

**An investigation on the effectiveness of monetary policy
implementation by the South African Reserve Bank (SARB) in
controlling consumer expenditures.**

By

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ABSTRACT

This study investigates the effectiveness of monetary policy as implemented by the South African Reserve Bank, in controlling consumer expenditures in the country. More specifically, the analysis focuses on the possible effect of the repo rate variations by the SARB, through its effect on commercial bank's credit extension, on consumer expenditures. Although the transmission of monetary fluctuations, through interest rate variations, to real economic variables such as consumption has dominated macroeconomics since at least the eighteenth century. However, empirical studies conducted in investigating the effects of interest rates on consumer expenditures have yielded inconsistent results, with the observation that many available analysis on this topic failed to establish a clear association, positive or negative, between those variables. This reinforces the common view that, the debate about the real effects of monetary policy, through interest rate manipulations, on consumer expenditures is still widely open, especially as far as emerging markets like South Africa are concerned.

The empirical test of whether monetary policy, through interest rate, is a significant determinant of the general level of consumption is performed in this study with aggregate time series data of South Africa for the period 1970 - 2006. The existence of a long-run relationship between policy interest rates and consumer expenditures is tested using Johansen's cointegration test, along with Error Correction Model (ECM), as the research aims to establish the existence of the interest rate channel of monetary policy, within the current policy framework implemented by the Reserve Bank.

Although the empirical analysis in the end shows only a small sensitivity of consumer expenditures to variations in interest rates/repo rate by the SARB, it is sufficient for this study to establish the existence of an interest channel of monetary policy transmission in South Africa. However, the importance of time lags associated with any particular act of monetary policy appears to be a more crucial factor in assessing the effectiveness of policy actions by the Reserve Bank.

DECLARATION

I, LONTSI Tchinda Patrick, declare that the dissertation for the Masters Degree (Mcom) in Economics at the North-West University hereby submitted, has not previously been submitted by me for a degree at this or any other university, that it is my own work and that all material contained herein has been duly acknowledged.

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CHAPTER1

INTRODUCTION

1.1 Background of the Study

Over the last ten years the South African economy has experienced a remarkable period of economic stability, with the longest business cycle expansion in the country's history since 1999. The real economic growth rate averaged 3.1 percent during the period 1995 to 2004 (Du Plessis, Smit & Sturzenegger, 2007: 5). The democratic transition and the progressive reintroduction of South Africa into the world economy in 1994 imposed some major structural economic changes. One of those changes included the initiation of financial liberalisation by the government, following the De Kock Commission reports (1985) advocating a more market-oriented monetary policy. Aron and Muellbaur (2000) argued that, as a result of the above mentioned report, interest and credit controls were removed progressively around 1985. Also important is the fact that, after the political transformation of the country into a democratic republic in 1994, more black people in the country obtained formal employment, particularly in the public sector, earning extra income, and gaining access to credit that was not available to that section of the population before.

All these factors, coupled with financial liberalisation, gave rise to asset booms and to an increase in consumption or in consumer spending on expensive items such as cars, furniture and other household equipments. In fact, by the year 2005, growth in final consumption expenditures reached a peak of 6.9%, which represented the fastest growth since 1981. More precisely, and as indicated by the Standard Bank report (2007), an all-time record of 301 154 new passenger

cars was sold during the same year indicating a high 26.7% increase in sales from the previous year 2004.

At the same time, mortgage lending increased by 28% from the year before, together with instalment sales credit by 21.8% and leasing finance by 19.1%. (Standard Bank, 2007: 5). Relatively strong economic growth, generous wage settlements and employment gains, all together in an environment of both lower inflation and interest rates, were the main reasons behind the rapid expansion in consumer expenditures during that period. Another important reason have been given by the strong rise in asset prices, also known as the "wealth effect" which is due to the impact of changing property and equity prices on consumer expenditures (Aron and Muelbauer, 2000).

From mid-2006, the changed global financial environment due to external shocks to the economy in the form of sudden increase in oil prices in the international market caused an unexpected and significant increase in inflation, with inflation reaching a maximum of 13% during the year 2008. Also, strong expenditure growth and buoyant credit extension, prompted the Monetary Policy Committee (MPC) of the Bank to tighten policy. This was done in a gradual fashion, with the MPC increasing the repurchase rate by 50 basis points at a time at four successive meetings, starting in June 2006, in order to keep the monetary policy stance consistent with the achievement of the Bank's main objectives. Similar considerations led the Monetary Policy Committee to raise the repurchase rate in August 2007, again by 50 basis points. In general, the Monetary Policy Committee increased the repurchase rate by a cumulative 500 basis points starting in June 2006, making the ongoing tightening cycle the longest since South Africa adopted the current policy framework. More specifically, the repurchase rate was increased by 300 basis points between 1 June 2007 and mid-June 2008. (SARB, 2008).

The repo rate is the main policy instrument in the hands of the reserve bank, and represents the lowest rate at which commercial banks that are experiencing shortfalls are able to acquire funds from the SARB. The repo rate has almost a direct influence on bank lending rates and on all others rates in the economy, because the prime lending rate, which is the rate charged by commercial banks to the public is directly affected by the repo rate, since a change in the repo rate automatically lead to a change in the prime rate by approximatively the same proportion. Consequently monetary policies such as lending rates variation is expected to have a direct affect on economics variables, including bank credit extension to consumer spendings and ultimately the rate of inflation (SARB 2005:2).

As a result of this new development in the overall economic environment, a tight monetary policy was then implemented by the South African "Reserve Bank" in order to slow down consumer expenditures and especially credit allocation by financial institutions to households. However, the expected results of the contractionary monetary policy on consumer expenditures did not materialise, since it was observed that credit extention by commercial banks to the general public, and consequently the general level of private consumption continued to grow during that same period of tight monetary policy.

The debt-to-income ratio of households rose to 65.6% during the year 2006 and a record level of 73.1% during the year after, representing approximately 49% of GDP accumulated over the past five years (Standard bank, 2008). The observed strong growth in credit extension together with the turn in the interest rate cycle increased the general concern regarding the health of consumers' and businesses' finances. As a result, individuals have been seriously faced by real purchasing power erosion causing an increase in insolvencies of individuals by 62% in the last quarter of 2008. In addition, the saving behaviour of individual consumers which provides an indication of their ability to face unexpected shocks to their income was very low during the same period at around 0.1% of

disposable income, affecting individuals' capability to repay their debts, as indicated by the SARB (2008) annual report . A high level of repossession by Commercial Banks has been observed throughout the period 2006-2009 in terms of durable goods and particularly cars and houses.

The fact that consumer expenditures remained at a high level during the period where the reserve bank was implementing a contractionary policy, increased the perception of many observers and particularly the general public about the effectiveness of the current monetary policy framework, suggesting that the current SARB's policy framework is not appropriate for the South African economy or at least not well-implemented by the Reserve Bank.

1.2 Problem statement



Since the middle of the year 2006, the South African "Reserve Bank" started implementing a contractionary monetary policy, through variations in its main policy instrument the repo rate. The main objective of the SARB was to decrease the level of credit extended by Commercial Banks to individual consumers or households, in order to slow down the high level of consumer expenditures in the country, which has since been identified as one of the major determinant of inflation (Akinboade et al, 2001). However, the expected result of these actions did not follow suit, since credit extension as well as consumer expenditures continued to grow under the ongoing contractionary environment.

The expected ultimate outcome of this policy is to bring back and maintain the inflation rate in the country within the specified policy target ranges of three to six percent.

1.3 Aims and objectives of the study

This study is aimed at analysing the causal relationship between monetary policy, as implemented by the South African "Reserve Bank", and consumer expenditures in the South African economy. The main objective of this study is to explain the process through which changes in the repo rate can affect consumer expenditures in South Africa. This is also known as the interest rate channel of monetary policy.

Other objectives include:

- 1.3.1** Evaluating the responsiveness of consumer expenditures to changes in interest rates within the current monetary policy framework.
- 1.3.2** Determining the direction of causality between the repo rate and consumer expenditures in South Africa.
- 1.3.3** Examining the effect of inflation on consumer expenditures in South Africa, within the current policy framework.
- 1.3.4** Assessing the effectiveness of monetary policy intervention by the SARB, through variations/manipulations of its main policy instrument; the repo rate.

1.4 Research question

Monetary policy interventions, through variations of the repo rate, and consequently variations in other market interest rates, are expected to have a significant impact on consumer expenditures, via the interest rate channel of monetary policy transmission. This gives rise to the following research question:

- 1.4.1** Is there an interest rate channel for monetary policy in South Africa?

Closely link to the main research question are the following other related questions:

1.4.2 Is private households' consumption affected by variations in the repo rate by the South African "Reserve Bank"?

1.4.3 What is the direction of causality between households' consumption and the prime interest rate?

1.4.4 What role does the level of inflation play in the relationship between interest rate and consumer expenditures?

1.4.5 What other economic variables play a significant role into the model relating consumer expenditures and monetary policy in South Africa?

1.5 Significance of the study

Analysing the effectiveness of the repo rate control by the South African "Reserve Bank" in constraining consumer expenditures, within the current monetary policy framework is important because; firstly, the results obtained in this study might influence the government, monetary authorities as well as policy makers in the formulation and the implementation of appropriate policies necessary in maintaining price stability in South Africa, which represent the primary goal of the Reserve bank (SARB: 2005). Therefore, given the results obtained at the end of this study, a re-evaluation/revision of the current policy by the monetary authority might be suggested, in order to transform the policy into a more efficient one. It can also suggest the possible adoption of a new and more appropriate monetary policy regime.

Secondly, South Africa being an emerging market and the strongest economy in Africa, the result of this study might affect other emerging markets in the continent regarding the selection of the best path to price stability or economic growth, through the adoption of a much more efficient monetary policy regime.

1.6 Delimitations and limitations of the study

The focus of this study is to explain the process through which monetary policy as implemented by the SARB, affects consumer expenditures in the country. More specifically, the study concentrates only in evaluating the responsiveness, if any, and as accurately as possible, of consumer expenditures to variations of lending rates by the Reserve Bank, through their effect on Commercial Banks' credit extension to individual consumer, during the recent contractionary policy implemented by the Bank.

In order to understand the possible causal relationship that might exist between the main variables under analysis, the study uses past information on policy rates and consumer expenditures in South Africa from the period 1970 to 2006.

1.7 Methodology

The methodological aspect of the study involved the use of econometric techniques, coupled with descriptive statistics as well as informal interviews/discussions with well-resourced analysts and researchers from Stat S.A (North-West region) and the SARB, this was done in order to obtain the appropriate, necessary information and results for the study.

The model relating the aggregate available variables is composed of one dependent variable; consumer expenditures (C_{ex}), expressed as a function of two other important variables that are central to individual consumption these are: disposable income (Y_d) and households' wealth (W_h). Furthermore, interest rate or repo rate (r) have been included into the model as a proxy for monetary policy, together with some additional variables namely; the Consumer Price Index (CPI) and the unemployment rate (U_n) in order to fully integrate the possible effect of other economic factors within the principal relationship under investigation.

Analysing the possible causal long-run relationship between consumer expenditures and monetary policy, is conducted through regression analysis on the available time series data, using the well-known Ordinary Least Squared (OLS) method. The Johansen cointegration analysis is further conducted and followed by Granger causality tests, indeed after having performed the necessary tests for stationarity on the time series data, and the stability tests on the specified model. These tests include the Augmented Dickey-Fuller (ADF) and Phillips-Perron tests (PP) for stationarity, and the Ramsey RESET and CUSUM tests for the stability of the model.

1.8 Assumptions of the study

The study assumed that, although there are many other monetary policy's actions that the South African "Reserve Bank" can take, the term "policy actions" refers here in this study exclusively to an increase/decrease in the repurchase rate which remain the main instrument in the hands of the Bank.

Moreover, the inclusion of uncertainty proxies such as the Consumer Price Index and the unemployment rate in the model, is justified by the assumption that consumers are perceived to be less confident about the future, including their job security and their revenues, depending on the speed at which those two variables fluctuate.

1.9 Definition of terms

Monetary policy: The Bank of England report (2006), defined monetary policy as the process by which the government, through Central Banks, or monetary authority, manages the money supply to achieve specific goals. Monetary policy is generally referred to as either being an expansionary policy or a contractionary policy. An expansionary policy increases the total supply of money in the

economy, and a contractionary policy decrease the total money supply, the general level of activities in the country as a whole including credit allocation, investment, consumption and output.

Consumer expenditures: It is defined as the total final consumption expenditures per year by households in current prices

Bank's credit extension: It is defined as the total domestic credit extended by all monetary institutions in the country.

Households' wealth: Refers to the net wealth of the household sector including durable goods, and represents present discounted value of current income, including the values of residential estates and other valuable assets.

Unemployment rate: As it is defined by the Stats.SA's official or narrow rate, represents the number of unemployed persons and actively looking for a job, in the country, expressed as a percentage of the labour force.

1.10 Layout of the study

The study is structured as follows:

Chapter 2: Literature Review

It is the first section of the literature review. It assists to shed light on what direction the debates on the topic have taken. The chapter critically reviews theories on monetary economics developed by some major schools of thought. The chapter also critically evaluates the international perspective of the topic, as well as the South African's perspective.

Chapter 3: The South African Economy

This chapter is the second section of the literature review. It totally focuses on the South African economy as a whole, and particularly on the effect of the repo rate control by the SARB on some specific sectors of the economy.

Chapter 4: Research Methodology

The chapter describes step by step the methodology to use in the econometric analysis of the study. Variables are explained and the model is defined in details. The analysis covers the period from 1970 to 2006.

Chapter 5: Analysis and interpretation of results

This chapter involves the econometric analysis of the time series data. It also focus on the in depth discussion on and the interpretation of the results obtained from analysing the time series data.

Chapter 6: Summary, conclusions and recommendations

The chapter provides a summary of the findings by giving a clear answer to the research question. It also provides policy implications and possible suggestions for future research.

1.11 Summary

The first chapter of this study introduced the topic, with a focus placed on some of the most important phases of the research process namely; the background to and the statement of the problem, the objectives, the importance, the methodology and the layout of the study as well as the research question which will guide the study throughout its evolution.

Following are the next two chapters of the literature review, with the first one concentrating on the critical evaluation of some specific theories on monetary

economics, and also on certain important empirical studies related to the current topic. The second chapter of the literature review is totally dedicated in analysing the South African economy as a whole, with a focus on some specific sectors of the economy namely; the Banking sector, with a focus on the role of the South African "Reserve Bank" in conducting monetary policy within the country.

CHAPTER 2

LITERATURE REVIEW

2.1 Monetary theories

2.1.1 Introduction

Monetary relationships have been studied for many centuries and therefore, this subject contains a large number of theories (Bain and Howells, 2003: 1). The current well-accepted approach or knowledge concerning all important issues of monetary economics has moved through a number of theoretical models from various economist and school of thought, ranging from the Classical approach to monetary economic theory, through the Keynesian system , till the Monetarist model in the mid 1960s.

This section of the paper intends firstly, to provide a review of some of those important and well established models or theories in monetary economics, especially when the role of interest rate in the transmission mechanism is concerned. Secondly, an emphasis is placed on the link existing between monetary theory and consumer behaviour theory, which remains the focus in this study, and finally this is directly followed by an evaluation of the contributions made by various researchers as far as this topic is concerned.

2.1.2 An overview of the evolution of monetary thinking

Monetary economics is very important in modern economies since monetary policy decisions have major impact on every aspect, and basically every sector of the economy. In fact, it is one amongst a large number of policies available to the authorities in the pursuit of macroeconomics objectives. Basically these

objectives can be limited to four; namely, low inflation, high or full employment, balance of payments equilibrium and a satisfactory rate of growth of real income. Three major schools of thought or models have dominated the study of modern macroeconomics, and the study of monetary economics, namely, the Classical, the Keynesian and the Monetarist Schools.

Firstly, the Quantity Theory of Money developed by Fisher (1911) is the essential aspect of the contribution made by the classical economic system. The theory can be traced back at least as far as the eighteenth century, and can be seen as a reaction to the Mercantilists' identification of money with wealth (Bain et al, 2003:97). It is not seen as a theory of the demand for money at all but dealt with the use of money in transactions rather than with the decision to hold money. The Classical school of thought believes that, with flexible money wage rates and prices, full employment equilibrium can be achieved in the competitive labour market (Vane and Thomson, 1979: 27). Moreover, it is also argued in this approach that money is neutral, and that any change in the money supply would have significant effect on real economic variables such as the real wage rate, the real interest rate, investment, output and employment. Money in the quantity theory is generally seen as a substitute for goods, and the existing transmission mechanism is one of direct substitution of money for goods.

Secondly, Keynes (1936) proposed a radically different theory of the demand for money, based upon the motives for holding money. He gave interest rates a much more important role in the theory, and postulated that different people would have different expectations about the future course of the rate of interest and therefore, different demand for money function (Vane et al, 1979: 31). A fall in the rate of interest below the normal level, would make people to expect the rate of interest to rise again in the next period, they would have a preference for money as they would anticipate a capital losses on their financial assets bond holdings. The transmission mechanism in the Keynesian approach involved a change in the money supply leading to changes in the rate of interest, which in

turn influences the level of investment. Money in this process is then seen as a pure substitute for financial assets, as compared to the direct substitution of money for goods observed in the classical approach.

Finally, the Monetarists, through Friedman's view postulated that both the real rate of interest and real income are determined by real monetary forces. As Denis (1981: 111) explained, this school of thought is mainly concerned with reinforcing the role of monetary forces in a modern economy. Accordingly, they argued that, money is first of all an asset, and therefore, the demand for money must be analysed in exactly the same way as the demand for any other commodity. A stable relationship then exists between the demand for money and few economic variables, including the rate of interest and wealth. However, monetarism is firstly and mostly seen as a long-term policy-oriented doctrine, primarily designed to avoid, rather than to cure any disequilibrium that can occurred in the economic system. (Vane et al 1979)

In summary, the differences between the above mentioned schools of thought, especially between the Keynesian and the Monetarist schools are one of degree rather than of principle. As Vane et al (1979: 191) pointed out, many of their differences can be limited to a package of empirically testable propositions.

In the next section of this chapter, emphasis is placed on the transmission mechanism of monetary policy as described in the three major schools of thought.

2.2 The transmission mechanism of monetary policy

Behind different studies of the role of monetary factors lie differences of opinion regarding the number and significance of the channels through which monetary forces operate. The transmission mechanisms of monetary policy simply represent the different channels through which policy actions taken by Central Banks affect specific targeted variables in the economic system. Some specific

channels have been identified and are now well accepted by various economists all over the world. These are the interest rate channel, the exchange rate channel, the credit channel and other assets price channel.

2.2.1 The Classical approach of the transmission mechanism

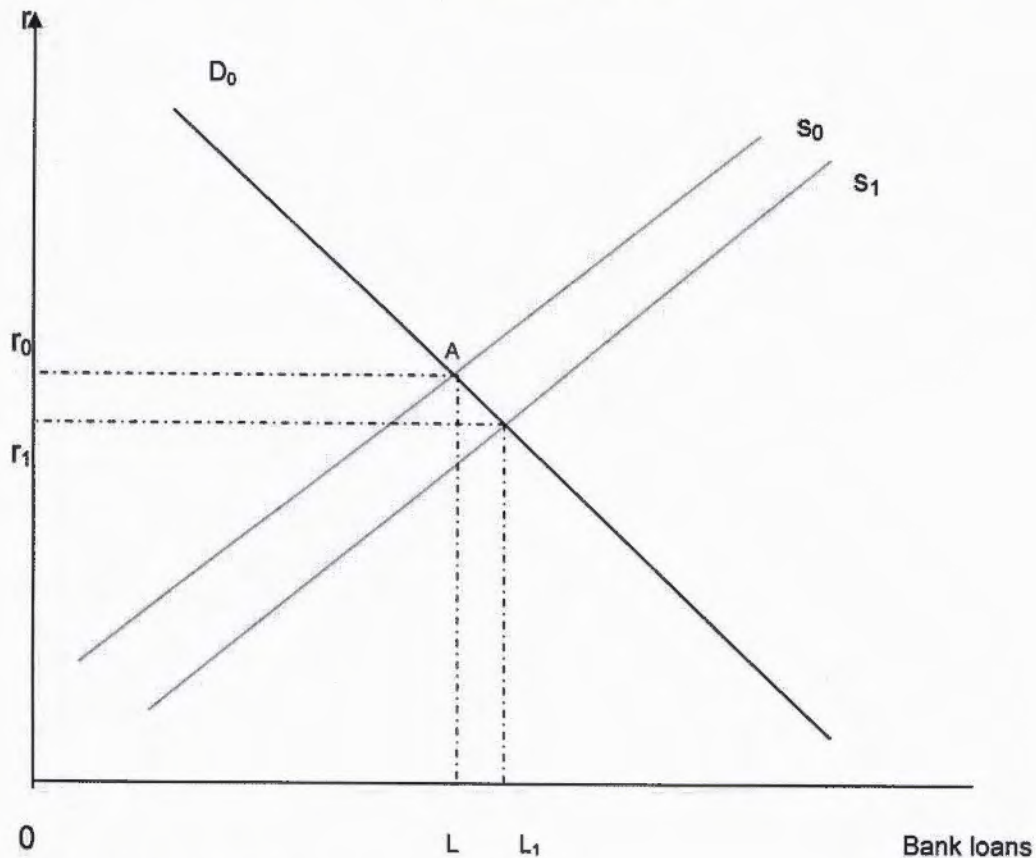
In the Classical school, the role of money in the macroeconomic system has been relegated to the background. Dennis (1981: 42) stated that, money is seen as a veil behind which the action of real forces is concealed. The most important contribution in this approach was made by Fisher (1911), with his well known quantity theory equation:

$$MV = PQ$$

Implying that the amount of money in circulation (M) multiply by the average number of times that money rotates around the system in a given time period, also known as the velocity (V), must by definition equal the money values of transactions, or the value of output bought (PQ). With (P) representing the price level and (Q) the real income or output of that period.

As far as the transmission mechanism of monetary policy is concerned, it is argued in this approach that, there is a direct and mechanical link between money and prices, implying that money supply and prices will always change by the same proportion. However, as quoted by Skaggs (1995), there exist an indirect link or mechanism, suggesting that money affects the price level through interest rates. This indirect link is seen to be more appropriate in a system where commercial banks exist with the rate of interest becoming a key part of the transmission mechanism. This indirect link is schematically represented in figure 2.1 below.

Figure 2.1: The indirect mechanism of monetary policy transmission in the Classical model



Source: Denis (1981:56)

In the figure 2.1 above, it is observed that, the system is in equilibrium at point A, where the supply of money, represented by (S_0), equals the demand for money (D_0), with an equilibrium rate of interest (r_0). The theory allows the system to be disturbed by an external force, being any types of open market operation by the monetary authority. This operation causes a rise (or a decline) in the money supply, depending on the nature of the operation, namely purchasing or selling government securities. In this particular case, it is assumed an open market purchase of government bonds. This leads to an increase in money supply,

causing the supply curve to shift from (S_0) to (S_1), the interest rate to fall from (r_0) to (r_1), and hence bank loans to increase from (L) to (L_1). The new low market interest rate encourages firms to invest in new capital assets, and individuals, with now a relative excess holding of money balances to run them down by purchasing durables goods.

Knowing that, the transmission mechanism refers to how a change in the money supply is channelled through a particular model to influence real or nominal variables in the economy, it can then be noted from the observation of this figure that, monetary policy in the Classical view has an indirect effect on consumer spending on goods, via the rate of interest.

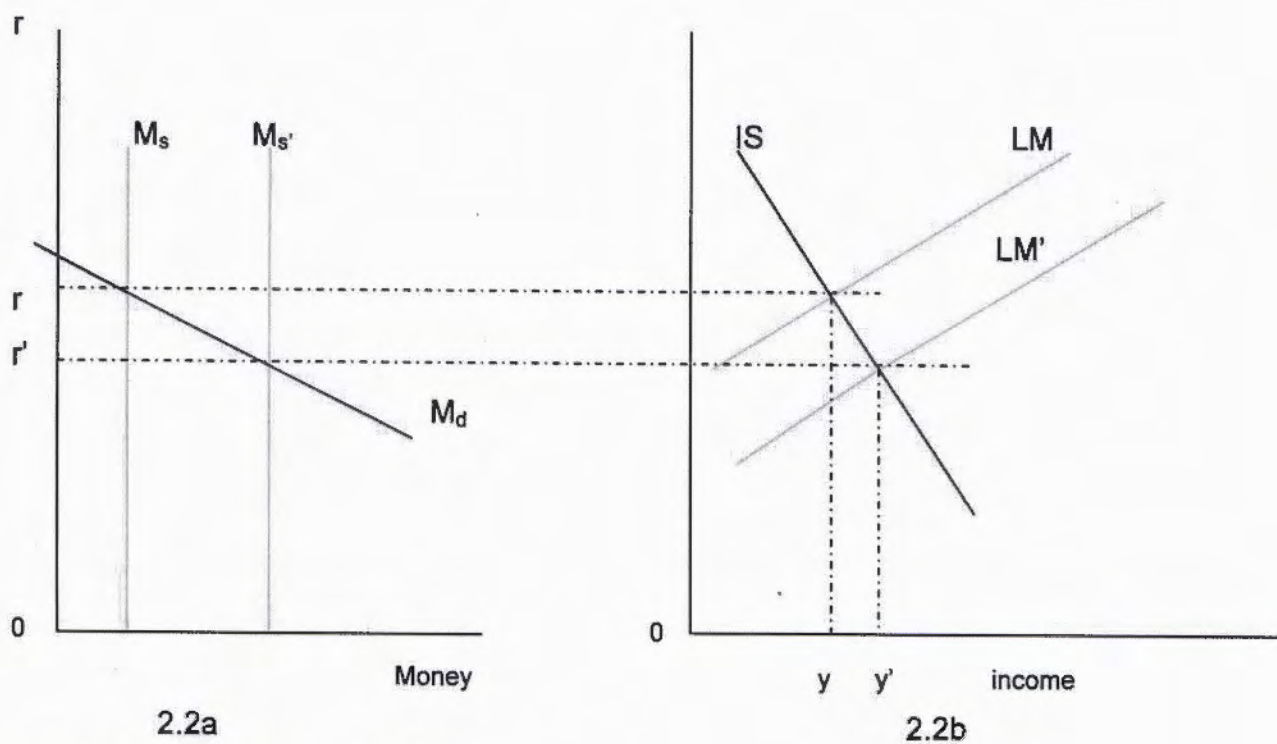
2.2.2 Keynesian approach of monetary transmission mechanism

Keynes (1936), formulated a completely different approach to macroeconomics as a whole. This model is based on new theoretical approaches to the demand for money, and the allocation of income between consumption and saving. Even the strong assumption that money wages are inflexible was refuted by Keynes. The major new idea introduced in this approach is the liquidity-preference theory, stating that, the demand for money is determined by three different motives; transaction, precautionary and speculative motives.

The Keynesian transmission mechanism of money is complex and indirect, the basic assumption behind this analysis is that there is a close substitutability between money and other financial assets, such as governments' bills and bonds. Therefore, a small rise in the rate of interest on such assets would cause investors to move out those assets for liquid assets or cash. By extensively analysing the transmission mechanism in the Keynesian model it appears that, the theory completely rejected any direct effects on income or wealth, advocates by the Classical school (Denis 1981: 81). Hence, the transmission mechanism of monetary policy appears to be weak in the Keynesian model.

Schematically, the indirect transmission of money in the Keynesian model can be seen in figure 2.2 below.

Figure 2.2: Transmission mechanism of monetary policy in the Keynesian system



Source: Bain and Howells (2003: 184)

The analysis of figure 2.2 begins at a point of equilibrium in the money market, with the demand for money (M_d) being equal to the supply of money (M_s). Assuming an increase in the supply of money impulses by the monetary authority, this causes a temporary excess supply of money, which is reflected on one hand in figure 2.2a by the shift of the supply curve from M_s to $M_{s'}$. Due to the Keynesian assumption of high interest elasticity of the demand for money, this produces only a small fall in the interest rate from r to r' .

Figure 2.2b on the other hand, shows a slight increase in investment with the LM curve moving slightly from LM to LM', causes also a small change in income from Y to Y'.

The transmission mechanism as explained by the Keynesian model strongly implied that, the interest rate channel of monetary policy is not a powerful tool in the hands of Central Banks. A change in interest rates by the Reserve bank, in trying to influence household consumption through several channels might not produce the expected result. Keynes (1936: page) assumed a low level of substitutability between money and real (physical) assets such as houses, cars and others consumer goods. As he argues, there must be a large change in the rate of interest on real assets in order to encourage consumers to shift from spending on consumer durables into money.

2.2.3 The Monetarist view

The modern Quantity Theory of MoneyQuantity Theory of MoneyQuantity Theory of Money developed by the Monetarists started in the mid 1960s and considerably challenges the Keynesian macroeconomics thinking. The most important contribution in this school of thought was made by Milton Friedman in 1956, with the introduction of his revised Quantity Theory of MoneyQuantity Theory of MoneyQuantity Theory of Money.

The theory concentrated principally on ultimate wealth holders, and analysed their demand for money in the same way as the demand for any asset. Wealth was then an important component of the demand for money function in the Monetarist model. Hence, Milton suggested the use of permanent income or wealth, including human and non-human wealth, as a constraint in the demand for money function.

Basically Friedman regarded his theory as a restatement of the quantity theory developed earlier by the Classical school of thought (Bain et al, 2003: 124)

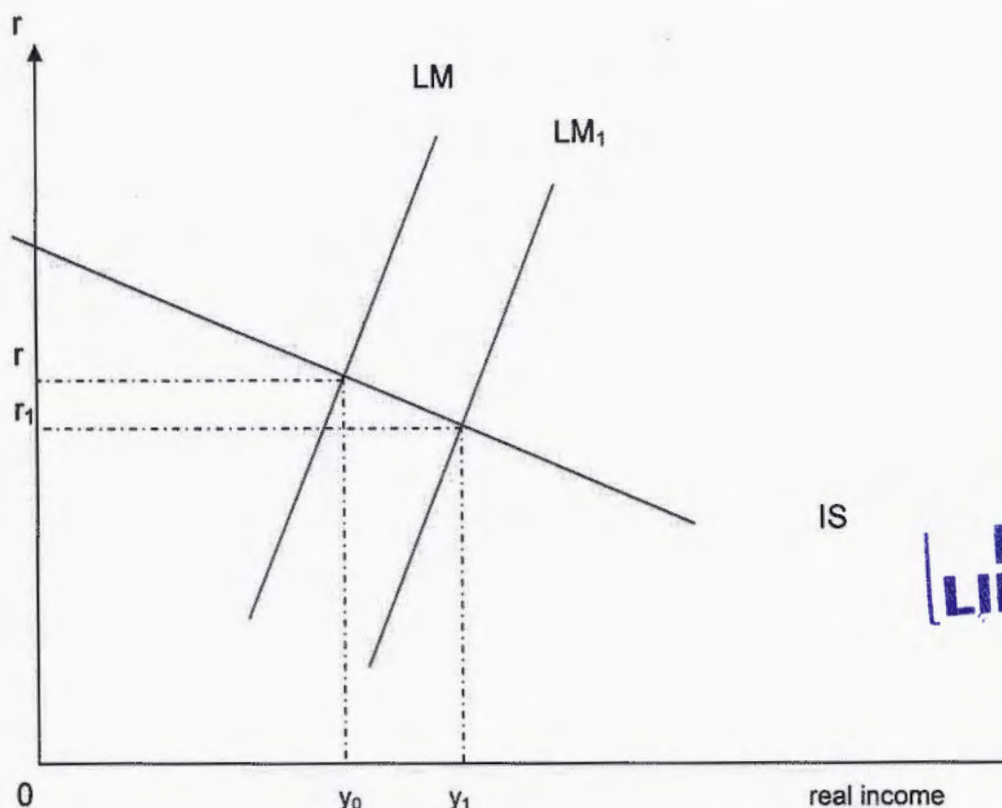
One of the key features in Friedman's analysis was that, it was a theory of stocks, money and assets, in contrast to the Keynesian model, which was only concerned with savings, consumer's expenditure, output and investment.

The emphasis put upon asset markets in Friedman's analysis is important for this research because, amongst the most important asset markets in South Africa are houses and consumer durables markets, such as cars and furniture. Since the main objective in this paper is to investigate on the effects of monetary policy on such market, namely the market for consumer durables, the Monetarist approach becomes crucial here in this ongoing analysis.

The transmission mechanism here is a direct one, hence, a change in the money supply, induced by the monetary authority, causes disequilibrium in the money market which is directly transmitted to the goods market. Money in this approach was assumed to have an influence on output or transactions, as well as on prices, and was seen as a unique asset, which served as a substitute, not necessarily a closed one, for assets of all sorts. (Denis, 1981: 118).

Schematically, representing the transmission mechanisms in the Monetarist approach in figure 2.3 shows; firstly, that the LM curve is much steeper than in the Keynesian model, this reflects the fact that there is a low level of substitutability between money and bonds, hence, low interest rate elasticity of the demand for money. Moreover, there exists no liquidity trap, implying that an increase in the money supply is expected to affect the rate of interest negatively. Finally, that the IS curve is less steep, reflecting the assumption of high interest elasticity of investment in the monetarist thought.

Figure 2.3: The monetarist transmission mechanism of money



Source: Denis (1981:120)

In analysing the role of interest rates specifically, Friedman (1968) argued that interest rates are misleading indicators of whether a monetary policy is tight or easy. This is so because the initial fall in interest rates, following a monetary expansion, is automatically and rapidly reversed after a certain period. He went further by arguing that, whatever the exact channel in place or in use, the increase in aggregate demand will after a certain length of time cause the rate of interest to rise and eventually move above its previous equilibrium level.

The transmission mechanism in the monetary approach involved a much large number of assets, both financial and real assets, than do others, in consequence

this approach gave a much stronger effect of monetary policy on aggregate economics variables.

2.2.4 Money demand, money supply and interest rates

Monetary theories on interest rates usually present slight differences in their explanation on how to view interest rates. Hence, according for example to the theory of Wicksell, the rate of interest is the rate that equilibrates the demand for and the supply of capital or loanable funds (Gupta and Moazzami, 1996: 99). That particular rate of interest at which supply equals demand is referred to as the natural rate of interest and it is assumed to be determined by real forces of the market. In addition, the Keynesian liquidity preference theory views nominal rate of interest as the price that equilibrates the supply and the demand for money or liquidity. With the supply of money being controlled by the monetary authorities, and the demand for money depending on the level of income.

However, despite these slight differences that can be observed in the definition of interest rate by different theories or schools of thought, interest rates are viewed by all as the vehicle through which monetary disturbances affect aggregate demand and thus are transmitted to the economy, and affecting major economic variables.

Variations of the levels of interest rates are due to many factors namely; money demand and money supply, changes in the general price level, expectations and uncertainty about future changes, changes in the ability to obtain credit, changes in the tax scheme, and many others. Amongst those factors, the demand for and the supply of money have been studied more intensively than others factors as far as their interactions with the level of interest rates are concerned. This interest in the demand for and the supply of money is due to their central importance for both economic theory and policy. The understanding of the money

market is therefore, essential both to the analysis of past monetary policies and to the formulation of appropriate future monetary policies.

Consequently, the expected rate of interest is one of the most important channel through which monetary policy influences the economy. Central Banks can therefore, determine how their policy actions are influencing the economy by observing what is happening to the real rate of interest. As Mullineaux and Protopapadakis (1975: 3) stated, a rising real rate would signal a more restrictive monetary policy, while a declining real rate would suggest some monetary ease.

From these analyses, it can be observed that variations in money demand and in money supply contain information on future monetary policy, which in turn immediately affects market interest rates. However, while there is a general agreement that the rate of return on financial assets or the rate of interest is the appropriate measure of the opportunity cost of holding money, and hence must be included into both demand for money and supply of money equations, existing studies in this area of interest diverge as to which one of the interest rates is most appropriate.

The major observation that can be drawn from the interactions between money demand/supply and interest rates is that, the stability of the demand for money function has an important implication for the conduct of monetary policy. Hence, Browne, Fagan and Henry (1997: 1) concluded that, even in the absence of an explicit monetary policy strategy, the stability of the link between money balances and prices is crucial in influencing monetary aggregates during the conduct of monetary policy by Central Banks.

In summary, the Quantity Theory of Money developed by the Classical, proposed a simplified model mostly based upon the equation of exchange and advocated that, changes in the money supply produces proportional changes in the general level of prices, due to the fact that money is considered to be neutral in relation to

income. In contrast, the Keynesian proposed a totally different theory based upon the motives for holding money, giving interest rate a much more important role, as far as the transmission process is concerned, but suggested a weak effect of monetary policy on aggregate variables. The monetarist, with Milton Friedman as the leader, later on proposed a reshape of the Quantity Theory of Money, with much more power given to monetary forces, and the introduction of the concept of wealth as a key determinant of the demand for money. Most of the theories studied above are common on certain points, as Bain et al (2003:127) pointed out; theories on the demand for money all supported the idea of stability. However, some important distinctions exist, mostly between Keynes and the others.

The expected effect on consumer expenditures through the interest rate, which remains the main focus of this dissertation, might not be observed under a Keynesian monetary policy framework, this is due to the fact that the theory suggested a weak effect of the transmission mechanism. This theory stated that the effect of interest rates on consumption is totally negligible. The monetarist policy framework, which is seen to be much more powerful as far as the transmission mechanism is concerned, can produce the expected effect of interest rates on consumer expenditures.

2.3 Consumer theory and the rate of interest

Gylfason (1981) argued that the effect of the rate of interest on aggregate consumption and saving has generally been considered as minor, the main reason for that is perhaps given by the fact that empirical research on the effects of interest rates on consumption and saving has failed to establish a clear association, positive or negative, between those variables.

Keynes, as quoted by Boskin (1978: 3) argued that current consumption is a function of current income with the marginal propensity to consume between zero

and unity, while the Classical view affirmed that consumption is a function of the rate of interest.

Early contributions on this topic include Modigliani (1953), Brumberg (1954), Friedman (1957) and many others. This section of the paper deals with the consumer theory developed by Green in 1971.

The main observation made in Green's consumer theory was that, the satisfaction derived from a given quantity of wealth, non-human in this case, is assumed to be independent of both future prices and interest rates changes. Moreover, the theory argued that, wealth (w) at a specific starting period, is the result of investing (I_0), plus earnings (E_0), less consumption (C_0), given a particular interest rate (r_0). The consumption functions, to maximise, of a particular consumer can be stated as:

$$C_0 + W/1+r_0 = I_0 + E_0$$

Subject to the following constraint: $f[C_0, W/1+r_0]$

After making some assumptions, such as, the interest rate is constant and C_0 , $W/1+r_0$ are always chosen in the same proportions; one important result can be observed:

If earnings are growing at a constant proportionate rate, hence wealth, income and consumption are expected to also eventually grow at the same rate, with consumption always a constant fraction of income. (Green, 1971).

This observation basically shows that as far as consumption is concerned, the rate of interest plays a minor role in determining the level of consumption. However, some studies found a strong relationship between the level of consumption and the rate of interest. Hence, Weber (1970; 591) argued that interest rates do significantly affect aggregate consumption, and that, an increase in the rate of interest increases aggregate consumption, other things being equal.

In summary, the available literature on this topic does not provide a clear answer on the real effect of interest rate on consumer spending. While some economists,

principally the pro-Keynesian, argued that the role of interest rate on consumer spending is almost negligible, some others indicated a much more direct link between monetary policy operations, through the rate of interest, and consumer expenditures on durable goods (Hamburger,1967:1149). Although a clear direction on the causal relationship between the rate of interest and consumer expenditures can not be derived from the available literature on this topic, it is however, necessary to investigate this relationship in the South African context, because interest rates are important variables to understand due to the fact that they link the economy of the present and the economy of the future through their effects on saving and investment. Moreover interest rates policy is considered as a key component of the actions undertake by the SARB, in order to influence the current high level of inflation in the country.

The following section concentrates on empirical studies dealing with the effects of interest rates on consumer spending, both on the South African experience and also on the international perspective in the subject.

2.4 Empirical studies of monetary policy

Although the investigation of the transmission of monetary fluctuations, through interest rate variations, to real output has dominated macroeconomics since at least the eighteenth century. However, as King (1986) argued, understanding the short-run impact of the transmission mechanism of money on nominal economics variables remains an unresolved research topic, because of the ambiguity in the results obtained as far as that relationship is concerned in the empirical literature concerning this sensible topic.

Hence, in the available empirical literature on consumer expenditures, monetary policy plays a major impact either through interest rate or liquid asset effects; however, empirical research on the effects of interest rates on consumption and

saving failed to establish a clear association, positive or negative between those variables. (Gylfason, 1981: 233)

Many studies available on this topic gave different conclusions on the real direction of causality between consumption and interest rates. Hence, in the US, Wright (1967:850) used a similar approach to Friedman's by introducing an interest variable into the consumption function. The main result obtain was that, there exist an empirical evidence of an inverse relationship between those two variables.

Juster and Wachtel (1972:106) obtained the same results regarding the direction of causality between consumer expenditures and the real rate of interest, although this study was particularly focused in analysing the impact of real interest rates on consumer expenditures on durable goods such as automobiles. More precisely, the above-mentioned author argued that a fully anticipated inflation increases consumer expenditures on non-durable goods, while at the same time creates the opposite effect on durable goods and personal saving.

Also Blinder (1975: 449), examined the effects of the distribution of income on consumption, the results obtain suggested that consumption is in fact affected by a redistribution of income, occurring via interest rates variations amongst others variables affecting consumption.

Boskin (1978: 25) presented some evidence suggesting that there is a positive relationship between private saving, implying therefore, a negative one with consumption, and the rate of return. Accordingly he reached the conclusion that these results have obvious implications for the effectiveness of monetary policy in the short and long run.

Similarly, Hamburger (1967:1149), argued that, the results obtained in analysing the effects of interest rates on the demand for consumer durable goods in the

U.S, suggested the existence of a direct link between monetary operations and consumer expenditures on durable goods, through the interest rate channel of transmission mechanism. This study failed to produce a clear conclusion about the nature of that particular relationship.

Again, Mishkin (1976:653) indicated a strong inverse relationship between nominal interest rates and consumer expenditures on durables goods. He further argued that, the traditional path for monetary policy effects on consumer durable expenditures is in fact quite powerful, exposing therefore, two additional channels through which the policy is transmitted namely; the effect on the prices of assets and the effect on the cost of availability of credit.

Although this first set of studies indicated a similar direction in the causal relationship between the rate of interest and consumer expenditures, the approach developed by the above-mentioned studies was quite different in certain points. Hence, while some of them, such as Wright (1967), Juster et al (1972), measured interest rates in nominal terms, others used real interest rates by including the effect of inflation in their analysis. These include for example Blinder (1975) and Boskin (1978). The main reason behind the inclusion of inflation in the analysis is given by Boskin(1978:6), via the argument that inflation may decrease the capital intensity of production and hence affect the real economy, excluding the expected rate of inflation may sometimes biase the estimated interest elasticity of consumption.

Other studies on the topic reached a different conclusion about the direction of the relationship between consumer expenditures and interest rates. Hence, Weber (1970) examined the impact of interest rates on aggregate consumption and, found a positive relationship between consumer expenditures and interest rates. The author attributed this positive relationship to the fact that, with an increase in the rate of interest, consumers have an opportunity to maintain the

same level of consumption in the future due to the potential income effects occurring from an interest rate increases. (Weber, 1970:600).

Similarly, Springer (1975) examined the impact of the rate of inflation on consumer expenditures. According to the above-mentioned author, a higher expected rate of inflation lowers the real rate of interest. His analysis showed that a higher expected rate of inflation induces a higher current level of expenditures on all types of consumer goods. (Springer, 1975:299).

Again the same differences in terms of the methodology adopted, also appears in this second set of studies. While Springer measured interest rates in real terms, Weber did not. Moreover, Weber (1975) went even further by concluding that inflation has no significant effect on aggregate consumption. Springer (1977:300) also argued that, the effects of nominal interest rates and inflation are different from different components of aggregate consumption and for different measures of the expected rate of inflation.

According to Mankiw (1985: 354), one channel through which real interest rates affect aggregate demand is consumer expenditure on goods. The interaction between interest rates and consumption decisions then plays an important role in a variety of macroeconomic models, hence the importance of measuring the interest sensitivity of consumer expenditure both on durables and on non-durables and services.

Changes in the money supply and bank credit are therefore, used extensively as measures or indicators of the direction of monetary policy. Since money and bank credit often move in opposite directions or change at different rates, the two measures provide different information about the direction of policy.

Although the available literature on this topic supported the view that consumption and interest rates are inversely related. However some of the

analyses on this topic have reached the opposite conclusion, by indicating that both variables move in the same direction. This reinforces the common view that, the debate about the real effects of monetary policy, through interest rate manipulations, on consumer expenditures is still widely open. Therefore, more investigations need to be done, especially in emerging markets like South Africa, where some sectors of the economy are in constant movement, especially the financial market sector, and constitutes a strong case to study.

Little empirical evidence has been produced concerning the particular relationship between the rate of interest and consumer expenditures, dealing with the South African economy. Most of the studies available here dealt with those two variables namely; interest rates and consumer expenditures, separately or most of the time associated with another different variable.

Hence, Aron and Muelbauer (2000) investigated the aggregate household consumption in South Africa, but the emphasis in this analysis was placed on the role of financial liberalisation and its effects on consumption. The study argued that increase in the substantial rise in the ratio of consumption and household debt to income, observed in the country since 1983, could not be explained in terms of income, income expectations, interest rates and wealth. Therefore, implying that the consumption behaviour of South African households might not be a factor of interest rates.

The consumption framework of South Africa's households was also investigated by Prinsloo (2000), through analysing the saving behaviour of the South African economy. The main argument in his analysis revolved on the fact that; because of the deregulation of financial institutions during the 1980s, many new lending opportunities were created for banks giving individuals much easier access to credit facilities. This further allowed household to maintain higher level of consumption than would not otherwise been possible. (Prinsloo, 2000:23).

Akinboade, Niedermeier and Siebrits (2001), examined the determinants of inflation in South Africa in order to investigate ways in which the current high inflation rate can be combated. The main conclusions reached in their study were that; inflation in South Africa is largely structural in nature. Therefore, the monetary authorities have limited control over its main determinants. This suggested that it will be difficult to achieve the objective of reducing inflation. This is mainly due to the fact that in the current monetary policy framework, the interest rate remains the principal instrument of monetary policy to fight inflation; this despite being subjected to long outside lags. Hence, in pursuing the objective of reducing inflation the SARB should include the space for the lag effects to be fully felt.

In summary, empirical studies conducted in investigating the effects of interest rates on aggregate consumption have yielded inconsistent results. Although most available studies found a positive long-run relationship, however, some studies have indicated an opposite direction for that specific relationship. The complexity in implementing and managing monetary policy is then accentuated by these observations. Consequently, Bernanke and Gertler (1995:27) argued that measuring the stance of monetary policy is not an easy act, they refers to the transmission mechanism as a "black box".

Part of the reasons making the assessment of the effect of monetary policy difficult to measure include, the fact that the time lags associated with any particular act of monetary policy may be much shorter or much longer. Those lags are highly sensible and depend among other things, on the size and the type of the economy, the state of business, the nature of the variable to be affected, consumer confidence on monetary institutions (Brain et al, 2003:179).

Hence analysing the effect of monetary policy, through the repo rate control by the SARB, on consumer expenditures in South Africa is not an obvious task, because the challenges faced by Central Banks in developing open economies

are much more complicated than those in developed economies. The construction of a model for developing economy, as well as the results expected, may differ from the ones of developed countries. (Berument, 2002:1).

2.5 Summary

The series of links between monetary policy change and the resulting changes in economics variables such as output, employment, and inflation are known as the transmission mechanisms of monetary policy. These transmission mechanisms so far have been analysed by various schools of thought, namely, the Classical, the Keynesian and the Monetarist. Although they all agree on the importance of monetary policy in the economic system, however the effects of monetary policy on economics variables appear to be weak in the Keynesian model, and much more stronger in the others.

One of the most important channel through which, monetary policy actions are transmitted to real variables in the economy is known as the interest rate channel. This because nowadays, monetary policy operates mainly through changes in the short-term market interest rate, which in turn are expected to affect other rates in the market place and the economic variables related to those specific rates. Hence, the effect of monetary policy, through interest rates manipulations, on consumer expenditures has been extensively studied by many researchers. The results obtained so far are at best ambiguous. While some researchers indicated a strong negative relationship between the two variables described above, others indicated the opposite.

The inconsistencies in the literature can partly be attributed to the wide variety of assumptions and models used to investigate that particular relationship. Thus, in analysing the nature of the causal relationship between interest rates and consumer expenditures in South Africa, as this dissertation intended to do, the choice of an appropriate methodology is an imperative step.

The next chapter constitutes the second part of the literature review, with the emphasis placed specifically on the South African economy as a whole and particularly on the rate of interest and its importance as a policy's instrument in affecting the economy as a whole and consumption in particular.

CHAPTER 3

THE SOUTH AFRICAN ECONOMY

3.1 Economy overview

Over the past 15 years South Africa has moved from an economy based on primary sector industries such as agriculture and mining to one dominated by the tertiary sector. The Economic growth in the country has been steady and unprecedented. In fact, the revised Statistics South Africa (2008) figures revealed that GDP rose by 2.7% in 2001, 3.7% in 2002, 3.1% in 2003, 4.9% in 2004, 5% in 2005, 5.4% in 2006 and 5.1% in 2007, producing an economic growth rate around the 5% mark in every quarter since the beginning of 2004. The 5% growth of the economy recorded in 2006 represented the highest rate of economic growth in 25 years. Consequently, the observed economic boom represented one of the longest sustained increases in income in about 40 years. The main characteristics, according to Smal, Pretorius and Ehlers (2007), of the South African economy over the last decade include lower and stable inflation, lower and stable real interest rates, positive and steady GDP growth, stable fiscal deficits and debt.

However, since 2007, with the international environment becoming highly unstable due to many factors namely; a sudden rise in oil prices, the instability in major financial and commodities markets and many others, the relationship between monetary aggregates and the demand for goods and services has significantly changed. Hence, the pursuance of price stability, which is the main objective of the SARB, is becoming even more difficult due to the fact that the complex transmission mechanisms of monetary policy are now disturbed by the changing world conditions.

The South African economy has not escaped the effects of the recent global economic crisis, due to the openness of its economy. In fact the global economic activity deteriorated suddenly at the end of 2007 and amplified in 2008 and 2009, as the international credit crisis intensified, and the economic growth is expected to moderate significantly in emerging-market and developing countries around the world including South Africa. Following these unexpected financial events, the latest IMF World Economic Outlook Update (2009) predicts that global output growth is projected to slow further, from 3.4% in 2008 to 0.5% in 2009, before rebounding to 3.0% in 2010. In the case of South Africa, despite recording a declining GDP, the economy growth was still positive in 2008 at 0.2%, unfortunately, as reported by the Standard bank (2009b) report, the country's economy hits its first recession for the first time after seventeen years, during the second quarter of 2009. The current GDP growth is estimated at - 0.6% for the year 2009.

As it has been argued by Smal and Jager (2001: 5), the role of Central Banks such as the SARB, is to implement sound monetary policies able to return the economy to a state of equilibrium in the presence of any external or internal shocks to the economy. It is therefore, very important to analyse how the SARB uses its main policy instrument namely, the repo rate, in order to face economic and financial disturbances.

3.2 The South African "Reserve Bank"

Aron and Muelbauer (2000:3) indicated that, basically there have been three broad monetary policy regimes implemented by the SARB since the 1960s. A liquid asset ratio-based system, with quantitative controls on interest rates and credit up to the early 1980s, was reformed gradually toward a cost of cash reserves-based system by about 1985. The SARB then adopted an inflation targeting monetary policy framework in February 2000, with the SARB's primary objective remaining in protecting the value of the currency so as to achieve

balanced and sustainable economic growth over the long term (Smal and Jager, 2001: 4).

3.2.1 An overview of the SARB

The South African Reserve Bank (SARB) is South Africa's Central Bank. It was established in 1921 in terms of the Currency and Banking Act of 1920 (Act No 31 of 1920). It was the fourth Central Bank to be established outside Europe and came into existence primarily due to the abnormal monetary and financial conditions that arose during and immediately after World War I. The Currency and Banking Act of 1920 was replaced by two subsequent Acts, namely the South African Reserve Bank Act of 1944 and the South African Reserve Bank Act of 1989 (Act No 90 of 1989). The bank has been privately owned since its establishment and presently has in excess of 650 shareholders. The Act of 1989 has a broad scope that encompasses all the functions and operations of the bank.

Liquid asset requirements were used as the principal monetary policy instrument from 1960 through mid-1982. Under the second system, pre-announced monetary targets were used for the first time, with the main policy emphasis on the Central Bank's discount rate in influencing the cost of overnight collateralised lending and hence, the market interest rates. The inflation-targeting monetary policy framework is the current regime under which the SARB operates, with an inflation target range set between 3 to 6 percent.

Van der Merwe (2004) gave some reasons why the SARB decided to shift its policy towards a formal inflation targeting framework. This includes the fact that with an informal inflation target in place, the public was at times unable to accurately judge the SARB's monetary policy stance. He also argued that an inflation targeting framework allows for better co-ordination between monetary policy and other economic policies. The inflation targeting framework increases

the accountability of the SARB with regard to monetary policy, as it becomes the bank's direct responsibility to ensure that inflation remains within the target range.

3.2.2 The SARB's influence on the economy

Being one of the most influential government policies, monetary policy aims at affecting the economy through the management of money and interest rates.

The South African Reserve Bank plays an important role in determining the level of short-term interest rates in the whole market, as these rates are closely related to the rates at which the Bank lends money to private-sector banks. By playing the role of the lender of last resort, the SARB acts as banker for private bank by lending money to commercial banks experiencing a cash shortfall or a need for liquidity on a daily basis. The bank is then able to manipulate the size and nature of its balance sheet in order to maintain the shortage at a level that it believes is appropriate to meet its objectives (SARB 2005:2).

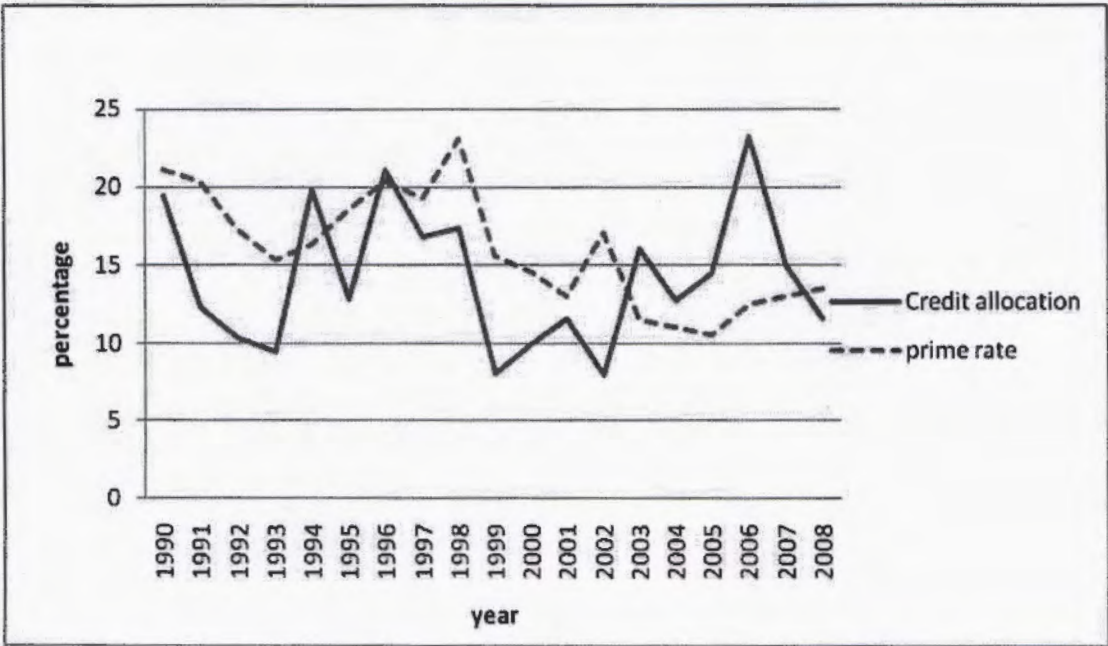
Commercial banks operating in the loan market adjust their rates according to change in the repo rate. Under this system, banks are obliged to utilise the Reserve Bank's accommodation facility through the repo system, which enables them to meet their daily liquidity requirements. To make the repo rate effective, the Reserve Bank intervenes in the money market to create a shortage by draining excess liquidity in circulation, causing a permanent indebtedness of commercial banks with the Reserve Bank.

According to the SARB's fact sheet number eight, the repo rate serves as a benchmark for the level of short-term interest rates. An increase in the repo rate by the SARB obliges commercial banks to raise the interest rates at which they take deposits from, and lend money to their customers. This causes a general rise in interest rates or the cost of holding money, and this eventually helps to

control inflation by reducing the demand for credit to be spent on the purchase of goods and services.

Figure 3.1 below and data in table A₁ (see appendix A) shows the evolution over a certain period of both the prime lending rate, which as it is known is affected by the SARB through policy actions, and the evolution over the same period of the amount of credit allocated by all financial institutions in the country to the entire economy.

Figure 3.1 Annual evolution of prime rate and credit allocation



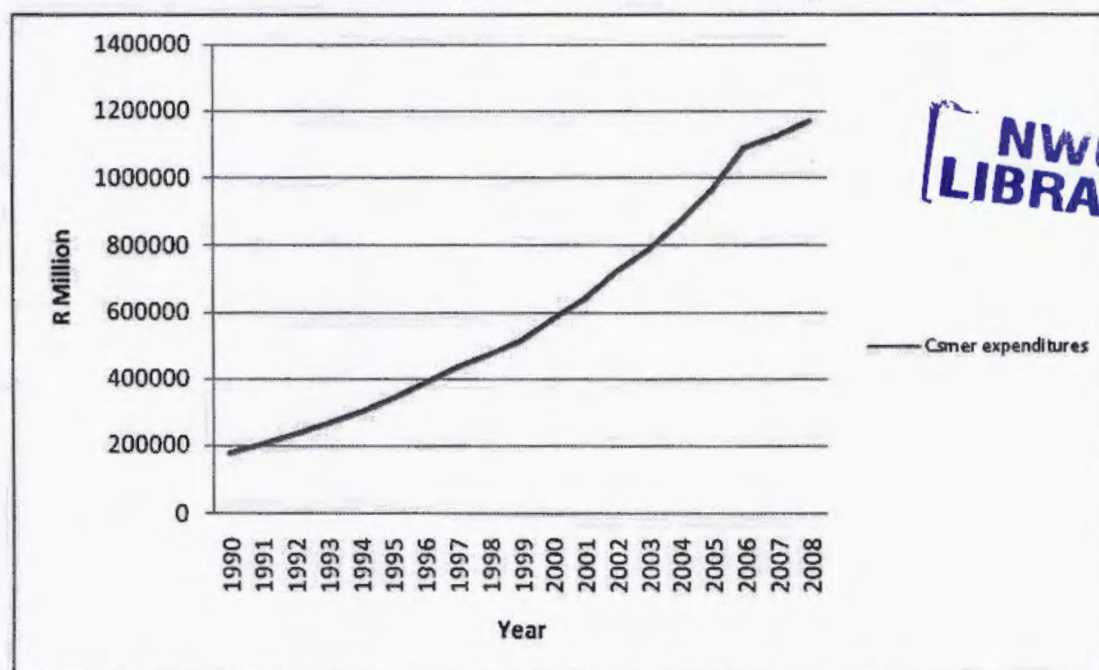
Source: own graph using Stat S.A data

4As it can be observed in the above figure, although the prime lending rate remained almost constant during the period from 2002-2005, the amount of credit allocated to the entire economy, as well as to the households sector, increased drastically and reached a peak in 2006. This period of over spending correspond to the one of economic boom that the country experienced, with an average of 5% GDP growth recorded each year. However, the contractionary policy implemented by the Bank in 2006 was materialised by an increase in the repo

rate, which was automatically followed by an increase in the prime lending rate of commercial banks (from 12% in 2006 to almost 14% at the end of 2008). This increase in the prime rate negatively affected the amount of credit allocated by financial institutions as it can be observed in the above figure, with the level of credit allocated although still increasing, but at a slower pace.

Although the increase in the repo rate by the SARB during the period of contractionary monetary policy was automatically followed by an increase in almost the same proportion in the bank's lending rates, consumer expenditures did not contracted as expected as it can be observed in Figure 3.2 below, obtained from table A₁ (see again appendix A).

Figure 3.2 : Annual evolution of Consumer expenditures



Source: own graph using Stat S.A data

The above figure shows that consumer expenditures in the country continued to grow at a fast increasing pace throughout the observed period. It is therefore, important to notice that by the beginning of the year 2007, the growth rate started just to slow down.

More specifically, the SARB (2008) report indicated that, total loans and advances extended to the domestic private sector continued to grow at a fast pace, despite the successive increases in domestic lending interest rates from June 2006. Banks' loans and advances increased by a record R315 billion in the twelve months to July 2007. Again, according to the same above-mentioned report, during that period all credit categories increased significantly, the household sector accounted for the greater part of the demand for bank loans and advances in 2006, with credit extension strongly influenced by consumption expenditure and the acquisition of real estate. From the second half of 2006, and during the year 2007, the corporate sector accounted for the bulk of the increase in bank credit extended to the private sector. In fact, the household sector's use of bank loans and advances rose by R145 billion or 21,8 per cent over the twelve months to July 2007, whereas the corporate sector's use of such advances increased by R169,7 billion and twelve-month growth accelerated to 31,6 per cent over the same period.

As far as the household sector is concerned, the Standard Bank (2008) report indicated that growth in real final consumption expenditure by households maintained an increasing pace throughout 2007, but gradually lost its speed in the first half of 2008. The contraction in real expenditure on durable goods, especially on motor vehicles, recreational and entertainment goods, slowed down the growth in real final consumption expenditure by households during the year 2008 and is expected to follow the same pattern in 2009. Hence, growth in total loans and advances extended to the private sector slowed in the twelve months to June 2008 as lending and borrowing conditions became unfavourable due to tightening in monetary policy.

In fact, the contraction in households' consumption expenditures in the country was considerable only around the third quarter of the year 2008 (almost seven quarters after the first contractionary monetary policy action was taken), with

consumption of durable goods in particular, declining by almost 10%, while consumption of non-durable goods also contracting (Mboweni, 2008:39).

This observation connected to the time taken by a policy action to be materialised is in fact not surprising because, as indicated by Smal et al (2007), any policy indication by the SARB must be reflected on specific economics variables, through the various transmission mechanisms in place with time lags.

This strategy reinforces the crucial role played by time lags in the transmission of any policy action taken by the Reserve Bank, including the expected impact on consumer expenditures from an increase in the repo rate and hence on commercial banks lending rates.

3.2.3 SARB and the banking system (repo rate and bank lending rates)

Weth (2002), explained that, in a fully competitive environment, the bank lending rate should be, in the long run, related to the level of market rates, which are determined by monetary policy implemented by Central Banks. Therefore, in a liberalized financial system Central Banks control bank lending rates only indirectly; they are able to affect market interest rates through their intervention instruments. However, as quoted by Cottarelli, Ferri and Generale (1995), the speed at which changes in policy conditions are transmitted to banks lending rates differs due to many reasons.

The process through which changes in market rates are transmitted to lending rates is also known as “the pass-through” and it has been discussed intensively in the research field connected to monetary policy, since the transmission of market rates to bank retails rates is an important element in the monetary transmission process. There is a common agreement among researchers suggesting that market conditions are not passed on to bank interest rates immediately due to time lags existing alongside the transmission of monetary

policy to aggregate variables in the economy. Despite time lags are crucial in the pass-through process, some other important factors influencing the responsiveness of loan rates to market or policy interest rates are also given by some study.

Weth (2002:2) indicated that, banks respond to changes in policy rates depending on their size, the volume of their savings/deposits and their long-term business with non-banks. Therefore, it has been observed that large banks and banks with few savings deposits adjust their lending rates to market interest rates more quickly than other banks.

In South Africa, the SARB's key operational instrument, within the current monetary policy framework, is the level of short-term interest rates. The Reserve bank largely determines the level of short-term interest rates and is able to influence these rates through its control over the repo rate.

Also, the fact that credit allocation by commercial banks and consequently consumer expenditures, did not react automatically to the contractionary policy imposed by the SARB, might be due to the necessary adjustments that commercial banks had to face under the "pass-through" process, depending on their size, the level of their liquidity and the characteristics of their customers.

Faure (2003: 144-162) observed that, although the transmission of Central Banks' policies, from a change in their inter-bank rate to commercial banks lending rates, might be subjected to time lags and other factors, sometimes it might be a much more direct relationship.

3.3 Summary

In summary, recent changes in the South African financial system and especially in the world economic conditions, pose challenges to the conduct of monetary policy. As Wesso (2002) argued, those challenges includes, changes in the

implementation of monetary policy, financial innovations, the integration of international financial markets, the removal of most external capital controls and many others. More importantly, the weakened financial system and lack of confidence which limited credit available to all, caused policy implementation in advanced and developing economies to be reviewed for the greater part of 2008. Thus, Central Banks around the world have reacted to the current economic meltdown by pumping the system with liquidity, for some, and for other including the SARB, by slashing interest rates and guaranteeing deposits.

All those factors in a certain way, might have affected the equilibrium relationship between the variables that determine the demand for and the supply of money, with the possibility of creating some major disturbances in the economy as a whole. Since the economy is constantly affected by various external influences and shocks, the aim of monetary policy, implemented by Central Banks, is to return the economy to a state of equilibrium, by using their policy instruments and the various existing channels of policy transmission. However, as argued by Smal and Jager (2001: 5), if market interest rates, the exchange rate, credit allocation or other asset prices do not respond meaningfully to variations in the policy instrument, monetary policy have little effect on the economy, meaning that the channels are blocked or not fully functional. This observation shows how difficult implementing monetary policy is, this basically due to the complexity in the transmission mechanisms of monetary policy, together with the perpetual changes occurring in the world financial conditions.

Hence, it is important to determine and to observe how actions taken by the SARB are transmitted to the entire economy. It is also essential to determine how the model reacts to potential exogenous shocks.

As it has been described in the previously-mentioned analysis of Smal et al (2007), time lags play a vital role in the transmission of policy actions and it is important to pay a particular attention on those lags during the monetary policy

formulation process. Smal et al (2007: 24) concluded that, the structure and theoretical foundation of the SARB's core model as it is today, do not guarantee successful monetary implementation, but its importance lies in the fact that the model perfectly exposes the existing links between the key sectors and the keys variables in the inflationary process of the South African economy.

The recent economic outlook, from all major research institutions indicates that, as a result of favourable fuel price developments and other factors such as the current economic slow down, inflation is expected to ease rapidly in South Africa, to around the mid-point of the target ranges by the third quarter of this year. The improvement in inflation and interest rates will have important effects on specific sectors of the economy, including consumption by its household component which is under study here. Household expenditures are expected to contract by 0.4% in 2009 from an estimated 2.5% in 2008 (Standard Bank, 2009).

Tighter policies by monetary authorities are at some degree justified at the time; nevertheless, re-launching the economy might take a lot more than slashing interest rates. The first requirement is patience as the situation cannot be rectified quickly, nor is it one that Central Banks can solve in isolation. Hence, the importance of the space given to time lags in order to benefit from the full effect of current policies' actions.

This chapter concludes the literature review of this ongoing study, which helped in understanding not only the different theories related to the topic, but also the past and current developments that occurred within the South African economy as a whole. The next chapter deals exclusively in presenting the methodology to be used in explaining the process through which changes in the repo rate affects consumer expenditures within the country, which remains the main objective of the study.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

Keynes (1936: 93) argued that: "The usual type of short-period fluctuation in the rate of interest is not likely . . . to have much direct influence on spending either way". However, given the importance of aggregate demand and spending in the whole economic system, it is nevertheless important to analyse the question whether monetary policy can directly affect aggregate demand, aggregate spending or aggregate consumption through the rate of interest. Hence, the purpose of this ongoing study, which is to explain the causal relationship that might exist between consumption or consumer expenditures and monetary policy (via the repo rate and its effect on banks lending rates) in South Africa.

4.2 Data collection

As a first step of this analysis, an important amount of reading was undertaken in order to gather necessary information on the studied topic. The readings helped in understanding the topic extensively, especially as far as theories on monetary economics and consumer behaviour have evolved through different schools of thought. Moreover, it helped in understanding the current developments about the topic in the research community all over the world. This first part of the research process was necessary in terms of providing a critical evaluation of both the international and South African perspective on the topic, which forms part of the literature review.

The second important step of the research process was devoted into the collection of the necessary data to be analysed in the study. The model relating the aggregate available variables is composed of one dependent variable

consumer expenditures (C_{ex}) which is expressed as a function of two other important variables that are central to individual consumption these are: disposable income (Y_d) and households' wealth (W_h). Furthermore, interest rate or repo rate (r) was included into the model as a proxy for monetary policy. Some additional variables namely; the Consumer Price Index (CPI) and the unemployment rate (U_n) were also added into the model, this in order to fully integrate the possible effect of other economic factors within the principal relationship under investigation.

Firstly, data on consumer expenditures, disposable income, prime interest rate and Consumer Price Index were directly obtained from the SARB's web site. A formal discussion together with an informal interview was conducted with Dr Smal from the SARB's research unit, during the Monetary Policy Committee (MPC) explanation tour in Mafikeng on the 19th of May 2009.

Secondly, due to the controversy surrounding the accepted official definition of unemployment in South Africa, data on this particular variable was more difficult to obtain. Part of them was obtained through the North-West regional office of Stat S.A (data ranging from 1994-2006), and data prior to that period have been estimated from the study of both Kingdon and Knight (2001) and Vivek and Ricci (2005).

Similarly, data on households' wealth in South Africa were not constructed on a regular basis prior to 1999, they have then been estimated in this study using the graphs obtained from the study of Aron and Muellbauer (2006a and 2006b).

The econometric approach was the next important step of the study, it involved the analysis and the interpretation of the results obtained. Analysing the possible causal long-run relationship between consumer expenditures and the repo rate, was conducted through regression analysis on the available time series data, using the well-known ordinary least squared (OLS) method.

Time series analysis was preferred in this study because of the fact that it is possible with this technique to use past information on the available variables in order to develop a statistical relationship between them, and further to use the obtained relationship in order to make macroeconomic forecasting on future values, based on regression analysis. It was then necessary to use time series in this analysis because the study intended to apply cointegration analysis and Error Correction Model (ECM), which are both powerful econometric analysis of time series, because it is possible, with particularly the ECM, to combine both the short-run and the long-run properties of the economic relationship under investigation.

The empirical test of whether monetary policy (through interest rate) is a significant determinant of aggregate household consumption in south Africa, was performed in this study with aggregate annually time series data of South Africa for the period 1970-2006. The Econometric Views (Eviews) software package was used to perform the analysis. The empirical estimation of the model required data or variables that are summarised in the following table 4.1, together with their respective abbreviations. It is important to note at this point that all variables have been firstly transformed into their respective natural logarithm values before making any calculations using the Eviews software package. Time differences have been denoted by D and the logarithm values of variables by Ln.

Table 4.1: List and abbreviations of variables in the model

Variable		Description
C_{ex}	Consumption expenditure	Total final consumption expenditure by households (current prices) as given by the SARB.
Y_d	Disposable income	Disposable income of households in current prices as given by the SARB.
prime (r)	prime interest rate	Prime overdraft rate as given in percentage by the SARB.
CPI	Consumer price index	Headline Consumer Price Index as given by the SARB.
W_h	Households' wealth	Net wealth of the household sector including durable consumer goods. Estimates derive for S.A from existing data by Aron and Muellbauer (1999, 2000a & b).
U_n	Unemployment	Unemployment rate, defined as the number of unemployed persons in S.A expressed as a percentage of the labour force, and are obtained from Stat S.A

4.3 Steps of the econometric analysis

The study explains the existence of such a relationship between monetary policy and consumer expenditures, by implementing a four-step econometric procedure which includes:

1- The general starting point of a procedure involving time series data is the test of the unit root in order to determine the order of integration of the relevant variables. This is justify by the fact that, the common knowledge recognises that many macroeconomics time series data are not stationary, and contains unit roots (Anwar, Davies and Sampath, 1996: 223). This test is then necessary in order to avoid such econometrics problems like the spurious regression, which

arises because of the presence of a strong trend between two time series data. The order of integration of all the variables in this study is determined by employing tests developed by Dickey and Fuller (1979), Phillips and Perron (1988).

2- If all variables are integrated of the same order, a maximum likelihood method of cointegration, proposed by Johansen (1988), and later improved by Johansen and Juselius (1990), is applied in order to determine the number of cointegrating vectors. If one or more cointegration vectors are found to exist, any short-run disequilibrium is corrected with an error correction model (ECM). The cointegration test is helpful in determining the existence of a long run relationship between the variables.

3- The next step is to perform a series of diagnostic tests on the Error Correction Model's residuals, as well as stability tests on the regressed equation. Those tests are respectively designed to verify for the statistical significance of the model, and to evaluate whether the performance of the model in predicting an outcome is compatible with its performance in the sample period used in the analysis. Those tests are helpful in determining whether there are inclusions of irrelevant variables (or exclusion of relevant variables) in the model. The diagnostic tests include; the Jarque-Bera normality test; the Breusch-Godfrey's serial correlation test; ARCH LM test and White heteroscedasticity tests. Furthermore, the Ramsey RESET test and the Recursive Estimates tests (CUSUM and CUSUM of Squares) are used to test for the stability of the model.

4- The last step is to perform the Granger causality test. Introduced by Granger (1981), the test is developed in order to find out if there is a short-run relationship among the main variables of the model. More specifically, it is performed to find out if one variable is causally related to another one in the model. In this case it is performed in order to determine the causality between consumer expenditures (C_{ex}) and the monetary policy indicator which is the short-term interest rate (r).

4.4 The Model

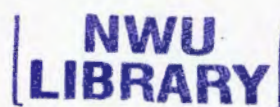
In the available literature on this particular topic, three different theories, namely, the relative income hypothesis of Duesenberry (1949), the life-cycle hypothesis of Modigliani and Brumberg (1953, 1954) and the permanent-income hypothesis of Milton Friedman (1957) have been widely used in analysing the consumption function. The most prominent theory among these three is the permanent-income hypothesis which basically stipulated that, consumption of nondurable goods and services is chosen to match permanent income, defined as the annuity value of human and nonhuman wealth. This implies that consumption responds to any unpredictable change in permanent income, but very little to transitory fluctuations in income (Ludvigson and Steindel, 1999: 35).

Since both the life-cycle hypothesis and the permanent-income hypothesis of consumption and saving have a common origin in the theory of intertemporal choice, and that both hypothesis are consistent with an aggregate consumption function in the form $C = F(\text{income, wealth etc...})$, the approach in this analysis was therefore, based on those two theories, with an econometric technique similar to that used by both Boskin (1978) and Gylfason (1981).

As argued by Ludvigson et al (1999), the permanent-income hypothesis implied that there is a linear relationship between aggregate consumption, aggregate labor income and aggregate net wealth. Based on that, the current analysis estimated a small, dynamic structural model that included three principal variables that are central to consumer spending, namely, consumer expenditures (C_{ex}), disposable income (Y_d), and household wealth (W_h).

$$C_{ex} = f(Y_d, W_h) \tag{4.1}$$

Three additional variables, reflecting the effects of uncertainty, were also included in the model these are; the repo rate (r) or a prime overdraft rate (as the indicator of monetary policy), the CPI as a measure of inflation and the unemployment rate (U_n) to measure money income that is high or low relative to the recent past. This last variable U_n was expected to have a negative impact on current saving (a positive impact on consumption), since it represents a negative transitory income effect (Juster and Taylor, 1975: 205).



Given those variables, our model was given the following form:

$C_{ex} = F(Y_d, r, W_h, CPI, U_n)$, which in a simple linear form will be written as:

$$C_{ex} = \alpha + \beta_1 Y_d + \beta_2 r + \beta_3 W_h + \beta_4 CPI + \beta_5 U_n + \epsilon \quad (4.2)$$

Where α is a constant and the β_i are parameters of each variable. As it has been observed in the available literature on the topic, it is common to obtain data with strong seasonal pattern, which must be taken into account. This pattern tends to increase with time. A solution to this was given by Davidson et al (1978), by suggesting that, transformation of those data into their respective logarithms values gives a stable seasonal pattern throughout the period study. Furthermore, according to the same authors, taking logarithms values also largely eliminates the tendency for the fluctuations to increase over time and expresses the model in terms of proportionate changes in behaviour. Although there are associated effects from this technique on the structure of the error term. However, Mayes (1981) argued that using this technique also helps to avoid any problem of heteroscedasticity in the errors, which might have occurred as a result of the increasing fluctuations in the untransformed data. Therefore, all the variables in the model were transformed into their logarithm form and the following linear logarithm equation was obtained:

$$\text{Log } C_{ex} = \alpha + \beta_1 \log Y_d + \beta_2 \log r + \beta_3 \log W_h + \beta_4 \log CPI + \beta_5 \log U_n + \epsilon \quad (4.3)$$

4.5 Econometric approach

4.5.1 Unit Roots tests

In order to determine whether the time series data in the above-described model contained unit roots, the study employed tests constructed by Dickey and Fuller (1979), Phillips, and Peron (1988), this in order to determine whether the variables follow a non-stationary trend or whether the series are stationary. These two approaches are described below.

4.5.1.1 Augmented Dickey and Fuller (ADF)

Before conducting any causality tests, the classical regression model requires that all the variables involved in the model must be stationary, this means that their means and variances remain the same (are constant) no matter at what time they are measured. In addition, the values of the covariance between two time periods will depend only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed.

Each respective time series is then first tested with the use of a unit root test developed by Dickey and Fuller (1979). This technique is employed to test for the order of integration or to test for the level of integration of the variables used in the model, this in order to determine whether the variables follow a non-stationary trend or whether the series are stationary.

Practically speaking, the process is conducted by testing firstly with the time series in levels that include both the constant term and the time trend. Next, the same test is performed on the residuals, which include neither the constant term nor the time trend.

The hypothesis that is tested is the null hypothesis of the existence of a unit root against the alternative of stationarity. Testing for unit root using the Augmented Dickey and Fuller test involves the estimation of the following regression:¹

$$\Delta Y_t = \beta_1 + \rho Y_{t-1} + \alpha_i \sum_{i=1}^m \Delta Y_{t-i} + \varepsilon_t \quad (4.4)$$

The null hypothesis is that $\rho = 0$ (has a unit root) and the alternative is that $\rho < 0$ (stationary). In estimating the equation, if the value of the lagged coefficient is greater than the critical value, at the various levels of significance, then the null hypotheses that the series has a unit root can be rejected and it can be concluded that the series is stationary. In performing the ADF test, a particular attention is paid on choosing the appropriate optimal lag-length, since it appears to be one of the most critical point in unit root testing. The test is performed on the model with trend and intercept first, intercept only, and finally on the model with none of the both above. The null hypothesis ($\delta=0$ or $\rho=1$), implying that there is a unit root on the time series data (i.e. nonstationary), is tested using the t (tau) statistic. The stars above the ADF critical value indicate statistical significance level of 1, 5 and 10 percent respectively. Recall that the more stars we have, the more often the null hypothesis H_0 of non-stationarity is rejected (implying that the more likely the series is stationary).

Dickey-Fuller tests enable not only to detect the existence of a trend (unit root test) but also to determine the best way to make a chronic stationary.

¹ This section is drawn from Darnell (1997: 41)

4.5.1.2 Phillips and Perron (PP)

In order to verify that the unit root results are accurate, it is useful to perform a second unit root test, which is the one developed by Phillips and Perron

(1988:335). This method utilises a nonparametric approach to control serial correlation in the error term. Assumptions related to the data generating process of the times series under study are necessary to be made here. Basically, the choices are the same as those explained in the Augmented Dickey and Fuller test. Whichever assumption is used in the ADF test is used for the PP test.

As it was argued by Chang et al (2001: 1291), once a unit root has been confirmed for a data series, the question is whether there exists some long-run equilibrium relationship among variables. Therefore, if the series is found to be non-stationary, the next step is to test for cointegration.

4.5.2 Cointegration analysis and Error Correction Models (ECM)²

The majority of macroeconomic time series are non-stationary by nature, this has facilitate the development of various non-stationary time series analysis techniques, the most prominent being cointegration analysis. This concept of cointegration, introduced by Granger (1981:128) and later extended by Engle and Granger (1987:253), is based on the principle that the linear combination of two non-stationary series results in a stationary series.

The Engle-Granger test involves a number of steps. First using series of the same order of integration, the relationship specified in the model is estimated with the use of the Ordinary Least Squares (OLS) method. Next, for each of the relationships estimated, the residual series is generated and subjected to a unit root test using the ADF test. However, since the estimated error terms are based on the estimated cointegrating parameter, the ADF critical values are no longer appropriate.

² See Engle and Granger (1987), Stock (1999) and De Angelis et al (2005)

Instead, Engle and Granger (1987:269) have calculated the appropriate values. If the residuals of the regressions are found to be stationary, that is $I(0)$, then a

linear combination of two non-stationary series exists, thus the estimated regression is not spurious. This means that there is a long-run equilibrium relationship between the variables.

According to Engle and Granger (1987:273), the series y_t and x_t are said to be cointegrated of order $(d; b)$, denoted by $y_t, x_t \sim CI(d, b)$, if the series are integrated of order d , and also there exists a linear combination of y_t and x_t - say $\alpha_1 y_t + \alpha_2 x_t$ - that is integrated of order $(d-b)$, where $b > 0$. The vector $[\alpha_1, \alpha_2]'$ is called the cointegrating vector.

Suppose the series y_t and x_t are $CI(1; 1)$, the regression equation:

$$y_t = \beta x_t + u_t \quad (4.5)$$

With stationary residuals u_t , implying that the linear combination of y_t and x_t given by $y_t - \beta x_t$ with cointegrating vector $[1, -\beta]'$ is stationary.

Given y_t and x_t are drifting together in time, $y_t = \beta x_t$ can be interpreted as the long-run equilibrium and u_t can be referred to as the equilibrium error, which has zero mean and constant variance. Testing for cointegration amounts to testing for a unit root in the residuals. If y_t and x_t are integrated and not cointegrated, then the residual series u_t is integrated; if y_t and x_t are integrated and cointegrated, then u_t is stationary (Engle and Granger, 1987:275).

However, the cointegration method by Johansen (1988) is one of the most popular techniques in the available literature, Johansen (1988) allows one to estimate multiple long run relationships between a set of non-stationary variables, via cointegrating vectors, as well as any short run dynamics in these variables.

Cointegration tests in this paper were then conducted using the method developed by Johansen (1988), Johansen and Juselius (1990). This approach

provides a statistical framework, which allows analysing long-term relationships between non-stationary time series in a dynamic specification method. It applies the maximum likelihood procedure to determine the presence of cointegrating vectors in non-stationary time series. Generally a set of variables is said to be cointegrated if a linear combination of the individual series, which are $I(d)$, is stationary. A series X_t is said to be integrated of order d ($X_t - I(d)$), if it is found stationary after differencing (d) times (that means it contains d unit roots). Again two time series are said to be cointegrated if it is found that they are integrated of the same order, in this case, the regression on the level of those two variables is said to be meaningful, then a linear combination of two non-stationary series exists, thus the estimated regression is not spurious. This means that there is a long-run equilibrium relationship between the variables, and no long-term information is loss. This procedure is currently the most reliable test for cointegration and avoids the problems with Engle and Granger's (1987) two-step procedure.

This above comparison was explained by Arize (1995) who argued that, the Johansen procedure is preferred to Engle and Granger's (1987) residual-base technique because the Johansen's procedure; captures fully the underlying time-series properties of the data; provides estimates of all the cointegrating vectors that exist within a vector of variables; offers a test statistic for the number of cointegrating vectors; and provides a test statistic that is more discerning in its ability to reject a false null hypothesis. Thus, an additional advantage of this procedure is that it allows direct hypothesis tests on the coefficients entering the cointegrating vectors.

However, both the Engle and Granger's and the Johansen techniques agreed on the fact that, when time series are non stationary and cointegrated, it is useful to estimate their relation through an error correction model. Engle and Granger (1987) showed that every cointegrated series can be represented by an Error Correction Model (ECM). For each explicative variable, an ECM is estimated and

incorporated in the first difference of the independent variables. The ECM facilitates an investigation of both long run and short run dynamic relationships. The coefficient of the error correction term (Err.ecm) measures the short run adjustments towards the long run equilibrium position. Building an ECM involves the following steps:

- Determining the characteristics of the variables
- Determining the residual of the model's equation as well as testing the residual for cointegration using Augmented Dickey and Fuller tests.

4.5.3 Diagnostic and Stability Tests

Residual tests or diagnostic tests involve testing the obtained residuals from the error-correction model firstly, for stationarity by using the Augmented Dickey and Fuller test in order to confirm the cointegrated characteristics of the variables in the model, and secondly testing the residuals allows to verify the statistical significance of the fitted regressed equation or model. Different residual tests have been used in this study and are discussed below together with the proposed stability tests used.

4.5.3.1 Histogram and normality test.

This test produces a histogram of the residuals and the Jarque-Bera statistic for testing their normality (Eviews 3.1: 222). More precisely, the Jarque-Bera test statistic tests whether variables are normally distributed in the model and, moreover, the test measures the difference of skewness and kurtosis of series with those from normal distribution. The null hypothesis H_0 : residuals are normally distributed is tested against the alternative of non-normality in the distribution of the residual. H_0 is rejected if the t-statistic value obtained is less than the critical probability value $p=0.05$.

4.5.3.2 Serial correlation tests

There are many different types of serial correlation tests available, this study employed the Breusch-Godfrey LM- test in order to test for the presence/absence of serial correlation in the residuals. The above mentioned test is suitable for large sample and can detect higher serial correlation, moreover unlike other serial correlation tests, the Breusch-Godfrey test is applicable whether lagged dependent variables are included or not (Eviews 3.1: 223). The null hypothesis to be tested here is H_0 : No serial correlation up to a specific order P . Rejection of the null hypothesis is only possible if the t-statistic is less than the critical probability value $p = 0.05$.

4.5.3.3 ARCH LM test

The Autoregressive Conditional Heteroscedasticity (ARCH) LM test is the test for heteroscedasticity in the disturbances, which like autocorrelation invalidates the conventional standard error formulas. Testing for heteroscedasticity is justified from the fact that in working with macroeconomics time series data, it is observed that the size of residuals appears to be related to the size of recent residuals (Engle, 1986: 990). The test is based on the regression of squared residuals or lagged and belongs to a class of asymptotic large sample LM tests. The null hypothesis H_0 of no ARCH up to a specific order q in the residuals is tested and H_0 is rejected if the p critical value ($P = 0.05$) is less than the obtained t-statistic value.

4.5.3.4 White's heteroscedasticity tests

The test was developed by Halbert White and is only applicable to the residuals from a least squares regression. The test is based on the augmented regression and provides a test of the hypothesis that the coefficients of the variables in the augmented regression are all zero (Eviews 3.1: 224). This test is also known as a

general test for model misspecification. The null hypothesis H_0 of no heteroscedasticity up to order q in residuals is tested against the alternative hypothesis H_A of heteroscedasticity of some unknown general form. The same principle as for the above previous tests is applied in order to determine whether to reject/accept H_0 .

4.5.3.5 Ramsey Reset and Recursive Estimates (CUSUM) stability tests

Stability tests of a regression model are tests designed to evaluate whether the performance of a model in a prediction period is compatible with its performance in the sample period used to fit it. They are important in evaluating the following types of misspecification:

- Inclusion of irrelevant variables
- Exclusion of relevant variables

In this analysis the following two tests were used to test for the stability of the model: the Ramsey RESET and the Recursive Estimates (CUSUM and CUSUM of Squares) tests.

4.5.4 Granger-Causality tests³

Introduced by Granger (1969), Granger tests are performed to find out if one variable is causally related to another. In general, the Granger causality test utilises the F -statistic to explore whether lagged values of x contribute significantly to the explanation of y_t , once lagged values of y have been incorporated. If they do not, then x is said not to 'Granger cause' y , and if they do, x 'Granger causes' y . Similarly, examining whether y 'Granger causes' x , the contribution of lagged values of y to the explanation of x is examined, after having already accommodated the contribution of lagged x to its own explanation. The hypothesis to be verified here is H_0 : the null hypothesis of no granger causality.

Note that the statement "x Granger causes y" does not imply that y is the effect or the result of x. As Granger (1981) emphasises, the fact that causality exists does not imply a cause-effect relationship, but rather is based on predictability. Moreover, Darnell (1997:41) indicates that Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term.

More practically, as Granger (1986) points out, if a cointegration vector exists between two variables, then there is causality among these variables at least in one direction. The model can then be expressed as an ECM as follows:

$$\Delta Y_{it} = \epsilon_{it} + \alpha_{it} + \beta' Z_{t-1} + \sum_{i=1}^m a_i \Delta Y_{1, t-1} + \sum_{i=1}^m b_i \Delta Y_{2, t-1} + \sum_{i=1}^m c_i \Delta Y_{3, t-1} \quad (4.6)$$

2 For this section see Engle and Granger (1987), Granger (1981, 1986), Darnell (1997) and Chang et al (2001).

$\beta'Z_{t-1}$ contains r cointegrating terms, reflecting the long-run equilibrium relationship among variables.

From the system, the Granger-causality tests are examined by testing whether all the coefficients of $\Delta Y_{2,t-1}$ or $\Delta Y_{3,t-1}$ are statistically different from zero as a group based on a standard F -test and/or the β 's coefficient of error correction term is also significant. From the above equation it is possible to test whether a causal relationship exists between two specific variables in the equation. If bi-directional Granger causality is found between the two principal variables in the model of the ongoing study, namely, short term interest rate r (reflecting monetary policy by the South African "Reserve Bank" and consumer/households expenditures C_{ex} , then it can be concluded that monetary policy have indeed a direct effect on consumer spending in South Africa.

Note that, Granger-causality tests are very sensitive to lag length selection hence, in this paper the lag lengths were determined using two different well-known criteria namely, the Akaike information criterion (AIC) and the Schwartz criterion (SC). As it is explained by Gonzalo (1994), it is possible that the two criteria methods mentioned above might produced different optimal lag lengths. In this case, the criteria yielding the highest lag length is chosen.

4.6 Summary

This chapter described the four-step econometric procedure that is planned to be followed in order to investigate the existence of the long-run relationship and more precisely, if possible, the direction of causality between monetary policy, through the repo rate (r) and consumer expenditures or consumption by household (C_{ex}) in South Africa. In doing so, it is important to note at this point that, in order to take account of the possible effect of other economic factors on this relationship, additional variables namely, inflation, disposable income, unemployment rate, and households' wealth were added into the model.

The economic approach in this analysis was basically and entirely based on building a cointegration analysis framework, describing the existing relationship between those two principal variables firstly, and moreover the effect of the additional variables in the model. Recall that cointegration can be simply defined as a long-term or equilibrium relationship between two series. This makes this approach an efficient and better analysis technique in this case because, cointegration analysis is more likely to be able to establish whether the SARB's repo rate effect on other market rates, affects also consumer expenditures in a certain way.

The first step in the cointegration framework involves determining the order of integration of all the variables in the model by employing tests described by Dickey and Fuller (1979) and Phillips and Perron (1988). Then a maximum likelihood method of cointegration, proposed by Johansen (1988), Johansen and Juselius (1990) is described. If cointegration is established, the short-run dynamics of this relationship is modelled with an Error Correction Model (ECM) framework. The next step is to perform the necessary diagnostic tests on the residuals and the tests for stability namely; the Jarque-Bera test, the Breusch-Godfrey test, the ARCH LM-test and the White test all for diagnostic testing, the Ramsey RESET and the CUSUM tests for stability, in order to verify that the model is properly specified.

The final step in this econometric analysis is to perform the Granger causality test introduced by Granger (1969), in order to determine if one of the principal variables in the model is causally related to the other one.

CHAPTER 5

ANALYSIS AND INTERPRETATION OF RESULTS

5.1 Introduction

This chapter concentrates on the in-depth and complete analysis of the time series data necessary for achieving the main objective of this ongoing research. The statistical manipulation of the data is discussed and undertaken in this section, this in order to empirically explain, describe and estimate the possible causal relationship that might exist between the principal economic variables introduced in the previous chapter.

The chapter is divided into two major sections. The first section, which concentrates on the presentation and the analysis of the obtained results, starts with a description of the variables required in the study to perform the necessary econometric tests. Also included is a visual inspection of all time series data used in the analysis, which is useful because it can provide the analysis with a first impression or an idea about the characteristics of the data. The study's next important step is to proceed with testing for the order of integration by carrying out unit root tests, this in order to compare the results obtained with the visual inspection of the data. The econometric analysis continues with performing the Johansen cointegration analysis, which is directly followed by the building of an ECM. Finally, the econometric analysis ends with the completion of Granger-causality tests and the necessary tests for stability.

The second major section of this chapter is the one focusing on the complete interpretation of the results thus obtained from the econometric analysis.

Given the variables described in table 4.1 in the previous chapter, the empirical results are therefore, presented in the following section.

5.2 Analysis of the results

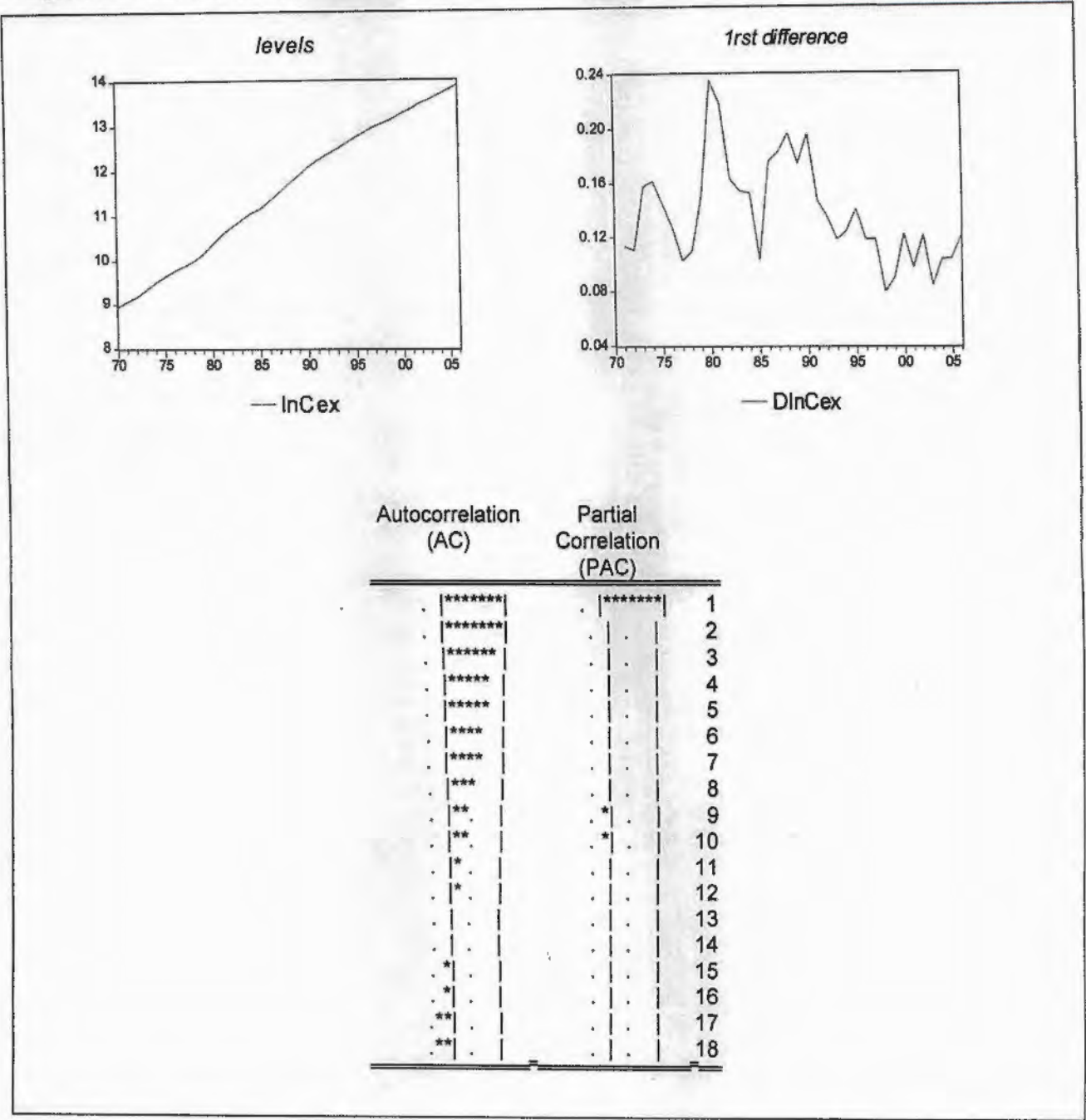
5.2.1 Visual Inspection of the Data

Each variable described in table 4.1 is plotted using the procedure described in the Eviews software econometric package. The graphs, tables and all the results thus obtained represent what is known as the data generating process (DGP). The visual inspection of the data represents each time series data in a three-plot figure, which respectively shows the time series in levels, first difference form and in correlogram, namely the autocorrelation (AC) and the partial autocorrelation (PAC) of data in levels. Furthermore, each time series is deeply analysed and discussed, together with the trend observed on each graphical representation and their respective expected sign in the model or the regressed equation.

5.2.1.1 Total Consumption expenditures (C_{ex})

Data on consumer expenditures used in this study are derived entirely from the SARB's statistical/econometric database system. It represents the yearly total final consumption expenditure by South Africa (S.A)'s households in millions Rand, estimated in current prices. Consumer expenditure (C_{ex}) instead of pure consumption is used in the study as it is suggested by Blinder (1981). The main reason behind this choice is given by the fact that, it is much more appropriate to use consumer expenditure when the focus of the study is on the evaluation of a policy (fiscal or monetary), as it is the case here, rather than on testing a particular theory. Blinder (1981:39) argued that using consumer expenditures allows avoiding many complicated issues of definition. However, adopting this particular variable comes along with some inconveniences, which basically might affect the expected sign of consumer expenditures (particularly on durable goods) in the model.

Figure 5.1: Graphical representation of consumer expenditures (C_{ex})



The above figure 5.1 representing C_{ex} in levels suggests that the variable is non-stationary, hence it can be observed on the graph that it follows an upward trend and moreover it exhibits significant time dependence. However, the plot of the same variable in first difference exhibits a more stationary shape, indicating

that the data in this form might be stationary, but this indication needs to be verified with a more accurate test namely, the ADF or the Phillips-Peron. The autocorrelation plot shows that the sample AC is very strong and positive, but decays slowly and even turns negative toward the end of the sample period. The fact that there exists no subsequent spiking during the declining trend of the AC, and that it declines gradually also suggests that the series might be non-stationary. The partial autocorrelation plot clearly shows that only the first lag is significant at a 95% level of confidence.

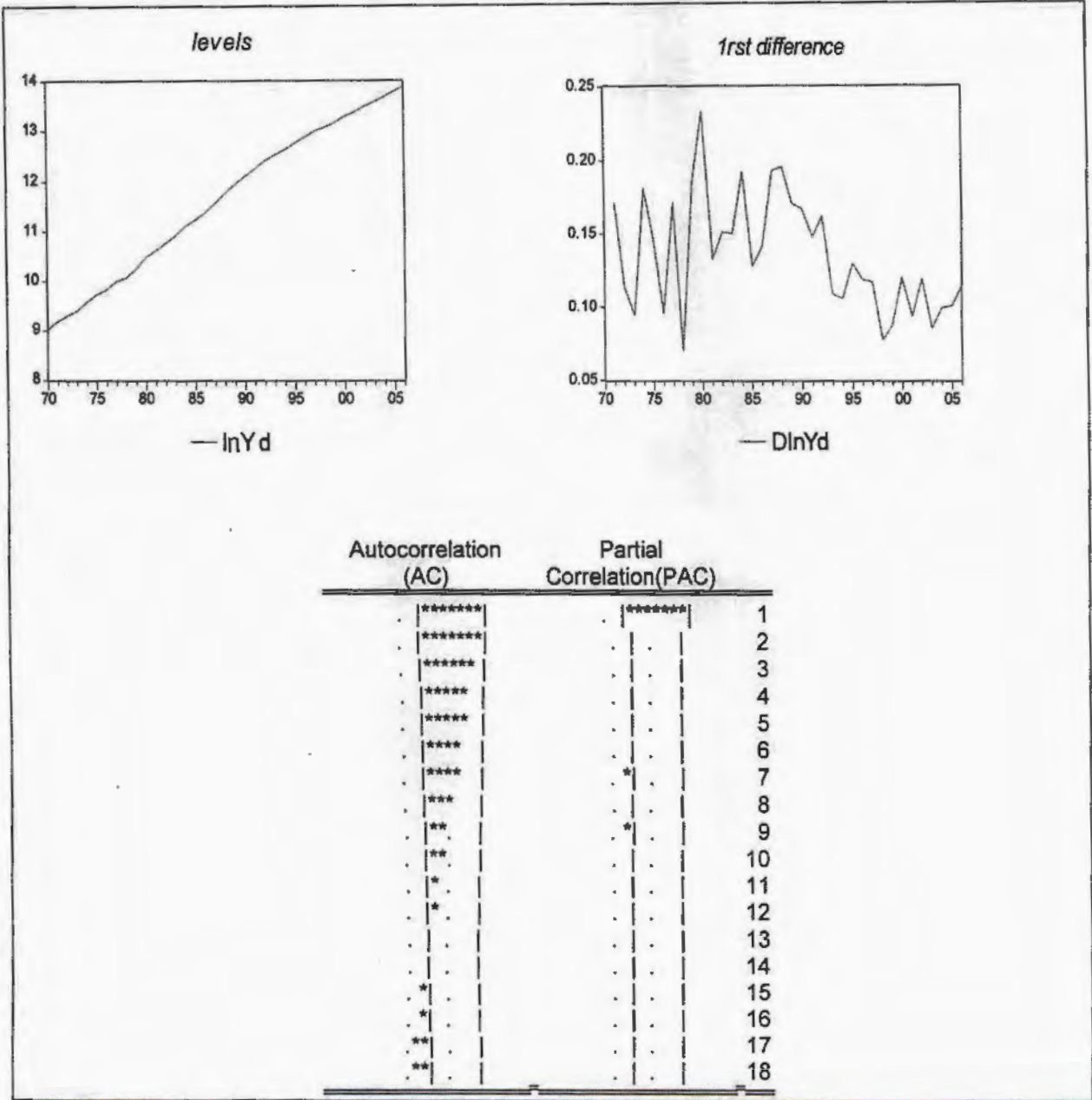
5.2.1.2 Disposable income (Y_d)

Disposable income data are also obtained from the SARB's database. Representing yearly disposable income of households in South Africa, in current prices, from 1970 to 2006. Theoretically, both the permanent income and the life-cycle model are identical, at least as far as their basis are concerned. Both argued that consumption is expressed as a function of current disposable income (real or nominal, total or per capita), and that it is possible to divide disposable income into labor income and property income (or net worth). Nominal disposable income is used in this study as one of the major determinant of consumer expenditures. Furthermore, according to Friedman's permanent income hypothesis, an expected low income should produce a negative impact on all categories of consumer expenditures (Springer, 1977: 304). A positive sign is expected in the model as far as the relationship between disposable income and consumer expenditures is concerned.

The representation of disposable income in figure 5.2 below shows that, the time series data in levels are non-stationary as they exhibit a strong and positive trend. However, when differenced once, the time series appears to be stationary. By examining the autocorrelations plot, it can be observed that the AC are strong and decay gradually without any subsequent spiking, again suggesting a

possible non-stationarity of the series. The plot of the PAC shows that lag one is the most significant.

Figure 5.2: Graphical representation of disposable income (Yd)



5.2.1.3 Prime overdraft interest rate(r)

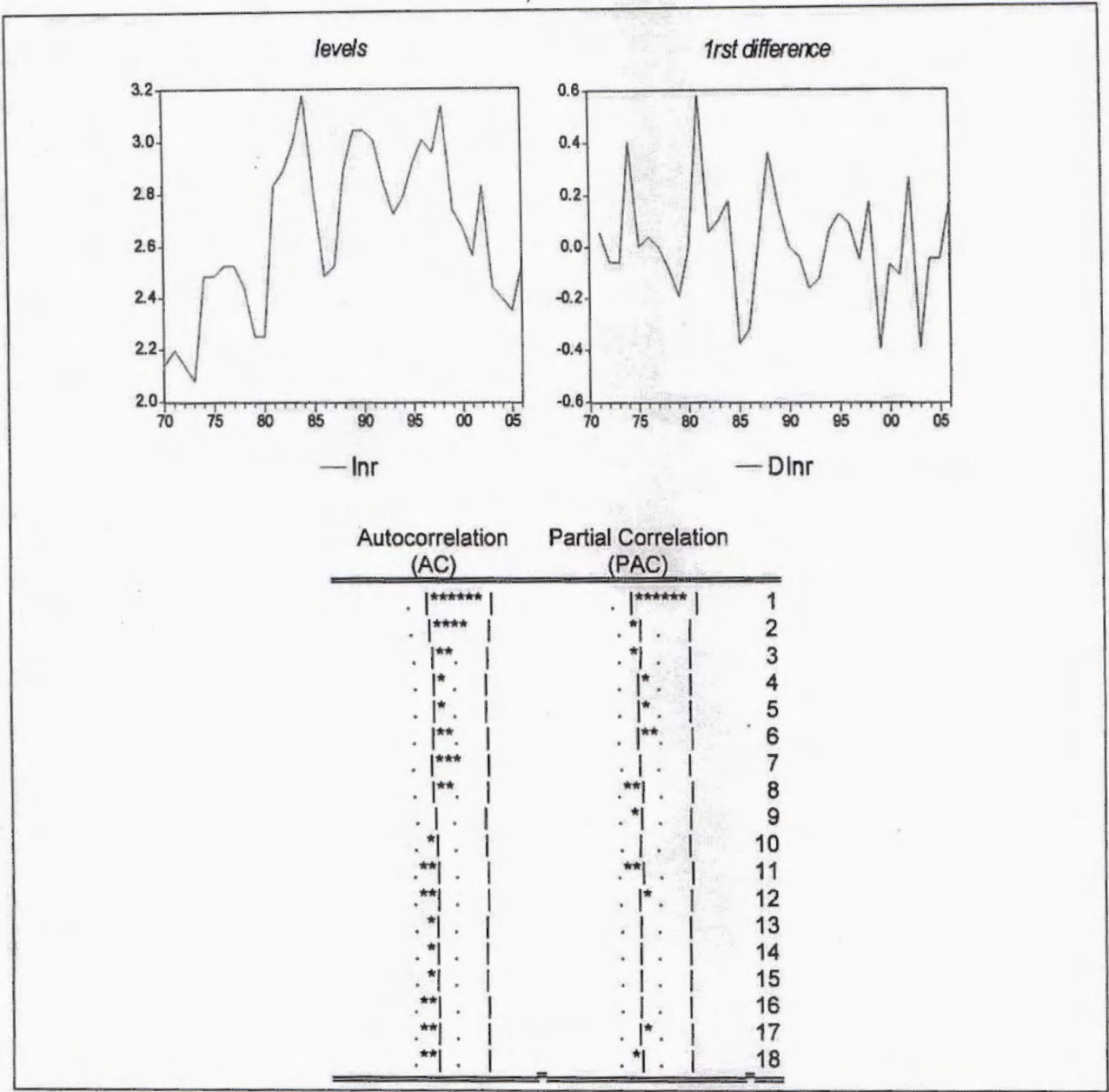
In the study, the prime overdraft rate is used as an indicator of monetary policy implemented by the SARB, since it is well known that the main instrument of monetary policy in the hand of the reserve bank is the repo rate, which also serves as a benchmark for the level of short-term interest rates in the entire economy (SARB 2005:2). A monetary policy indication through a variation in the repo rate is also observed in a change on all short-term market rates, including the prime overdraft rate. It is then acceptable to use the prime overdraft rate as the indicator of monetary policy variations in this study.

While the data on the overdraft rate are given in per cent per annum and are easily obtainable from the SARB's database, however the effect of short-term interest rates on consumption or consumer expenditures is very ambiguous in the literature and mostly depends on the size of the respective substitution, income and wealth effects (Gupta,1987). Therefore, the expected sign on the consumption function equation remains unknown at this point.

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Figure 5.3 below shows that, the time series data in levels form is non-stationary and follows multiple trends whereas, the first difference form demonstrates a typical mean reverting stationary shape. The visual analysis of the series tentatively suggests a possible first-difference stationarity. The AC function plot shows that the sample autocorrelations are irregular, do not follow a moving average process and therefore, this suggests a possible non-stationary series. Both the AC and the PAC plot together suggest the existence of a unit root.

Figure 5.3: Graphical representation of Prime rate (r)



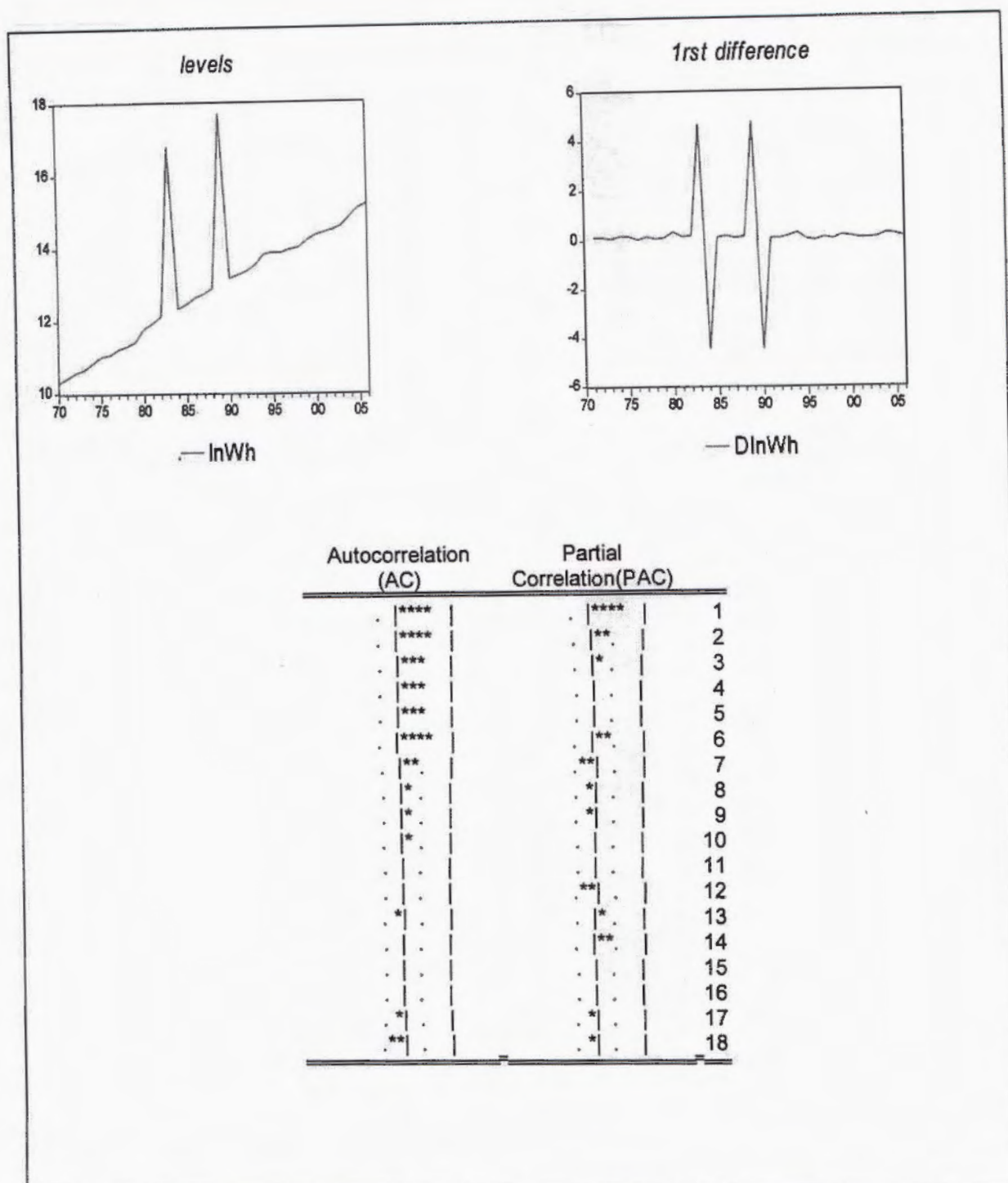
5.2.1.4 Households' wealth (W_h)

The rapid expansion of wealth in recent years raised an important number of questions for economic analysis. Poterba (2000) argued that, considerable changes in the values of residential estates and in equity markets have attracted particular attention in the research community, about the possible effect of household-sector wealth on total consumption expenditures of private households. This follows the main hypothesis of both the PIH and the LCH, which suggested that consumption or consumer expenditure was mainly determined by disposable income and individual real wealth (defined as the present discounted value of current and future income).

This observation on rapid expansion of wealth around the world is equally true in South Africa, with Aron, Muellbauer and Prinsloo (2006:66) indicating that the recent strong growth in household wealth in South Africa can mainly be attributed to substantial increases in asset prices, particularly in the private property and equity markets.

The current study includes wealth variables for South Africa from 1970 to 2006, obtained from wealth estimates (on a market value basis), constructed by Aron and Muellbauer in 1999. Unfortunately, the first reliable market-value data on wealth are reported from 1975, consequently, data prior to this are estimated using the graph and the methodology of Aron and Muellbauer (2006a and 2006b). However, the effect of market-value wealth on consumption appears to be a source of controversy among researchers, with evidences on their effect on consumption remaining mixed (Barata and Pacheco, 2003: 4). The results obtained are mostly influenced by the country observed, the data range selected and also by the wealth definition used.

Figure 5.4: Graphical representation of households' wealth (W_h)



The visual inspection of the data on household's wealth (W_h) in figure 5.4 above shows that, the data is non-stationary in levels forms. The graph indicates a strong positive trend with two major peaks the first one in the mid 80's and a

second one in the early 90's. Those peaks are probably the result of the rapid expansion of wealth around the world including in South Africa, especially in the values of residential estates and in equity markets. The plot of the first difference of the time series data indicates a more stationary shape, showing a sort of mean reverting stationary shape, with the mean revolving around zero. Observing the plot of the AC, it suggests that the autocorrelations are weak and decay slowly until it became negative toward the end of the sample. As for the PAC plot with a 95% confidence, it shows that only lag one is significant. Both the AC and the PAC plots indicate that the data are not stationary.

5.2.1.5 Unemployment (U_n)

The statistics on South African employment and other labour market characteristics has been subjected to considerable scrutiny in the literature and generally, the basic statistics on employment and unemployment are found to be controversial (Du Plessis et al, 2007: 13). According to the labor force survey (2007) from Statistics South Africa (Stats SA), unemployment rate can be defined as the number of unemployed persons in South Africa expressed as a percentage of the labour force. There are two main definitions of unemployment (two unemployment rates) as far as South Africa is concerned; the narrow or official rate and the broad or expanded rate. The official definition counts as unemployed all jobless persons who want work and searched for work in the recent past (typically, in the four weeks prior to the survey). The expanded definition drops the search criterion and counts as unemployed all jobless persons who reported that they want work even if they did not search in the reference period. In other words, the expanded definition includes both the searching and the non-searching unemployed. Stats SA adopted the official definition of unemployment in 1998 (Stats SA, 1998: 1).

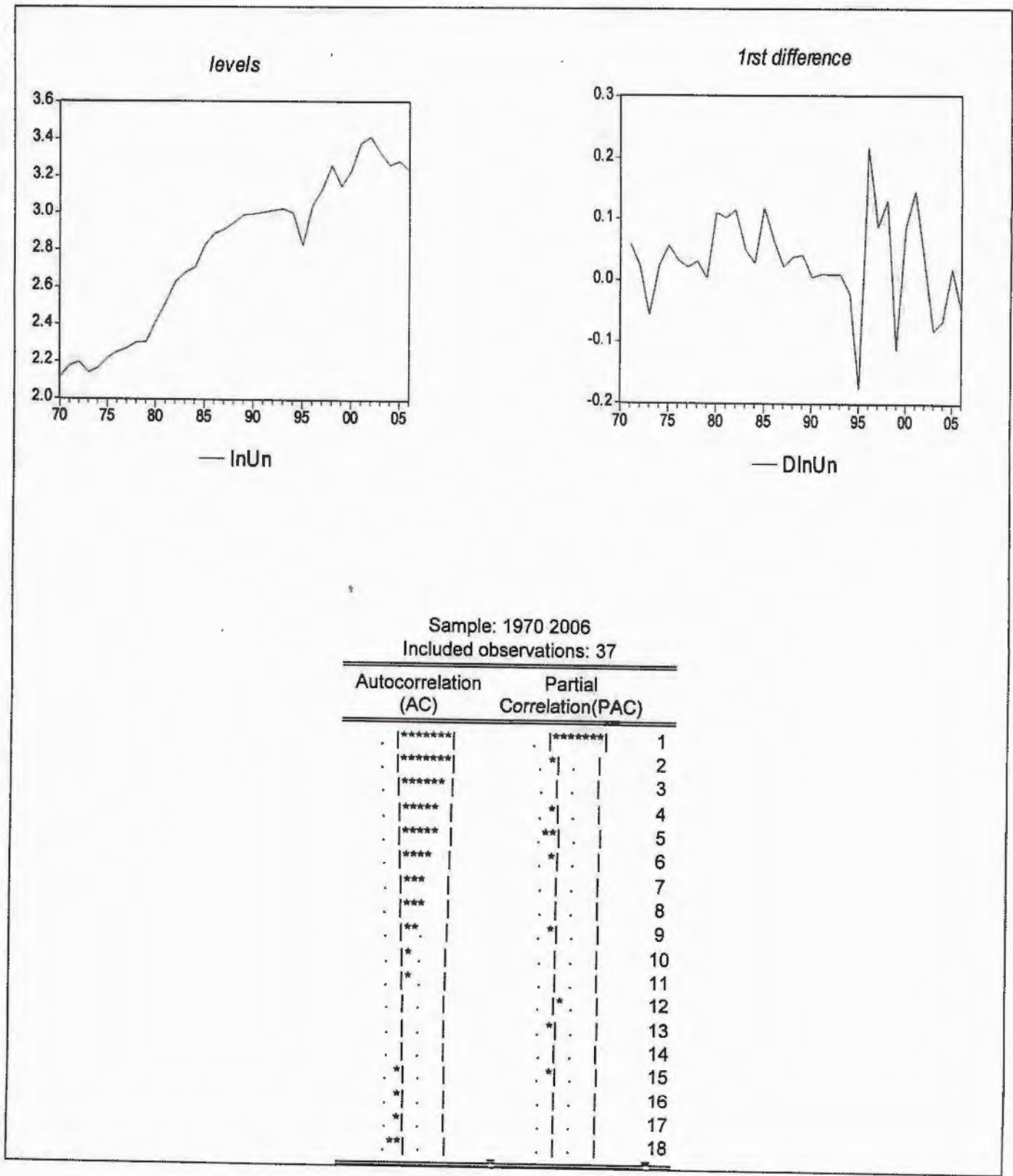
Data on unemployment in this study are obtained from the Stats SA database, and represents the published official unemployment rate in percentage, as

opposed to the revised rate, in the country from 1970 to 2006. However, unemployment data are available in the Stats SA database only from 1994. Hence, data prior to that are obtained from 1980-1994, and estimated from 1970-1980, using the study of both Kingdon and Knight (2001), and Vivek and Ricci (2005).

As explained by Gylfason (1981:240), the unemployment rate is used as proxy or an indicator for general uncertainty on the assumption that consumers feel less confident about their future, including their own job security, the faster/slower unemployment varies. Although according to Juster and Taylor (1975), the impact of unemployment on consumption is expected to be positive, however, in the available literature on the topic, both a negative effect of U_n on consumption and a total non-effect of U_n on consumption were found by Howard (1978) and Boskin (1978) respectively.

Observing the representation of unemployment in figure 5.5 below shows that, the time series data in levels are non-stationary as they exhibit strong and positive trends. However, when differenced once, the time series, although not so clear, appears to be much more stationary than the data in levels. However this first impression needs to be verified further by the use of appropriate techniques for stationarity. Observing the plot of the AC, it suggests that the autocorrelations are weak and decay slowly until it became negative toward the end of the sample. As for the PAC plot with a 95% confidence, it shows that only lag one is significant. Both the AC and the PAC plots indicate that the data are not stationary in level form.

Figure 5.5: Graphical representation of Unemployment (U_n)



It is important to note at this stage that, data on unemployment in South Africa are highly controversial, in the sense that, different estimates are produced for the same period depending on the definition adopted, making them imperfect (Kingdon and Knight, 2001: 404) .

The poor availability of reliable microeconomic data, the presence of several factors (e.g: the non inclusion of the informal sector) related to the apartheid era, and many other problems connected with compiling and interpreting S.A's labour market statistics, complicate considerably any empirical analysis where those data are involved. Hence, interpreting and manipulating unemployment data in this study should be handled with considerable attention.

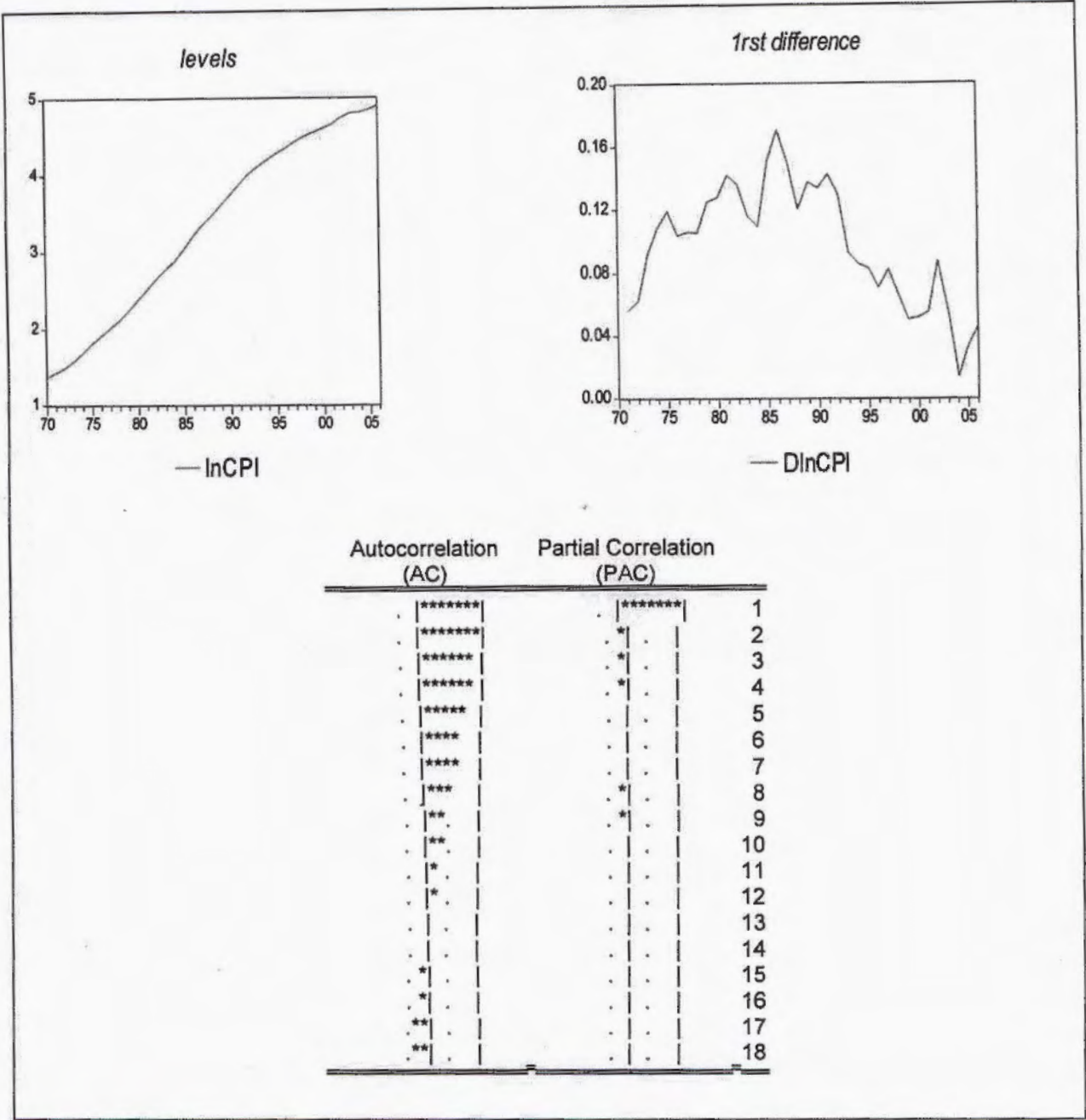
5.2.1.6 Consumer Price Index (CPI)

South Africa has three measures of consumer price inflation these are; the headline Consumer Price Index (CPI), the core Consumer Price Index, and the overall index excluding the effects of changes in mortgage costs (CPIX). Thus, as it is explained by Van der Merwe (2004: 4), these different measures are then aggregated to represent the Consumer Price Index for the country as a whole. This current study uses the headline Consumer Price Index (CPI), which is the one directly linked to changes in the Reserve Bank's repurchase rate. A variation in the SARB's monetary policy is expected to have an immediate effect in the overall Consumer Price Index since mortgage interest payments, which are include in the index, will be affected.

There is a high controversy about the expected and the real effect of price inflation on consumer expenditures in the literature. In brief, there is very little empirical evidence from which to indicate either a permanent positive or a permanent negative relationship between the expected inflation rate and consumer expenditures. The results are mixed and equally distributed among the

two possible effects, with some results even indicating that inflation plays no role in the aggregate consumption function.

Figure 5.6: Graphical representation of Consumer Price Index (CPI)



The above figure 5.6 representing CPI in levels suggests that the variable is non-stationary, as it can be observed on the graph that it follows an upward trend and

moreover exhibits significant time dependence. However, the plot of the same variable in first difference exhibits a more stationary shape, indicating that the data in this form might be stationary. The autocorrelation plot shows that the sample AC is very strong and positive, but decay slowly and finally turn negative toward the end of the sample period. The fact that there exists no subsequent spiking during the declining trend of the AC also suggests that the series might be non-stationary. The partial autocorrelation plot clearly shows that only the first lag is significant at a 95% level of confidence.

The next step of the study is to verify those conclusions suggested by the observation or the visual inspection of all the available time series data; this can be achieved by the use two formal unit root procedures namely, the Augmented Dickey-Fuller (ADF) and the Phillips-Peron (PP) tests. However, before taking that next step, the econometric analysis proceeds with the running of some multiple regressions, which serves as a means to determine which one of the variables makes statistical significant contribution to the dependent variable (C_{ex}). It is important to note at this point that, the direct application of OLS to non-stationary data, as it is the case in the following section, may produced regressions that are misspecified or spurious by nature (Granger and Newbold, 1974). In fact, it is an important step in order to better understand and describe the available time series data.

5.2.2 Spurious regressions

Two different regressions are estimated in this analysis, with consumer expenditures (C_{ex}) as the dependent variable in both equations. The first equation represents the basic estimate of the private/household consumption function, with the inclusion in the equation of only the principal variables that are central to consumer spending namely; disposable income (Y_d) and household wealth (W_h). Since analysing the effect of monetary policy on consumer

expenditures is the principal objective of this study, the prime rate (r) is also included in the regression.

In the second regression, the expected rate of inflation (CPI) is included in the model, this in order to test whether inflation influences consumer expenditures independently of the effect of the rate of interest. Moreover, the effect of uncertainty, represented by the unemployment rate (U_n), is also investigated in this second equation by the inclusion of the above-mentioned variable in the regression. The respective sign of each coefficient represents the effect of each variable on consumer expenditures and indicates whether this effect is positive or negative. Although the value of a coefficient indicates the importance of its variable's contribution to private household expenditures, it does not necessarily assume a causal relationship.

5.2.2.1 First regression

The following first model is analysed in this section:

$$\ln Cex = \alpha + \beta_1 \ln Y_d + \beta_2 \ln r + \beta_3 \ln W_h + \epsilon \quad (5.1)$$

The DGP from the Eviews econometric software package gives the table below:

Table 5.1: spurious regression1

Dependent Variable: LNCEX				
Method: Least Squares				
Date: 05/16/09 Time: 11:13				
Sample: 1970 2006				
Included observations: 37				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNR	0.021968	0.013868	1.584065	0.1227
LNWH	0.005880	0.024372	0.241256	0.8108
LNVD	1.014350	0.024492	41.41617	0.0000
C	-0.350728	0.049856	-7.034786	0.0000
R-squared	0.999807	Mean dependent var		11.57606
Adjusted R-squared	0.999790	S.D. dependent var		1.566284
S.E. of regression	0.022717	Akaike info criterion		-4.629617

Sum squared resid	0.017030	Schwarz criterion	-4.455464
Log likelihood	89.64791	F-statistic	57035.33
Durbin-Watson stat	1.695508	Prob(F-statistic)	0.000000

Source: Own calculations using Eviews

The following consumption function is obtained from the first regression:

$$\ln C_{ex} = -0.35 + 1.01 \ln Y_d + 0.02 \ln r + 0.005 \ln W_h \quad (5.2)$$

(-7.03) (41.41) (1.58) (0.24)

$$R^2 = 0.99 \quad SSR = 0.017 \quad SE = 0.022 \quad D.W. = 1.69.$$

The adjusted coefficient of determination is R^2 , SE is the estimated standard error of the regression, SSR is the sum of squared residuals, and D.W. is the Durbin Watson test for the presence/absence of autocorrelated errors. Estimated t-ratios appear in parentheses below each estimated coefficients.

Observing the above regression, equation 5.2 performs quite well by conventional standards. The estimated $SE = 0.022$, is just a small fraction of the mean value of the dependent variable. Individual coefficients are measured relatively precisely and have the expected signs, except the sign of the coefficient for the rate of interest. The important point to note at this stage is that, the estimated coefficient on interest rate indicates considerable sensitivity of consumer expenditures to changes in nominal interest rates. There is an apparent positive interest effect on consumer expenditures, which is quite surprising because it might suggest a positive relationship between monetary policy and consumer/household expenditures, rather than an inverse relationship between the two variables, as expected.

However, as Marmol (1998) pointed out, it is a well-known fact since Yule (1926) and Granger and Newbold (1974) that regressions involving non-stationary series can indicate spurious correlations despite the absence of any correlation between the underlying series. Hence, when dealing with spuriously related non-stationary time series data, standard Ordinary Least Square inference remains invalid. More precisely, the F- and t - tests diverge, which implies that rejections

grow with the size of the sample, despite the lack of relation among the relevant processes.

The difficulty that arises when employing regression with non-stationary series is the spurious problem which can be observed by a high value of the adjusted coefficient of determination (R^2). This can be seen in equation 5.2 above with $R^2 = 0.99$. In line with this observation, Ahmad and Harnhirun (1995), argued that, high R^2 may only indicate correlated trends and not true economic relationships. Hence, in such situations, the usual Ordinary Least Squares (OLS) significance tests performed on the regression coefficients can be quite misleading, since these type of regressions tend to produce performance statistics that are inflated in nature, such as high R^2 's and t-statistics, which often lead investigators to commit a high frequency of Type I errors (Granger and Newbold, 1974).

5.2.2.2 Second regression



Many authors have investigated the effect of inflation on consumer spending. For example, Boskin (1978:6) argued that inflation may decrease the capital intensity of production and hence affect the real economy. Therefore, inflation may sometimes biases the estimated interest elasticity of consumption. Also, uncertainty about the future may have a considerable influence on consumption and saving decisions, for example the unemployment rate may represents uncertainty about the future stream of revenues. Following this observation, Gylfason (1981: 239) argued that, increased uncertainty makes the consumer less inclined to expose his resources to the possibility of loss, but at the same time makes it necessary for him to save more in order to protect himself against such a loss. The effect of these two variables namely, CPI and U_n are taken into consideration in the next regression, and both variables are included as additional regressors in the basic consumption equation. The following second model is obtained and analysed in this section:

$$\ln C_{ex} = \alpha + \beta_1 \ln Y_d + \beta_2 \ln r + \beta_3 \ln W_h + \beta_4 \ln CPI + \beta_5 \ln U_n + \epsilon \quad (5.3)$$

The table below is obtained using the Eviews software package:

Table 5.2: Spurious regression 2

Dependent Variable: LNCEX
Method: Least Squares
Date: 05/17/09 Time: 23:45
Sample: 1970 2006
Included observations: 37

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPPI	-0.025825	0.071417	-0.361602	0.7201
LNLR	0.021524	0.017193	1.251937	0.2200
LNUN	-0.001468	0.044273	-0.033150	0.9738
LNWH	0.002568	0.003928	0.653785	0.5181
LNVD	1.038231	0.053862	19.27578	0.0000
C	-0.494982	0.414841	-1.193184	0.2418
R-squared	0.999811	Mean dependent var	11.57606	
Adjusted R-squared	0.999780	S.D. dependent var	1.566284	
S.E. of regression	0.023208	Akaike info criterion	-4.541280	
Sum squared resid	0.016696	Schwarz criterion	-4.280050	
Log likelihood	90.01369	F-statistic	32789.23	
Durbin-Watson stat	1.810293	Prob(F-statistic)	0.000000	

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This yields the following regressed equation:

$$\begin{aligned} \ln C_{ex} = & -0.49 + 1.03 \ln Y_d + 0.02 \ln r \\ & (-1.2) \quad (19.27) \quad (1.25) \\ & + 0.002 \ln W_h - 0.02 \ln CPI - 0.001 \ln U_n \\ & (0.63) \quad (-0.36) \quad (-0.033) \end{aligned} \quad (5.4)$$

$R^2 = 0.99$ $SSR = 0.0166$ $SE = 0.023$ $D.W. = 1.81$

From equation 5.4 above, it can be observed that, the estimated interest elasticity of consumer spending is still substantial and virtually unchanged at 0, 02. The other coefficients are hardly affected by the inclusion of the two new independent variables in the model, and both uncertainties' variables CPI and U_n

have the expected negative sign. Furthermore, the high value of D.W= 1.81, indicates the possible presence of autocorrelation of residuals.

Although the estimates presented in this section may seem to be low at first sight, they somehow indicate considerable sensitivity of consumption or consumer expenditures to changes in interest rates.

However, it has been well established that time series data such as the ones used in this study tend to exhibit either a deterministic and/or stochastic time trend and are therefore, non-stationary. The direct application of OLS to non-stationary data produces regressions that are misspecified or spurious in nature, and significant tests performed on the regression coefficients can be quite misleading. It will be inappropriate at this stage of the study, to make some conclusions and assumptions about the nature of the relationship between the available time series variables, and precisely about the nature of the relationship between monetary policy and consumer expenditures, which remains the main focus of this ongoing study.

The next important step is to first test each variable for stationarity. Consequently, this study tests the variables in question for a unit root (non-stationarity) by using the Augmented Dickey-Fuller test (ADF). This study also performs unit root tests on the relevant variables using the Phillips-Perron (PP) test regression.

5.2.3. Unit root tests

This section of the study is devoted to testing for the order of integration. In other words, each variable is tested for stationary. This is done firstly by testing the time series in levels form that include both constant and time trend, and later with constant only. Furthermore, the same test is performed on the time series data in first difference form and if necessary the second difference form is also tested.

The hypothesis that is tested is the null hypothesis of the existence of a unit root (non- stationarity) against the alternative of stationarity (no unit root). Note that two different tests for stationarity are performed in this study namely, the ADF and the PP tests.

5.2.3.1 Augmented Dickey-Fuller test for stationarity.

The following two tables are obtained from the DGP produced by Eviews:

Table 5.3: Augmented Dickey-Fuller (ADF) unit root tests for stationarity with constant and time trend

Variables	Lags	Levels	First difference	1%	5%	10%
ln C _{ex}	1	-0.861	-3.36*	-4.24	-3.54	-3.20
ln Y _d	1	0.285	-3.56**	-4.24	-3.54	-3.20
ln r	2	-2.38	- 4.64***	-4.24	-3.54	-3.20
ln W _h	4	-2.56	-6.31***	-4.27	-3.55	-3.21
ln CPI	5	-2.24	-1.71	-4.28	-3.56	-3.21
ln U _n	1	-1.57	-4.30***	-4.24	-3.54	-3.20

Signif codes 1% (***), 5% (**), 10% (*)

Table 5.4: Augmented Dickey-Fuller unit root tests for stationarity with constant only

Variables	Lags	Levels	First difference	1%	5%	10%
ln C _{ex}	1	-1.70	-2.63*	-3.62	-2.94	-2.61
ln Y _d	1	-1.87	-2.81*	-3.62	-2.94	-2.61
ln r	4	-1.81	- 4.76***	-3.64	-2.95	-2.61

ln W_h	1	-1.95	-6.77***	-3.62	-2.94	-2.61
ln CPI	1	-2.63*	-1.66	-3.62	-2.94	-2.61
ln U_n	4	-1.80	-4.23***	-3.64	-2.95	-2.61

Signif codes 1% (***), 5% (**), 10% (*)

The tables above present the results of running ADF tests on the variables in logarithmic form with a deterministic trend. It is important to note at this stage that the order of lag length is determined by using the Final Prediction Error (FPE) criterion, suggested by Akaike in applying the Akaike Information Criterion (AIC). The lag orders have been determined by choosing the smallest lag length such that the residuals of the ADF regression yield empirically white noise.

The results from the above first table indicate that the null hypothesis of non-stationarity cannot be rejected for any variables in level form with a deterministic trend. Hence, all the variables when tested for stationarity under the assumption of constant and time trend are non-stationary in levels form. When the same ADF test is applied to these variables in first differences, under the same assumption of a constant and deterministic time trend, most of the variables become stationary at 1% level of significance for three of them (U_n , W_h and r), at 5% level of significance for Y_d and at 10% for C_{ex} . However, the variable CPI is still non-stationary in first difference, only the second difference of this variable appears to become stationary.

The second table presents the results of running an Augmented Dickey-Fuller test for the variables in both level and differenced form under the assumption of a stochastic trend only (intercept only). It can be seen from the table 5.4 that all the variables in level form are non-stationary, except the variable CPI, which appears to be stationary in level. In the case of first differences, the null hypothesis of non-stationarity is rejected for all the remaining variables, at 1% level of

significance for U_n , r and W_h , and at 10% for both C_{ex} and Y_d . All the variables in the study can be treated as integrated of order one that is $I(1)$, except for the variable CPI.

The next step of the study is to perform the second test for stationarity namely the Phillips-Perron (PP) test, in order to verify and confirm the results obtained from the ADF.

5.2.3.2 Phillips-Peron test for stationarity

The following tables summarise the results of the Phillips-Peron tests:

Table 5.5: Phillips-Peron (PP) unit root tests for stationarity with constant and time trend

Variables	Lags	Levels	First difference	1%	5%	10%
$\ln C_{ex}$	3	0.009	-3.21*	-4.23	-3.53	-3.20
$\ln Y_d$	3	0.29	-4.95***	-4.24	-3.54	-3.20
$\ln r$	3	-2.21	-5.70***	-4.23	-3.53	-3.20
$\ln W_h$	3	-5.74***	-12.57***	-4.23	-3.53	-3.20
$\ln CPI$	3	0.96	-2.55	-4.24	-3.54	-3.20
$\ln U_n$	3	-1.52	-5.63***	-4.23	-3.53	-3.20

Signif codes 1% (***), 5% (**), 10% (*)

Table 5.6: Phillips-Peron (PP) unit root tests for stationarity with constant only

Variables	Lags	Levels	First difference	1%	5%	10%
$\ln C_{ex}$	3	-1.75	-2.69*	-3.62	-2.94	-2.61
$\ln Y_d$	3	-2.21	-4.45***	-3.62	-2.94	-2.61

ln r	3	-2.44	- 5.63***	-3.64	-2.95	-2.61
ln W _h	3	-2.81*	-12.74***	-3.62	-2.94	-2.61
ln CPI	3	-1.88	-1.37	-3.62	-2.94	-2.61
ln U _n	3	-1.26	-5.60***	-3.64	-2.94	-2.61

Signif codes 1% (***), 5% (**), 10% (*)

The PP unit root tests summarised in the above tables, confirm and even reinforce the previous results obtained from the ADF tests. Indeed, all the variables appear to be stationary in first differences form, with most of them rejecting the null hypothesis of non-stationary at 1% level of significance (Y_d , r , W_h and U_n), only C_{ex} is rejecting the null hypothesis at 10% level of significance. Moreover, CPI still appears non-stationary both in level and first difference forms. In summary, the hypothesis of a unit root in the first difference data is rejected for most of the variables at 1% level of significance for both the ADF and PP tests, except for CPI which appears to reject the null hypothesis when differenced twice. This indicates that variables C_{ex} , r , Y_d , W_h and U_n are all integrated of order one, $I(1)$. It is therefore, possible to estimate the model relating those variables using the simple OLS method. The following model is therefore, obtained:

$$\ln C_{ex} = -0.34 + 1.01 \ln Y_d + 0.018 \ln r + 0.002 \ln W_h - 0.005 U_n \quad (5.5)$$

(-8.18) (90.03) (1.23) (0.74) (-0.12)

$$R^2 = 0.99 \quad SSR = 0.016 \quad SE = 0.022 \quad D.W. = 1.75.$$

Table 5.7: Regression equation with cointegrated variables

Dependent Variable: LNCEX
Method: Least Squares
Date: 06/02/09 Time: 13:37
Sample: 1970 2006

Included observations: 37

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNR	0.018734	0.015154	1.236256	0.2254
LNUN	-0.005079	0.042542	-0.119377	0.9057
LNWH	0.002842	0.003801	0.747729	0.4601
LNVD	1.019201	0.011320	90.03618	0.0000
C	-0.345776	0.042251	-8.183775	0.0000
R-squared	0.999810	Mean dependent var	11.57606	
Adjusted R-squared	0.999786	S.D. dependent var	1.566284	
S.E. of regression	0.022890	Akaike info criterion	-4.591125	
Sum squared resid	0.016767	Schwarz criterion	-4.373434	
Log likelihood	89.93582	F-statistic	42130.94	
Durbin-Watson stat	1.751524	Prob(F-statistic)	0.000000	

Source: own calculations using Eviews

Moreover, since those variables are found to be integrated of the same order, it is therefore, possible to determine whether there is at least one linear combination of these variables (integrated of the same order) that is $I(0)$. In other words, it is possible to test whether a long-run relationship exists between these variables, through cointegration analysis.

5.2.4 Cointegration analysis

The cointegration analysis in this study is performed with the use of the cointegration method first proposed by Johansen (1988) and later improved by Johansen and Juselius (1990). This method is preferred over the original one proposed by Engle and Granger (1987) because it is capable of determining the number of cointegrating vectors for any given number of non-stationary series of the same order. Moreover, as Ramirez (2000:150) argued, the application of the Johansen cointegration techniques is appropriate in the presence of more than two variables in the model, as it is the case in this ongoing analysis.

Johansen (1988) provided two different tests, the trace test and the maximum eigenvalue test to determine the number of cointegrating vectors. If a cointegrating vector or vectors are indicated by the trace and the maximum

eigenvalue tests as statistically significant, this implies a stationary long-run equilibrium relationship between the variables. If more than one vector is found, then the test may indicate more than one relationship (Johansen and Juselius 1990).

However, before carrying out the cointegration test, the Johansen procedure requires that one of the five deterministic trend assumptions be selected for the analysis. The discussion about the selection of deterministic components in the model is outlined below.

5.2.4.1 Deterministic trend assumptions.

The idea that empirical results may be dependent on how the deterministic components are included in the model is not new in the analysis of cointegrated relationship. Johansen (1988) emphasised that, the choice of the deterministic components of a model has important implications for the asymptotic distribution of the test statistics. Ahking (2002: 53) indicated that, empirical results can potentially differ depending on the deterministic components included in the model. The choice or the selection of appropriate deterministic components is therefore, an important and crucial step to undertake before performing the cointegration test, as it can help to avoid the consequences on the regressed model from mis-specifying the deterministic components.

Five tables of critical values corresponding to five different ways that the deterministic components could be included in a cointegration model are provided by Johansen (1988). The five different possible cases are summarised as follows:

- Case 1: The model does not allow for any deterministic component in the data. This is the most restrictive and unusual case, that should be used with great caution (Ahking, 2002: 55).

- Case 2: The model does not allow for any linear trends in the data, but allows for constants in the cointegration space. This situation is the minimum deterministic component recommended by Johansen (1995), since the constants can account for differences in measurement units.
- Case 3: In addition for what is allowed in case 2, this model also allows for linear deterministic trends in the data.
- Case 4: In this model, both constants and linear trends are allowed in the cointegration space, in addition to the drift terms. Ahking (2002: 55) argued that, it is the model to use if some of the stochastic variables are trend-stationary.
- Case 5: The model places no restrictions on the deterministic components. However, this case is also considered to be unusual, because it may be a case of model mis-specification.

Recall that the unit root analysis concluded that all the cointegrated variables contain a drift and trend parameter in levels. Economically, the equilibrium condition between expected nominal interest rates and consumer expenditures is likely to exhibit trends. This is because short-term interest rates are directly administrated by the SARB as part of the monetary policy framework in order to affect economic variables, including consumer expenditures, and that the latest variable is totally out of the Reserve Bank control. Consequently, since there seems to be a linear trend in all the nonstationary series, cointegration tests are conducted with the inclusion of a deterministic linear trend. The combination of statistical criteria and economic theory suggests that the levels data and the cointegrating equation display trends.

Deterministic trend assumption as in case 3 is therefore, most appropriate for this long-run analysis between nominal interest rates and consumer expenditures.

Although the selection of appropriate deterministic trend assumptions is an important step in the Johansen procedure, it is however also important to note

that there is no obvious ways to determine which of the deterministic components should be included and whether or not they should be included in the cointegration space (Ahking, 2002 : 56).

5.2.4.2 The Johansen cointegration test

There are two test statistics for cointegration tests according to Johansen (1988) namely; the maximum eigenvalue or Lambda-max (λ max) and the trace statistics tests. The Lambda-max test statistic tests the null hypothesis of r cointegrating vector(s) against the specific alternative of $r + 1$ cointegrating vector(s). The trace statistic, on the other hand, tests the null hypothesis of no cointegrating vector ($r = 0$) against a general alternative of one or more cointegrating vectors ($r > 0$). However, It is well known that cointegration tests are very sensitive to the choice of lag length, it is therefore, essential that the lag length for both the cointegration analysis and the Error Correction Model are chosen according to a consistent procedure.

Table 5.8 below reports the trace test and the maximum eigenvalue test, as well as the lag length chosen. The number of cointegrated vectors are obtained after an incremental sequence of testing. If the null hypothesis of at most zero cointegrating relationships is rejected in favour of at most one cointegrating relationship, then in the next step the null hypothesis of at most one cointegrating relationship is tested against the alternative of at most two cointegrating relationships, and so on. Therefore, if p is the number of available variables integrated of the same order (all the variables in this study, excluding CPI), and r is the rank (number of cointegrating equations), then the trace test tests the hypothesis that $r \leq p$ against the alternative. The null hypothesis fails to be rejected when the test statistic is smaller than the trace test's critical values. The maximum eigenvalue test tests the null of r cointegrating equation against the alternative of $r+1$ cointegrating equations. The null hypothesis fails to be rejected when the test statistic is smaller than the maximum eigenvalue test's critical values (Hendry and Juselius, 2000:19).

The complete results obtained from Eviews are presented in appendix A.

Table 5.8: Cointegration analysis

SERIES: ln Cex, ln r, ln Un, ln Wh, ln Yd

Test assumption: Linear deterministic trend in the data

Eigenvalue Hypothesized	Likelihood Ratio	5% critical value	1% critical value	No of CE(s)
0.721	114.626	68.52	76.07	None**
0.670	75.151	47.21	54.46	At most 1**
0.499	33.399	29.68	35.65	At most 2*
0.167	9.851	15.41	20.04	At most 3
0.100	3.611	3.76	6.65	At most 4

Normalised Cointegrating Vectors; coefficients normalised on ln C_{ex} (1st CE)

Vector	ln C _{ex}	ln r	ln U _n	ln W _h	ln Y _d	C
1	1.000	-7.18 ^{e-06}	0.00748	-0.033	-0.986	0.30
		(0.010)	(0.028)	(0.005)	(0.008)	

Note: t-ratios are in parenthesis.

* (**) denotes rejection of the hypothesis at 5% (1%) significance level

L.R. test indicates 3 cointegrating equations (CE) at 5% significance level.

Table 5.8 above reports the Johansen maximum L.R. tests for cointegration for the consumer expenditures equation. The first column of the table gives the eigenvalues in descending order, while the second column reports the corresponding trace statistics generated from the maximum L.R. test statistic.

The next two columns report, respectively, the critical values at the five and one per cent levels. Finally, the last column gives the null hypotheses, $p - r$, ranging from no cointegrating relationships ($r = p$) up to at most four cointegrating vectors (given that the number of variables, $p = 5$).

Starting with the λ -max test results, the null hypothesis $r = 0$ (no cointegration) is rejected in favour of $r = 1$ in each case. The calculated test statistics range from a low of 0.100 to a high of 0.721. Furthermore, the null hypotheses of $r \leq 1$, $r \leq 2$, are all rejected in favour of the alternative hypotheses of $r = 2$ and $r = 3$, at 1% and 5% level of significance respectively. Only the null hypothesis of $r \leq 3$ cannot be rejected in favour of the alternative hypotheses of $r = 4$. These results indicate the presence of at most 3 cointegrating relationship for the model.

For the trace test results, we obtain similar conclusions when the null hypothesis of $r = 0$ is tested against the alternative hypothesis of $r \geq 1$ in each case. Moreover, the null hypothesis $r \leq 1$, $r \leq 2$ against $r \geq 2$ and $r \geq 3$ is rejected in all case at 1% and 5% level of significance respectively.

It can be concluded from the L.R ratio statistics that, in the presence of a deterministic trend, the consumer expenditures function and monetary policy (through nominal interest rates) are cointegrated, meaning that, there exists at least one (at most 3) linear combination of the $I(1)$ variables that links them in a stable and long-run relationship. The first cointegrating vector or equation is also reported in table 5.8 above as vector 1. To facilitate economic interpretation of the estimated vectors and to investigate the principal relationship of this ongoing analysis, namely the relationship between consumer/household expenditures and monetary policy, the estimated vectors are normalised on the variable consumer expenditures ($\ln C_{ex}$). The equation then obtained relates $\ln C_{ex}$, as the dependent variables, to all $I(1)$ variables in the model namely; $\ln r$, $\ln Y_d$, $\ln U_n$, and $\ln W_h$.

The normalised equation is obtained by dividing each cointegrating vector by the negative of the cointegrating vector on consumer expenditures. Hence all the long-run estimates have reversed sign because of the normalisation process.

As pointed out by Arize (1995: 43), the Granger representation theorem proved that, if a cointegrating relationship exists among a set of $I(1)$ series, then a dynamic error-correction representation of the data also exists. Therefore, since the existence of a long-run relationship has been established between consumer expenditures and all the other independent variables in the model, the short-run dynamics of the model can be established within an Error-Correction Model (ECM).

5.2.5 Error-correction Model

The information provided by the Johansen's cointegration tests can now be used to generate a set of Error Correction (EC) models that capture the short and long-run behaviour of the model. The changes in the relevant variables represent short-run elasticities, while the coefficient on the EC term shows how quickly the system re-established its long-run position.

The EC model is a model that combines both the short-run properties of economic relationships in first difference form, as well as the long-run information provided by the data in level form. Hence, EC models help to estimate the speed of adjustment back to the long-run or stable condition among variables (Ramirez, 2000: 150).

Table 5.9 below summarises the results of the error correction model for the existing long-term consumer expenditures function. More particularly, only the first cointegrating vector or equation namely vector 1, is reported in the above-

mentioned table. This because it is the only equation relating and providing estimated long-term coefficients for all the cointegrated variables in the model.

Table 5.9: Error Correction Model

Lag 2	β	α	Adj. R^2	R^2
$\ln C_{ex}$	1	-0.742 (0.272) [-2.76]	0.63	0.751
$\ln r$	-7.18 ^{e-06} (0.01) [-0.00066]	3.282 (2.151) [1.525]	0.27	0.513
$\ln U_n$	0.0074 (0.028) [0.266]	0.645 (0.971) [0.664]	- 0.152	0.231
$\ln W_h$	-0.031 (0.009) [-3.166]	49.52 (13.688) [3.617]	0.47	0.646
$\ln Y_d$	-0.98 (0.01) [-90.5)	-0.884 (0.381) [-2.317]	0.33	0.554

Note: Standard errors and t-ratio in () and [] respectively
See Appendix B for complete Eviews results

In the above table, α and β forms the EC mechanisms, with α indicating the speed of adjustment back to the long-run relationship among the variables in the model. The changes in the relevant independent variables represent short-run elasticities.

Hence, α reflects the speed at which consumer expenditures (C_{ex}) shifts to eliminate shocks affecting any independent variables in the model, within a specific period. The Error Correction Model shows that C_{ex} moves 74.2 percent

in the same year to eliminate a long-run disequilibrium caused by any shocks from an independent variable in the model.

5.2.6 Residual diagnostic testing and stability tests.

5.2.6.1 Residual tests

Appropriate diagnostic tests are furthermore applied to the residual of the obtained fitted long-run EC regression, in order to verify for the statistical significance of the equation. These tests are summarised in table 5.10 below (for complete results of the residual testing, see appendix C and D).

Residual diagnostic tests are applied to test the null hypothesis H_0 that residuals are normally distributed (Jarque-Bera test); that there are no serial correlation (Breusch-Godfrey); no ARCH (ARCH test) and no heteroscedasticity (both White tests). As it can be observed from the table 5.10 below, H_0 is accepted in almost all the residual tests, except for the white test (no cross terms). The main conclusion that can be drawn from this analysis is that all the diagnostic tests are insignificant, indicating that the errors are normally distributed, homoscedastic, and not serial correlated. The model then fulfils the conditions of serial noncorrelation, homoscedasticity, zero disturbance mean, structural stability, and normality of residuals.

Table 5.10: ECM residual tests

Residual diagnostic test	Test	Test statistic	P-value	Conclusion
Normality test	Jarque-Bera	0.141	0.93	H_0 accepted
Serial correlation	Breusch-Godfrey	0.49	0.62	H_0 accepted
ARCH LM test	ARCH Test	2.92	0.068	H_0 accepted

White heteroscedasticity	White test (no cross terms)	2.60	0.03	H_0 rejected
White heteroscedasticity	White test (cross terms)	1.74	0.11	H_0 accepted

Note: T-statistic and P- value are calculated using Eviews

In this regard, testing the EC residual for stationarity, using the well-known ADF test, shows that the residual is stationary and contain no unit root. The ADF test statistic is 4.35 in absolute value, which is greater than the MacKinnon critical values at 10%, 5% and 1%. Hence the null hypothesis of a unit root is rejected at all the above mentioned level of statistical significance. This confirms the fact that all the variables in the fitted EC equation are indeed cointegrated. The complete result of this test is shown in appendix C (table C₁).

5.2.6.2 Stability tests

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Stability tests on a regressed model are designed to evaluate the performance power of a model in estimating predictions. It is then a necessary step in the ongoing analysis to perform the necessary stability tests, in order to evaluate the presence of any types of mis-specification in the regressed model. The above mentioned tests help to evaluate whether there are any shifts in the parameters in the prediction model. Two specific stability tests are performed in this analysis namely; the Ramsey RESET and the Recursive Estimates (CUSUM and CUSUM of Squares) test.

The Ramsey reset test, also known as the Regression Specification Error test, suggests to test the following null hypothesis $H_0: u_t \sim N(0, \sigma^2)$, implying that the residual is normally distributed with mean zero and variance (σ^2), against the alternative hypothesis; $H_a: u_t \sim N(\mu, \sigma^2), \mu \neq 0$. The log likelihood ratio and the F-test are both used to test $H_0: \gamma_i = 0$.

Hence, H_0 is rejected if the probability value $p \leq 0.05$, otherwise do not reject H_0 . Falling to reject the null hypothesis implies that $y_i = 0$, and that there are no misspecification in the model. The following table 5.11 is obtained after performing the Ramsey Reset test using Eviews (see also appendix D, table D₅).

Table 5.11: Stability tests results

Ramsey RESET Test:

F-statistic	1.727836	Probability	0.171870
Log likelihood ratio	8.162472	Probability	0.085805

Source: own calculation using Eviews

As it can be observed from the above table 5.11, the obtained p- value is 0.17 which is obviously greater than the critical p-value = 0.05, the null hypothesis H_0 of no mis-specification in the model is not rejected. This means that the model is statistically well specified and that the residual is normally distributed with means zero and variance (σ^2).

The Recursive estimation test (CUSUM and CUSUM of Squares) looks at the cumulative sum of the residuals. In the plot produced with this test, the cumulative sum is plotted against time and two critical lines are also represented. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines (Eviews 3.1: 231). Both CUSUM and CUSUM of Squares graphs are represented in appendix D, figure D₃ and D₄ respectively. Both graphs show that the estimated model is stable at 5% level of significance throughout the period within which the study is conducted. However, the cumulative sum goes slightly outside the two 5% critical line for a short period of time, around the late 80'S, as it is shown by figure D₄ in appendix D, but this

short deviation is automatically corrected thereafter and this really not affects the overall stability of the entire model.

The next step in the study is to perform the necessary causality tests in order to determine the existence, as well as the direction of causality between the variables in the model.

5.2.7 Granger-causality tests

The fact that correlation exist between two or more variables does not necessarily imply causation or causal relationship in any meaningful sense of the word (Engle and Granger, 1987). The existence of a specific test for causality, introduced by Granger in 1969.

Granger-causality tests are performed to find out if one variable is causally related to another. In general, the Granger causality test utilises the *F*-statistic to explore whether lagged values of *x* contribute significantly to the explanation of *y*, once lagged values of *y* have been incorporated. If they do not, then *x* is said not to "Granger cause" *y*, and if they do, *x* "Granger causes" *y*.

As stated above, testing for causality using the Granger's method is made possible through the analysis of the *F*-test or the *p*-value ($P > (F)$). The hypothesis to be verified is H_0 : the null hypothesis of no Granger causality. Given that the study has opted for $\alpha = 0.05$ level of significance, the null hypothesis of no Granger causality must be rejected if the *p*-value is smaller than the level of significance that is if $(P > (F)) < 0.05$. Otherwise, H_0 cannot be rejected.

Table 5.12 below is obtained from the Eviews DGP, and summarises the Granger-causality tests results among all the cointegrated variables in the model. It is important to note that in general it is better to use more than fewer lags, since the theory is based on the relevance of all past information. Therefore, the

current test adopts 5 lags as the appropriate lag-length to investigate the causality between all the cointegrated variables in the model. For complete Eviews results see appendix E (table E₁).

Table 5.12: Granger-causality tests results

Dependent variable	Independent variable	Lags	F-statistic	Probability	Conclusion
lnr	lnC _{ex}	5	4.03	0.01	Ho is rejected
lnC _{ex}	lnr		2.51	0.06	Ho is not rejected
lnU _n	lnC _{ex}	5	0.84	0.53	Ho is not rejected
ln C _{ex}	lnU _n		2.12	0.10	Ho is not rejected
lnW _h	lnC _{ex}	5	2.30	0.08	Ho is not rejected
lnC _{ex}	lnW _h		6.03	0.001	Ho is rejected
lnY _d	lnC _{ex}	5	1.88	0.14	Ho is not rejected
lnC _{ex}	lnY _d		1.47	0.24	Ho is not rejected
lnU _n	lnr	5	0.93	0.47	Ho is not rejected
lnr	lnU _n		0.53	0.75	Ho is not rejected
lnW _h	lnr	5	0.95	0.47	Ho is not rejected
lnr	lnW _h		2.76	0.04	Ho is rejected
lnY _d	lnr	5	1.72	0.17	Ho is not rejected
lnr	lnY _d		0.98	0.45	Ho is not rejected
lnW _h	lnU _n	5	0.25	0.93	Ho is not rejected
lnU _n	lnW _h		2.96	0.03	Ho is rejected
lnY _d	lnU _n	5	2.51	0.06	Ho is not rejected
lnU _n	lnY _d		0.67	0.65	Ho is not rejected
lnY _d	lnW _h	5	4.36	0.007	Ho is rejected
lnW _h	lnY _d		0.72	0.61	Ho is not rejected

Source: Own calculations using Eviews.

Observing table 5.12 above shows the existence of five Granger-causal relationships amongst the variables in the model. These causalities are listed below:

- lnr do Granger cause ln C_{ex}
- ln C_{ex} do Granger cause lnW_h
- lnr do Granger cause lnW_h

- $\ln U_n$ do Granger cause $\ln W_h$
- $\ln Y_d$ do Granger cause $\ln W_h$

Although the importance of Granger causality tests is crucial when analysing the behaviour of time series data over a certain period, it is however important, as Granger (1981:126) said, to note that the statement "x Grange causes y" does not imply that y is the effect or the result of x. Granger causality simply measures precedence and information content but does not by itself indicate causality in the more common use of the term.

5.2.8 Summary

Almost all the variables in the model, except from the CPI, are found to be non-stationary in levels and stationary in first difference according to a combination of visual inspection and two formal unit root tests (ADF and PP). The fact that the variables are integrated of the same order $I(1)$, allows for the implementation of the Johansen's cointegration techniques, in order to determine whether there exist at least one linear combination of these cointegrated variables that is stationary. The cointegration analysis shows the existence of at most three cointegrating equations at 5% level of significance in this study.

Amongst those three cointegrating equations, the study focus on the first cointegrating equation or vector, which is the one relating all the cointegrated variables in the study. Furthermore, since the existence of a long-run relationship have been established between consumer expenditures and all the other independent $I(1)$ variables in the model, the short-run dynamics of the model is then described within an error-correction model (ECM), which allows to combine both the short-run properties of economic relationships in first difference form, as well as the long-run information provided by the data in level form.

The implementation of the ADF test on the residuals of the first cointegrating vector, confirm the fact that all the variables in the model are indeed $I(1)$. The same, a series of diagnostic and stability tests are applied to both the residuals and the model respectively, in order to verify the statistical significance of the overall model. All the appropriate tests confirm that the ECM is very robust and that the residuals are normally distributed, homoscedastic and not serial correlated.

Finally Granger-causality tests are applied to the model in order to investigate the existence of causal relationships amongst the variables in the model. The analysis shows the existence of five causal relationships between the principal variables.

The next section of the chapter is the part of the study devoted to the interpretation of the results obtained from the econometric analysis of the time series data.

5.3 Interpretation of the results

5.3.1 Introduction

Aron and Muellbauer (2000) pointed out the fact that there is little published literature on saving/consumption behaviour in S.A. This, according to the above mentioned authors is surprising given the importance of household consumption in GDP and its role in the monetary policy transmission mechanism, which runs from interest changes to output or economic variables. The current study attempts to make some contribution to this line of research by analysing and explaining the reaction of consumer expenditure to variations of the repo rate, under the current SARB's monetary policy framework.

Following in this section is the economic interpretation of the results obtained from analysing the available time series data in the previous one. Moreover, the results obtained from the econometric analysis of the data are analysed with regard to the main objective of this study. Furthermore, the results are also compared to the well-known results obtained in the empirical literature available on this topic.

5.3.2 The interest elasticity of consumer expenditures in South Africa

As discussed in previous chapters, and base on different theories on consumption namely, the LCH and the PIH, the main factors explaining consumer expenditures include disposable income, household wealth, interest rate, unemployment rate and the consumer price index.

Since the CPI is found not to be cointegrated with the other variables and, following the assumptions of cointegration analysis, the consumer expenditure model/equation have been estimated without CPI as an independent variable.

The estimated fitted equation 5.5 shows the short-run effect of the cointegrating vector relating all the above mentioned variables. The estimate of the elasticity of consumer expenditures with respect to the interest rate is 0.018. As it has been observed, the estimated equation performed quite well by conventional standards, with estimated standard error representing just a tiny fraction at 0.02. The individual coefficients are obtained relatively precisely and have the expected signs. However, the regressed equation in the short-run indicates a positive relationship between interest rates and consumer expenditures indicating that, an increase in interest rate by 1 percentage point will result in an increase in consumer expenditures by 1.8 percent (0.018 millions Rand).

This first result is quite surprising because as far as the theory is concerned, there should be a negative relationship between interest rates and consumer

expenditures. However, this result can be explained by the fact that, the regressed equation expresses the relationship between the main variables in the short-run only. In line with this observation, the Classical Theory indicated that, an increase in real interest rate leads to different effects on saving and consumption and brings ambiguity on the overall relationship between real interest rates and consumption. Thus, an increase in real interest rates encourages more individuals to substitute current saving for more quantity of current consumption. This because, a higher interest rate makes people to feel richer than before and this result in higher consumption in the short-run (Weber, 1970: 600). This effect is known as the income effect.

The long-run effect is quite different as it can be seen in both table 5.8 and 5.9 showing the results of the cointegration analysis and the ECM respectively. It is important at this point to recall that, cointegration analysis and ECM combine both the short-run properties of economic relationships in first difference form, as well as the long-run information provided by the data in level form. Therefore, the result of the ECM indicates an interest elasticity of consumer expenditures equal to -7.18×10^{-6} (- 0.00000718), reflecting just a small sensitivity of consumer expenditures to changes in the nominal interest rate, with however, the expected negative relationship between those two variables when both the short-run and the long-run properties of their economic relationship are taken into consideration. This particular long-run observation reinforces the importance of time lags during the implementation and the transmission of policy actions by any Central Banks and particularly the SARB. The SARB's core forecasting model developed by Smal et al (2007) indicated that, the maximum impact of a 100-basis-point repurchase rate change, on a specific economic variable, will be fully observed after an average of seven quarters. Since mid-2006, the repurchase rate have been increase ten time by an average of 50 basis points, in order to influence (in this case to reduce) some specific economic variable in the S.A economy namely; bank's credit extension, consumer expenditures and ultimately inflation. But, as it has been indicated by Mboweni (2008:39), household

consumption expenditure contracted for the first time in the third quarter of the year 2008 (almost seven quarters after the first contractionary monetary policy action was taken), with consumption of durable goods in particular declining by almost 10 per cent, while consumption of non-durable goods also contracting. In line with these observations about time lags, SARB's analysts argued that given the lag in the reaction of economic variables to interest changes, the focus of monetary policy is on the medium-to longer-term expected trajectory rather than on the current outcomes (SARB, 2009: 22).

5.3.3 The interest rate channel of monetary policy transmission

Although the econometric analysis in the long-run shows only a small sensitivity of consumer expenditures to variations in interest rates/repo rate by the SARB, nevertheless, the fact that consumer expenditures respond in a certain direction to variations in the main policy instrument in the hands of the Reserve Bank, is an important step in answering two of the main research questions of this study.

Consequently, since the responsiveness of consumer expenditures to changes in interest rates have been econometrically established within the current SARB's policy framework, it is then appropriate for this study to affirm that private/household consumption is indeed affected by variations in the repo rate and by monetary policy implemented by the SARB. Moreover, it is therefore, established in this study that the interest channel of monetary transmission does exist as far as the South Africa economy is concerned.

5.3.4 Causal relationships

Granger causality tests are important when analysing the behaviour of time series data over a specific period, because the tests help to determine if a variable is causally related to another in the model.

The current analysis on the effects of interest rate on consumer expenditures in South Africa is able to confirm the existence of five causal relationships in this model. These causalities are shown in table 5.12 and are listed above that table. Among those five causal relationships, two of them namely; the causal relationship between interest rate and consumer expenditures and the one between consumer expenditures and household wealth, are of a central importance for this study and are discussed below.

5.3.4.1 Consumer expenditures and interest rate

As Granger (1986) argued, if the lagged values of a variable X contribute significantly to the explanation of another variable Y , once lagged values of Y have been incorporated, X is said to "Granger causes" Y . Hence the fact that the econometrical analysis in this study indicated that $\ln r$ Granger causes $\ln C_{ex}$ proved that, it is possible to explain the behaviour of consumer expenditures in the long-run, base on past information contain in the time values of interest rates, which are affected by policy actions by the SARB.

However, the fact that $\ln r$ granger causes $\ln C_{ex}$, does not by itself imply a cause-effect relationship, as Granger (1981) argued, it is rather an indication that it is possible to use information content in the properties or behaviour of $\ln r$ in order to make predictions about the future behaviour of consumer expenditures $\ln C_{ex}$. This particular indication or observation about the existence of a causal relationship between those two variables is important in the sense that, it confirm the fact that the SARB can effectively make use of its interest rate policy in order to influence consumer expenditures in a specific direction.

The empirical results reported in this study indicates that consumer expenditures in South Africa vary inversely in the long-run with prime interest rate set by the SARB. These obtained results about the direction of causality between interest rate and consumer expenditures is consistent with those found by Aron and

Muellbauer (2000) while studying personal and corporate saving in South Africa. Their study indicated that real interest rates in South Africa have significant direct negative effects on consumption, this presumably because of the mix of substitution, income, and user-cost-of-durables effects predicted by economic theory. The results of this study is also consistent with what was found by Wright (1967), Juster and Wachtel (1972), Mishkin (1976), Boskin(1978) and Gylfason (1981) in analysing the nature of the relationship between consumption/saving and interest rates in the U.S.

5.3.4.2 Consumer expenditures and household Wealth

The second important causal relationship which the current study is able to identify is the causality between consumer expenditures and household wealth. This relationship is important due to the fact that the rapid expansion of wealth, in the world including South Africa and more particularly in the values of residential estates and in equity market, have in a certain way produced a considerable effect on total expenditures by private households. Therefore, this particular phenomenon might have influenced the traditional relationship between households' expenditures and nominal interest rates. The arguments of Aron et al (2006a: 61) that there is widespread new concern among Central Banks about the real influence of house prices on consumption and that the current debate is on how monetary policy should react to asset price fluctuations in the context of liberalised credit markets.

The empirical results of the current study indicate a wealth elasticity of consumer expenditures in South Africa to be 0.002 in the short-run and 0.033 (in absolute value) when both the short-run and the long-run properties of the relationship is taken into consideration. This is a clear evidence of a wealth effect. However, these results are not really significant and appear to be weak. This may be due to the fact that housing wealth is still underestimated in the country, but the

dramatic rise in housing wealth by around 60 percent observed in the country from 2003 to 2005 may well resolve this problem.

Aron and Muellbauer (2006b:30) report that, the first major peak observed in the value of wealth in S.A around the mid-1980's, especially after 1986, produced the elasticity of consumer spending with respect to real housing wealth to be around 100 times as large as that of illiquid financial wealth. The same authors further argued that increases in wealth have induced a shift in the average propensity to consume, together with important interactions effects with for example, housing wealth, income growth expectations, interest rates and indicators of uncertainty (Aron et al, 2006b:2).

Hence, the importance of the household sector wealth and the influence it has on total consumption, apart from the traditional importance/influence of nominal interest rates, in the economy should be acknowledged.

5.3.5 The role of uncertainty

As Gylfason (1981: 239) pointed out, many researchers have argued that among the explanation of the higher values of saving in the U.S around the 70s, is the high variable inflation and unemployment rates which have created unusual degree of uncertainty for consumers.

The importance of uncertainty proxies, as critical factors affecting consumer behaviour/expenditures, should be recognised in analysing consumption functions. However, it is in fact impossible to predict how uncertainty about the future influences consumption decisions. Uncertainty according to the same above-mentioned author has two different kinds of effects. Hence, increased uncertainty makes the consumer less inclined to expose his resources to the possibility of loss, but at the same time makes it necessary for him to save more in order to protect himself against such a loss. These effects are respectively similar to the substitution and income effects of income redistribution.

The two proxies or variables that are used in this study to evaluate whether uncertainty about the future in general, influences consumption decisions are the rate of inflation (CPI) and the unemployment rate (U_n).



5.3.5.1 The effect of inflation

Many authors emphasised on the effect of inflation on saving and consumption. For example both Wachtel (1975) and Springer (1977), indicated that the direction of the effects of inflation on consumption is different for both different components of aggregate consumption and for different measures of the expected rate of inflation.

The econometric analysis performed in the previous section of this chapter, particularly the unit root tests and the test for cointegration, showed that the rate of inflation CPI is the only variable not cointegrated with the others. According to the assumptions of cointegration analysis it is therefore, not possible to evaluate the long-run properties of the relationship that might exist between consumer expenditures, interest rates, and CPI, since the variables are not all integrated of the same order. However, as McCallum (1993) argued, it is highly misleading to conclude that in any practical sense, long-run relationships are inexistent between two specific variables, only because they are not cointegrated. Although two variables might not be cointegrated, it is important to use traditional economic theory in order to draw conclusions about the nature of their relationship. In this particular case, it is well-known that the effect of inflation on nominal interest rate is embodied in the traditional Fischer's theory of interest. This confirms that although the two variables are not cointegrated in this study, nevertheless inflation rates have a traditional effect on Consumer Price Index and also on consumer expenditures, and that the existence of a long-run relationship between those variables is entirely valid.

In this study the nominal interest rate and the rate of inflation are able to influence consumer expenditures separately. This makes it then possible to evaluate whether the two estimates or elasticities are equal in absolute value and test whether inflation influences consumer expenditures independently of the effect of the real interest rate. This is similar to the approach taken by Gylfason (1981: 236) who argued that, if for example consumer expenditure is inversely related to expected rate of inflation, then the data should show that the expected rate of inflation has more effect than the interest rates on consumption. If however, these two effects are found to be similar in magnitude, then the result may be interpreted as indirect evidence that the effect of inflation on consumer expenditures cannot be detected in the data.

The regression relating all the variables in the model, including the two proxies for uncertainty, is estimated using the normal Ordinary Least Squares method. The resulting equation takes the form of equation (5.4). The estimated model suggests that the estimate of the elasticity of consumer expenditures with respect to inflation in the short run is -0.02, which is similar in absolute value to the elasticity of C_{ex} with respect to the short-term interest rate. However, the expected negative sign is obtained, indicating an inverse relationship between inflation and consumer expenditures. The elasticity of -0.02 obtained suggests that an increase in CPI by 1 percentage point reduces C_{ex} *ceteris paribus* by 2 percent (0.02 Millions Rand). The hypothesis that increased uncertainty about the inflation rate reduces consumption cannot be rejected. The hypothesis that can be rejected at this point is the one suggesting no effect of inflation on consumer expenditures in South Africa.

Also, it is important to note at this point that, an increase in inflation also raises interest rates. Therefore, the overall net effect of an increase in CPI on consumer expenditures might in fact be smaller than it appears to be. Since both the elasticities of inflation and interest rates with respect to consumer expenditures are shown to be similar in magnitude (absolute value) at -0.02 and 0.02

respectively, and base on the approach of Gylfason (1981), this might be an indication that the accurate effect of inflation on consumer expenditures in this study might not be fully determined.

The ambiguity about the real effect and particularly the expected direction of the effect of inflation on consumption is not new to the research environment. Juster et al (1972) argued that, economists have usually taken the view that an expected rise in prices promotes an increase in expenditures, because people will tend to substitute goods for money and thus to spend more and save less. However there is an alternative view more close to psychologists and socialists than to economists, arguing that a rise in prices anticipated or not, will tend to increase savings and reduce spending, because of the effect that rising prices has on consumer confidence and consumer optimism.

5.3.5.2 Unemployment effects

The unemployment rate (U_n) was introduced into the model as a proxy to precautionary behaviour of household. This behaviour according to Deaton (1991) is motivated by uncertainty in the future stream of revenues. Moreover, to justify the inclusion of U_n in the model, there is the assumption that consumers are perceived to be less confident about the future, including about their job security and their revenues, depending on the speed at which unemployment rate vary.

The estimates of the coefficient of U_n in the model are almost similar in both the short-run and the long-run analysis. The estimates are shown in equation (5.5) and in table (5.7) and are given at -0.005 in the short-term analysis and at -0.007 under the ECM analysis. Hence the estimate of the unemployment elasticity of consumer expenditures in South Africa is negative and varies between 0.5 – 0.7 percent. This indicates that an increase in the unemployment rate by an

assumed 1 percentage point will negatively affect consumer expenditures by an average 0.6 percent.

Although the coefficient of unemployment obtained appears to be all significant at 1% percent level as it is indicated by the t-values shown in parenthesis under each estimate, however, those estimates are very weak in magnitude. This results might be due to the fact that statistics on employment and unemployment in South Africa are said to be very controversial and not so much reliable (Du Plessis et al, 2007).

5.4 Conclusion

The results obtained from the econometric analysis of the relationship between consumer expenditures and monetary policy, through interest rates variations by the SARB have been exposed and interpreted in this chapter. The empirical results reported in this analysis is capital in answering all major questions of this ongoing study, and moreover in evaluating the hypotheses established at the beginning of the study. Basically the following major findings can be drawn from analysing the effect of monetary policy on consumer expenditures in S.A:

Firstly, the analysis confirms that consumer expenditures indeed respond to variations in the repo rate by the SARB, indicating therefore, the existence of an interest rate channel for monetary policy transmission in the current monetary policy framework context.

Secondly, there exist an inverse relationship between interest rates and consumer expenditures in South Africa, in the long-run. This observation reinforces the crucial importance of time lags in implementing monetary policies. Thirdly, household wealth is a major factor influencing consumer expenditures in the country, although its importance is still underestimated.

Finally, the importance of the uncertainty factor, shown by inflation and unemployment rates, is capital in analysing consumer expenditures. The analysis indicates that increased uncertainty in the country about the future in general (inflation and unemployment in this case), produces a negative effect on consumer confidence and optimism and also on their expenditures.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMENDATIONS

6.1 Introduction

Identifying the complete effect of monetary policies is not a simple task according to Berument (2007) who argued that, the reason for this is given by the fact that actions of Central Banks depend on both the state of the economy and the intention of the Bank on what specific goal to achieve when setting up any particular policy. Monetary policies, implemented by Central Banks are then expected to impact on the whole economic system, by influencing certain intermediate variables such as interest rates, money supply, investments, GDP and consumption, through various available transmission mechanisms or channels. These transmission mechanisms according to Bernanke and Blinder (1992: 905) include; the interest rate channel, the exchange rate channel, other assets price channel, the credit channel and some others.

This study presented an empirical investigation into the existence of the interest rate channel of monetary policy transmission in South Africa, under the current SARB's policy framework. More specifically, the analysis is performed by analysing the response of consumer expenditures to variations into the main SARB's policy instrument namely the repo rate, via its effect on bank lending rates and hence credit allocation by commercial banks.

The econometric analysis is conducted under the well-known Johansen's cointegration analysis, together with Error Correction Models (ECM) and Granger Causality tests, covering the period from 1970 to 2006.

6.2 Summary of Findings

A quite large number of researches have been conducted in developed countries including; the U.K, the U.S, the Euro zone, in order to determine the effect of interest rates on consumption and consumer expenditures. The results obtained yield conflicting conclusions, with both a negative and a positive relationship between the two variables detected. However, little has been done to explore this relationship in developing countries and more particularly in South Africa. This is very surprising, given the current importance of the household sector in affecting economic growth and also its importance in assessing the effectiveness of monetary policies.

The statistical results obtained in this study are dependent on the econometric specification, therefore, any conclusion must only be tentative. The empirical results obtained from the econometric analysis of the available time series data in this study, confirmed the existence of an interest rate channel of monetary policy in South Africa, although only a small long- term negative sensitivity of consumer expenditures to variations in interest rates by the SARB is reported in this study. These results are consistent with those reported by different important researchers on this topic namely; Boskin (1978) and Gylfason (1981).

This study was able to identify two different effects of interest rates on consumer expenditures in South Africa. While the short-run effect indicates a positive relationship between interest rates and consumer expenditures, in contrast the analysis performed through the ECM, indicates a negative low magnitude response of consumer expenditures to interest rates.

This first major result is quite interesting because it reinforces the importance of time lags as far as monetary policy transmissions is concerned in South Africa, by suggesting that monetary policy's actions by the SARB produce considerable impact only after a certain period of time (medium to long-term). Smal et al

(2007) estimated the time lags for monetary policy transmission in S.A to be around seven quarters.

Furthermore, the study was also able to confirm the existence of a causal relationship between consumer expenditures and household wealth. This second major finding is important because, the rapid expansion in the value of wealth that have been observed in the country recently might have considerably affected consumer spending behaviour, and the traditional relationship between consumer expenditures and interest rates variations by the monetary authority. However, the fact that the result of the elasticity of consumer expenditures with respect to households wealth appears to be weak in this study, is an indication that households wealth is still underestimated when analysing consumption functions. More attention should then be directed, as Aron et al (2006a) argued, in building accurate household wealth estimates in South Africa, in order to fully investigate their effects on consumer behaviour/expenditures and also to determine how monetary policy transmissions are affected because of this particular important factor.

In addition, the role of uncertainty have been found to be capital when analysing the relationship between monetary policy and consumer expenditures in South Africa. Uncertainty, represents by inflation rates through the Consumer Price Index (CPI) and unemployment rates, appeared to be a critical factor affecting consumer expenditures under the current policy framework. Both uncertainty proxies indicated that consumer expenditures react negatively to an increase in either inflation or unemployment rates. The accurate or full effect of inflation on consumer expenditures could not be entirely determined in this study due to fact that a more specific analysis of their relationship could not be obtained through an ECM. But, the weak elasticity of consumer expenditures with respect to unemployment obtained in the study is probably due to the controversy surrounding statistical data on unemployment in South Africa.

Although some of the results obtained appears to be weak in magnitude, however, most of these results are all statistically and economically significant and might have an important contribution as far as the implementation of the current monetary policy regime is concerned in South Africa.

6.3 Some implications for the current monetary policy regime

Due to the relative new existence of most inflation-targeting monetary regimes, very few previous study have empirically investigated the existence of an interest rate channel under this policy framework. This study is an attempt to fill the gap and to uncover a variety of possible interesting relationships specific to an inflation-targeting regime.

In April 2000, South Africa adopted an inflation-targeting monetary policy framework. One of the main reasons given by the monetary authority to justify a shift from the previous monetary policy approach to a monetary framework that target inflation directly was to achieve greater credibility of monetary policy and higher degree of transparency and accountability to the general public. However, the inflation-targeting framework has been openly criticized by almost all sectors in the country's economy of being too much rigid. Nevertheless, the policy has enjoyed a good deal of credibility and has made promising steps towards successfully containing inflation since its implementation.

One of the most important problems with inflation targeting policy is on the ability of the Central Bank to fully control inflation. As Svensson (1999: 627) argued, inflation control is imperfect due to lags in the transmission mechanism, uncertainty about the current state of the economy and future observable or unobservable shocks to the economy, and the influence of other factors than monetary policy on inflation. The imperfect control of inflation makes both the implementation and the monitoring of inflation targeting difficult.

From June 2006, in reaction to the deterioration in inflation outlook at the time, due to external shocks to the economy in the form of sudden increase in oil prices in the international market, the repo rate was increased by the SARB from 7.0 percent to a peak of 12.0 percent in the end of December 2008. The fact that inflation remains at a high level during that period of tightening monetary policy, increased the perception of many observers and particularly the general public that inflation-targeting was not appropriate for South Africa economy or not well-implemented by the Reserve Bank. However, the recent improvements in the overall inflation outlook and the further expected reduction in the medium-term inflation figures have given way for a more accommodative action by the SARB, with a reduction in the repo rate by 350 basis points since December 2008 (SARB, 2009: 36).

Although the recent improvements observed in the inflation outlook are partly due to the severe downturn in the global economy since the middle of 2008, nevertheless the continuing slow return of inflation within the target range is also a result of some firm monetary actions taken by the SARB since the mid-2006, which were expected to produce a considerable impact on the economy after a certain period, assumed to be an average of seven quarters as found by Smal et al (2007) and as it has been confirmed in this study through the econometric analysis.

The most recent inflation figures projections according to the SARB's inflation forecasting model, indicates a reduction in the average CPI inflation rate to 6.2 percent in the third quarter of 2009. Thereafter, inflation is expected to increase marginally to 6.4 percent in the beginning of 2010, before resuming its downward trajectory and return within the policy's target range at 5.4 percent by the end of the forecast period in the last quarter of 2010 (SARB, 2009: 35). However, due to the current high level of uncertainty in the rate of change in global economic developments, these forecasts are subjected to a higher degree of risk.

The current difficult economic conditions that started in developed countries around the world during the middle of 2008, and the speed at which it spread to almost all part of the world, also affected emerging markets such as South Africa. This unexpected situation has created new challenges for monetary policy-makers forcing monetary authorities around the world to use a range a conventional and unconventional policy to support their economies. Although the South African economy have also been affected by the these new developments, however, the impact has been moderate due to factors such as a stable domestic banking system, a reduction in interest rates, a drop in the price of petrol between November 2008 and February 2009, a relative stable exchange rate and some few others (*Financial Stability Review*, 2009: 3). Allowing the SARB to focus on its mandate of achieving price stability within a flexible inflation-targeting framework.

6.4 Conclusions and policy recommendations

The relative weak sensitivity of consumer expenditures to monetary policy actions in the long-run found in this study, suggests that in current circumstances, although possible, it will be difficult for the SARB to obtain a full and expected impact of policy actions on consumer expenditures, since it appears that it exist other important factors apart from the level of interest rate, which consumers take into consideration when making spending decisions.

However, the fact that the interest rate channel exists has a significant importance for the monetary transmission mechanism/system in South Africa, with time lags playing a considerable role in the transmission process.

It is therefore, important for the Reserve Bank to provide more attention and to acknowledge the existence of other factors affecting consumer expenditures in South Africa namely, household wealth and unemployment rate, when implementing its policy. More precisely this can be achieved by developing more

accurate statistic data on those particular two variables for use in future empirical econometric studies, thereby presenting exciting research opportunities in exploring how consumer expenditures can be fully influenced within the current monetary policy framework.

This observation is consistent with the conclusion reached by Aron and Muellbauer (2000) indicating that the results obtained while studying corporate and personal saving in South Africa threw important light on the monetary transmission mechanism, by indicating that there are multiple channels through which interest rates affect consumption expenditures. In addition to the existing direct effect, a rise in the real interest rate appears to have even larger indirect effects through asset prices, income, and income expectations. Consequently, without official data on the stock of wealth, these apparently large asset effects are difficult to be measure with a high degree of accuracy.

In addition, the adoption by the SARB of a conditional inflation forecast as an intermediate target variable can be a solution to the problem of imperfect control of inflation and hence all related variables such as consumer expenditures, especially under some unexpected observable and unobservable shocks to the economy. This solution is proposed by King (1994: 118), who argued that the intermediate target is the expected level of inflation at some future date chosen to allow for the lag between changes in interest rates and the resulting changes in inflation. Moreover, still connected with the introduction of an intermediate target, Von Hagen (1998) emphasised on the fact that the advantage of using a conditional inflation forecast is that it induces some discipline when applying judgements and extra-model information. Hence, using an intermediate forecast under the current SARB's inflation-targeting framework, should definitely improve the well-desired flexibility characteristic of the policy. This will positively affect the necessary transparency and accountability, in the eyes of the general public, from any Central Bank applying inflation-targeting as its main monetary policy.

Finally, the Reserve Bank of South Africa or/and the government as monetary authorities can still improve in the flexible aspect of the current policy framework, by following the example of the New Zealand, which provides an "escape clause" allowing the inflation target to be suspend or modified in the face of unexpected economic developments, strongly and negatively affecting the economy. This is necessary because an exclusive emphasis on inflation goals could lead to a highly unstable real economy under a significant supply shock, such as a large change in the price of oil. (Bernanke and Mishkin, 1997: 105).

Distinguishing the relative importance of various channels of monetary transmission is therefore, useful for many reasons. Now, understanding which financial aggregates are impacted by policy would improve the understanding of links between the financial and real sectors of the economy; also more information about the transmission mechanism might lead to a better choice of targets. In particular, if for example the credit channel is an important part of the transmission mechanism, bank portfolios should be the focus of more attention, if the interest rate channel is crucial, then the Central Bank may need to focus on an interest rate target.

APPENDIX A

Table A₁

Annual evolution of prime rate, consumer expenditures and credit allocation

Years	Credit allocation (%)	prime rate (%)	Csmer expenditures (R Million)
1990	19.41	21	176754.3
1991	12.34	20.25	204633.5
1992	10.4	17.25	234167
1993	9.5	15.25	263427
1994	19.8	16.25	298173
1995	12.84	18.5	343037
1996	21.02	20.25	385921
1997	16.75	19.25	434307
1998	17.35	23	470165
1999	8.07	15.5	514271
2000	10	14.5	580802
2001	11.63	13	639800
2002	8	17	722091
2003	16.08	11.5	785632
2004	12.73	11	870806
2005	14.45	10.5	965764
2006	23.18	12.5	1088852
2007	15	13	1123475
2008	11.62	13.5	1168759

Table A₂

Johansen Cointegration Analysis

Date: 05/2009

Sample: 1970 2006

Included observations: 34

Test assumption: Linear deterministic trend in the data

Series: LnCex Lnr LnUn LnWh LnYd

Lags interval: 1 to 2

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.721597	114.6269	68.52	76.07	None **
0.670556	71.15160	47.21	54.46	At most 1 **
0.499717	33.39979	29.68	35.65	At most 2 *

0.167683	9.851999	15.41	20.04	At most 3
0.100775	3.611554	3.76	6.65	At most 4

* (**) denotes rejection of the hypothesis at 5% (1%) significance level
L.R. test indicates 3 cointegrating equations at 5% significance level.

Unnormalized Cointegrating Coefficients

LNCEX	LNR	LNUN	LNWH	LNVD
-11.69180	8.39E-05	-0.087466	0.389464	11.53296
10.90889	0.196315	-1.437585	0.095615	-10.84674
-0.224685	-0.732108	-2.568715	0.164543	0.882165
-7.915212	0.401577	-0.364823	0.042059	8.218161
-5.088669	0.839084	-0.767901	-0.185133	5.436430

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNCEX	LNR	LNUN	LNWH	LNVD	C
1.000000	-7.18E-06 (0.01093)	0.007481 (0.02812)	-0.033311 (0.00584)	-0.986415 (0.00808)	0.306539
Log likelihood	194.1800				

Normalized Cointegrating Coefficients: 2 Cointegrating Equation(s)

LNCEX	LNR	LNUN	LNWH	LNVD	C
1.000000	0.000000	0.007425 (0.09498)	-0.033294 (0.02908)	-0.986418 (0.00944)	0.306493
0.000000	1.000000	-7.735451 (8.28271)	2.337143 (2.53618)	-0.438115 (0.82335)	-6.506430
Log likelihood	213.0559				

Normalized Cointegrating Coefficients: 3 Cointegrating Equation(s)

LNCEX	LNR	LNUN	LNWH	LNVD	C
1.000000	0.000000	0.000000	-0.031609 (0.00998)	-0.986111 (0.01090)	0.301650
0.000000	1.000000	0.000000	0.581345 (0.33706)	-0.757472 (0.36785)	-1.461665
0.000000	0.000000	1.000000	-0.226981	-0.041285	0.652162

(0.08353) (0.09116)

Log
likelihood 224.8298

Normalized Cointegrating Coefficients: 4 Cointegrating Equation(s)

LNCEX	LNR	LNUN	LNWH	LNYP	C
1.000000	0.000000	0.000000	0.000000	-1.028426 (0.00787)	0.381353
0.000000	1.000000	0.000000	0.000000	0.020772 (0.14501)	-2.927556
0.000000	0.000000	1.000000	0.000000	-0.345143 (0.05675)	1.224505
0.000000	0.000000	0.000000	1.000000	-1.338694 (0.26514)	2.521549

Log
likelihood 227.9500

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APPENDIX B

Table B₁:

Vector Error Correction Model (ECM)

Date: 05/21/09 Time: 22:24

Sample(adjusted): 1973 2006

Included observations: 34 after adjusting endpoints

Standard errors & t-statistics in parentheses

Cointegrating Eq: CointEq1						
LNCEX(-1)	1.000000					
LNR(-1)	-7.18E-06 (0.01093) (-0.00066)					
LNUN(-1)	0.007481 (0.02812) (0.26606)					
LNWH(-1)	-0.033311 (0.00584) (-5.70828)					
LNVD(-1)	-0.986415 (0.00808) (-122.118)					
C	0.306539					
Error Correction:	D(LNCEX)	D(LNR)	D(LNUN)	D(LNWH)	D(LNVD)	
CointEq1	-0.752961 (0.27288) (-2.75936)	3.282258 (2.15193) (1.52526)	0.645211 (0.97157) (0.66409)	49.51874 (13.6886) (3.61752)	-0.884842 (0.38184) (-2.31730)	
D(LNCEX(-1))	1.202065 (0.26885) (4.47116)	3.733688 (2.12018) (1.76102)	0.718208 (0.95723) (0.75030)	-8.035150 (13.4866) (-0.59579)	1.308180 (0.37621) (3.47728)	
D(LNCEX(-2))	0.095037 (0.27174) (0.34974)	-0.848931 (2.14298) (-0.39615)	-0.671904 (0.96753) (-0.69446)	-20.90065 (13.6316) (-1.53325)	0.732287 (0.38025) (1.92579)	
D(LNR(-1))	-0.051835 (0.02657) (-1.95084)	-0.401694 (0.20954) (-1.91704)	-0.021824 (0.09460) (-0.23068)	0.303187 (1.33289) (0.22747)	-0.055726 (0.03718) (-1.49878)	

D(LNR(-2))	0.005028 (0.02790) (0.18023)	-0.013989 (0.22002) (-0.06358)	0.094952 (0.09933) (0.95588)	2.480527 (1.39954) (1.77239)	-0.034553 (0.03904) (-0.88507)
D(LNUN(-1))	0.049406 (0.06032) (0.81906)	-0.046061 (0.47569) (-0.09683)	0.018269 (0.21477) (0.08506)	0.034630 (3.02591) (0.01144)	0.010912 (0.08441) (0.12928)
D(LNUN(-2))	-0.017864 (0.05624) (-0.31764)	-0.294978 (0.44352) (-0.66508)	-0.120026 (0.20024) (-0.59940)	-0.850390 (2.82127) (-0.30142)	0.018118 (0.07870) (0.23022)
D(LNWH(-1))	-0.011007 (0.00666) (-1.65301)	0.118203 (0.05251) (2.25090)	0.006798 (0.02371) (0.28675)	0.331942 (0.33404) (0.99371)	-0.014388 (0.00932) (-1.54410)
D(LNWH(-2))	-0.010532 (0.00437) (-2.41048)	0.046057 (0.03446) (1.33664)	-0.002210 (0.01556) (-0.14207)	-0.044169 (0.21919) (-0.20151)	-0.008439 (0.00611) (-1.38020)
D(LNYD(-1))	-0.474860 (0.28431) (-1.67020)	1.059809 (2.24213) (0.47268)	0.854672 (1.01229) (0.84429)	35.35722 (14.2624) (2.47906)	-1.042363 (0.39785) (-2.62001)
D(LNYD(-2))	-0.346440 (0.22214) (-1.55957)	0.253706 (1.75182) (0.14482)	-0.057745 (0.79092) (-0.07301)	14.41024 (11.1434) (1.29316)	-0.749761 (0.31084) (-2.41201)
C	0.072659 (0.02910) (2.49659)	-0.574925 (0.22951) (-2.50499)	-0.080741 (0.10362) (-0.77920)	-2.620776 (1.45994) (-1.79513)	0.097692 (0.04072) (2.39883)
R-squared	0.751704	0.513576	0.231967	0.646081	0.554070
Adj. R-squared	0.627556	0.270365	-0.152049	0.469121	0.331106
Sum sq. resids	0.011984	0.745276	0.151917	30.15622	0.023465
S.E. equation	0.023339	0.184055	0.083098	1.170785	0.032659
F-statistic	6.054904	2.111642	0.604056	3.651004	2.485013
Log likelihood	86.91587	16.70224	43.73939	-46.20443	75.49217
Akaike AIC	-4.406816	-0.276602	-1.867023	3.423790	-3.734834
Schwarz SC	-3.868100	0.262113	-1.328307	3.962506	-3.196118
Mean dependent	0.138910	0.011343	0.030631	0.135679	0.134874
S.D. dependent	0.038243	0.215474	0.077421	1.606865	0.039932
Determinant Residual		7.53E-12			
Covariance					
Log Likelihood		194.1800			
Akaike Information Criteria		-7.598822			
Schwarz Criteria		-4.680780			

APPENDIX C

Table C₁:

Stationarity test of the ECM Residual

ADF Test Statistic	-4.350845	1% Critical Value*	-4.2712
		5% Critical Value	-3.5562
		10% Critical Value	-3.2109

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RESID01)

Method: Least Squares

Date: 05/21/09 Time: 23:00

Sample(adjusted): 1975 2006

Included observations: 32 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID01(-1)	-1.133420	0.260506	-4.350845	0.0002
D(RESID01(-1))	0.164637	0.183173	0.898808	0.3764
C	0.007417	0.008635	0.859006	0.3976
@TREND(1970)	-0.000395	0.000388	-1.017852	0.3175
R-squared	0.497748	Mean dependent var		0.000364
Adjusted R-squared	0.443936	S.D. dependent var		0.026076
S.E. of regression	0.019445	Akaike info criterion		-4.926030
Sum squared resid	0.010587	Schwarz criterion		-4.742813
Log likelihood	82.81648	F-statistic		9.249653
Durbin-Watson stat	2.022145	Prob(F-statistic)		0.000205

APPENDIX D

Figure D₁: Residual graphs

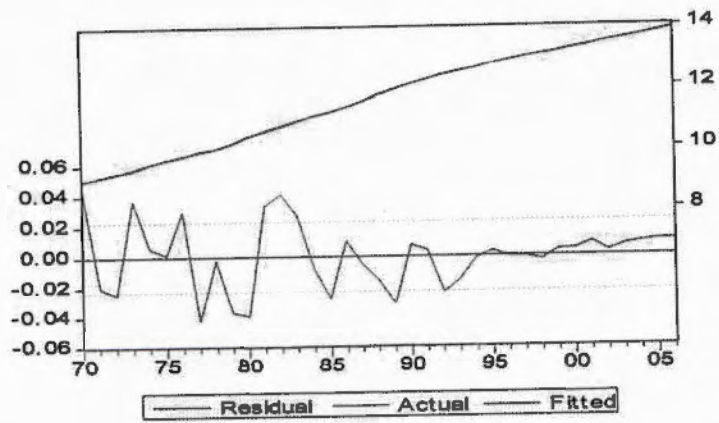


Figure D₂: Residual tests – Normality Assumption

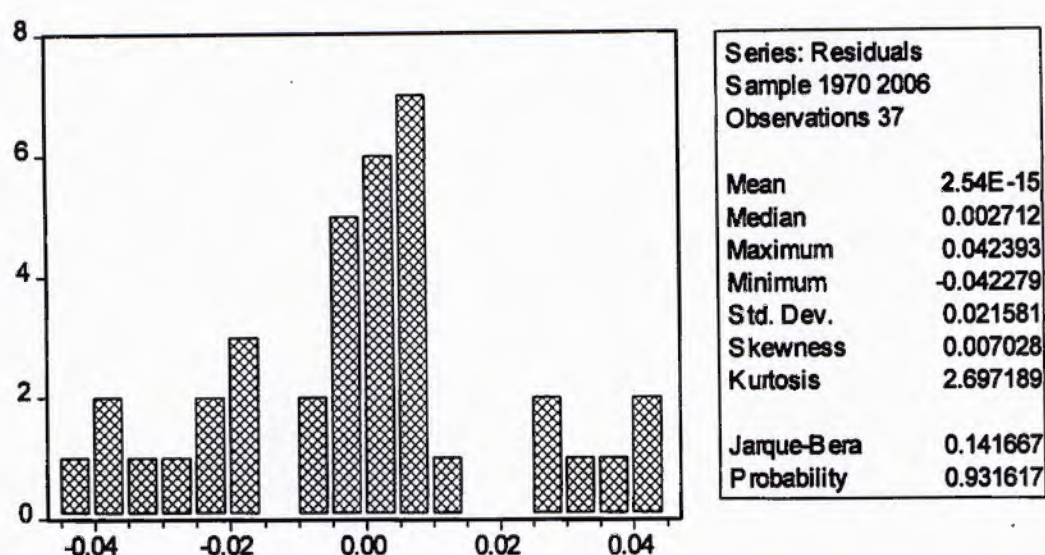


Table D₁: Residual tests – Serial correlation LM Test (Breusch-Godfrey)

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.489133	Probability	0.692530
Obs*R-squared	1.782027	Probability	0.618854

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 05/23/09 Time: 14:28

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNR	-0.001606	0.015897	-0.101028	0.9202
LNUN	0.004755	0.044306	0.107325	0.9153
LNWH	0.000540	0.003995	0.135082	0.8935
LNVD	-0.001713	0.011780	-0.145395	0.8854
C	0.003777	0.044590	0.084704	0.9331
RESID(-1)	0.083862	0.187762	0.446638	0.6585
RESID(-2)	-0.214382	0.186502	-1.149490	0.2597
RESID(-3)	0.019514	0.193693	0.100747	0.9204
R-squared	0.048163	Mean dependent var	2.54E-15	
Adjusted R-squared	-0.181591	S.D. dependent var	0.021581	
S.E. of regression	0.023459	Akaike info criterion	-4.478325	

Sum squared resid	0.015959	Schwarz criterion	-4.130018
Log likelihood	90.84900	F-statistic	0.209628
Durbin-Watson stat	1.875602	Prob(F-statistic)	0.980476

Table D₂: Residual tests – Heteroscedasticity ARCH Test

ARCH Test:

F-statistic	2.924075	Probability	0.068184
Obs*R-squared	5.408065	Probability	0.066935

Test Equation:

Dependent Variable: RESID²

Method: Least Squares

Date: 05/23/09 Time: 14:39

Sample(adjusted): 1972 2006

Included observations: 35 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000216	0.000126	1.714578	0.0961
RESID ² (-1)	0.323755	0.173175	1.869518	0.0707
RESID ² (-2)	0.133084	0.161175	0.825708	0.4151
R-squared	0.154516	Mean dependent var		0.000417
Adjusted R-squared	0.101673	S.D. dependent var		0.000570
S.E. of regression	0.000540	Akaike info criterion		-12.12804
Sum squared resid	9.33E-06	Schwarz criterion		-11.99473
Log likelihood	215.2407	F-statistic		2.924075
Durbin-Watson stat	2.145483	Prob(F-statistic)		0.068184

**Table D₃: Residual tests – Heteroscedasticity White test
(No cross terms)**

White Heteroscedasticity Test:

F-statistic	2.599258	Probability	0.029127
Obs*R-squared	15.76791	Probability	0.045825

Test Equation:

Dependent Variable: RESID²

Method: Least Squares

Date: 05/23/09 Time: 14:47

Sample: 1970 2006

Included observations: 37

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000709	0.010165	0.069727	0.9449
LNR	-0.004785	0.006113	-0.782770	0.4403
LNR^2	0.000796	0.001130	0.704280	0.4871
LNUN	-0.001475	0.009122	-0.161656	0.8727
LNUN^2	0.000169	0.001562	0.108446	0.9144
LNWH	-0.000570	0.002528	-0.225537	0.8232
LNWH^2	2.27E-05	8.45E-05	0.268046	0.7906
LNVD	0.002331	0.003498	0.666418	0.5106
LNVD^2	-0.000102	0.000139	-0.735282	0.4683
R-squared	0.426160	Mean dependent var		0.000453
Adjusted R-squared	0.262205	S.D. dependent var		0.000598
S.E. of regression	0.000514	Akaike info criterion		-12.10061
Sum squared resid	7.40E-06	Schwarz criterion		-11.70877
Log likelihood	232.8613	F-statistic		2.599258
Durbin-Watson stat	1.863247	Prob(F-statistic)		0.029127

Table D4: Residual tests – Heteroscedasticity White test
(Cross terms)

White Heteroscedasticity Test:

F-statistic	1.746585	Probability	0.117074
Obs*R-squared	19.47661	Probability	0.147525

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 05/23/09 Time: 14:51

Sample: 1970 2006

Included observations: 37

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.010830	0.032818	-0.330007	0.7445
LNR	-0.006306	0.013249	-0.475917	0.6388
LNR^2	-0.000165	0.001607	-0.102507	0.9193
LNR*LNUN	0.011244	0.007297	1.540871	0.1376
LNR*LNWH	0.003657	0.005004	0.730737	0.4727
LNR*LNVD	-0.006152	0.005148	-1.194903	0.2448
LNUN	-0.046475	0.032605	-1.425375	0.1681
LNUN^2	-5.87E-05	0.009641	-0.006084	0.9952
LNUN*LNWH	0.014816	0.015633	0.947747	0.3536
LNUN*LNVD	-0.014937	0.017907	-0.834109	0.4132
LNWH	0.008839	0.019960	0.442844	0.6622
LNWH^2	-0.000956	0.000597	-1.600764	0.1237
LNWH*LNVD	-0.002908	0.004249	-0.684553	0.5008

LNYD	0.004715	0.013518	0.348780	0.7306
LNYD^2	0.003836	0.004724	0.812024	0.4255
R-squared	0.526395	Mean dependent var	0.000453	
Adjusted R-squared	0.225010	S.D. dependent var	0.000598	
S.E. of regression	0.000527	Akaike info criterion	-11.96827	
Sum squared resid	6.11E-06	Schwarz criterion	-11.31519	
Log likelihood	236.4129	F-statistic	1.746585	
Durbin-Watson stat	1.860709	Prob(F-statistic)	0.117074	

Table D₅: Ramsey Reset test

Ramsey RESET Test:

F-statistic	1.727836	Probability	0.171870
Log likelihood ratio	8.162472	Probability	0.085805

Test Equation:

Dependent Variable: LNCEX

Method: Least Squares

Date: 05/24/09 Time: 18:12

Sample: 1970 2006

Included observations: 37

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNR	-1.763258	1.454183	-1.212542	0.2354
LNUN	0.477610	0.379076	1.259933	0.2181
LNWH	-0.273379	0.220580	-1.239366	0.2255
LNYD	-97.72326	79.09387	-1.235535	0.2269
C	253.1702	200.9595	1.259807	0.2181
FITTED^2	16.96374	13.76251	1.232605	0.2280
FITTED^3	-1.476419	1.213973	-1.216188	0.2341
FITTED^4	0.063859	0.053271	1.198752	0.2407
FITTED^5	-0.001098	0.000930	-1.180007	0.2479
R-squared	0.999848	Mean dependent var	11.57606	
Adjusted R-squared	0.999804	S.D. dependent var	1.566284	
S.E. of regression	0.021915	Akaike info criterion	-4.595517	
Sum squared resid	0.013447	Schwarz criterion	-4.203672	
Log likelihood	94.01706	F-statistic	22982.86	
Durbin-Watson stat	2.096415	Prob(F-statistic)	0.000000	

Figure D₃: CUSUM test

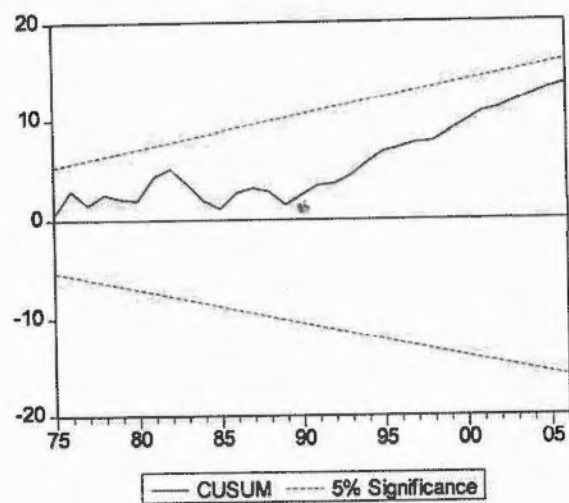
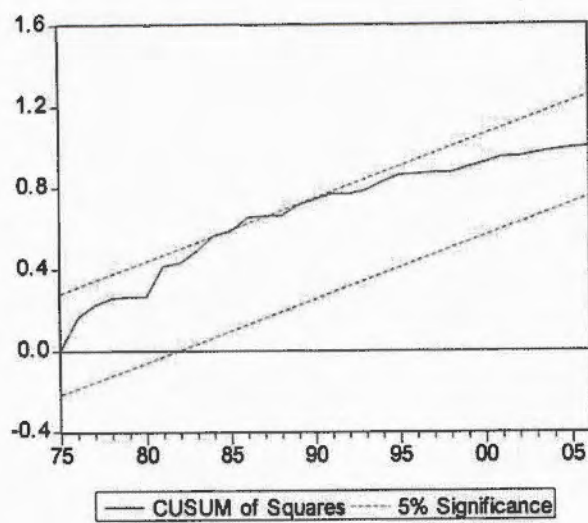


Figure D₄: CUSUM of Squares test



APPENDIX E
Table E₁: Granger-Causality Tests

Pairwise Granger Causality Tests

Date: 05/25/09 Time: 16:39

Sample: 1970 2006

Lags: 5

Null Hypothesis:	Obs	F-Statistic	Probability
LNR does not Granger Cause LNCEX	32	4.03260	0.01011
LNCEX does not Granger Cause LNR		2.51177	0.06220
LNUN does not Granger Cause LNCEX	32	0.84128	0.53559
LNCEX does not Granger Cause LNUN		2.11973	0.10298
LNWH does not Granger Cause LNCEX	32	2.30173	0.08137
LNCEX does not Granger Cause LNWH		6.03239	0.00130
LNYP does not Granger Cause LNCEX	32	1.88967	0.13910
LNCEX does not Granger Cause LNYP		1.47800	0.23903
LNUN does not Granger Cause LNR	32	0.93781	0.47698
LNR does not Granger Cause LNUN		0.53231	0.74941
LNWH does not Granger Cause LNR	32	0.95193	0.46882
LNR does not Granger Cause LNWH		2.76300	0.04534
LNYP does not Granger Cause LNR	32	1.72223	0.17335
LNR does not Granger Cause LNYP		0.98113	0.45230
LNWH does not Granger Cause LNUN	32	0.25278	0.93366
LNUN does not Granger Cause LNWH		2.96404	0.03536
LNYP does not Granger Cause LNUN	32	2.51216	0.06217
LNUN does not Granger Cause LNYP		0.67033	0.65029
LNYP does not Granger Cause LNWH	32	4.36229	0.00703
LNWH does not Granger Cause LNYP		0.72795	0.61028

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