuals.* This subsection explains the meaning of the disequilibrium in residuals in the four markets. It further reveals how the markets are linked by studying the correlation coefficients under the two regimes.

If  $\epsilon_{CONS_t}$  is less than zero, it means that given  $CONS_t - Y_t = \epsilon_{CONS_t}$ , real consumption is relatively lower to real income. People are not spending enough money on consumption goods, and equilibrium in the consumption market requires policies aimed at increasing consumption. This may be in the form of transfers to the economic class that have high marginal propensity to consume (usually the poor in the society).

If  $\epsilon_{CONS_t}$  is greater than zero, it means that real consumption is relatively high compared to real income. Therefore, people are spending more than what the economy is generating. Consumption might be financed by borrowing against future income. This

may also mean that demand for imported goods is increasing as a result of implementing open economic policies.

A case of  $\varepsilon_{INV_t}$  being less than zero means that given  $INV_t - Y_t = \varepsilon_{INV_t}$ , real investment is relatively lower to real income. This can be as disinvestments in the 1980s or the effects of uncertainty and open market economy being subjected to capital flight. If  $\varepsilon_{INV_t}$  is greater than zero it means that real investment is high relative to income. Favorable economic conditions such as rising consumer confidence, lower rates on the cost of borrowing money for investments, as well as positive global economic conditions would be good for investment to increase.

If  $\varepsilon_{MD_t}$  is greater than zero, it means that given  $M_t^D - P - Y + R = \varepsilon_{MD_t}$ , money demand is too large. People are holding too much money, and as a result spending is too low. The effects of this will be a slow down in the economy. This is because of the inverse relationship between low spending and economic growth. Also, if  $\varepsilon_{MD_t}$  is greater than zero, it is expected that  $\varepsilon_{CONST_t}$  will be negative. This is because consumption is low relative to income. Again, consumption is low because of lower spending since consumers are holding too much money. Note that South Africa had one of the highest income inequality ratings in the world. With the wealth concentrated in fewer hands, and the majority living in poverty, average spending relative to income will be low. The reason can be that the marginal propensity to consume (MPC) reaches a point where it declines as income increases. But if it was the income for the poor increasing, their MPC would still be increasing.

It is also expected that  $\epsilon_{INVS_t}$  will be less than zero. Investment is too low relative to income. It is for the same reason as above where there is holding of too much money rather than spending (investing) it. Under regime II, massive disinvestments were to blame for the fall in total investment.

Investment fluctuated a lot under the regime II than under regime I despite the fact that there was much unrest under the second regime (see the residuals for investment in figures 5.1a and 5.1b).

Figure 5.1a: Investment Residuals – Regime I

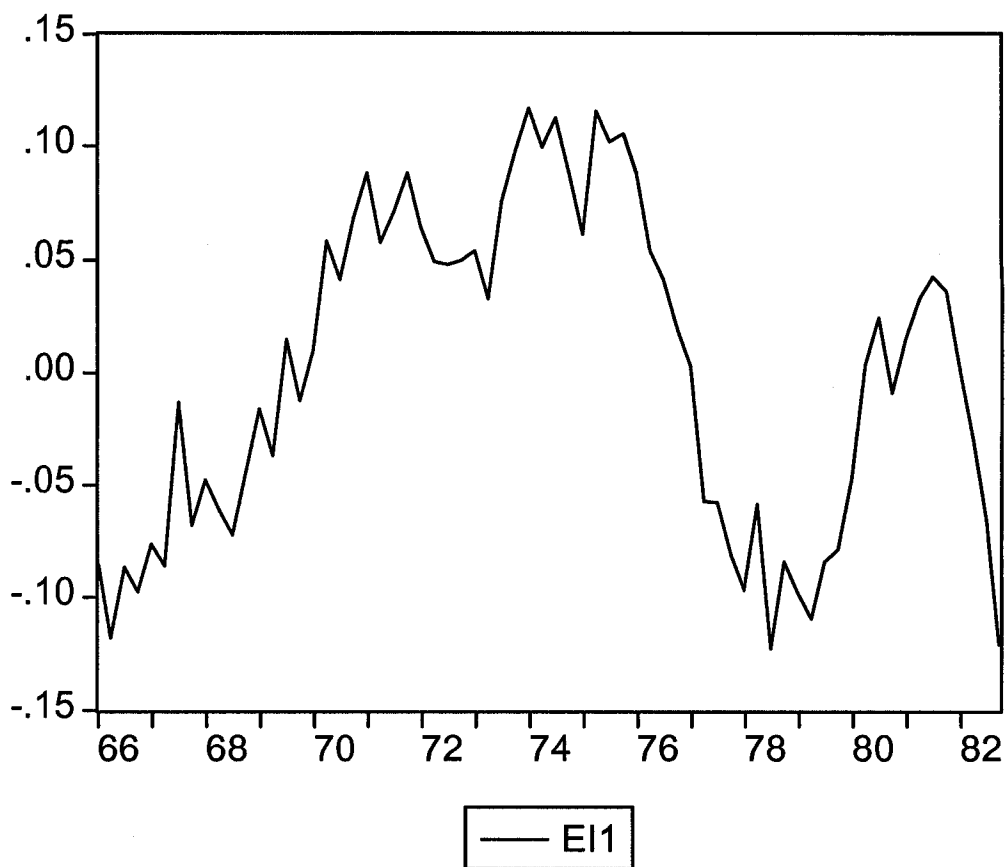
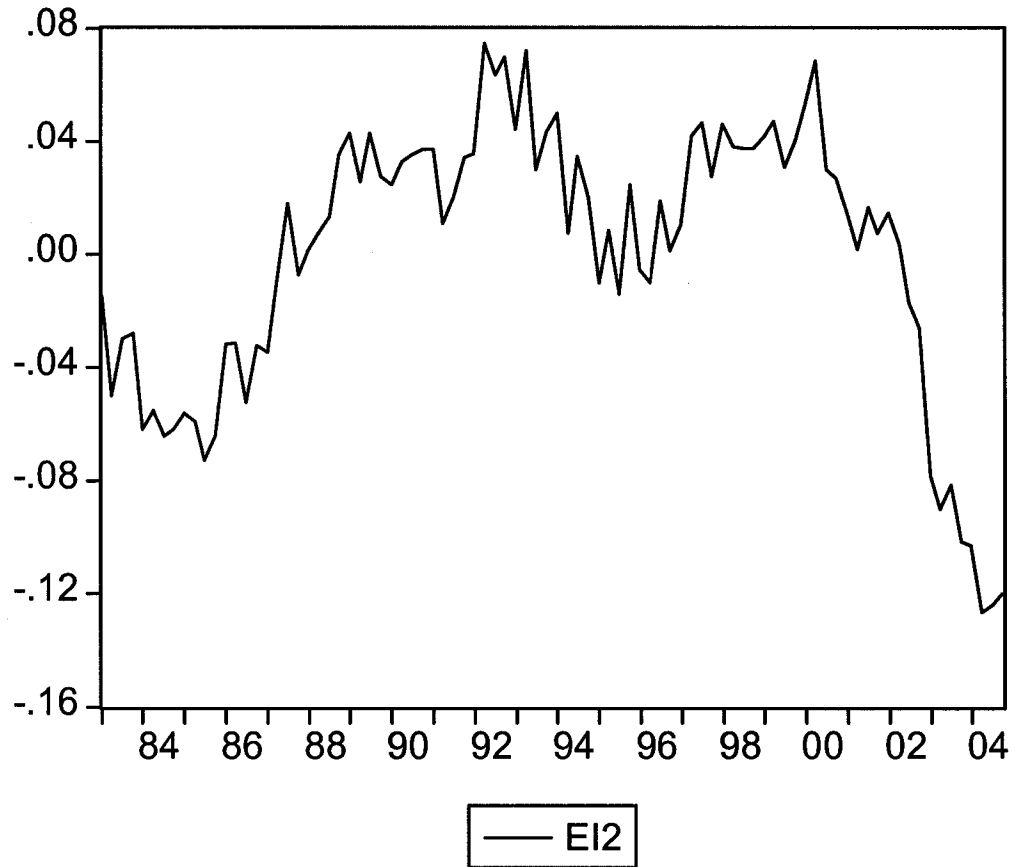


Figure 5.1b: Investment Residuals – Regime II



Apart from 2003 and 2004, the investment residuals under the second regime fluctuated relatively well inside the -0.08 and 0.08 range compared with -0.12 to 0.12 in the first regime. Still, despite the unrests and disinvestments during the second regime, investments behaved better under the second regime when market oriented policies were followed.

$\epsilon_{MS_t}$  greater than zero means that there is too much money supply in the economy. It is expected that increasing money supply should make  $\epsilon_{CONS_t}$  and  $\epsilon_{INVS_t}$  to be positive. When credit is cheap (as is the case when there is too much supply of money), it is

convenient to borrow money for investments in the economy. Also, some individuals do borrow to spend on the consumption of durable goods.

### 5.6. Correlation Coefficients and Persistent Profile

In table 5.8 the correlation coefficient for  $\epsilon_{MSt}$  and  $\epsilon_{MDt}$  is negative both in both regimes. This means that whatever policies the governors followed in the second regime did not change the money demand and money supply relationships. A negative correlation coefficient sign, as in the case of  $\epsilon_{MSt}$  and  $\epsilon_{MDt}$ , means the two vectors move in different directions when reacting to changes in variables that move to clear or to further drive the vectors out of equilibrium.

Table 5.8: Signs for the correlation coefficients

Residual terms	Regime I	Regime II
$\epsilon_{MSt}, \epsilon_{MDt}$	(-)	(-)
$\epsilon_{MSt}, \epsilon_{CONSt}$	(+)	(-)
$\epsilon_{MDt}, \epsilon_{CONSt}$	(-)	(+)
$\epsilon_{MSt}, \epsilon_{INvt}$	(+)	(+)
$\epsilon_{MDt}, \epsilon_{INvt}$	(-)	(-)
$\epsilon_{CONSt}, \epsilon_{INvt}$	(+)	(-)

The main question here is whether these correlation coefficients are consistent with the expectations based on economic theory. Correlation coefficients allow one to evaluate the relationships between the vectors. Table 5.8 shows summary of correlation signs for the selected residuals based on table 5.7. The combinations of residuals under

consideration are  $(\epsilon_{MSt}, \epsilon_{MDt})$ ,  $(\epsilon_{MSt}, \epsilon_{CONSTt})$ ,  $(\epsilon_{MDt}, \epsilon_{CONSTt})$ ,  $(\epsilon_{MSt}, \epsilon_{INVS_t})$   $(\epsilon_{MDt}, \epsilon_{INVS_t})$  and  $(\epsilon_{CONSTt}, \epsilon_{INVS_t})$ .

The correlation coefficient between  $\epsilon_{MSt}$  and  $\epsilon_{MDt}$  is less than zero under both regimes. Negative correlation coefficient here implies that  $\epsilon_{MDt}$  is greater than zero and  $\epsilon_{MSt}$  is less than zero, or  $\epsilon_{MDt}$  is less than zero and  $\epsilon_{MSt}$  is greater than zero. If  $\epsilon_{MDt}$  is greater than zero it means that people are holding too much money and this slows down economic growth. The same applies to  $\epsilon_{MSt}$  being less than zero where money supply is low, resulting in slowdown in economic growth. Low expenditure and a tight money supply policy are associated with slowdown in real output growth.

$(\epsilon_{MSt}, \epsilon_{CONSTt})$  and  $(\epsilon_{MSt}, \epsilon_{INVS_t})$  are both positive in the first regime. In this case,  $\epsilon_{MSt}$  and  $\epsilon_{CONSTt}$  are each greater than zero. Also,  $\epsilon_{MSt}$  and  $\epsilon_{INVS_t}$  are each greater than zero.  $\epsilon_{MSt}$  greater than zero means that there is enough money supply, which is good for borrowers. The available credit can be spent on consumer goods and services or be invested. This is in line with the notion of  $\epsilon_{CONSTt}$  greater than zero, where consumption is relatively large compared with income. Investment is also relatively large compared with income.

The correlation coefficient for money supply and investment residuals remains positive in the second regime. But  $(\epsilon_{MSt}, \epsilon_{CONSTt})$  becomes negative in the second period. In this case  $\epsilon_{MSt}$  is greater than zero while  $\epsilon_{CONSTt}$  is less than zero. This might be as a result of investment becoming a larger part of available money supplied in the economy because of the disinvestments by international companies that took place in the second

period. As the country struggled with maintaining investments level necessary to sustain the economy, it made sense to cut expenditure on consumption and increase expenditure on investments. Hence, real consumption is relatively low to real income.

Now consider  $(\epsilon_{MDt}, \epsilon_{CONST})$  and  $(\epsilon_{MDt}, \epsilon_{INVS_t})$ . They are each negative under the first regime. This is a situation where  $\epsilon_{MDt}$  is greater than zero and  $\epsilon_{CONST}$  is less than zero, or  $\epsilon_{MDt}$  is less than zero and  $\epsilon_{CONST}$  is greater than zero for consumption-money demand relationship. For investment-money demand relationship it means that either  $\epsilon_{MDt}$  is greater than zero and  $\epsilon_{INV_t}$  is less than zero, or  $\epsilon_{MDt}$  is less than zero and  $\epsilon_{INV_t}$  is greater than zero.  $\epsilon_{MDt}$  greater than zero means that people are holding too much money and not spending enough on consumption and investment. This is confirmed by the fact that real consumption is relatively less to real income and real investment is also relatively less to real income. But  $\epsilon_{MDt}$  less than zero means that people are holding less money, and spend more on consumption and investments. This is good for economic growth.

The above relationship holds for  $(\epsilon_{MDt}, \epsilon_{INVS_t})$  and not for  $(\epsilon_{MDt}, \epsilon_{CONST})$  under the second regime. The reason for a positive  $(\epsilon_{MDt}, \epsilon_{CONST})$  may be due to a consumption oriented society in South Africa. The later years of the second regime saw a rising black middle-class that contributed largely to increase in real consumption. The bulk of their income goes to buying houses, cars and other durable goods (Burger, Van der Berg and Nieftagodien, 2004). But the wealth is not equitably distributed even amongst blacks. This may later affect total consumption as the number of the poor increases.

Lastly, consider the correlation coefficient between  $(\epsilon_{\text{CONST}}, \epsilon_{\text{INVEST}})$ . Assuming that what is not spent on consumption gets invested, one needs to consider the income distribution in South Africa. What is contributing to increase or decrease in consumption relative to investment? The current constitution is against any form of discrimination. But not every one has the necessary skills to participate in the wealth of the country. There is however, concern that South Africa continues to be a marginalized society. This time the economic division is not much of a racial issue, but a growing gap between the richest and the poor blacks.

The level of unemployment in South Africa shows a rising pattern in the past 45 years. According to Loots (1997), South Africa's unemployment rate ranges from a low of 6.6 percent in the 1960s, 6.7 percent in the 1970s, 12.4 percent in 1985, and 29.6 percent in 1993. From the government report the reasons for high unemployment are as follows;

“Declining economic growth due to declining investment explains part of the steady rise in unemployment levels during the 1980s and 1990s. Other factors include policies which decreased the cost of capital relative to labor, thereby encouraging more capital-intensive production, and increasing demand for skilled rather than unskilled labor; the rising cost of unskilled labor in the formal sector due to increasing unionization and labor market regulation; apartheid spatial policies which increased the difficulty and cost of job-seeking by those living in remote areas; and under-investment in education, which limits the opportunities open to many of the unemployed.” Loots (1997)

Black Empowerment Equity (BEE) is a government backed policy to empower blacks economically. However, only a few blacks benefited from the program. According to World Socialist Web Site, BEE is contributing to inequality amongst the blacks. It made these arguments: “Overall BEE seems to have entrenched inequality in South Africa. While the incomes of the top 10 percent of black earners have increased by 30 percent since 1995, the incomes of the bottom 40 percent have decreased in real terms. While the

South African working class continues to fall deeper into poverty, a tiny percentage of the population has seen phenomenal increases in personal wealth. This is producing the conditions for a social conflagration.”

Simkins (2005) maintains that on a national level poverty worsened over the 1991-1996 period, and the period 1996-2001 showed no improvements. At the same time, income inequality in South Africa as measured by the GINI coefficient rose from 0.56 in 1995 to 0.57 in 2002.

In the first regime the correlation coefficient ( $\epsilon_{\text{CONSt}}, \epsilon_{\text{INVSst}}$ ) is positive, but negative in the second regime. This shows that there is less competition for resources under the first regime. It may be the issue of excess capacity where unemployment was very low. Wages were low too. Under regime II, there is now much competition for resources. When one sector expands, the other sector has to contract. There is competition for resources as the rising black middle class is now commanding more resources. Also, note that the sign for the disequilibrium residuals in the second period is the same as that of the United States.<sup>6</sup>

By using the correlation coefficient signs as well as referring to the speed of adjustment in tables 5.5(a) and 5.5(b), one can deduce whether real or nominal factors are responsible for tying the markets considered here. From table 5.8, the relationship between money supply market and the consumption market differs under the two regimes. Under the first regime, the correlation coefficient sign between money supply vector and consumption vector is negative. This is a situation where  $\epsilon_{\text{MSst}}$  and  $\epsilon_{\text{CONSt}}$  are

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<sup>6</sup> See Cutler et al (1997)

each greater than zero. If  $\epsilon_{MSt}$  is greater than zero, this implies that monetary base is too large or money supply is too small. Regarding  $\epsilon_{CONSt}$  being greater than zero, it implies that consumption is too high or real income is too low. An expansionary monetary policy will affect the two markets as follows; first an increase in money supply will bring the money market back to equilibrium while increasing real income as well. Second, the increase in real income will bring the consumption market back to equilibrium. In this case it is the real factor (real income) that ties the consumption and the money market.

Under the second regime, the correlation coefficient sign for  $\epsilon_{MSt}$  and  $\epsilon_{CONSt}$  is negative. This may be the case of  $\epsilon_{MSt}$  greater than zero and  $\epsilon_{CONSt}$  less than zero. For  $\epsilon_{CONSt}$  less than zero the economic interpretation would be that either consumption is too low or that income is too large. But under the second regime real income is insignificant, hence the interest rates clear the consumption market. Interest rates will fall to bring consumption market back to equilibrium. The impact on the money market will be an increase in money supply, which is desirable for equilibrating the money supply market. This is consistent with the argument put forth by Bell (2001), Hodge (2001), Rangasamy, Swanepoel and Visser (2005) in that the recommendations for market oriented policy instruments would allow interest rates to be effective in the money market, and therefore the real sector since the two markets are linked. So, in the second regime nominal factors (interest rates and money) tie the consumption and money market. This is contrary to the first regime where interest rates were mostly fixed.

The correlation coefficient for money demand and consumption vectors has different signs under the two regimes – negative sign in first regime and a positive sign in the second regime. The important thing to note here is that the coefficient sign relates to

the speed of adjustment results under the first regime where real income clears the consumption market while it further drives the money demand vector out of equilibrium. Given equation (5.4) if  $\epsilon_{MDt}$  is greater than zero, this implies that money demand is too low, income too large or prices are too high. In the first regime, the response is an increase in income which further drives the money demand market out of equilibrium, but in the second regime income increases to clear the money market. The increase in output is followed by an increase in prices.

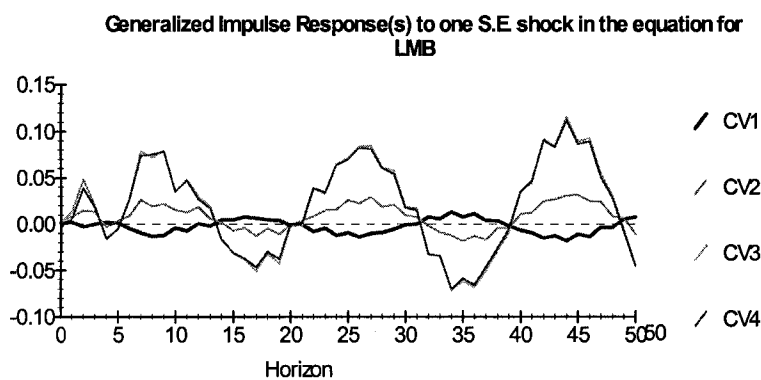
Prices enter the money market through the money demand vector and not through the money supply vector. Prices are significant at the 5 percent level in the second regime. The speed of adjustment for prices is 0.016. Given equations (5.4) and (5.8) a negative sign for the speed of adjustment is required to re-attain equilibrium in the money market. But the positive sign here means that prices further drive the market out of equilibrium in the second period. The relevance of these results is that prices were insignificant in the first regime which is consistent with the price setting regime of the time. In the second regime, prices move although they help to further drive the market out of equilibrium. This disequilibrium factor may be due to the aftermath of the oil shocks and the declining price of gold in the early 1980s. It was also during this period when South Africa experienced massive disinvestments.

Finally the persistent profiles in the two regimes are considered. The persistent profiles for selected policy variables are illustrated by a series of graphs representing the two regimes. The results of the persistent profiles serve to further strengthen the case of the responsiveness of policy variables in the two periods.

Policy variables considered here are monetary base and money aggregates. A comparison is made between two regimes on which variables move further away from equilibrium when a shock is introduced. Also, of the four vectors considered which ones come back to equilibrium faster. In this case persistent profiles are used to test for stability and to show which of the two regimes have a quicker equilibration process.

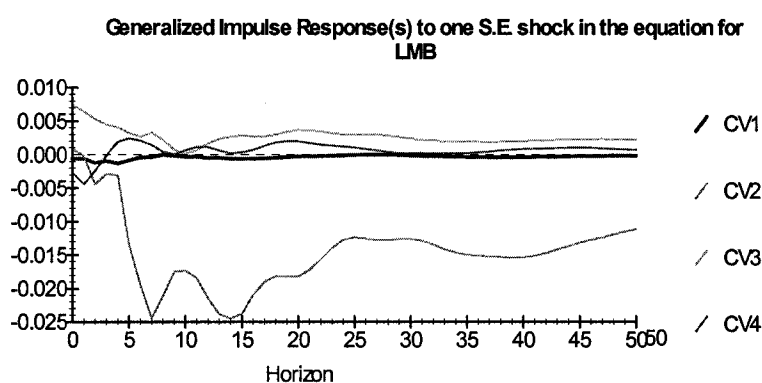
Now, consider a shock in monetary base in the money supply vector, that is, in  $-2.024M_t + 1.00MB - 0.382R_t = \epsilon_{MSt}$ . However, the impact of this shock is felt through all four vectors. The impact of the shocks is shown in figures 5.2a to 5.4b. A closer look on the scales would suggest that deviation from equilibrium is greater under regime two than under the second regime. Investment vector (CV2) that diverts outside the /0.01/ in the second regime. In the first regime all the systems fall outside the /0.01/ limits. One could conclude that under the first regime, the impacts of the shocks were greater and they did not die away suddenly as compared to what happened under the second regime.

Figure 5.2a Persistent profile (monetary base) – Regime I



It is interesting to note that money supply (CV3) and money demand (CV4) vectors had exactly the same movements under the first regime. That is not the case under the second regime. As stated in chapter four, the first regime was characterized by the use of non-market monetary policy instruments where the authorities could set limit on credit extended by banks to borrowers. This might be the reason for money demand and money supply to move together in reacting to the shock in monetary base.

Figure 5.2b Persistent profile (monetary base) – Regime II



A shock in M3 also shows much deviation from equilibrium under the first regime than the second regime. Investment vector (CV2) deviates comparatively more than other vectors under the second regime. It however remained within the /0.01/ for most part of the second period. Under both regimes consumption vector (CV1) did not deviate much from equilibrium after a shock to money aggregates. In the second regime it was even better than in the first regime.

These results suggest more stability to the system under regime two. The results depict a well-behaved system although the second regime was characterized by civil unrests and uncertainty about the future of the new government. This included the time where the country was more open to changes in the international markets.

Figure 5.3a Persistent profile (M3) – Regime I

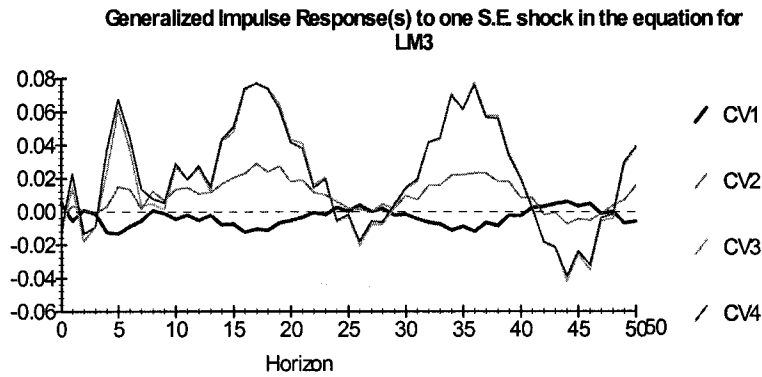
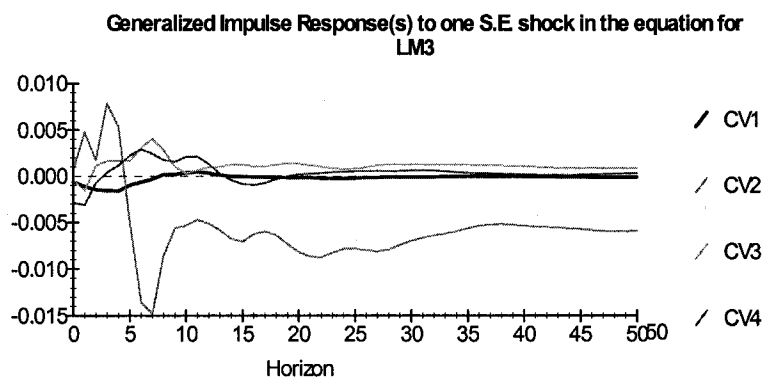


Figure 5.3b Persistent profile (M3) – Regime II



Variations on investment residuals have shown that investment is more volatile in the first regime than in the second. This means that a one standard error shock will be larger in the first than in the second regime. Note that investment vector represents the commodity market in this study. Figures 5.4(a) and 5.4(b) shows persistent profiles in the two regimes.

Figure 5.3(a): Persistent profile (Investment) – Regime I

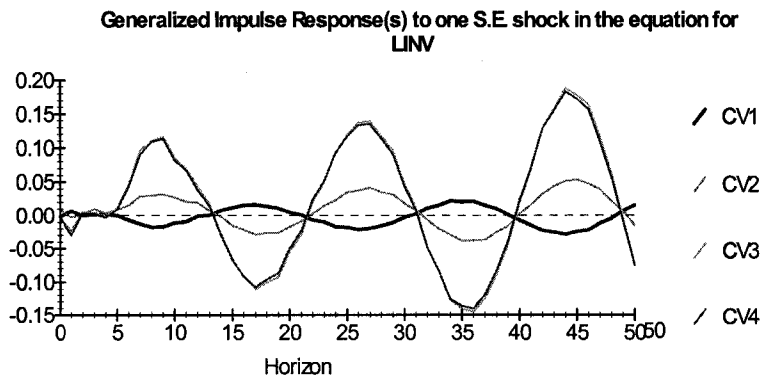
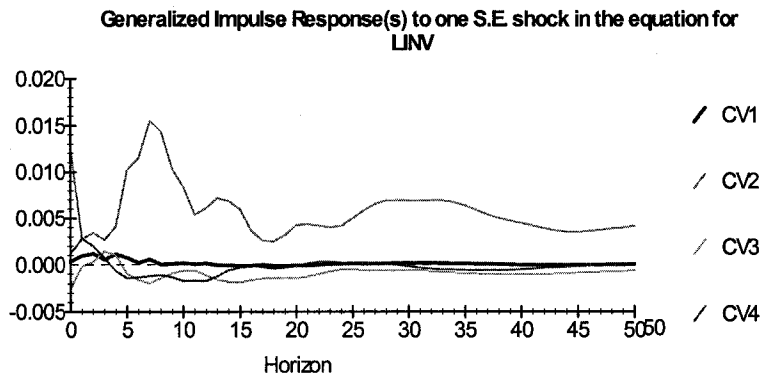


Figure 5.3(b): Persistent profile (Investment) – Regime II



## Chapter 6

### CONCLUSION

This study made use of cointegration method to estimate models for two economic regimes in South Africa. The two regimes are analyzed based on monetary policy instruments used when the country was facing various social, political and economic changes over the past four decades. The major monetary change in the sampled period was the switch from the use of non-market policy instruments to market oriented monetary policy instruments.

Full system models for each regime were constructed. The system included real consumption, real investment, money demand, and money supply vectors. These four cointegrating vectors were tested and evaluated based on macroeconomic theories. When compared to other studies, the second regime model had results closer to those found when using the United States data. But the first regime results were much different when non-market policies were followed. This is in line Van der Merwe's argument that the market approach is a better vehicle for the Reserve Bank in carrying out monetary policies.

Speeds of adjustment parameters were estimated. The results were mixed in terms of variables that cleared the vectors under the two regimes. An example is that income further drove the money demand vector out of equilibrium whereas in cleared

that vector under the second regime. But there was consistency in other vectors. It was found that real investment cleared the investment vector in both equations.

Variances and persistent profiles showed better estimation results in the second regime than in the first regime. Better results were found despite the economic difficulties such as disinvestments by international companies, trade and economic sanctions, as well as civilian unrests during the second regime. These problems were compounded by uncertainty during transition to the non-racial democratic government and the country's exposure to global financial crisis of the late 1990s.

The estimated model confirmed stability of the money market in South Africa and that was what Weso (2002) suggested in his study. Money variables were found to be useful in the estimation a system that included the real investment and real consumption market. This is contrary to the conclusion made by Moll (1999) who argued that monetary variables have little or no influence over private consumption and investment. Money market stability could be attributed to better specification of the model. This was done by including the money supply market – where the unique variable added to the model is monetary base.

Economic activities in the first regime were dominated by the commodity market. As a result, this sector attracted huge investments. Commodity market was exposed to international economic shocks. Slow down in global economic activities resulted in decreasing international demand for commodities which meant a declining total exports for South Africa. The mining industry, for example, did suffer from falling prices of gold, and this contributed to economic slow down. This study also showed that investment was more volatile in the first period.

The findings of the study also show that consumption and investment patterns could be affected by income distribution. The fact that the gap between the rich and the poor is widening may result in a decline in total consumption. Even a small percentage of blacks who are big spenders at the moment would eventually scale down their spending. People will be holding too much money, and spending less on goods and services. This may result in a slowdown in economic growth.

Future research work will include imports in the estimated model. This is because South Africa has been fully integrated into the global economy. Also, increase in real consumption means that imports are required to supplement domestic produced goods. The other area to be explored will be the forecasting which is useful for policy formulations.

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