

**MONETARY POLICY TRANSMISSION IN SOUTH AFRICA: THE PRIME  
RATE-DEMAND FOR CREDIT PHASE**

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## **ABSTRACT**

A voluminous literature attempts to explain the various channels of the monetary policy transmission mechanism through which central banks ultimately achieve price stability. However, most research focuses on interest rate pass-through and the demand for money phase, while there is limited research on the demand for credit. This study endeavours to contribute to the understanding of this neglected phase of monetary policy transmission by exploring the response of the real demand for bank credit by the private sector to changes in the real prime rate from 1990:1 to 2004:4 in South Africa.

Firstly, the behaviour of the real prime rate in relation to the repo rate is explored using graphical analysis. The study observes that an increase in the repo rate causes an increase in the real prime rate, such that there is always a margin of three or four percentage points between the two rates. Secondly, using secondary data, the Johansen methodology is used to determine the relationship between the demand for bank credit and its determinants (GDP, inflation, real prime rate and real yield on government bonds). Two cointegrating relationships are found. The Gaussian errors from one cointegrating vector are used to model the Vector Error Correction Model, which provides the short-run dynamics and the long-run results, through the use of Eviews 5 software.

The results of the study show that while all other variables are negatively related to the demand for bank credit in the long-run, GDP has a positive influence. In

the short-run, yield on government bonds and inflation coefficients depict a positive association, while the coefficients of real prime rate and GDP are negative. The error correction coefficient is -0.32, which implies that a 32% adjustment to equilibrium happens in the demand for bank credit in a quarter and that the complete adjustment takes about three quarters to complete. Thirdly, the generalised impulse responses results indicate that the impact on the real prime rate affects the demand for bank credit from the first quarter. The study concludes that the real prime rate has a negative impact on the demand for credit both in the short-run and long-run.

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## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 CONTEXT OF THE STUDY**

Throughout the world, most central banks' monetary policy initiatives aim to achieve and maintain price stability and the South African Reserve Bank (SARB) is no exception. The SARB's primary objective<sup>1</sup> of monetary policy is to protect the value of the currency (attain price stability) so as to obtain balanced and sustainable real economic growth in the economy over the medium and long-term (Mboweni, 2000a:1).

In order to attain price stability, the SARB sets in motion a sequence of economic events (referred to in the literature as the transmission mechanism of monetary policy) through its monetary policy operational framework. The speed and effectiveness of this sequence of events greatly depends on the structure and the depth of the economy's financial system (Loayza and Schmidt-Hebbel, 2002:9). In the South African context, the banking system and the money market are the first link in the transmission mechanism. This means that banks have a paramount effect on the effectiveness of monetary policy and have the potential to either facilitate an environment that promotes stability or that may contribute to financial instability.

The SARB has adopted the cash reserve system of monetary control in order to influence the inflation outcome. This framework is centred on influencing the overall lending policies of banks and the demand for money and credit through changes in bank liquidity and interest rates in the money market (Faure, 2003a:21).

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<sup>1</sup> This objective is clearly articulated in both the Constitution of the Republic of South Africa, Act No. 108 of 1996, and in the South African Reserve Bank, Act No. 90 of 1989.

The cash reserve system involves the creation of a bank liquidity shortage by the SARB. The SARB creates this liquidity shortage (also called a money market shortage) using the cash reserve requirement ratio on banks and various types of open market operations. In this context, liquidity refers to the cash balances of the banks at the SARB that are in excess of the mandatory balances and are available to the banks to settle transactions with their counterparts (South African Reserve Bank, 2002:1). Due to the liquidity shortage perpetuated by the SARB, the banks will be bound to borrow cash reserves.

In order to assist the banks to meet their liquidity deficiency, the SARB always keeps its discount window open so that the banks may borrow cash reserves. The SARB charges the banks the repurchase agreement (repo) rate for the cash reserves. Since the repo rate is generally higher than the market call rates, the banks first compete for finances in the private bank-to-bank interbank market in order to avoid borrowing from the SARB (Faure, 2005:69). In the event of not being able to fund themselves in the interbank market, the banks will be compelled to borrow funds from the SARB. They borrow by selling eligible securities (treasury bills, Land Bank bills, central government bonds and Reserve Bank debentures) to the SARB, in return for cash reserves and paying the repo rate on the cash reserves they receive (Du Plooy, 1998:3).

The repo rate has a substantial influence on the private bank-to-bank interbank rate and the wholesale call money rate, which in turn influence the other lending and deposit rates (Faure, 2005:130). The lending rate charged by banks for their lending to individuals and firms (prime rate) will exceed the repo rate by a margin sufficient to cover transaction costs and the default risk (Whittaker, 2003:5). This adjustment in the lending rate in turn influences the demand for bank credit.

However, the question of the extent to which the demand for bank credit responds to changes in lending rate is an empirical one. In order to determine the responsiveness of the demand for bank credit to the changes in the lending rate,

the few studies that explore this relationship have suggested different models which are grounded on different theories. The main theories that the studies have drawn from are the post-Keynesian and Fisherine theories.

The empirical work on credit demand was explored as early as the 1930s by Tinbergen and several developments in modelling demand for credit have been made since then. There has been a shift from using single equations to the currently prominent estimation procedure called the cointegration, error-correction framework. Most of the recent studies that model the demand for bank credit, for example Fase (1995), Ghosh and Ghosh (1999), Howells and Hussein (1999), Calza *et al.* (2001a) and Ikhida (2002), explore the dynamics of the relationship between the lending rate and the demand for bank credit by employing the cointegration, error-correction framework. All these studies found that there was a negative relationship between the lending rate and bank credit demand.

## **1.2 GOAL OF THE STUDY**

A voluminous literature attempts to explain the various channels of the monetary policy transmission mechanism (see, for example, Mishkin (1995), Faure (2003a) and Smal and De Jager (2001)<sup>2</sup>). However, most research focuses on the interest rate pass-through and the demand for money phase, while there is limited research on the demand for credit. This study endeavours to contribute to the understanding of this phase of the monetary policy transmission by studying this much-neglected area. The primary goal of this study is to estimate the responsiveness of the demand for bank credit by the private sector to changes in bank lending rates (prime rate) in South Africa. As part of the overall objective, the following sub-objectives will be addressed: firstly, a brief examination of the prime lending rate behaviour in relation to the repo rate is made. Secondly, the study analyses the determinants of bank credit demand, giving special emphasis

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<sup>2</sup> The studies by Faure (2003a) and Smal and De Jager (2001) outline the South African monetary policy transmission mechanism.

to the prime lending rate and finally, the study determines how long it takes for the prime rate to influence bank credit.

The study of this kind of relationship is not only timely, but also relevant, given the prominence of bank credit's influence in the conduct of monetary policy and its significance for economic activity in South Africa. In addition, studying this relationship will show whether credit demand is responding in the manner in which the monetary authorities are expecting it to behave for monetary policy to be effectual.

## **1.2 STRUCTURE OF THE STUDY**

This study consists of six chapters, including this chapter. Chapter two lays the groundwork for the study. This chapter is dedicated to the discussion of monetary policy implementation and the legal, as well as the institutional factors that facilitate the smooth transmission of monetary policy. Within the discussion, this chapter gives a brief examination of the behaviour of the prime rate in relation to the repo rate by making use of the secondary data from the various issues of the South African Reserve Bank's Quarterly Bulletin. It covers the period, 1998-2004 and makes use of a graphic representation of the relationship. This addresses sub-objective one.

Chapter three reviews the theoretical and the empirical work that explored the demand for bank credit (models). The various determinants of the demand for bank credit that can be used in modelling the demand for bank credit in South Africa will be derived from this chapter.

In chapter four, the demand for bank credit by the private sector in South Africa is modelled. The study considers the common determinants of the demand for bank credit derived from the review of the literature in chapter three. In addition, the study will discuss the historical background of the bank credit market in South Africa and the stylized facts about bank credit to the private sector in South

Africa. It is important to discuss the historical background of the South African bank credit market because it will highlight the factors that have specifically contributed to the outcome of the demand for bank credit over the period of the study that could be included in the model.

In addition, this chapter discusses the methods that the study uses to accomplish the second and third sub-objectives. To meet the second sub-objective, the study employs the cointegration, error correction framework, which combines the long-run relationships between economic variables with their short-run dynamic properties. The underlying concept of this method is discussed and the various steps involved in the procedure are outlined. Finally, the impulse response analysis, which is used to accomplish the third objective, is explained.

In Chapter 5, the research results are presented, interpreted and evaluated against the findings of other studies in the field. Chapter six gives a summary of the conclusions of the study. It also presents recommendations for further research in the area of monetary policy transmission, in particular, the prime rate-demand for credit phase.

## **CHAPTER TWO**

### **MONETARY POLICY IMPLEMENTATION FRAMEWORK**

#### **2.1 INTRODUCTION**

Monetary policy transmission is a complex and interesting topic. There are several channels of monetary policy transmission. However, the most prominent one at present in South Africa is the traditional interest rate channel. The critical element of this monetary policy transmission mechanism is the degree and speed at which changes in the short-term policy rate pass-through to other interest rates in the economy (Bredin *et al.*, 2001:3). The sequence of events involved in this channel generally starts with an indirect influence by the SARB monetary policy authorities on the overall lending policy of banks through changes in bank liquidity and interest rates in the money market (South African Reserve Bank, 1997:6).

The nature and scope of the sequence of policy events largely depends on structural, legal and institutional features of the country's financial system (Fourie *et al.*, 1996:256). In essence, the economy's financial market, legal and institutional arrangements greatly contribute to the extent and speed of the transmission of monetary policy decisions in that economy.

#### **2.2 INSTITUTIONAL ARRANGEMENTS AND AUTONOMY OF THE SARB**

The SARB was established in 1921 as the central bank of South Africa in terms of the Currency and Banking Act of 1920 (Gidlow, 2003:49). Among other responsibilities, the SARB is responsible for the formulation and implementation of monetary policy in South Africa (The Constitution of the Republic of South Africa, Act 108 of 1996: section 223). The Constitution of the Republic of South Africa, Act No.108 of 1996 and the South African Reserve Bank Act No.90 of 1989 both clearly articulate this responsibility.

In order to enable the SARB to execute monetary policy, the Constitution of the Republic of South Africa has given the Board of the SARB an important degree of independence from short-term political pressure. Autonomy or legal central bank independence refers to the freedom of the SARB to pursue monetary policy that is free from political dictation. According to the Constitution of the Republic (Act 108 of 1996: section 224(2)), in pursuit of its primary objective (explained in chapter one), the SARB must perform its functions independently and without fear, favour or prejudice. However, the SARB must regularly consult the Cabinet member responsible for national financial matters (Minister of Finance).

The various governments give the central banks independence so that they may attain price stability by means of three mechanisms: increasing the credibility of commitment to price stability, ensuring that the central bank gives price stability preference over short-term public sector goals, such as unemployment (guarding against inflation bias), and implementing barriers to financing government debt (Posen, 1993:42). The significance of ensuring that price stability has preference over other macroeconomic objectives is to avoid the problem of time inconsistency. This refers to the policymakers' tendency to choose suboptimal monetary policy decisions. An example of such a policy might be the monetary authorities' decision to reduce the level of unemployment at the expense of a higher average inflation rate, even though the monetary authorities could achieve that same level of unemployment at a lower rate of inflation.

It is important to state that the legal independence granted to the SARB only dictates a degree of freedom to use the monetary policy tools at its disposal to achieve monetary stability<sup>3</sup> (Van den Heever, 2001:175). It does not give the SARB the freedom to pursue its own goals. This means that the SARB is given instrument independence and not goal independence. In addition, giving the

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<sup>3</sup> It is the government that sets monetary policy objectives, for example, the inflation target, and not the SARB. All the SARB does is use the tools to pursue the set target.

SARB independence does not guarantee that it will use the instruments accordingly for manoeuvring monetary policy into the right course. Rather, it positions the central bank that is committed to achieving price stability to do this, without any form of pressure from the government.

### **2.3 ACCOUNTABILITY AND TRANSPARENCY**

As a creation of the government, the SARB is not independent. It is accountable to Parliament and the Government has an important say in its activities (Mboweni, 2000a:2). Sections 31 and 32 of the Reserve Bank Act of 1989 ensure that the SARB does not pursue its own objectives; rather, that it uses its discretion to achieve price stability.

In terms of the Reserve Bank Act (1989: section 31), the Governor of the SARB must submit an annual report on the pragmatic implementation of monetary policy to the Minister of Finance. In this way, if the SARB fails to meet the monetary policy targets, the governor has to explain the causes of the failure. Section 32 states that the SARB must submit a monthly statement of its assets and liabilities and its annual financial statements to the Department of Finance. The Minister of Finance then lays these reports upon the table in Parliament. In addition, the governor of the SARB might be summoned to appear before the Parliamentary Portfolio Standing Committee on Finance to explain its monetary policy stance and to address questions on its view of financial and economic developments.

Furthermore, according to Section 37 of the Reserve Bank Act of 1989, if the Minister of Finance realises that there has been a deviation from the primary objective or a failure to comply with any provision of the Act, he may give notice to the Board of the Bank in writing to ask them to rectify the default within a specific time span. If the Board fails to comply with the notice, the Minister may apply to the court for an order compelling the Board to deal with the default.

These sections of the Act attempt to guarantee accountability by increasing the transparency of the authorities' conduct of monetary policy. Following the adoption of inflation targeting in South Africa, the SARB intensified its efforts to communicate and clarify monetary policy, not only to the government, but also to the public at large. This manner of transparency not only creates public interest and improves the understanding of monetary policy, but it also enables the SARB to defend itself more easily against any undermining of its authority through government pressure (Wagner, 2000:65). Moreover, transparency of monetary policy decisions regarding price stability improves the predictability of monetary policy and helps ensure that the market participants' expectations are consistent with the price stability objectives and this improves the effectiveness of the operation of inflation targeting (Mboweni, 1999:400).

Monetary authorities have taken several practical steps in order to enhance transparency and public understanding of and support for monetary policy. These are the public announcement of the inflation target, explanation of monetary policy decisions in a statement that the SARB issues following each seven-weekly meeting of the Monetary Policy Committee (MPC) and discussion of the macroeconomic developments and monetary policy actions in the SARB's various publications (Van den Heever, 2001:175). The publications include the Quarterly Bulletin, Annual Economic Review and the Governor's Address at the annual meeting of shareholders.

The monetary policy authorities also hold the Monetary Policy Forum twice a year in major centres. The forum facilitates an avenue for a discussion on monetary policy decisions and general economic developments and ensures that the interested market participants get an opportunity to convey their views and that the authorities include these views in the determination of monetary policy (Mboweni, 2000a:3). Moreover, the SARB publishes the Monetary Policy Review twice a year. The review analyses developments in South Africa and the rest of the world that could affect inflation and describes the decisions taken by the

SARB. Finally, the governor regularly appears before parliament and participates in public discussions (Van den Heever, 2001:176).

## **2.4 THE OBJECTIVES OF MONETARY POLICY**

The primary objective of the South African Reserve Bank as earlier explained, is to “*protect the value of the currency in the interest of balanced and sustainable economic growth in the Republic*” (Constitution of the Republic of South Africa, 1996: section 224(1)). The SARB has interpreted this to mean that it has to achieve and maintain price stability in order to attain the ultimate goal of sustainable economic growth (Mboweni, 2002:1). This does not imply that the central bankers have no interest in other macroeconomic objectives, such as unemployment reduction. Rather, the monetary policy authorities believe that they will contribute to maximum economic development by achieving and maintaining a low, stable and predictable level of domestic inflation (Mboweni, 2002:1). In turn, a low inflationary environment requires a stable financial environment - financial stability (Mboweni, 2000a:1).

### **2.4.1 Financial stability**

In order to achieve monetary stability (inflation target) in South Africa, the monetary policy authorities firmly aim for the ultimate objective of establishing and maintaining a stable financial environment over the medium and long-term (Van der Merwe, 1999:231). The SARB does not regard financial stability as an end in itself. Rather, it considers it as the key area of proficiency and the best contribution that the SARB can make towards sound and sustainable macroeconomic growth and development (Mboweni, 2000a:1; Wessels, 2004:141).

Before engaging in a discussion on how the SARB attempts to achieve financial stability, it is important to define it. The definition of financial stability is important in that it predetermines the conduct and the role of monetary policy in achieving financial stability (Issing, 2003:1). Though there is an ongoing debate with regard

to the generally accepted definition of financial stability, (see Issing, 2003), most papers, for example Mboweni (2000b:1), give a definition that is system-based, as opposed to the definition that is based on volatility of directly observable financial variables.

The system-based definition of financial stability refers to a "*situation in which the capacity of financial institutions and markets to efficiently mobilize savings, provide liquidity and allocate investment is maintained unimpaired*" (Crockett, 2002:1). On the contrary, volatility-based definitions "*equate financial stability with situations without banking crisis and with asset price stability, including interest rate smoothness, relative to some benchmark*" (Issing, 2003:1).

According to the system-based definition (which is the definition in operation in South Africa), financial stability does not exclude periodic failure of individual financial institutions and fluctuations in financial asset prices (Mboweni, 2000b:1). The failure of an individual financial institution and fluctuations in the asset prices are of concern only if the swings in asset prices result in a severe misallocation of capital and if the individual institutions lead to systemic risks, that is, impair the intermediation role of the entire financial system (Crockett, 2002:1; Mboweni, 2000a:1; Issing, 2003:1).

Financial stability has two elements, namely, monetary stability and the stability in the financial sector. These are clearly entrenched within the definition of financial stability by the SARB. In the South African context, financial stability refers to a situation in which the rate of inflation is not a major concern of the people in making any economic decisions and they have a high degree of confidence that the financial institutions and financial markets are able to meet their contractual obligations without external assistance (Mboweni, 2000a:4).

The two elements of financial stability, price stability and stability of the financial sector are highly correlated and have a two-way causal relationship. Failure to

control inflation or bring it to lower levels can lead to tighter monetary policy, exorbitant interest rates, an increase in the non-performing loans of banks and a fall in asset and collateral values, which can cause failures in the financial sector (Faure, 2003a:3). Such disruptions in the financial system will weaken the effectiveness of monetary policy in the economy and could materially affect changes in price levels.

#### **2.4.1.1 Stability in the financial sector**

As mentioned earlier, attaining stability in the financial sector is vital and conducive to attaining a low and stable level of inflation. It is important because the central bank largely implements monetary policy through its operations in financial markets, and the transmission of monetary policy into the real economy depends crucially on the smooth functioning of key financial institutions and markets (Ferguson, 2003:8). Recently, stability in the financial sector has increased in significance because the financial sector now plays a greater role in resource allocation, due to the advances in information technology and financial liberalization, which underpinned a quantum leap in the role of the financial environment in shaping economic outcomes (Crockett, 2002:2).

The South African financial sector encompasses the banking, insurance and securities industries (Hawkins, 2001:4). Different independent regulators regulate all these three components of the financial sector. The Registrar of Banks, which comprises of the Bank Supervision Department of the South African Reserve Bank, regulates the banking industry. The Financial Services Board (FSB) regulates both the insurance and the securities industry, although the JSE Limited is the actual, although not official, daily regulator (Hawkins, 2001: 7).

Although all these components of the financial sector are significant to the stability of the financial system as a whole, the banking industry is the most strictly regulated. This mainly emanates from the uniqueness of the banks' capital structure and their liquidity production function, which makes banks more

susceptible of instabilities in the financial sector. According to Macey and O'hara (2003:97), the banks' capital structure is unique in two ways. Firstly, banks have a tendency to hold very little equity in comparison with other institutions. Secondly, the banks' liabilities are mostly in the form of deposits. The deposits are available to the depositors on demand whereas their assets often take the form of long-term loans that cannot be 'called-in' or easily sold if the bank needs to pay its depositors. Consequently, this exposes banks to maturity/liquidity mismatch, which in turn poses risks such as liquidity risk<sup>4</sup> and systemic risk (Gidlow, 2003:6).

The Bank Supervision Department of the SARB seeks to counteract these risks and therefore achieve stability in the banking industry by means of two policy initiatives (Gidlow, 2003:60). The first policy initiative of the Banking Supervision Department of the SARB is to ensure that banks manage their risks in a manner that minimizes systemic risk in the banking sector, thereby ensuring the safety of the depositor's money. This is vital because efficient monetary policy transmission to the economy at large requires a sound banking system (Nel, 1995:2). Secondly, the SARB acts as a lender of last resort when banks face adverse financial pressures. It is important that the SARB act as a lender of last resort because financial stability also requires well-developed markets that are efficient in the provision of finances.

#### **2.4.1.1.1 Risk management in the banking industry**

Since authorities license the financial institutions to operate only if they can prove that their operations support the objectives of the regulatory authorities, the strategies they adopt have to be consistent with the objectives of the regulators (Falkena and Llewellyn, 1999:1). The overall objective of the Bank Supervision Department of the SARB is to contribute domestically and internationally to the stability and efficiency of the banking system and depositor protection (Faure,

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<sup>4</sup> Liquidity risk is a "risk that a depository institution will not have sufficient cash or liquid assets to meet borrower and depositor demand" (Van Zyl *et al.*, 2003:401).

2002:38). The three objectives of the regulatory authorities in South Africa are: 1) to ensure a safe and sound financial system, 2) to enhance the confidence of and fairness to investors and 3) to ensure an efficient and effective financial system (Falkena and Llewellyn, 1999:1). These are discussed further below.

### **1) *Safety and soundness of the financial system***

The financial system has to be safe in order to facilitate an environment in which the public can freely trade without fear of losing their savings and investments. If the financial system is neither safe nor sound, the banking sector is bound to impose uncertainty on both business partners and the regulatory authorities. The banks need adequate capital, sufficient liquidity at all times and adequate transparency towards their shareholders and clients in order to be safe and sound (Falkena and Llewellyn, 1999:5). The regulatory authorities establish the safety and soundness of the financial system through the capital adequacy requirements, adequate liquidity requirements and an acceptable profitability profile.

The measure of profitability used by the regulatory authorities in South Africa is return on shareholders' equity (ROE) and the widely accepted global target is 15% of ROE (Falkena and Llewellyn, 1999:22). ROE focuses on the management's ability to generate profits per rand of the shareholders' equity. The significance of monitoring the ROE lies in the fact that it supports greater confidence in a financial institution. In turn, confidence encourages the market participants to save with and borrow from the banks.

On the other hand, adequate liquidity requirements contribute to the soundness and safety of the banks by enabling the banks to determine the extent of their liquidity mismatch because of the combination of their transactions. The liquidity mismatch shows the extent to which interest-bearing assets exceed interest-bearing liabilities at different terms (Nel, 1995:4). The major risk that this mismatch causes is the liquidity risk. The SARB reports liquidity risk in Form DI

300 (Nel, 1995:4). The SARB controls this risk through the 'repo' rate accommodation policy of the monetary policy authorities, which deals with unexpected liquidity demands.

The third way of maintaining a sound financial system is through imposing capital adequacy requirements on the banks. Capital has to be of high quality, readily available and adequate to meet both regulatory requirements and the banks' own requirements (Mboweni, 2004:2). The significance or reason behind the capital requirements is to ensure that financial intermediaries operate in ways that are financially prudent and fiscally sound (Allen, 1997:121). Moreover, adequate capital serves as a cushion that protects creditors' (depositors and other market participants that provided loan finance) claims against the losses that the banks might incur (Nel, 1995:2; Allen, 1997:121).

South Africa adheres to the capital-adequacy guidelines for banks set by the Basel Committee on Banking Supervision. Although the capital ratio stipulated by the Capital Accord is 8% of risk weighted assets, the South African banks maintain 10% of risk weighted assets as mandated by the Registrar of Banks in 2001 (Mboweni, 2004:2). Information on capital adequacy requirements is available in Form DI 400 of the South African Reserve Bank Quarterly Bulletin.

## **2) Confidence and fairness**

The financial institutions have to obtain the confidence of and show fairness to the users of their financial services by providing adequate services and protecting their invested funds against the consequences of default (Nel, 1995:6). This involves eliminating bad business practices and possible conflicts of interests and facilitating transparency, integrity and good corporate governance (Falkena and Llewellyn, 1999:1).

### **3) Efficiency and effectiveness**

An institution needs to be robust to face competition from various institutions, whether local or international. Robustness refers to the ability of the financial system to remain stable and efficient under a wide range of market conditions and shocks (Falkena and Llewellyn, 1999:22). The greater the efficiency, the greater the potential returns for shareholders and the greater its robustness to withstand unexpected shocks.

An institution should not only be efficient, but also effective in its supply of financial services. The institution's services should be available to a broad spectrum of clients. In South Africa, the efficiency of the banking sector is determined by expressing operating expenses as a percentage of total income (Hawkins, 2001:25). The efficiency ratio in South Africa was 65% by the end of October 2004, which was good when taking into account that the international benchmark for efficiency was 60% in 2004 (Mboweni, 2004:2). One of the factors that contributed to greater efficiency is increased competition since the democratization of South Africa.

The regulatory authorities have undergone several developments in an attempt to make financial services more accessible, since the vast majority of the population in South Africa does not have satisfactory access to the formal banking sector (Kruger, 2004:4). Some of these developments include the creation of tiers in the banking system to allow smaller and more diverse institutions to participate in emerging markets and to make financial services more accessible to different classes in society (Kruger, 2004:4).

#### **2.4.1.1.2 SARB as a lender of last resort**

The role of the lender of last resort (LLR) is common to central banks around the world. However, it differs across the central banks in terms of the operational framework through which central banks operate in their role as LLR. The LLR function entails making credit facilities available to the banks at the central bank

when the banks experience a liquidity shortage that other financial or non-financial institutions cannot readily satisfy (Fourie *et al.*, 1996:59).

While this facility is available to the South African banks, the Banking Supervision Department points out that this facility is not automatic and might not be accessible where there is suspicion of fraud (Hawkins, 2001:12). The SARB extends accommodation in several ways that will be discussed later.

#### **2.4.1.2 Achieving and maintaining price (monetary) stability**

Price stability is achieved when changes in the rate of inflation do not materially affect the economic decision-making process of market participants (Stals, 1997:1). This implies that even though the relative price movements will still have an impact on production, consumption and investment, the rate of inflation is not an important factor in the decisions taken by producers, consumers and the authorities under stable price conditions (Mboweni, 2000b: 1).

In order to attain price stability, which is to maintain the inflation rate within the targeted range of 3-6%, the SARB has adopted an inflation-targeting framework. Inflation targeting is a monetary policy framework whose primary aim is to reduce inflation or maintain price stability (South African Reserve Bank, 2001:3). This framework is characterized by a public announcement of the inflation target, increased transparency of monetary policy decision making, the accountability of central bank to achieve the target and a commitment to price stability as a primary monetary policy goal.

Inflation targeting involves forecasting the future path of inflation and then using the discrepancy between the inflation forecast and the actual level as an indicator of how much monetary policy should be adjusted (Debelle *et al.*, 1998:2; Green, 1996:793). A central bank first chooses a target for the long-run nominal interest rate, based on its inflation target, and then uses the interest rates to maintain the target level. When the expected rate of inflation deviates from the desired target,

the monetary policy authorities assertively respond by increasing interest rates above the long run target level by more than the increase in the expected rate of inflation. However, they do not adjust the interest rates by a large percentage. They make relatively small changes at a time in order to make monetary policy effective.

This policy has no operational rules regarding the choice of monetary policy instruments that the SARB may use. The SARB uses all available information and the instruments at its disposal to achieve the set target of 3-6%. The set target range helps to stir and coordinate the anti-inflationary force within the economy around a particular numerical value. This in turn strengthens the commitment to price stability.

In order to meet the target, the SARB has, since March 1998, adopted an operational control framework that specifies the repurchase agreement rate as its operational variable of monetary policy (Gidlow, 2003:55). As an instrument of monetary policy, refinancing system (accommodation policy) derives its importance from the fact that it enables the central bank to exert a dominant influence over the level of money market rates and other short-term interest rates (Fourie *et al.*, 1996:252). As in the previous system, where the bank rate was the policy variable, the SARB uses its refinancing system as the main mechanism to influence bank liquidity, interest rates and, ultimately, monetary stability. Concisely, the overall mechanism or implementation of monetary policy through which the SARB intends to influence the economy is similar.

## **2.5 THE MONETARY POLICY IMPLEMENTATION FRAMEWORK**

### **2.5.1 Estimating money market shortage**

The initial step involved in the current implementation system is the estimation of the liquidity shortage in the banking sector. The SARB estimates the banks' overall liquidity requirement on a daily basis. It is in the best position to estimate the daily liquidity requirement because it is the sole creator or destroyer of

liquidity and it has the best overall market information about the factors influencing liquidity (South African Reserve Bank, 2002:3). In order to arrive at the overall market information, the SARB authorities take into consideration all transactions that either expand or contract the domestically registered banks' balances at the SARB. The SARB is able to observe the changes in banks' balances because the locally registered banks have to keep the reserve accounts<sup>5</sup> and current accounts with the SARB. These accounts can be observed in the general SARB balance sheet in Figure 2.1 below.

Figure 2.1 General SARB balance sheet.

SARB	
Liabilities	Assets
A. Bank notes and coin	F. Foreign assets
B. Deposits	G. Claims on government
1. Banks (Cash reserves) accounts	H. Repo assets
a. Required	I. Other assets
b. Current (usually=0)	
2. Government	
C. Foreign loans	
D. Reserve Bank securities	
E. Other liabilities	

Source: Faure, 2003a:6

The required reserve account represents the balances held by the banks in terms of the statutory cash reserve requirement. The balances in the required reserve accounts are a specified percentage of the banks' deposit liabilities, while the current accounts of the banks are where all the excess reserves are held (Faure, 2003a:26). Since the banks do not earn any interest on the current accounts they maintain with the SARB, the banks have an incentive to avoid surplus balances and keep this account at almost zero. The banks are to some extent encouraged to maintain their current accounts at zero or as small as possible, in the sense that the SARB rectifies any cash balance deficiency the banks may incur at the discount window (Meijer, 1997:5).

<sup>5</sup> B1a represents the reserve account and B1b represents the current account of the banks with the SARB in the central bank's balance sheet above.

It is worth mentioning that it is only the transactions that take place between the banks and the SARB that create a money market shortage (H) and not the transactions between the banks themselves (South African Reserve Bank, 2002:2). Item H in the above balance sheet represents the money market shortage. Since in a balanced balance sheet liabilities are equal to assets, item H must be equal to all liability items in the SARB's balance sheet minus all the remaining asset items. Hence, a rise in liability items will increase the money market shortage, while an increase in the asset item will reduce borrowed reserves.

In most cases, the SARB is responsible for the changes in the other balance sheet items (besides H) (Faure, 2002:105). *"It is important to note that these so-called causes of changes in the money market shortage are merely the statistical causes. The actual or real causes are the underlying transactions of the Reserve Bank itself (called managed factors) or the public (called unmanaged factors) that bring about changes in the balance sheet items"* (Faure, 2002:105). For example, the money market shortage will rise if government deposits (B2) rise (underlying transaction: the SARB transfers government funds from the tax and loan accounts to the exchequer account) and fall if the cash reserve requirement falls (underlying transaction: a reduction in the cash reserve requirement percentage) (Faure, 2003:29).

The SARB also regularly forecasts what the money market shortage will be without its deliberate intervention (Meijer, 1997:3). The SARB analyses these estimates along with the information derived from the banks' accounts with the SARB and then estimates the overall money market shortage.

### **2.5.2 Creating a money market shortage**

The main tools that the SARB uses in order to create money market shortage are cash reserve requirements and various types of open market operations. However, several other transactions increase the liquidity shortage. West

(2005:16) outlines some of the examples of these transactions to be an increase in notes and coins in circulation outside the SARB, an increase in the deposits of the government with the SARB and the selling of gold and other foreign reserves by the SARB to the banks. The main reason that the SARB creates a liquidity shortage is to enhance the effectiveness of the repo rate as a tool of monetary policy.

### **2.5.2.1 Cash reserve requirements**

A reserve requirement is an obligation on a bank to hold deposits with the central bank. In South Africa, the cash reserve requirement for banks has taken different forms at different times since the establishment of the SARB, in 1921 (Van der Merwe, 1999:240). Though the SARB currently uses the cash reserve requirement as a supplementary instrument of monetary policy from time to time, it did not initially regard it as a primary tool of monetary policy. Rather, the SARB designed the cash reserve requirement as a tool to protect liquidity, solvency and the safety of banks and other financial intermediaries (ABSA, 2000:9).

The cash reserve requirement is currently a useful monetary policy tool because it creates a demand for the SARB reserves that is crucial for the effectiveness of monetary policy (Van der Merwe, 1999:240). Nonetheless, it has several disadvantages. It complicates internal procedures of bank reserve management (Axilrod, 1997:180). Moreover, taking into account that there is increased openness and competition due to factors such as financial liberalisation across countries, the reserve requirement may place banks that are subject to it at a competitive disadvantage relative to other banks that are not exposed to this requirement. The main reason that such banks become disadvantaged is that they do not earn any interest on the funds that they maintain with the SARB, which imposes an unfair “tax” on banks and squeezes the interest margins of banks’ tax (Axilrod, 1997:180).

The SARB currently uses the cash reserve requirement to reduce the volatility of money market interest rates on a daily basis by allowing banks to utilize their cash balances to meet their cash reserve requirement and meet their daily needs (Gidlow, 2003:70). The banks now have greater flexibility in managing their daily liquidity because they are not bound to maintain the required minimum cash reserves with the SARB on a daily basis. However, the average amount of their cash reserves over each maintenance period of one month should match the mandatory reserves (Du Plooy, 1998:2).

With the introduction of the new accommodation procedures in March 1998 and in an effort to simplify the cash reserve requirement, the statutory rate was set at a single minimum cash reserve requirement ratio of 2.5% of the value of total liabilities (ABSA, 2000:10). The banks are required to hold this prescribed percentage of their total liabilities in cash in their cash reserve accounts at the SARB (South African Reserve Bank, 2002: 2).

As an instrument of monetary policy, the cash reserve requirement influences money market liquidity. This is mainly through changes in the money supply and changes in the cash reserve requirement percentage (Faure, 2003c: 24).

#### **2.5.2.2 Open market operations (OMO)**

Open market operations refers to the purchase or sale of securities, such as government bonds and Land Bank bills, by a central bank in the secondary markets for these assets, in order to support monetary policy aims (Gidlow, 2003:59). The SARB undertakes open market operations involving the purchase of securities from the banks in order to inject cash reserves into the domestic banking system and uses open market sales to drain cash reserves from the banking system (Gidlow, 1998:21).

*“Open market operations can be conducted either actively by aiming at a quantity of reserves or passively by aiming at the money market interest rate or at a*

*closely related measure of the banking system's liquidity position"* (Axilrod, 1997:198). The SARB has mainly devoted its open market operations to making small adjustments to credit conditions and interest rates in order to maintain the smooth functioning of the banking system (Gidlow, 1998:22). Economists refer to these technical adjustments in market conditions as defensive open market operations and their basic purpose is to maintain the current pattern of interest rates and banking liquidity unchanged (Gidlow, 1998:22).

Open market operations improve the flexibility of monetary policy operations in terms of time and the magnitude of the impact of the operations on monetary policy as a whole. Unlike direct controls, they avoid economic and financial market inefficiencies (Axilrod, 1997:173). Axilrod (1997:178) proposes that central banks can improve the effectiveness of open market operations by placing some limitations on the accessibility of funds at the discount window and other central bank lending facilities. An example is charging higher interest rates at the discount window or imposing restrictive rules that deter access to the central bank's credit facilities.

The SARB engages in the following open market operations: longer-term reverse repos, SARB debentures and foreign exchange swap transactions. There are generally more types of open market operations (see, for example, South African Reserve Bank, 2003:4). However, the study focuses on those that the SARB specifically uses to drain liquidity.

## **Types of open-market operations**

### **a) Longer-term reverse repurchase transactions**

Longer-term reverse repurchase transactions constitute the selling of bonds by the SARB from its monetary policy portfolio under repurchase contracts and paying interest rate tendered by the banks in return for their cash (South African Reserve Bank, 2002:2). The SARB first announces the underlying bonds and the amount of cash on offer in the reverse repurchase auction. In response, the

banks submit their bids for cash, the corresponding cash rates to the nearest 0.01% and the underlying bond (South African Reserve Bank, 2003:4). The SARB then ranks and allots these bids in ascending order and pays interest rates tendered by the banks on the cash it withdraws from the banks.

#### **b) Reserve Bank debentures**

The SARB also drains liquidity by issuing its own debentures with varying maturities of up to 91 days. The SARB auctions them weekly, normally on Wednesdays (South African Reserve Bank, 2002:2).

In the same manner as the repurchase transactions, the SARB invites the banks to offer cash on a tender basis. In reaction to the invitation, the banks make an offer in terms of interest rates payable on the SARB debentures. However, the SARB has a right to reject individual tenders and to accept individual tenders in part (South African Reserve Bank, 2003:5).

The banks submit the bids, which they express to the nearest 0.005%, either via SWIFT, the Money Market Internet System (MMIS) or by submitting original tender forms at the SARB's head office or branches (South African Reserve Bank, 2003:5). The banks sometimes make special arrangements to submit bids telephonically, but prior approval from the Financial Markets Department in Pretoria is required (South African Reserve Bank, 2003:5). The SARB then allocates debentures in ascending order of the interest rates bid, until it has fully allocated the amount on tender.

#### **c) Foreign-exchange swap transactions**

With swaps, the SARB swaps dollars for rands to drain rand liquidity from the market temporarily. These swaps are short-term transactions that normally mature before the month-ends (South African Reserve Bank, year unknown: 2)

The banks tender for dollars at the interest rate levels at which they are willing to offer rands to the SARB. In turn, the SARB sells dollars spot and simultaneously buys the same amount of rands forward over a specific period and pays the banks the interest rate that they have tendered for (Kelly, 1993:298). The banks earn the interest rate both on the premium earned from selling the dollars forward and on placing the dollars on deposit at the SARB for the particular period (Kelly, 1993:298).

### **2.5.3 Refinancing of the liquidity shortage in the interbank market**

Following the creation of the money market shortage by the SARB, the banks are obliged to seek funding from the interbank market in order to meet their daily liquidity needs and mandatory reserves. The interbank market is the market for bank loans to and deposits among various banks (Botha, 2003:69). In this market, banks do not create new funds, but only borrow and lend existing funds with one another.

It is important at this stage to delineate the interbank markets to avoid confusion. There exist two interbank markets: one in which private sector banks lend to and borrow from one another (the private bank-to-bank interbank market) and the central bank-to-private bank interbank market or the cash reserve funds market (Faure, 2005:145). The former is a two-way market and the latter a one-way market, that is, the SARB lends to the banks, but the banks do not lend to the SARB.

Both of these interbank markets play at least two crucial roles in the modern financial system. Firstly, the central banks actively intervene to guide their policy interest rates in these markets. Secondly, well functioning interbank markets allow for more efficient financial intermediation by effectively channelling liquidity from institutions with a surplus of funds to those in need (Furfine, 2002:809). This implies that a well-functioning interbank market delivers the desired allocation of

bank reserves within the banking system at the rate decided upon by the central bank.

The SARB always keeps its discount window open so that the banks may borrow cash reserves. However, the banks choose to first compete for finances in the private bank-to-bank interbank market because the repo rate that the SARB charges is generally higher than the market call rates (Faure, 2005:69).

#### **2.5.3.1 Private bank-to-bank interbank market**

It is only fair at this point to at least attempt to explain how banks know the total reserves that they owe the SARB before we delve into the discussion of what takes place in this market. The banks never know their exact balances until the final interbank clearing has taken place. Because of this, they often get involved in other transactions with other banks during office hours. The banks deposit with other banks or withdraw deposits from other banks. At the end of the final interbank clearing, the clearing banks end up with a net cash reserve position on their current accounts with the SARB (Faure, 2002:142). These net cash positions reflect the amounts owed to and by the SARB. The negative or deficit balances on the banks' accounts reflect that the banks are in contravention of the cash reserve requirement, while the banks with positive balances have a surplus on their current account balances with the SARB.

Since the SARB forbids negative balances and expects banks to settle them before the next morning (Botha, 2003:69), the banks with negative balances will endeavour to borrow reserves from the banks that have positive balances or excess reserves on their accounts. The reason for borrowing from other banks is that the only alternative is to borrow the reserves required to make up for the shortfall from the SARB at the repo rate, which is the highest short-term rate in the market, disregarding the marginal lending rate (Faure, 2002:142). On the other hand, the banks that have a comparative advantage in the deposit market and have positive balances will endeavour to lend their excess reserves to the

deficit banks on an overnight basis (Botha, 2003:70). In the context of the same bank group, for example, a large commercial bank in a group that is able to attract deposits at a lower rate than a smaller fellow subsidiary will attempt to lend to other banks in its group (Faure, 2002:140). However, due to risk aversion, the highly-rated banks that are in surplus may not always be willing to place their surplus funds on deposit with lower-rated banks, particularly those that are not in their banking group. The surplus bank may make a loan to the smaller bank against a pledge by the smaller bank to deliver securities as collateral (Faure, 2003c:7).

### **2.5.3.2 SARB-to-private bank interbank market**

However, not all the banks get funding in the private bank-to-bank market. In such instances, the banks have no other option but to borrow reserves from the SARB at the repo rate. This is mainly because the central bank is the sole source of cash reserves and it has to assume its role of lender of last resort (Faure, 2004:148). In addition, banks will be compelled to borrow from the SARB in order to maintain the cash reserve requirement of 2.5% of their deposits in cash at the SARB (Botha, 2003:69).

In order to meet the liquidity demands of the banks in deficit, the SARB keeps its discount window open. At the discount window, the SARB provides the banks with cash balances on deposit with itself. It does not provide banks with money or credit (Meijer, 1997:2). The significance of providing cash balances at the discount window or refinancing lies in the fact that it permits the SARB to implement its repo policy effectively through changes in the terms and conditions through which banks can be granted accommodation. The SARB can only effectively implement its repo policy by making variations in the rate of interest that it charges banks for accommodation, since the SARB refinances banks unconditionally (Meijer, 1997:13).

The SARB currently refinances the banks in five ways. These are the refinancing repo auctions, supplementary repo auctions, final clearing repo auctions, marginal lending facility and access to statutory cash reserve deposits (West, 2005:16).

At the auctions, the SARB provides liquidity to the banks by means of repurchase transactions. The SARB conducts fixed-rate repurchase transactions (the Monetary Policy Committee (MPC) determines the rate) with one-week maturities (South African Reserve Bank, 2003:3; Gidlow, 2001:10). Repurchase transactions are transactions “*under which funds are borrowed through the sale of short-term securities such as, treasury bills, and the simultaneous agreement to repurchase the same or similar securities after a specific time at a specified price*” (Goodspeed, 2004:47). The banks sell the securities to the SARB for a period of one week in return for cash, while paying the repo rate on the cash they receive. No actual flows of cash and securities take place. The SARB simply credits and debits the banks’ accounts with it. The SARB transfers ownership of the securities electronically in the Central Depository (CD) and the Financial Instruments Register (FIR) (South African Reserve Bank, 2002:3).

The eligible instruments that the SARB uses in its repurchase transactions are rand denominated government bonds, treasury bills, SARB debentures, Land Bank bills and coupon and principal Separate Trading of Registered Interest and Principal of Securities (STRIPS) of government bonds (South African Reserve Bank, 2003:5). The holders of these eligible assets should have full title of the assets offered for the repurchase transaction and these assets may not become redeemable during the life of the repurchase transaction for which they are used (South African Reserve Bank, 2003:3).

The SARB only allows the banks as its counterparts to tender for repurchase agreements (Du Plooy, 1998:2; Van der Merwe, 1999:247). This is primarily because the objective of the repurchase system is to regulate liquidity in the

banking system and not other markets within the economic system. However, the banks have to sign a Master Repurchase Agreement (based on the International Securities Market Association Agreement) before they can participate in the repo tenders.

The SARB restricts the amount it supplies at the main repo auction to the estimated liquidity requirement. Upon receiving the bids, the SARB allots them with the highest interest rate levels first and then lower bids are accepted until the total amount of liquidity on supply is exhausted (South African Reserve Bank, 2003:3). The SARB then publishes the yields for the valuation of securities that it accepts in repurchase transactions on Reuters Monitor Screen, InetBridge (Telerate), Bloomberg and the internet ([www.reservebank.co.za](http://www.reservebank.co.za)) at around 12:00 on Wednesday mornings (South African Reserve Bank, 2003:3). The SARB initially transfers the information to Reuters, Bloomberg and InetBridge, and only transfers to and updates information on the internet as a backup after a few seconds (South African Reserve Bank, 2003:15).

If the aggregate amount of bids exceeds the remaining allotment at the accepted lowest interest rate level, the SARB allots the remaining amount on a pro rata basis (Van der Merwe, 1999:247). This means that each bank receives a similar percentage of the amount bid for, such that the total allocation is equal to the estimated liquidity requirement (South African Reserve Bank, 2004:8).

However, when the banks tender for an amount less than the estimated liquidity, the SARB provides liquidity amounting to their individual bids (South African Reserve Bank, 2004:9). This means that the total amount that the SARB allocates is smaller than the estimated required amount. The SARB provides these funds at the weekly repo auction at the repo rate that the MPC determines (South African Reserve Bank, 2003:3).

If the amount supplied in the main weekly repo auction is less than or exceeds the banks' combined liquidity need by more than R100 million, the SARB generally squares off this position at the end of each settlement day through supplementary auctions (Faure, 2005:10). A supplementary repo auction provides additional liquidity to the banks. The SARB conducts this overnight facility at the repo rate. It does not charge a penalty rate if shortfalls or surpluses are a consequence of its miscalculation of the market's liquidity needs (South African Reserve Bank, 2002:3). The only difference between the supplementary auctions and the main auction is that in the former, the repos have a maturity period of one day and not a week, as in the case of the latter.

In the case where the actual and the estimated liquidity requirement deviate by a small amount (less than R100 million) and the SARB does not regard the deviation to be a consequence of its error in estimating liquidity requirements, the banks will have to seek funds in the final clearing repo auction (West, 2005:17). Final clearing auctions are available to the banks at their discretion. In this final clearing mechanism, the SARB funds the banks' short positions at 150 basis points above the repo rate (South African Reserve Bank, 2002:3).

If the banks fail to make use of the final-clearing repo auction, the SARB automatically squares off their accounts in the marginal lending facility. In this facility, the SARB provides liquidity against some specified collateral at a rate of 500 basis points above the repo rate (West, 2005:17). The banks endeavour to avoid borrowing under this facility due to the high penalty rate; therefore, they make use of this facility only in emergencies when they are under extreme liquidity pressure.

Another means available to the banks to meet their liquidity shortage is access to their mandatory cash reserve balances with the SARB. The banks may deposit or withdraw from their cash reserve deposit as long as they comply with the

minimum amount of cash reserves on an average basis over the full maintenance period as explained above (South African Reserve Bank, 2002: 4).

The several ways of refinancing by the SARB discussed above are all important for the efficacy of monetary policy. However, the main auctions and the supplementary auctions in which banks get funding at the repo rate are most crucial because the repo rate is central to the transmission of monetary policy. As the banks borrow from the SARB at the repo rate, the repo rate directly influences the prime overdraft rate, private bank-to-bank interbank rate and the wholesale call money rate, which in turn influences the other money market interest rates (ABSA, 2001:3; Faure, 2005:130).

## **2.6 RELATIONSHIP BETWEEN REPO RATE AND PRIME RATE<sup>6</sup>**

According to Gidlow (2002:57), the repo rate directly influences the prime overdraft rate in two ways. First, it directly influences the marginal cost of funding for the banks, that is, when the repo rate increases, the rate at which banks borrow funds increases. This in turn affects the rate at which they make loans to their clients. The effect happens across the board, such that it is not only banks that borrow in the repo auctions that are affected; even those banks that used alternative sources of finances adjust their rates. This is mainly due to the competition in the commercial bank sector. Secondly, it reflects the monetary policy stance.

There is therefore a close positive correlation between repo rate and prime rate, such that when the repo rate increases the prime rate also increases. De Jager (1998:26) summarizes this relationship in the form of an algebraic model as follows:

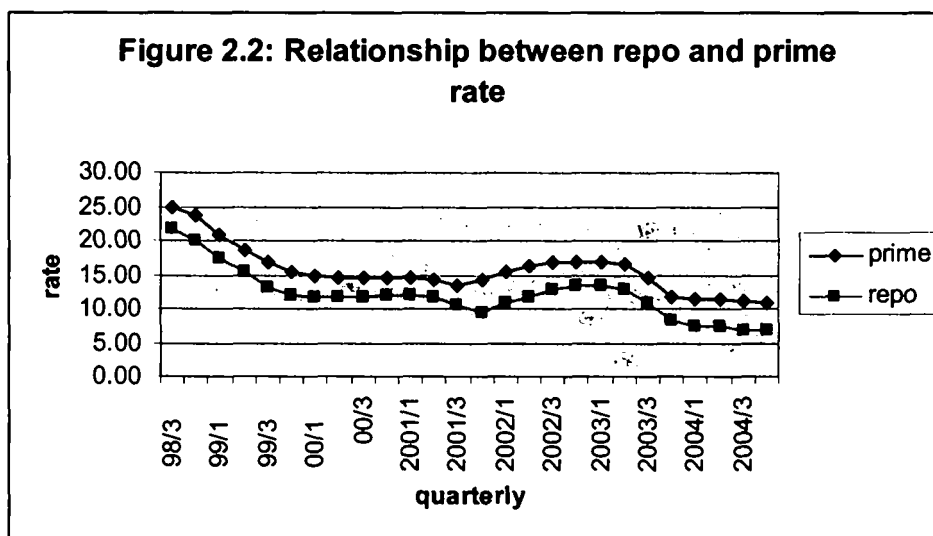
$$R_z = R_s + R_p$$

---

<sup>6</sup> The study only focused on the relationship between repo rate and prime rate. The relationship between repo rate and other money market rates is outside the scope of this study.

where,  $R_z$  denotes the rate of interest on prime overdraft facilities,  $R_s$  is the repo rate and  $R_p = (R_z - R_s)$  is the gap or margin between the repo rate and the prime rate. This equation concurs with Whittaker's (2003:5) statement that the prime rate charged by banks for lending to industries and firms exceeds the repo rate by a margin that is sufficient to cover transaction costs and default risk.

The margin between the repo rate and the prime rate is evident in Figure 2.2 below.



Source: Data was compiled from the SARB Quarterly Bulletin

Although the mandatory margin between prime rate and repo rate no longer exists, banks still informally maintain a margin between the two rates. In the same manner as when the SARB regulated the margin, banks maintain the prime rate in an average range of three to four percentage points above the repo rate (Flint, 1999:1).

It is only in periods of extreme volatility, as in 1998, that the banks struggle to maintain the three to four percentage point margin. At this time, the repo rate was extremely volatile. The prime rate increased to a peak of 25.5% around October. Following this incident, when the margin between the repo rate and the prime rate increased to four percentage points or more, the banks responded by

reducing the prime rate by approximately one percentage point at a time such that the average margin has been 3.6% since October 1998 (Flint, 1999:1).

In summary, the prime rate increases when the repo rate increases, or falls when the repo rate falls. This trend is observable from Figure 2.2. In the same manner, the prime rate does not change as long as the repo rate does not change.

## **2.7 CONCLUSION**

The SARB uses its current refinancing policy to promote financial stability by managing the liquidity needs of the banking system and to achieve the inflation target through its interest rate policy. The interest rate policy can only be effective if banks borrow from the SARB at the repo rate. In order to make sure that banks borrow from the SARB, the SARB intervenes in the money market and causes a permanent liquidity shortage through the cash reserve requirement ratio and open market operations. In this manner, banks are obliged to borrow from the SARB at the repo rate at all times. The repo rate directly influences the prime overdraft rate and the other rates of banks, which in turn affect money market asset rates. This is the first most important step in the transmission of monetary policy. The next stage in the transmission of monetary policy happens as the prime rate influences the demand for bank credit.

Several factors contribute to this effective transmission of monetary policy. When the SARB makes the initial policy decision (changes the repo rate), a stable financial environment and appropriate legal arrangements must be in place in order for the money market to effectively transmit the policy decision throughout the economy and bring expected results. The regulations that the Banking Supervision Department of the SARB imposes on the banks are important because they facilitate a safe environment in the banking sector and make a smooth transmission of policy through banks possible.

## **CHAPTER 3**

### **THE DETERMINANTS OF THE DEMAND FOR CREDIT AND CREDIT DEMAND MODELS**

#### **3.1 INTRODUCTION**

The last section of the previous chapter highlighted the fact that, following a change in the repo rate, the prime overdraft rate changes and in turn influences the demand for bank credit by market participants. This chapter reviews both the empirical and the theoretical determinants of the demand for bank credit. Traditionally, the determinants of bank credit demand have been those variables that capture changes in a firm's costs of production (Howells and Hussein, 1999:452). However, the recent developments in the financial markets due to liberalization and technological innovation have also introduced the other determinants. The main theories that will help us to recognize the other determinants of the demand for bank credit are the post-Keynesian theory and the Fisherine theory.

The dominant theory in this field of research is the post-Keynesian monetary theory of the endogeneity of credit that perceives the demand for credit to be determined by the behaviour of nominal output (Howells and Hussein, 1999:441). Howells and Hussein (1999:452) sum up the importance of the behaviour of output as a determinant of demand for credit in a statement: "state of trade" creates loan demand. The "State of trade" phenomenon of the Post-Keynesian theory focuses on firms as the source of demand for credit, captures the changes in firms' costs and volume of production, and disregards the contribution of households toward credit demand. On the contrary, the Fisherine theory focuses on the household as the unit of decision and perceives the demand for credit by the household to arise as members of households attempt to maximize utility. There is limited work in the area of study related to the Fisherine theory.

Generally, there are few theoretical and empirical works in this area. The Post-Keynesian and Fisherine theories also fail to give extensive and comprehensive theoretical grounds for the determinants of the demand for bank credit. The limited literature in this area has been the concern of several contributors in this field over time. These are some of the comments of the contributors in this field:

*“In fact, we lack any basic convention about the proper theoretical variables to measure total borrowing capacity, and therefore about the proper scale variable(s) to employ in an aggregate demand for commercial bank loans” (Melitz and Pardue, 1973:669).*

*“While economic literature contains much empirical research on the demand for money, there are surprisingly few studies on the demand for bank credit ..., this neglect is remarkable, perhaps deserving the attention of historians of economic thought” (Fase, 1995:99).*

*“Nevertheless, unlike euro area money demand, the developments of credit have received relatively little attention so far and, despite the vast literature on theoretical and empirical aspects of the credit channel, empirical evidence on the determinants of credit demand ... remains rather limited” (Calza et al. 2001a:7).*

Most of the empirical studies in this area of study focus on developed countries. Only a few empirical studies attempt to explore the demand for loans in developing countries.

## **3.2 THEORITICAL BACKGROUND**

### **3.2.1 The Post-Keynesian approach<sup>7</sup>**

The post-Keynesian analysis depends heavily on the behaviour of the monetary policy authorities in terms of accommodating liquidity shortages and the firms' production costs. Most of the postulates of this school of thought are in line with the accommodation system in South Africa, as explained above. Post-Keynesian theory postulates that the central banks always act as lenders of last resort by providing commercial banks with funds at a certain rate of interest because failure to provide finances to the banks can easily result in a liquidity crisis as customers "run" on their banks for various reasons, even because of a simple rumour on insolvency (Arestis, 1992:184). The liability management that most financial markets employ also ensures that the central bank meets the commercial banks' financial requirements, even in periods when monetary policy authorities implement contractionary monetary policy.

In this manner, the bank customers can expect a steady supply of funds, even during periods when monetary policy authorities initiate stringent credit policies (Arestis and Eichner, 1988:1008). According to the post-Keynesian school of thought, the central bank sets the policy rate at which it lends to commercial banks and the commercial banks, in turn, set their own rate at which they are ready to satisfy the firms' demand for credit to finance working capital (Arestis and Eichner, 1988:1009). The relevance of this to the credit demand model is that, all else being normal, the expectation of the availability of credit should not significantly determine the customers' demand for loans.

According to the post-Keynesian theory, the major determinant of demand for credit by firms is the firms' need for working capital finance. In turn, the determinants of the firms' needs for working capital are the expected transactions

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<sup>7</sup> The Institutionalist school of thought also holds similar views to the Post-Keynesians regarding the determinants of bank credit demand.

of the firms, whose proxy is changes in costs of production and changes in the expected level of output of the firm (Arestis, 1992:190).

### **3.2.1.1 Costs of production as determinants of the demand for bank credit**

Firms produce commodities within a particular time span and incur production costs in money terms in order to produce them. It does not matter what the stage of production is; the work in progress needs funding in order to be completed. However, since firms will only make profits in the form of cash income if they finance their working capital, be it factors of production or inventory stocks, they will be obliged to borrow from external sources (Moore, 1989:72). After they have made profits, they are able to meet their financial needs and settle their debts.

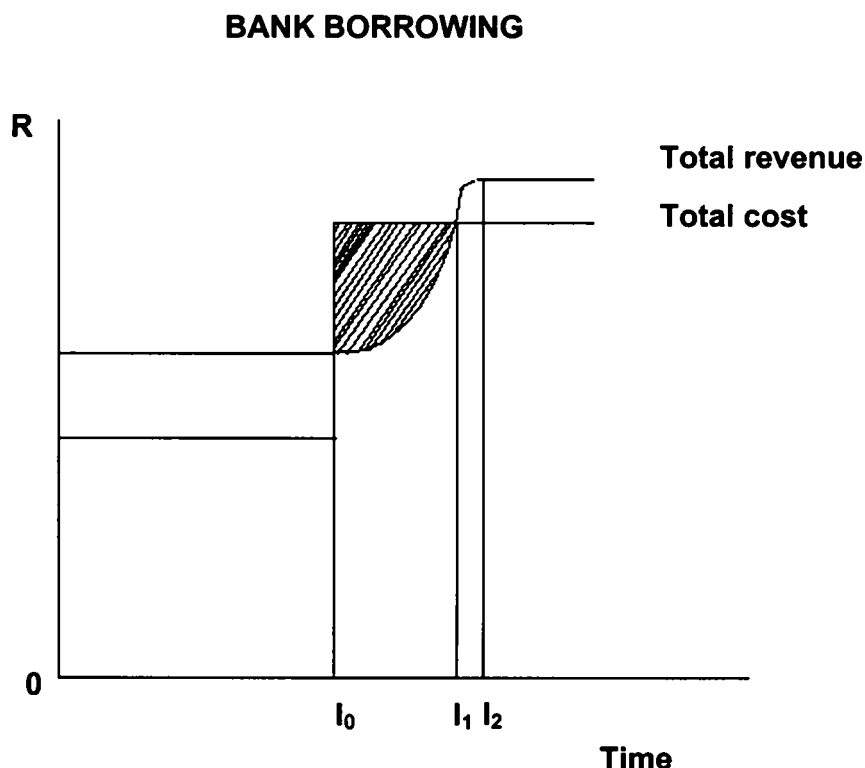
According to Arestis (1992:190), if the firms incur increases in the costs of production at some point in time, they will have to look for external financial assistance again. This is mainly because the firms do not raise their selling prices instantaneously in response to higher costs of production, but only increase the price when the higher costs of production have actually increased the cost of the finished products for sale (Moore and Smit, 1986:88). At this stage, the firms that are determined to maintain or expand their output level will demand external funding between the period of the cost increase and the period when they receive higher proceeds from sales because of higher mark-up prices (Hewitson, 1997: 128; Arestis, 1992:190).

Arestis (1992:190) explains the process with the aid of a diagram (see Figure 3.1). As in the above discussion, he assumes that:

- Production levels are constant.
- An increase in some component of costs leads to a fall in the net cash flow of the firm.

- The firm is initially in a steady state such that total revenue is greater than total costs of production by a margin that is sufficient for it to make satisfactory profit and finance its production costs.

Figure 3.1: Costs of production as determinants of demand for bank credit



Source: Moore (1983:546) in Arestis (1992:191)

At time  $t_0$ , in Figure 3.1 the firm is able to finance its costs from its profits. However, if the firm incurs high exogenous production cost during this period, it will no longer be in a position to finance all its production costs from its sales proceeds, since total costs will outweigh total revenue. In response to the increase in costs, the firm will increase its prices by a stable markup over historic normal unit costs such that total revenue increases gradually depending on the length of the production period (from  $t_0$  to  $t_2$ ). Therefore, firms will need additional capital finance until period  $t_2$ . This implies that increases in production costs such

as increases in money wage rates and raw materials costs directly result in an increase in the demand for bank loans.

In this analysis, Arestis (1992:191) considers the cost variables, such as wage bills ( $WB$ ), cost of raw materials ( $RM$ ) and tax payments ( $TP$ ). However, he comments that using the latter would not make any difference to the analysis. All these cost variables that he uses capture the expected changes in the demand for bank loans by the firms. Arestis (1992:192) captures the unexpected changes in borrowing by the firms in the ratio  $EI / FI$ , which measures the firms' external financing requirements. ( $EI$ ) is the sector's discretionary expenditure and ( $FI$ ) is the same sector's discretionary funds). Generally, discretionary expenditure has two characteristics: that of postponeability and that of external financing. Discretionary expenditure consists of investment expenditure and consumer durable expenditure (Arestis and Eichner, 1988:1010) Moore, 1988:1009), while discretionary funds represent the cash inflows of sectors. Discretionary funds are the difference between income received and non-discretionary expenditure.

The function of the change in the demand for loans by the firms ( $\Delta BLI$ ), as a result of changes in cost variables is as follows:

$$\Delta BLI = \Delta BLI(\Delta WB, \Delta RM, \Delta TP, EI / FI)$$

This functional representation states that changes (increases) in wages and increases in the cost of inputs, as well as the change in the total taxes paid, are the 'cost factors' that determine the increase in the demand for bank loans by the firms.

The Institutional theory, which is to some extent similar to the post-Keynesian theory, may be useful at this stage to provide a richer description of the pattern of firms' demand for loans as their costs and output levels fluctuate. According to this school of thought, internal funds are the most important source of funds for

all firms. Large firms may issue debt securities in order to meet their long-term funding requirements, while smaller firms rely more on bank loans for both short-term and long-term financing (Carrier and Marsh, 1995:481).

The institutional view is that the internal cash flows of borrowers and the business cycle have a substantial influence on credit demand. During the expansionary phase of the business cycle, firms' reliance on external finance increases because, during expansion, the interest rates paid on long-term financing options, such as bonds and equity, rise with the rest of the interest rates in the economy (Carrier and Marsh, 1995:481). This causes payments on issued securities or debt to increase at a faster rate than profits, which in turn negatively affects the firm's financial position, prevents the firm from efficiently meeting its payment obligations and compels the firm to seek external funding. The firms will therefore increase their demand for loans and forsake longer term financing options such as bonds.

In the same way that the higher costs of alternative sources of funds during the expansionary phase of the business cycle compel firms to demand loans, increases in costs that occur near business cycle peaks deteriorate the financial position of firms. The non-discretionary costs, such as involuntary inventory accumulation and declining sales, absorb any profits that firms make (Carrier and Marsh, 1995:481). This combination of increasing costs and falling profits increases the firms' demand for loans.

### **3.2.1.2 Changes in the demand of firms' output as a determinant of bank credit**

In the same vein as cost increases, the increase in the demand for the firms' output will influence its demand for external funds. According to Moore (1988:1005), "anytime" firms incur an increase in the demand for their products and wish to expand their output, they will demand loans from the banks in order to finance the increased demand for factors of production and other necessary

material inputs. In the same manner, Davidson (1994:135 in Howells, 1995:90) stated that firms would have a profit incentive to increase their bank loan demand “whenever” the demand for their commodities increases. Besides the profit motive, the firms will demand loans from banks because bank loans are a main source of funds available to the firms to bridge the gap that arises between expenditures incurred and revenues to finance increased output (Arestis, 1992:191). Briefly, the higher the expected level of output of the firm, the higher the demand for bank loans.

Costs remaining unchanged, a fall in the demand for firms’ output will also result in an increase in the demand for bank loans. This is because, as the sales volume declines, the profits of the firm also decline and the firm becomes incapable of financing the work in progress. Therefore, the firms will increase their demand for loans to finance the stocks of goods in process temporarily (Moore, 1988:75).

### **3.3 THE FISHERINE THEORY**

The fundamental concepts entrenched within Irvin Fisher’s theory are time preference and investment opportunity<sup>8</sup>. In order to generate a specific function of the demand for bank credit, the Fisherine approach assumes a process of utility maximization. In contrast to the post-Keynesian approach, the Fisherine approach considers households rather than firms as the basic unit of decision (Fase, 1995:101). Fisher presents his theory with the aid of diagrams (see Figure 3.2) and in algebraic form. He assumes that permanent income received by an individual in return of his or her labour or property and capital goods, is given and can be changed only by borrowing and lending/investing.

Fisher’s model entails the following assumptions:

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<sup>8</sup> At least with reference to individual credit behaviour.

- There are two periods, the present period and the next period. For example, it may be the current year and the next year.
- The individual receives the current year's income in a single point in time, so that the interval between the current year and next year is exactly a year, such that any given point in the quadrant represents a combination of this year and next year's income.
- The individual attempts to maximize utility.
- The model does not take into account the influence of anticipated movements in the flow of income between two periods.

The individual will attempt to maximise utility by choosing higher indifference curves. The indifference curves are the combinations of this year and next year's income and their slopes measure the marginal time preferences of the individual at the corresponding combination of the current year's income and the next year's income. The marginal time preference refers to how much one is willing to forgo in order to secure a small increase in present income. In order to explain the Fisherian theory, this paper adapts an illustration by Lutz (1967:86). Assume that at the slope at K in the diagram below, that is,  $OL (=180)/ OT (=100)$  the individual is ready to exchange R180 of next year's income for R100 of this year's income. His time preference is 80%<sup>9</sup>.

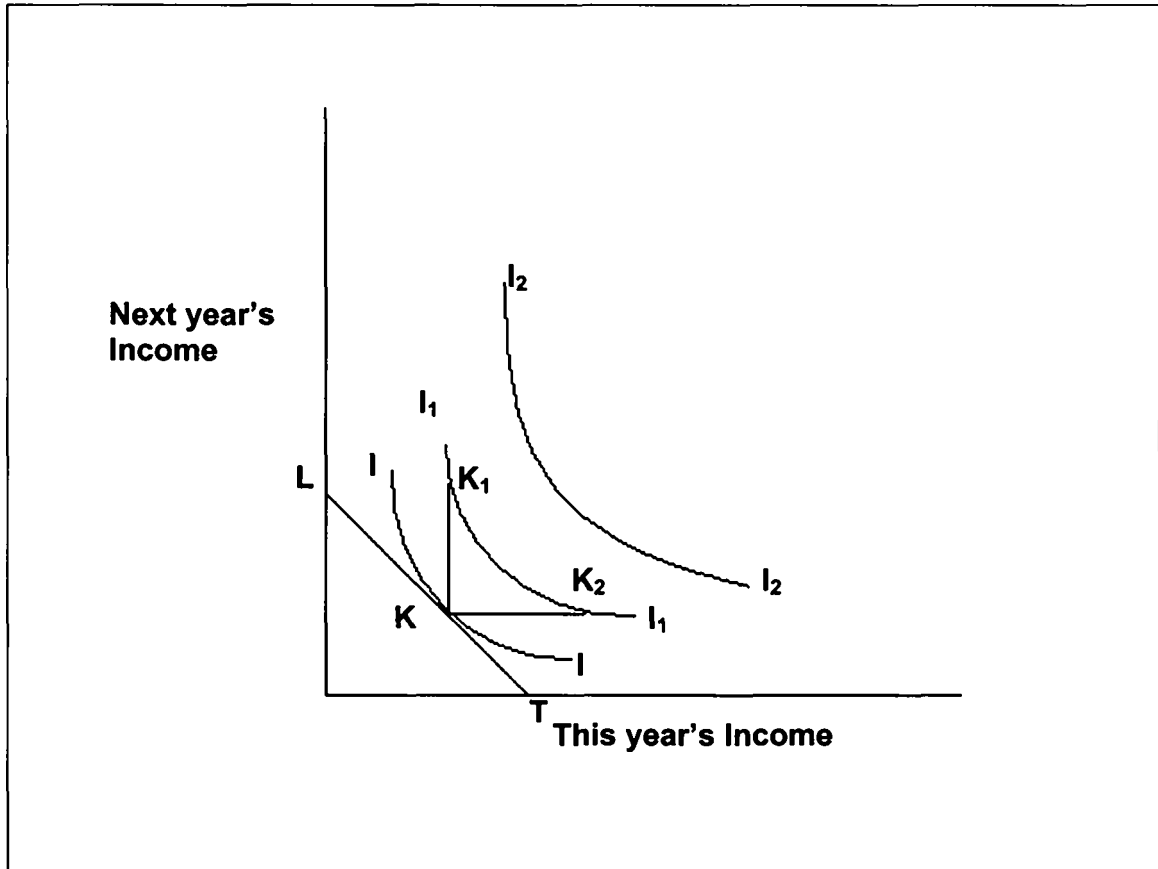
The individual will attempt to combine the present income with a higher future income, and future income with a higher present income. An example of such a decision is a move from K on I to K<sub>1</sub> on I<sub>1</sub>, or a move from K to K<sub>2</sub> on I<sub>1</sub> in Figure 3.2.

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<sup>9</sup> Time preference is different at different points on the same curve.



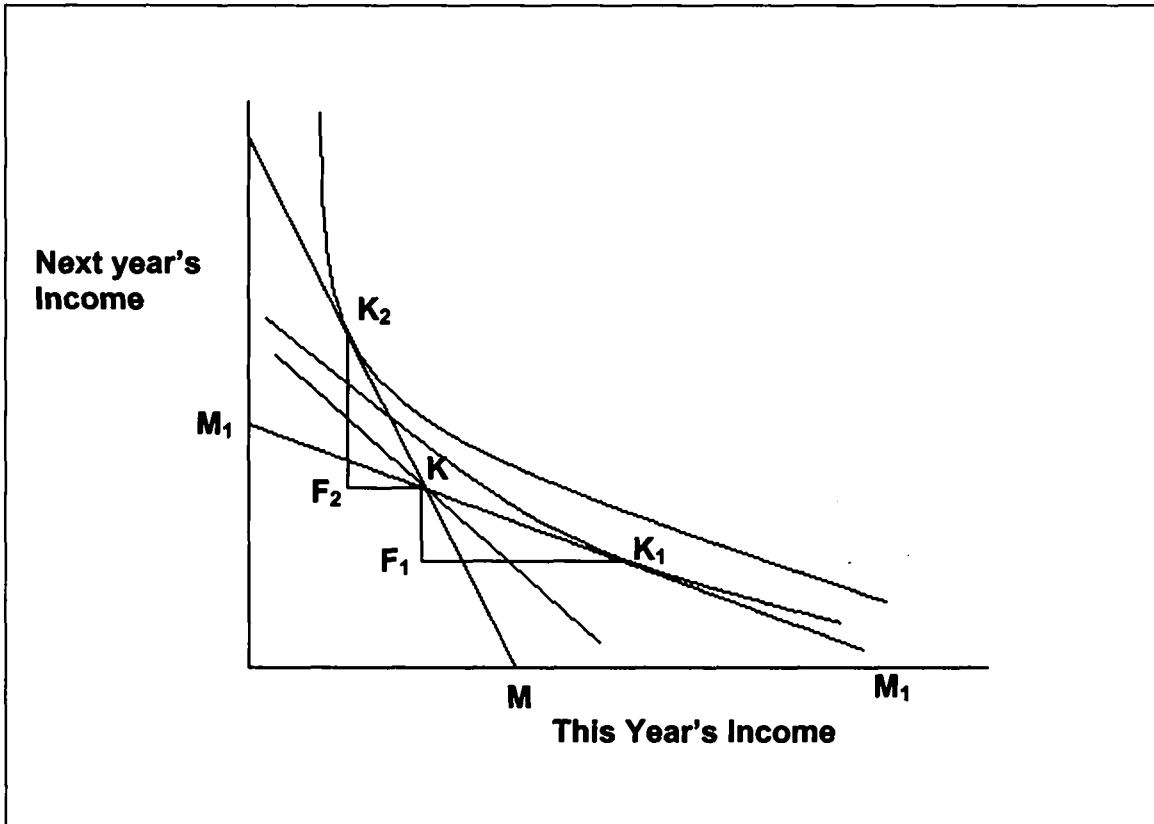
Figure 3.2: Fisher theory



Source: Lutz (1967:86)

The same concept as above still applies when we consider the individual's decisions to borrow and lend (represented in Figure 3.3 below). The slope of the tangential lines  $M$  and  $M_1M_1$  in this case is  $(1+i)$  where  $(i)$  represents the given market rate of interest. The individual can improve his position by reaching for higher indifference curves. In Figure 3.3, the individual will prefer  $K_2$ , which promises him much income next year in return for investing and accepting a smaller one this year, to position  $K$ . If however, the rate of interest should fall to a lower rate of interest, expressed by slope  $M_1M_1$  he will choose not to lend, but to borrow the amount  $F_1K_1$  since this will lift him to a higher indifference curve. This illustration shows that besides tastes for present relative to future consumption and vice versa, interest rate and investment opportunities are other determinants of demand for credit.

Figure 3.3: Fisher theory and bank credit demand



Source: Lutz (1967:86)

### 3.4 EMPIRICAL STUDIES

#### 3.4.1 Empirical studies in developed countries

Tinbergen (1934, 1937) was one of the first people to explore the econometric analysis of bank credit in the early 1930s (Fase, 1995:100). However, the demand for credit model that was later developed by Moore and Threadgold (1980, 1985), seemed to gain greater prominence with some writers in this field of research (Hewitson, 1997:128). Most of the research papers in this field are an application to developed countries. This paper will discuss some of these empirical studies in this section.

One of the earlier papers that studied the demand for bank loans was by Melitz and Pardue (1973). Melitz and Pardue (1973) drew theoretical background for their study from the Fisher theory. Their analysis was an attempt to bring some

theoretical background into the study of the demand for bank credit because they had realized that previous studies proceeded directly to the aggregate demand for commercial bank loans, without giving any theory to establish their work. They derived the determinants of the demand for credit in Italy by starting at microeconomic level and drawing from Irvin Fisher's model of individual credit behaviour. Melitz and Pardue perceived Fisher's model to be the most powerful tool applicable to provide an appropriate theoretical basis for their work.

In order to avoid repetition of the Fisher theory (discussed earlier), the study will only discuss the section of Melitz and Pardue's work where they introduce the credit market to Fisher analysis. Melitz and Pardue (1973:672) introduced the credit market through a set of credit opportunity lines giving alternative combinations of present and future income. They perceived these combinations as equally feasible through credit. The line CD in Figure 3.4 is an example of such a line and represents the highest line that the individual can attain based on his production opportunities. The slope of the line CD minus one gives the rate of interest on credit.



indices of tastes for, and the profitability of, credit. Melitz and Pardue (1973:683) also included real fixed investment ( $FI/P_e$ ), inventories in real terms ( $V/P_e$ ) and interest rate on commercial bank loans ( $r_c$ ). They did not include any other interest rates on alternative sources of funds because they did not perceive any interest rate suitable to reflect an alternative source of funds to both firms and households. They contended that, with the combination of alternatives to the heads of firms and heads of households, it was difficult to find a common alternative to bank loans for both groups. The other reason for not including another type of interest rate was to avoid multicollinearity. Their ultimate demand for commercial banks model was:

$$L_d / P_e = \alpha_0 + \alpha_1 Y_{PB} / P_e - \alpha_2 Y_{tb} / P_e - \alpha_3 (r_c - P_e) \pm \alpha_4 FI / P_e + \alpha_5 V / P_e \pm \alpha_6 X_1 \pm \alpha_7 X_2 \\ \pm \alpha_8 X_3 \pm \mu$$

where  $X_1$ ,  $X_2$  and  $X_3$  are seasonal dummy variables and  $\mu$  is a stochastic disturbance term.

Melitz and Pardue (1973:670) modelled their demand for commercial bank loans function in real terms and not nominal terms like several other studies because they perceived nominal demand for commercial bank loans to imply that borrowers suffered from money illusion. Money illusion occurs when market participants base their decisions on money values rather than on real values and one suffers from money illusion if a change in the level of prices, holding all other variables constant, affects their real behaviour (Dornbusch *et al.*, 1996:105). They argued that money illusion was contrary to theory. However, they presented some of their results from the single and simultaneous equation tests of the demand for commercial bank loans in nominal terms in order to add to the information about the possible role of money illusion.

and maximized the present value of the firm, independently of time preference and consumer tastes. Melitz and Pardue (1973:676) emphasized that firms would not borrow in order to redistribute consumption between the present and future, but would borrow to attain output levels that are impossible to achieve at the prevailing financial position. According to this part of the analysis, demand for credit by firms is dependent on the level of output.

Melitz and Pardue (1973:678) framed the credit demand ( $CD$ ) by an individual or corporation equation:

$$C_d / P_e = f(y_p / P_e, y_t / P_e, r - P_e, t)$$

as a function of permanent income ( $Y_p$ ), transitory income ( $Y_t$ ), nominal interest rate on credit ( $r$ ) and a Portmanteau term that measured indices of the contour of the production opportunity frontier and the indifference maps ( $t$ ). ( $P_e$ ) referred to the expected rate of change in the price level. This function incorporates the determinants of demand for loans by both firms and households.

In order to determine the demand for real commercial bank loans, they aggregated the credit over all borrowers and introduced factors that would affect the desired ratio of commercial bank loans to total credit and signified these influences as  $Q$ . The fundamental equation for demand for commercial bank loans in deterministic form was:

$$L_d / P_e = \alpha_0 + \alpha_1 Y_{pb} / P_e - \alpha_2 Y_{tb} / P_e - \alpha_3 (r - P_e) \pm \alpha_4 T \pm \alpha_5 Q.$$

Since Melitz and Pardue (1973:682) used quarterly data in all the flow variables in their model and observed that other studies indicated a seasonal element in the demand for commercial bank loans, they included seasonal dummy variables to avoid errors in their statistical results. They included these dummy variables as

Melitz and Pardue (1973:670) found that all the signs of the coefficients were as expected. The influence of permanent income on the demand for commercial bank loans was positive while that of transitory income was negative. They also observed that the real demand for bank loans responded more sharply to an increase in real fixed investment than an increase in real inventories (Melitz and Pardue, 1973:691). The coefficient of real lending rate was negative while those of the dummy variables were positive.

Contrary to Melitz and Pardue (1973), Caligiuri *et al.* (1974: 456) first presented a complete model of the financial sector in order to study the demand and supply of bank credit in Italy. They then reduced the financial sector model through aggregations and simplifications to a small model capable of analyzing the demand for bank credit. Caligiuri *et al.* (1974) placed a lot of emphasis on the hypothesis of substitutability between loans and bonds and that of equilibrium in the credit market to avoid the problem of credit rationing and delayed rates adjustments.

Caligiuri *et al.* (1974) described the behaviour of the private sector by means of five equations. Firstly, Caligiuri *et al.* (1974:459) showed a balance sheet identity from which they derived the demand for credit function. The balance sheet identity:

$$\Delta BMP = \Delta D + \Delta TPR + I = \Delta CR + \Delta ET + S ,$$

stated that total acquisition of new assets, whether in the form of monetary base (*BMP*), bank deposits (*D*), bonds (*TPR*) or physical assets (Investments (*I*)) must equal the change in total liabilities (consisting of bank loans (*CR*), bond issues (*ET*) and saving (*S*)). Caligiuri *et al.* (1974:460) focused on the credit side of the financial sector and its relationships with the policy variable controlled by the central bank. Taking into account the liability side of the balance sheet, they observed that there were two sources of funds, which were available to the

private sector. These were bank loans and the issue of bonds by the private sector.

Caligiuri *et al.* (1974:471) modelled their demand for bank loans (CR) as a function of balance of payments surplus (BP), income (Y) as a proxy of production, investment (I), interest rate on bonds ( $i_T$ ) and interest rates on bank credit ( $i_{CR}$ ). According to their functional notation:

$$\Delta CR = f(\Delta Y, I, BP, \Delta i_{CR}, \Delta i_T),$$

a change in demand for bank loans ( $\Delta CR$ ) is determined by changes in income ( $\Delta Y$ ), changes in the rate of interest on loans ( $\Delta i_{CR}$ ) and on the rate of interest on bonds  $\Delta i$ , and balance of payments surplus ( $BP$ ). ( $BP$ ) measured the amount of funds other than bank credit obtained by the private sector. Although a measure of the amount of credit extended by the central bank to the treasury and private sector in return of foreign exchange ( $\Delta BMTES$ ) was initially included in the above function as one of the determinants, Caligiuri *et al.* did not include it in their empirical estimation because of the complexity it introduced to the study. The other variables that Caligiuri *et al.* considered as the determinants of demand for credit, but did not include in their model, were the interest rates on deposits and investments. Their major reasons for omitting the interest rate on deposits and investments were lack of reliable data and the collinearity between the interest rate on bank credit and income. The demand for bank loans model that they finally estimated was:

$$\Delta CB_{PRT}^d = \alpha_0 + \beta_1 \Delta Y_t + \beta_2 \Delta Y_{t-1} + \dots + \beta_n \Delta Y_{t-n} + \gamma \Delta i_t + \mu_t$$

where  $CB$  measures demand for loans,  $Y_t$  measures income,  $BP$  balance of payments as above,  $i_t$  interest rate on bank loans and  $\mu_t$  is an error term. They estimated the model by ordinary least squares.

The results of their study (Caligiuri *et al.*, 1974:472) showed that the demand for bank loans in Italy increased on a one-to-one basis with increases in income. On the contrary, a balance of payments surplus proved to have a negative impact on demand for loans. An inflow of funds due to a balance of payments surplus reduced the demand for loans by approximately sixty percent of its size. Finally, the demand for credit proved to be inelastic to interest rates changes.

Unlike the study by Melitz and Pardue (1973), which drew on the Fisher theory, Moore and Threadgold estimated their demand for loans equation based on post-Keynesian views. Their study stemmed from the recognition that the production process took time to be complete and that firms incurred production costs prior to the receipt of sales proceeds, which created a demand for funds to meet working capital needs (Moore and Threadgold, 1985:67). Moore and Threadgold (1985) hypothesized that the changes in the working capital needs of the firms are the major determinant of changes in the demand for loans by firms (Hewitson, 1997:129). In the test of this hypothesis, they categorized the working capital needs or production costs into employment costs, raw material costs and tax payments (Hewitson, 1997:128).

Moore and Threadgold (1985:72) fitted a single short-run disequilibrium equation for bank borrowing by industrial and commercial companies in the UK. All the independent variables in the model were the components of the working capital of the firms. Their model was clear and easy because it ignored the complicated aspects of portfolio allocation behaviour. It was consistent with the view that banks set their base rate and attempted to meet the firms' demand that resulted (Moore and Threadgold, 1985:72). Their model was as follows:

$$LDI_t = a_0 + a_1\Delta WB + a_2\Delta WB_{t-1} + a_3\Delta MBM_t + a_4\Delta MBM_{t-1} + a_5\Delta MBM_{t-2} + a_6 IIC\$_t + a_7 IIC\$_{t-1} + a_8\Delta TYC_t + a\Delta TYC_{t-1}$$

*LDI* denotes quarterly flow of bank loans, *WB* is wage bill, *MBM* is import bill for basic materials and semi-manufactures, *IIC\$* is current price stock building<sup>10</sup> of firms, *TYC* is corporate payments and  $\Delta$  denotes quarterly change. They also included what they term a 'round-tripping' variable, which is in excess of the three-month CD rate over the prime lending rate, as an additional explanatory variable.

All the variables in the model, with the exception of stock building, were in first differences. Moore and Threadgold's justification for their use of first differences was that it was the change rather than the level of working capital finance that was of relevance and significance since firms could fully fund existing costs out of their current sales earnings (Moore and Threadgold, 1985:68; Hewitson, 1997:132). The results of their study presented evidence that the components of company working capital, particularly the wage bill, were important determinants of the demand for bank loans by industry.

Unlike previous studies, Arestis and Eichner (1988:1009) used a formal mathematical model to show the determinants of bank lending by the firms. According to their model, changes in gross domestic product ( $\Delta GDP$ ), the different credit policies put in place to redistribute or ration credit ( $X_0$ ) and the ratio of discretionary expenditure (*EI*) over the firm's discretionary funds (*FI*) determined the change in bank loans by the firms ( $\Delta BLI$ ). The functional form of this relationship, as written by Arestis and Eichner (1988:1009), was as follows:

$$\Delta BLI = \Delta BLI(\Delta GDP, EI, FI, X_0)$$

In terms of consumers, Arestis (1992:193) perceived changes in economic activity ( $\Delta Y$ ) and changes in interest rates ( $\Delta R$ ) to be the major determinants of consumers' demand for bank loans (*BLC*). He proposed that the consumers would be prepared to get into debt to finance purchases of durable goods as

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<sup>10</sup> It refers to the change in the book value of stocks excluding stock appreciation.

output expanded. In the same way that the ratio  $EI/FI$  influences bank lending by industries, the ratio  $EP/FP$  influences the change in bank lending of consumers positively. Arestis and Eichner (1988:1009) regarded  $EP/EF$  and changes in interest rates ( $\Delta R$ ), which accounted for possible portfolio effects and were a proxy for the relative attractiveness of alternative financial assets available to depositors to be major determinants of demand for loans by consumers. The relationship is as follows (Arestis, 1992:194):

$$\Delta BLC = \Delta BLC(\Delta R, \Delta Y, EP/FP)$$

In the same manner as Arestis and Eichner (1992), Fase (1995) made a unique contribution to this field of research. He introduced the determinants of bank credit demand that came about because of financial market developments. (Fase, 1995:100) also considered the fact that banks charged individuals different rates for their credit, such that the level of interest rate was not a unique and directly measurable market rate but a zone. He attained a specific or unique interest rate level to include in his demand for credit model by constructing a model through which he estimated the interest rate level with error.

According to Fase (1995:102), various economic factors, such as the expected cash flows and deliberate decisions to borrow from the banks determined the demand for short-term bank credit by the private sector in the Netherlands during the period of the study. He also viewed the behaviour of market participants as influenced by the objective function in their minds, possible activities, and the economic and institutional environment.

In particular, Fase (1995:105) reckoned the volume of expected sales ( $SA$ ), the price level ( $P$ ), the yield on long-term government bond ( $r_L$ ), lending rate of interest ( $r_B^*$ ) and the ratio of the volume of inventories to sales ( $q_n(N/SA)$ ) to be the major determinants of demand for loans. The ratio ( $q_n(N/SA)$ ) represented

the buffer stock mechanism in the balance sheet composition of the private sector. His model was as follows:

$$\Delta_4 \ln(CL/P) = \alpha_0 + \alpha_1(\ln(CL/P)_{-4} - \alpha_2 \ln SA_{-4}) + \alpha_3 \Delta_4 \ln SA + \alpha_4 r_B^* + \alpha_5 r_L + \alpha_6 \Delta_4 \ln q_n + \alpha_7 \Delta_4 \ln(CL/P)_{-1} + \alpha_8 \Delta_4 \ln SA_{-4} + U_1$$

Unlike earlier studies, Fase (1995) employed cointegration and error correction models. The major result from his study was the observation that bank credit demand was significantly elastic to changes in lending interest rates. This was contrary to the study by Moore and Threadgold (1985), which found bank credit to be insensitive to interest rate changes. Moore and Threadgold's justification for their results was that it was possible that increased demand for finance by industries coincided with the monetary authorities' decision to reduce bank credit through high interest rates (Arestis, 1991:192). In addition, they reasoned that the firms were most likely to lose their non-price competitiveness if they decreased production, sought for other means of financing or raised their prices in the short-run as interest rates increased.

In 1997, Hewitson (1997) revisited Moore and Threadgold's (1985) model. Hewitson (1997:134) used a modified model of Moore and Threadgold (1985) because he observed several weaknesses in Moore and Threadgold's model. The main objective of his research was to criticize Moore and Threadgold's demand for credit model and to determine whether it was applicable to the Australian data. Hewitson (1997) had observed that most post-Keynesians positively cited Moore and Threadgold's demand for credit model in their studies, but never criticized it. He scrutinized the model on both theoretical and empirical grounds.

Hewitson (1997:130) argued that the first assumption of Moore and Threadgold's model, which stated that the mark-up over the clearing banks' base rate was constant, posed the problem of an untested restriction with the potential to make

coefficient estimates biased. He argued that the restriction implied that changes in the base rate were the only interest rate changes that would affect the demand for loans and that other forms of interest rates had no influence whatsoever on the demand for bank loans.

Another argument by Hewitson (1997:130) concerning the assumptions was that the second assumption of the model, which assumed that the Bank of England constructed the time series of firms' inflationary expectations, was also an untested restriction. He based his argument on the theoretical grounds that it was the nominal interest rate and not the real rate that contributed to the firms' borrowing. He contended that the firms' expectations on output demand included inflationary expectations.

Hewitson's (1997:131) second argument was that their credit demand equation was more prone to the simultaneous equation bias problem because it was a reduced form model derived from a structural model of the market for bank loans. Moreover, he stated that the bias might emerge if the policy determined interest rate is a function of the variables in the loan demand function.

Thirdly, Hewitson (1997:132) argued that loans were not completely demand-determined. He emphasized that a distinction between the effective demand for loans function and the notional demand for loans function was necessary. The effective demand function represents firms that have actually borrowed from banks while the notional demand represents both satisfied and unsatisfied demand. Hewitson (1997:132) criticized Moore and Threadgold (1985) for using dummy variables in their model and not adequately addressing the variations in the demand for loans. He was of the opinion that this would restrict the shifts in the effective credit demand curve to the periods of the central bank's executed credit crunches.

Finally, the other problems that Hewitson (1997:134) observed were the fact that Moore and Threadgold specified the model in first differences, and that they specified the lag structure of the model a priori. He argued that the fact that the model specified the lag structure<sup>11</sup> a priori imposed yet another untested restriction. In terms of specifying the model in first differences, Hewitson failed to give any justification as to why this should be problematic in modelling the demand for credit. In fact, Hewitson (1997:129) also specified some of the determinants of the demand for loans (wage bill and import bill) in his model in first differences.

Although using first differences of the variables in the econometric models can avoid spurious regression problems<sup>12</sup>, it causes the time series to lose the long-run information on the variables (Harris, 1995:1). This disadvantage is very costly in time series statistical analysis because there is a necessity to retain this long-run information in order to show the co-movement of the variables because of the underlying equilibrating tendencies of economic forces, rather than because of common and yet unrelated time trends in data (Harris, 1995:1).

Hewitson (1997:134) made the following three changes to Moore and Threadgold's model:

- He used cointegration techniques to estimate the relationship between bank lending to business and working capital needs of firms, so that the demand for credit function incorporated both short-run dynamics and a long-run equilibrium relationship. He also used the error correction model to determine the short and long run dynamics of the relationship.
- He used the nominal interest rate actually charged by banks on loans and he did away with the a priori assumption of a fixed mark-up on the discount rate

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<sup>11</sup> The lag structure reflected the period within which it was expected that businesses would pass on cost increases to consumers.

<sup>12</sup> A spurious regression problem refers to instances in which the results obtained suggest there is a significant relationship between the variables in the regression model when these are actually contemporaneous correlations and not meaningful causal relations (Harris, 1995:14).

- Instead of fixing the lag structure as in Moore and Threadgold's model, he used the software package that gave the data the freedom to determine the lag structure within the constraints imposed by Microfit.

Hewitson (1997:129) estimated the model as follows:

$$LDI = C - \Delta W_t - \Delta IB_{t-1} + R\varepsilon$$

*LDI* denotes quarterly demand for total bank loans by industrial and commercial companies.  $\Delta W_t$  denotes first difference of the quarterly wage bill,  $IB_{t-1}$  is the first difference of the lagged quarterly import bill and  $R\varepsilon$  denotes the nominal interest rate on bank overdrafts.

Hewitson (1997:139) observed that the coefficients of the import bill and the nominal interest rate suggest a negative relationship between bank credit demand and these variables in the long-run. The coefficient of the wage bill was negative and significant, which supported Moore and Threadgold's (1985) hypothesis that the wage bill was a significant determinant of the demand for credit. However, the fact that the magnitude of the changes in the interest rates on the demand for bank credit was significantly larger than that of the changes in the wage bill did not support Moore and Threadgold's (1985) findings that working capital needs largely determine the demand for loans.

Howells and Hussein (1999:448) also used a credit demand model similar to that of Moore and Threadgold (1985). Their intention was to examine whether the cost and volume of production determined credit demand, as stated by the post-Keynesians. They disagreed with the Institutionalists and the post-Keynesian theory of the "state of trade", which, as explained earlier, focuses on the firms as the source of credit demand. They stated that the "state of trade" might not be correct and in turn give superfluous emphasis to the behaviour of GDP (Howells and Hussein, 1999:442).

Howells and Hussein (1999:442) presented two arguments against “state of trade”. Firstly, they argued that credit was required to finance all types of spending (new, second-hand and assets) and not only newly finished goods. They refer to spending on these assets or commodities as ‘total transactions’. Secondly, they stated that perceiving firms to be the major determinants of credit demand might have been justified in the 1980s when Moore and Threadgold did their research and not during the period of their own research, mainly due to recent deregulation and other innovations within the various economies. In addition, they argued that the components of the demand for credit have also changed ever since household sector borrowing overtook bank lending by firms (Howells and Hussein, 1999:442).

Howells and Hussein (1999:448) estimated two unrestricted error correction models of aggregate demand for bank loans. They used GDP to capture the “state of trade” in one model and used measures of total transactions, such as cost of loans and money’s own rate, in another. They improved Moore and Threadgold’s model by considering in their model, both households and firms to demand bank loans as a partial substitute for money.

The major contribution of Howells and Hussein (1999) was their introduction of the concept of the buffer stock mechanism. They stated that agents could meet their additional expenditure by demanding more loans or, alternatively, by issuing debt, selling some liquid assets from their portfolio or borrowing in the foreign exchange market (Howells and Hussein, 1999:447). This implies that the prices of debt or securities in the local and foreign markets could be the other determinants of bank credit demand because the firms would not demand bank loans if they could get all the required funds by selling assets.

The determinants of the demand for credit that Howells and Hussein (1999:448) included in their model were the price level ( $p$ ), the weighted average rate charged on bank loans ( $R_{ib}$ ), total spending ( $pt$ ), money’s own rate ( $R_m$ ), the rate

on three-month dollar deposits ( $REU$ ), the long term bond rate ( $R_{cl}$ ) and the inflation rate ( $Pr$ ). Their demand for loans ( $bl$ ) equation was as follows:

$$\Delta(bl - p) = \alpha_0 + \alpha_1\Delta(pt - p) + \alpha_2R_{bl} + \alpha_3R_m + \alpha_4REU + \alpha_5R_{cl} + \alpha_6\Delta Pr^{13}$$

The results showed that including total transactions (money's own rate and bank loan rate) to replace the level of output (GDP) in the demand for loans improved estimation in the case of the UK over the period 1973Q1- 1994Q4 (Howells and Hussein, 1999:442). The interest rates had no significant influence on demand for credit. This is consistent with Moore and Threadgold's (1985) paper that considered the quantity of the firms' output and costs to be major determinants of demand for credit. They found out that inflation had a negative influence on the demand for loans. This suggests that an increase in the inflation rate might have increased the risk of undertaking investment projects and discouraged investment, which in turn reduced the demand for bank credit (Howells and Hussein, 1999:448). Howells and Hussein (1999:448) also pointed out that the relationship between inflation and the demand for bank credit could also be positive if the rate of interest on loans is sticky and does not readily respond to changes in inflation such that an increase in inflation could lead to a short-run increase in the demand for loans.

Similar to Howells and Hussein's (1999) results, Ghosh and Ghosh's (1999) study also presented evidence of a negative relationship between inflation and credit demand. Ghosh and Ghosh (1999:5) specified the demand for bank loans in Indonesia and Korea to be a function of real lending rates ( $r_t$ ), current output ( $Y_t$ ), variance of growth in output ( $Y^\sigma$ ), inflation ( $\Pi_t$ ) and the stock market price ( $S^p$ ). They included the stock price as a proxy for future expected output. On the other hand, they included current output to capture working capital

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<sup>13</sup> In order to model the impact of GDP on the demand for credit, Howells and Hussein (1999) replaced ( $pt$ ) with GDP.

requirements and as an indicator for future output. Ghosh and Ghosh (1999:5) specified their model as follows:

$$C_t^d = \beta_0^d + \beta_1^d rt + \beta_2^d Y_t + \beta_3^d Y_t^\sigma + \beta_4^d S_t^p + \beta_5^d \Pi_t + \varepsilon_t^d$$

Ghosh and Ghosh (1999:6) estimated the model parameters through maximum likelihood analysis and used cointegration analysis for both countries. They used quarterly data and covered the period 1991:1-1998:3. The results on Indonesia presented evidence that the variance in output and inflation had a significant negative correlation with real bank credit demand, which was expected. Although interest rates also exhibited a negative association, it was insignificant. The coefficients of output and stock market price were both significant and positive.

Unlike the case of Indonesia where the coefficient of interest rates was insignificant, the interest rate coefficient was marginally significant in the case of Korea, though still negative. In the same way as in the case of Indonesia, the coefficient of output was positive and highly significant. The stock market price and inflation coefficients were also negative, but insignificant (Ghosh and Ghosh, 1999:7). This was unexpected.

The study by Pazarbaşıoğlu (1999) on Finland gave evidence of a significant negative effect and not a positive relationship with bank loan demand as was expected. Industrial production seemed to have no significant impact on bank credit demand, while lending rate and expected investment had a negative impact on the demand for bank credit, as was expected (Pazarbaşıoğlu, 1997:323).

Pazarbaşıoğlu (1997:320) estimated a simple credit demand ( $L'_d$ ) model in his attempt to determine whether there was a credit crunch in Finland following the banking crisis of 1992-93. The independent variables in his model were the bank

lending rate ( $i_{i,t}$ ), expected fixed investment ( $le_t$ ), expected rate of inflation ( $\Pi e_t$ ) and industrial production ( $Ye_t$ ). The estimated model was as follows:

$$L_t^d = \beta_0 + \beta i_{i,t} + \beta le_t + \beta \Pi e_t + \beta Ye_t$$

He included expected fixed investment and not the actual fixed investment as Melitz and Pardue (1973) did, because of his attempt to avoid imposing rationing on demand for credit.

Ogawa and Suzuki (2000) later complemented the work that Fase (1995) and Howells and Hussein (1999) had done, by introducing the influence of the recent institutional framework that makes credit easily accessible from the banks and capital markets. Financial innovation and deregulation have resulted in various financing options for firms, and have enabled different sizes of firms, particularly large ones, to raise funds directly from the capital markets by selling bonds or equity (Ogawa and Suzuki, 2000:7). This easy access to the capital markets has reduced the dependence of firms on bank loans.

Ogawa and Suzuki (2000:2) identified two main features that characterized the demand for loans by Japanese firms. The first one was the long-term relationship between a firm and its main banker. A good relationship between banks and their clients is important because it reduces problems such as adverse selection, which result from lack of information about the clients. Loan commitments are an example of some of the contracts that come to pass due to long-term relationships. The effect of these commitments on loan demand is that they increase the dependence of the clients on banks for funding because firms are certain that the banks will meet their loan demands under normal circumstances. Secondly, Ogawa and Suzuki (2000:2) considered the significance of land as a form of collateral when borrowing from banks. Ogawa and Suzuki (2000:2) considered these two factors as equal influences in the demand for bank loans by the Japanese firms.

They set up a model of bank loan demand by individual firms, allowing for the possibility that the firms could not borrow as much as they would have liked to. The basic structure of their model consisted of two reduced-form equations, a desired demand for bank loans and a maximum amount of loans that banks were willing to lend to the firms in return for collateral (Ogawa and Suzuki, 2000:4). The independent variables in their desired demand for bank loans model were activity level of the firm, size of the firm, a variety of interest rates, the firms' profit levels and access to the bond market.

Ogawa and Suzuki (2000:5) used sales levels in order to measure the activity level of the firm, capital stock of the firm to measure the size of the firm and the firms' profit levels as a proxy of internal funds available for the firm. They also used accessibility to the bond market to measure the extent to which the firms had substitutes for bank loans.

Ogawa and Suzuki (2000:5) deduced that firms' demand for loans increased with an expansion in the production capacity or sales. This is consistent with post-Keynesian theory. In addition, they observed that the demand for loans by larger firms to support financial and real transactions was greater than that of the relatively smaller firms, which concurred with the Institutionalist theory. On the other hand, they found out that the interest rate on loans exerted a negative effect on the demand for bank loans while the interest rates of substitutes had a positive effect on the loan demand.

One of the recent studies in developed countries was by Calza *et al.* (2001a). They conducted an econometric investigation of the total bank loan demand of the private sector in the euro area. Their study does not make any significant contribution to this field in terms of introducing new determinants of demand for credit. They restricted their explanatory variables to general economic activity

and the cost of loans. Calza *et al.* (2001a:9) estimated their model as a long-run relationship specified in semi log-linear form:

$$L = \alpha + \beta_1.GDP + \beta_2ST + \beta_3.LT + \varepsilon$$

$L$  denoted logarithm of loans to the private sector,  $GDP$  stood for logarithm of real output and  $LT$  and  $ST$  respectively denoted the real long-term rates and the short-term rates. In order to determine the real interest rates, they did not deflate nominal interest rates by expected inflation as usual; instead, they used the current level of inflation. The reason for this was that actual inflation was less likely to vary significantly from the expected inflation rate over a short period of time (Calza *et al.*, 2001a: 9-10).

Their results proved that the long-term interest rates were more significant than the short-term rates. Both short-term and long-term interest rates had positive coefficients. The real GDP coefficient was also positive in the long run. The theoretical reason for a positive relationship is that the increase in output will positively influence the expected income and profits, thus, the overall financial condition of the households and corporations. The increased output enables the market participants to support higher levels of indebtedness and consequently to finance higher consumption and investment by borrowing from the banks (Calza *et al.*, 2001:7). (Calza *et al.*, 2001:7) also noted that there could be a negative association between output and the demand for bank credit because companies might prefer to use their profits or other internal sources of funds to bank loans. and the households might choose to reduce their debt levels as output rises.

### **3.4.2 Empirical studies in developing countries**

Unlike in the case of developed countries, only a few empirical studies explore the demand for credit model or the determinants of the demand for bank credit in developing countries. De Jager and Smal did one of the earlier papers on the demand for credit model in developing countries and employed South African

data in 1985 (De Jager and Smal in Moore and Smit, 1986:90)<sup>14</sup>. They estimated the demand for credit equation as a function of GDP and the prime lending rate. According to the results, the coefficient of the *level* of the prime lending rate was significant and negative and that of the *change* in prime rate was more significant and highly positive.

Moore and Smit (1986) undertook another study that explored the demand for bank loans in South Africa. The independent variables in this model were the components of working capital demand, as in the demand for credit model that Moore and Threadgold estimated for the U.K. in 1985. They included the current and constant values of the change in the non-government wage bill, the change in inventories, the 3-month bankers' acceptances and the credit ceiling dummy in one model. In another model, Moore and Smit (1986:87-88) used the 3-month bankers' acceptances rate less inflation rate, to replace the 3-month bankers' acceptances rate.

According to the results, change in the non-government wage bill influenced the demand for bank loans on a one-to-one basis. This was consistent with the results from Moore and Threadgold's (1985) study on the U.K. The coefficients of both the nominal and the real rate of interest on the 3-month bankers' acceptances were insignificant and negative. Moore and Smit (1986:89) claimed that this might be because of the positive expectations effect and the misspecification inherent in a single equation framework. Moore and Smit (1986:89) suggested the use of simultaneous equations for more accurate results. The coefficient of the change in inventories was positive, while that of the dummy variable was negative.

Ikhide (2003) recently undertook a study in a developing country: Namibia. His study was an attempt to provide some evidence concerning the credit crunch in

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<sup>14</sup> This study does not to give a detailed account of the study by De Jager and because the article was not available in the source cited by Moore and Smit (1986).

Namibia between 1996-2000, by examining the main determinants of commercial bank loans and ascertaining if credit had been demand or supply constrained. He did this by estimating both credit supply and credit demand models using Namibian data.

The main determinants of bank credit demand ( $L_t^d$ ) that Ikhide included in his model were nominal lending rate ( $I_t$ ), inflation rate ( $P_t$ ), output gap ( $Y - \bar{Y}$ ), expected real income ( $eY_t$ ) and unexpected inflation rate ( $uP_t$ ). He specified his model in the form:

$$L_t^d = \beta_0 + \beta_1 P_t + \beta_2 eY_t + \beta_3 Y - \bar{Y} + \beta_4 uP_t + \beta_5 I_t$$

All these variables, except interest rate, were in log-linear form. Ikhide (2003:281) used inflation as a proxy for the general macroeconomic condition and he included the output gap as an additional explanatory variable in order to measure the impact of changes in output from its long-term pattern, as measured by expected income, and as a proxy of demand for credit during periods of declining income.

The results to the study showed that the real interest rate had a weak negative relationship with credit demand, while expected income had a strong positive association with credit demand (Ikhide, 2003:284-285). The output gap coefficient was significantly negative. On the contrary, inflation was not significant.

### **3.5 CONCLUSION**

Despite the different approaches that different studies use to derive the main determinants of bank credit demand, there are common determinants from the various studies. The fact that they are common determinants in various studies

(on different countries) does not necessarily mean that they will be significant in or relevant for any other country because of the different financial structures and the general economic environment. However, they offer a guideline on the determinants of bank credit demand that are more likely to be significant in the demand for bank credit model. The common determinants of the demand for credit according to the various studies are output or income, the interest rate on bank loans, fixed investment, (expected) inflation and the interest rate on alternative sources of finance, such as bonds. Table 3.4 gives a summary of the empirical studies cited in the above discussion.

**Table 3.4: Summary of empirical studies**

Author (year)	Country (period covered)	Explanatory variables	Method of estimation	Summary of results
Melitz J. and Pardue M. (1973)	USA (1951:1-1969:4)	-real fixed investment -seasonal dummy variables -real permanent income -real temporary income -real interest rate on commercial bank loans	One stage and two stage least squares.	Coefficients of permanent income, real fixed investment and real inventories were positive and consistently significant above 0.05%. Two of the dummies had positive coefficients while one had a negative coefficient. Transitory income also had a negative coefficient.
Caligiuri F.G., Fazio A. and Padoa-Schioppa T. (1974)	Italy (1958-1971)	-seasonal dummies -balance of payments surplus - interest on bank credit	Ordinary least squares	As income increased, demand for bank credit increased by an equal amount. An inflow of funds due to a surplus in the balance of payments reduced the demand for bank credit by approximately 60% of its magnitude. Interest coefficient was negative.
Moore B.J. and Threadgold A.R. (1985)	UK (1965:4-1981:2)	-wage bill of ICCS* -import bill for basis materials and semi-manufactures -current price of stock-building of ICCS -corporate payments of UK tax -excess 3 month CD rate over prime lending rate	Single equation framework	Demand for bank credit by ICCS appeared highly interest-inelastic, while all other variables besides wage bill were significant.
Moore B.J. and Smit B.W. (1986)	South Africa (1966-1984) (1966:3-1983:4)	-change in non-government wage bill -change in	Single equation framework	Changes in non-government wage bill explained more than 90% of changes in annual bank credit demand and about 80% on a quarterly basis.

		inventories -nominal and real 3 month BAs* -credit ceiling dummy		Both nominal and real rates on 3-month BAs* were insignificant. The coefficient of the dummy variable was negative while that of change in inventories was positive.
Fase M.M.G. (1995)	Netherlands (1970:1-1990:4)	-expected sales -yield on long-term government bond -ratio of the volume of inventories to sales -bank lending rate	Cointegration and error correction models	The estimates were all significantly different from zero. Bank lending rate coefficient was significant and negative while that of bond yield was positive. The long run sales coefficient was positive.
Hewitson G. (1997)	Australia	-wage bill of private sector -import bill of the business sector -nominal interest rate on bank overdrafts	Cointegration analysis and error correction models.	The coefficients of all the variables were negative in the long run.
Pazarbaşıoğlu C. (1997)	Finland (1981-86 and 1987-1995)	-bank lending rate -expected fixed investment - expected rate of inflation -industrial production	Maximum likelihood log-likelihood	Expected investment and lending rate both had expected negative signs. Output seemed to have significant explanatory power in the demand for bank credit. Inflation had a significant negative relationship with demand for credit in the post-deregulation period (1987-95)
Ghosh S.R. and Ghosh A.R. (1999)	Indonesia and Korea (1991:1-1998:3)	-real lending interest rate -current output -price of stock market -variance in growth of output -inflation	Maximum likelihood and cointegration analysis	<b>Indonesia</b> Coefficient of output was significant and positively related to loans. Real interest rate was significant and negatively related to credit demand. Stock market price was significant and positively related to credit demand. Both the variance in output growth and inflation coefficients had negative signs as was expected. <b>Korea</b> Coefficient of output was positive and highly significant, while that of the lending rate was negative. The variance in output growth, stock market prices and inflation were all negatively correlated to credit demand.
Howells P. and Hussein A.K. (1999)	UK (1970:1-1994:4)	-inflation rate -bank lending rate -money's own rate -rate on 3-month dollar deposits -long-term bond rate	Error correction models	Inflation rate coefficient was negative. The interest rates had no significant influence on the flow of bank lending.
Ogawa K. and Suzuki K. (2000)	Japan (1980-1993)	-dummy variables -activity level of the firm -size of the firm -firm's profit level -spectrum of interest rates -accessibility to bond market	Maximum likelihood estimation technique	The coefficients of loan interest rate, profit level and accessibility to corporate bond market were negative. Interest rates on substitutes, firm size and output has a positive relationship with demand for bank credit.
Calza A.,	Euro Area	-log of real GDP	Semi-log linear	Both real short-term and long term

Gartener C. and Sousa J. (2001a)	(1980:1-1992:2)	-real short-term interest rate -real long-term interest rate	model Cointegration-Johansen methodology and vector error correction model	interest rates were negatively related to loan demand in the long-run while real GDP depicted a positive association.
Ikhide S. (2003)	Namibia (1993:1-2002:4)	-output gap -expected real income -nominal lending rate -unexpected inflation -inflation rate	Switching regression model Cointegration analysis	Real interest rate and output gap were significant and negatively related to demand for bank credit. Inflation rate and expected income were also significant, but positively related to demand for bank credit. On the contrary, unexpected inflation was insignificant.
CCS is an abbreviation for industrial and commercial corporations. *BAs are bankers' acceptances				

The results of these studies also assist one to form expectations about the impact of the different determinants of bank credit demand. The studies show both positive and negative relationships between the demand for credit and GDP. The same applies to Inflation. The relationship between inflation and demand for bank credit is indeterminate in the short run, that is, it can be positive or negative. On the contrary, the relationship between the lending rate and the demand for bank credit is negative in all the studies. As the lending rate increases, the cost of loans increases and discourages firms and households from demanding loans.

## CHAPTER 4

### ANALYTICAL FRAMEWORK

#### 4.1 INTRODUCTION

The study observed from the previous chapter that the common determinants of the demand for bank credit are output, fixed investment, the rate of interest on bank loans, the rate of inflation and the rate of interest on alternative means of funding like bonds. In this chapter, the study draws from these common determinants, the stylized facts about bank credit and the historical background of the South African bank credit market in order to develop the demand for bank credit model, which will be used in the empirical estimation.

The study will then explain the cointegration, error-correction modelling framework, used in the study. The cointegration, error-correction modelling framework is the latest method used in the econometric analysis of such studies. Fase (1995), Hewitson (1997), Howells and Hussein (1999), Calza *et al.* (2001a) and Ikhide (2003), who explored the demand for bank credit in recent years, also used these econometric methods. According to Chakraborty and Basu (2002:1063), the two most commonly used tests of cointegration analysis are: the residual-based test for the hypothesis of no cointegration by Engle and Granger (1987), and the cointegrating test that is based on the system of equations utilizing vector autoregressive (VAR) models suggested by Johansen (1988, 1991) and Johansen and Juselius (1990).

## **4.2 THE SOUTH AFRICAN BANK CREDIT MARKET: HISTORICAL DEVELOPMENTS AND SOME STYLIZED FACTS**

### **4.2.1 Historical developments of the domestic credit market**

During the apartheid era, the bank credit market was highly constrained (Meagher and Wilkinson, 2001:4). The banks and other financial institutions were not interested in serving the majority of the population, particularly the low-end consumers and small businesses, which required small loans (Hawkins, 2001:30; Schoombee, 2004:599). The banks concentrated on larger firms and white citizens, such that the share of blacks in the formal bank credit market was only 5% in 1990, while their share of income and population were respectively 36% and 70% (Schoombee, 1998:338). The main reason for their lack of interest was entrenched in the fact that there were credit ceilings on the lending rates laid down by the Usury Act of 1968 in order to protect borrowers from exorbitant interest rate charges (Schoombee, 2004:599), which hindered the banks from charging interest rates that were high enough to match the default risk.

Although approximately 60% of the South African population still remained unbanked<sup>15</sup> even after democratization (Wiese, 1996, in Schoombee, 1998:33), the number of black South Africans who had access to bank credit increased, following the elections in 1994. This was mainly because more black South Africans obtained formal employment, particularly in the public sector (Aron and Muellbauer, 2000:17).

The banks' general lack of interest in offering services to the unbanked led to antagonism between the banks and the low-end consumers and small businesses, such that they did not trust banks or other formal institutions to meet

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<sup>15</sup> It generally refers to those with little or no access to financial services. The unbanked can be divided into those eligible for financial services such as those in low to middle income categories and those not eligible for financial services. For example, those who are without personal resources and are unemployed (including those who were initially employed, but had lost their jobs and were compelled to close their accounts), the informally employed or the sporadically employed (Falkena et al., 2004:86).

their demand for credit (Meagher and Wilkinson, 2001:4). The people resorted to other informal systems of credit, such as stokvels, traditional money lenders “mashonisa”, rotating savings and credit associations, which unfortunately, satisfied only the demand for consumption loans and not entrepreneurial funding requirements (Meagher and Wilkinson, 2001:4). These credit facilities involved small amounts, charged high interest rates and sometimes used physical force to ensure repayment.

After the democratization of South Africa in 1994, the government enforced developments in the credit market. The government pressurized the commercial banks to extend banking services and meet the demand for bank credit by the unbanked (Schoombee, 2004:598). The four major banking groups in South Africa, Nedcor, Standard, ABSA and FNB, entered the microlending market and commenced new divisions to serve the unbanked with great caution. Standard bank provided services to the urban population through its E-plan. It also entered a joint venture with African Investment Bank Limited (Abil), which is the largest microlender (Swart, 2003:105, in Schoombee, 2004:602). African Bank provided small loans ranging from 3-36 months to employed individuals with an average loan size of R4 400, where 35% of the loans met the demand for housing loans and 30% education loans and related needs (Meagher and Wilkinson, 2001:8).

Nedbank ventured into the low-income market through its People’s Bank division in 1995. In 2004, it had a client base of 2 million low and middle-income individuals (Schoombee, 2004:602). ABSA, through the NuBank division, provides loans to the market that was traditionally regarded as unbankable, those earning less than R1 400 per month and the small self-employed (Schoombee, 1998:351). NuBank provides both unsecured personal micro-loans<sup>16</sup> and micro-entrepreneur loans (Schoombee, 2004:602) and the largest single loan is R12 000 (Hawkins, 2001:35). Teba Bank, which is a “*niche bank, aiming to provide*


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<sup>16</sup> Micro-loans refer to both cash loans (loans for from 1-6 months) and term loans (for longer periods).

*affordable micro-financial services to the under-banked in non-metropolitan South Africa*" (Falkena et al., 2004:100) and not a division of any commercial bank, also offers services such as savings accounts, microlending and housing loans to the unbanked and underbanked.

Despite the banks' attempts to meet the demand for bank credit by people of low-income, the high cost of credit and the collateral demanded discouraged them from seeking loans from the banks. The lack of competition in this lower tier of the market significantly contributed towards the high costs of bank credit. Although financial liberalization has generally increased competition in the banking industry, it has not been influential in this lower tier of the banking sector in terms of competition, due to the foreign banks' lack of interest in the low-income market (Hawkins, 2001:26). The small and medium firms and low-income individuals are therefore exposed to interest rate charges that are even higher than those charged to corporations and wealthier individuals, who do not pay high premiums for being unbanked and receive unsolicited offers of credit (Schoombee, 1998:340; Hawkins, 2001:26). Table 4.1 shows the cost of credit for low-income consumers at a time when the prime rate was 17% and the Usury Cap was 24% for amounts less than ten thousand rands and 26% for amount more than ten thousand rands.

**Table 4.1: Costs of credit for low-income consumers**

Product	Effective annual rate	Income group Making use of product	
Unregistered microloans	360%	LSM 1-3	<div style="text-align: center;">                     High costs                        Low costs                 </div>
Formal microloans	44%-360%	LSM 1-6 Higher rates for LSM 1-3	
Instalment sales	16%-120%	LSM 1-6 Higher rates for LSM 1-4	
Credit cards (inc. store credit)	23%-65%	LSM 1-10 Higher rates for LSM 1-5	
Pension backed (banks plus Pension Administrators)	16.5%-18%	LSM 5-7	
Overdrafts and other loans	18%-23% (or higher Different products)	LSM 7-10 LSM 6 min for Current a/c	
Leases and high value instalment sales	16%-25%	LSM 8-10	
High-end mortgages	15%-19%	LSM 8-10	

Source: Feasibility, 2003 in Falkena *et al.*, 2004:97.  
 \*LSM is a demographic categorization based primarily on income category, but includes a number of other consumer patterns associated with different lifestyles. The LSM 1 group has an average monthly income of R500, LSM 1-3 earn up to R15000 per month. LSM 10 has an average monthly income of over R21 000.

An attempt to improve credit availability by introducing collateral (as a precondition to get a loan), also discouraged the small firms and individuals from borrowing. It automatically led to the financial exclusion of most individuals and firms since most of the South African citizens were denied right of ownership of their property (Hawkins, 2001:35), which meant that they could not use their

property as collateral. However, this changed when the formal banking sector changed its creditworthiness criterion to formal employment and permitted the customers to repay the loans through payroll deductions (Hawkins, 2001:35). The introduction of special mortgage accounts ("access bond accounts") also improved the households' access to credit since they were allowed to borrow and pay back from these accounts up to an agreed limit set by the value of their housing collateral (Aron and Muellbauer, 2000:17).

Besides the supply side factors, the low demand for bank credit by small businesses and the low income individuals is partially associated with the poor or low entrepreneurial skills culture amongst the poor and some low-income earners (Meagher and Wilkinson, 2001:4). They demand bank credit in order to finance consumption, housing, education and emergencies. They do not demand bank loans in order to generate income, that is, to invest (Meagher and Wilkinson, 2001:4; Schoombee, 2004:617).

At this point, one may conclude that, among other factors, the lack of collateral, the size of the loan, income, the presence of other alternative credit facilities and the availability of bank credit, were the major determinants of the demand for bank credit during and after the apartheid era in this section of the private sector.

In terms of large companies and wealthy individuals, the availability of credit does not seem to be a significant determinant of the demand for bank credit. Deregulation and liberalization of the banking sector introduced several financial instruments and institutions through which and from which, this category of the private sector could access credit. There has been an increase both in the number of foreign bank branches opened and the number of representative offices that exclusively offer their services to this group of the private sector (Hawkins, 2001:21).

Besides increasing the availability of credit through new instruments and institutions to the corporate sector, financial liberalization reduced credit constraints on households engaging in smoothing consumption. It also reduced the deposits that were required from the individuals who planned to buy houses for the first time and increased the availability of collateral-backed loans for households that already had collateral (Aron and Muellbauer, 2000:2).

It is important to realize that the determinants of the demand for bank credit by the small and medium firms are vital to the credit demand by large firms in South Africa. The reason behind this is that some large firms depend on the performance of the smaller firms for both the supply of and demand for commodities, that is, smaller firms may produce inputs for the production of goods in bigger firms; at the same time some smaller firms may be buyers of larger firms' output. In this manner, access to finances and the cost of bank credit to the small firms are also vital to the productivity of the large firms (Falkena *et al.*, 2004:122) and, to some extent, the demand for credit by the large firms.

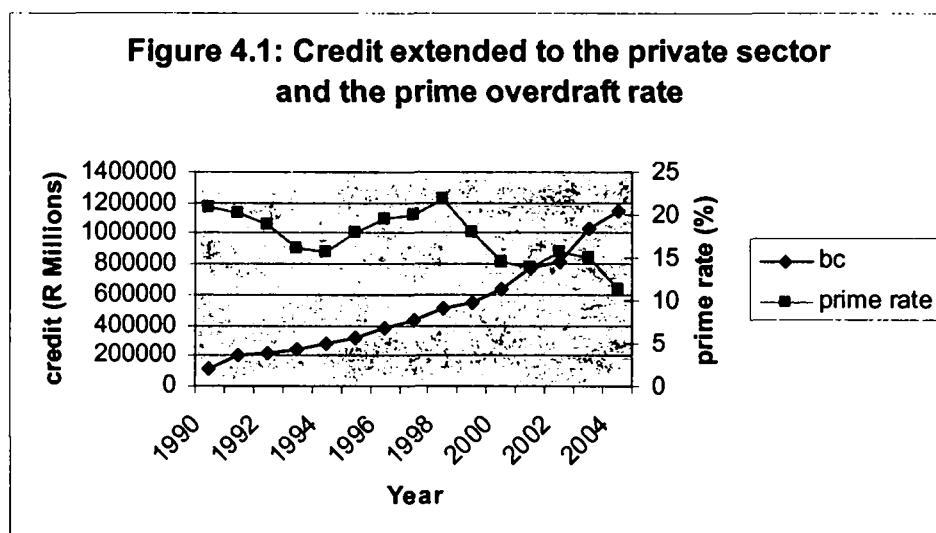
#### **4.2.2 The stylized facts about bank credit to the private sector**

The macroeconomic variables also carry great implications for the demand for bank credit by the private sector. The SARB's monetary policy was aimed at influencing the bank credit demand through interest rates to control inflation, and ultimately economic output, even before 1990. The SARB expected high levels or increases in the prime overdraft rate to reduce the demand for bank credit and ultimately, inflation. The notion was, "*the rate of interest is a price; if the price goes up, the demand for credit goes down; if it goes down, the demand for credit goes up*" (Botha, 1997:553).

Figure 4.1, which plots the time series of the level of bank credit extended to the private sector and the prime overdraft rate from 1990-2004, shows that, for most of the 1990s, the relationship was not as expected. Unlike the bank credit extension curve, which steadily increased throughout the time, the prime

overdraft rate curve reflected substantial decreases and increases. This suggests that the prime rate did not always negatively influence the bank credit extension as was expected. Rather, their relationship seemed to concur with Arestis' (1992:193) view that it is not the price of credit that determines or influences the level of the demand for bank credit, but its availability to the firms. According to Botha (1997:557), the South African public steadily demanded bank credit, despite the high costs in the early 1990s, because the SARB authorities had convinced them that maintaining high interest rates was the optimal way to deal with inflation.

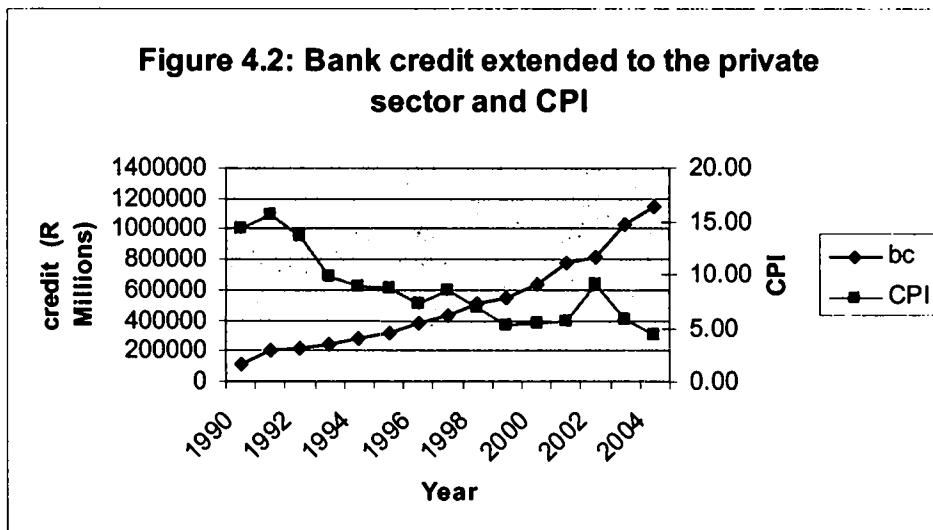
On the contrary, the graph suggests that there has been a negative association between the prime rate and bank credit extension since 1998. Even at the end of 2002, when there was an increase in the prime rate, bank credit extension declined. This is reflected by the fact that the bank credit extension curve increased at a decreasing rate at that time.



Source: Data was compiled from the SARB Quarterly Bulletin.

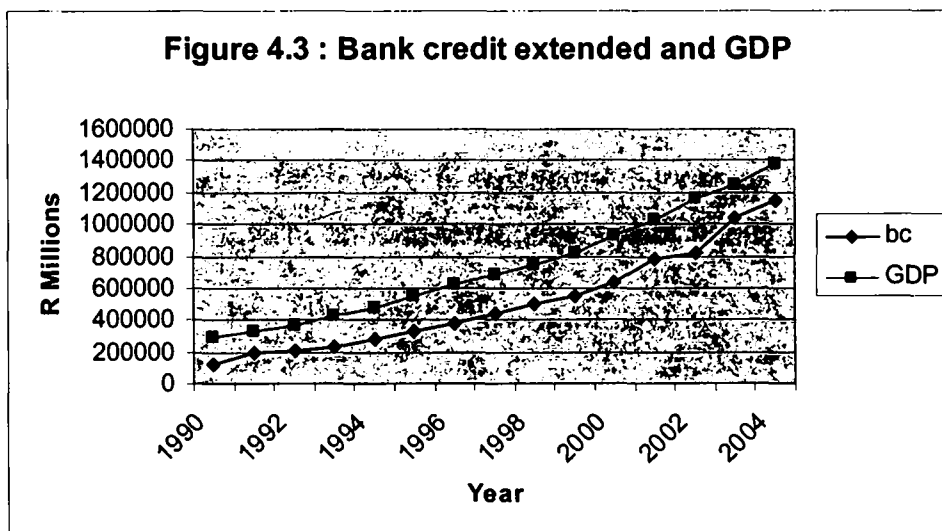
The relationship between inflation and bank credit was mainly negative throughout the sample period. While bank credit extended to the private sector

increased steadily, the inflation rate decreased steadily with the exception of 1998 and 2002.



Source: Data was compiled from the SARB Quarterly Bulletin.

On the other hand, Figure 4.3 shows that there was an upward trend in both GDP and bank credit extended for the time period under consideration. The implication of this consistent movement in the same direction is that there may be a causal relationship between the variables, such that an increase in the level of economic output results in an increase in the demand for bank credit, as postulated by the post-Keynesian theory.



Source: Data was compiled from the SARB Quarterly Bulletin.

### 4.2.3 Summary

To recapitulate, the common determinants of the demand for bank credit that are observed across the various members of the private sector are: the prime overdraft rate, the rates in the alternative markets, the macro-economic factors, in particular, the price level and economic output, collateral and the political situation. This shows us that the factors that explain the demand for bank credit in South Africa are by no means different from those of other countries. The study will use some of these determinants to construct a model for bank demand by the private sector in South Africa.

## 4.3 THE MODEL OF BANK CREDIT DEMAND TO THE PRIVATE SECTOR IN SOUTH AFRICA

### 4.3.1 The model

Based on the empirical studies discussed earlier, the theories regarding the demand for credit and the stylized facts about the bank credit market in South Africa, this study considers cost of bank credit and the macroeconomic variables as the determinants of the demand for bank credit to be included in the model. The paper has modified the models by Pazarbaşıoğlu (1997) and Fase (1995) in

order to model the demand for bank credit by the private sector in South Africa. Like Pazarbaşıoğlu (1997) and other studies, the model includes real GDP, the real bank lending rate and the rate of inflation (not the expected rate of inflation as Pazarbaşıoğlu (1997) did). In the same manner as Fase (1995), the model includes the real yield on long-term government bonds in the demand for bank credit model.

Following the suggestion by Fair (1987, in Hayo, 2000:583), bank credit and real GDP enter the model in logarithms, while the real yield on bonds is measured in percent per annum. The real prime rate is in logarithms. The long-run model for the demand for bank credit by the private sector in South Africa that the study estimates is therefore a semi-log linear model. The significance of using log-linear models is entrenched in the fact that log-transformation makes estimation simple by linearizing multiplicative models, reduces the impact of outliers and, reduces the increasing variance of trending time series (Wieringa and Horváth, 2005:279). The model takes the following form:

$$\ln Bc = \alpha + \beta_1 \ln GDP + \beta_2 \ln INF + \beta_3 \ln RP + \beta_4 YB + \varepsilon \quad (1)$$

$\ln Bc$  is the logarithm of real bank credit.  $\ln GDP$  is the logarithm of real GDP.  $INF$  is CPI inflation.  $\ln RP$  is the logarithm of the real prime overdraft rate.  $YB$  is the real yield on the long-term government bond and  $\varepsilon$  is an error term.

A priori, GDP and yield on the long-term government bond are expected to have a positive relationship with the demand for bank credit. Inflation and the prime overdraft rate are expected to have a negative relationship with the demand for bank credit. The study assumes that bank credit extended to the private sector is equivalent to the credit demanded by the private sector.

#### **4.3.1.1 Data description**

The study employs quarterly data for all the variables in the model over the period 1990:1 to 2004:4, such that there are 60 observations. Time series data on GDP is sourced from the International Monetary Fund (International Financial Statistics), while inflation, prime rate, bank credit and the yield on government bond are obtained from the various issues of the South African Reserve Bank Quarterly Bulletin.

The data on the real government bond yield refers to the secondary market yields on government bonds with maturity of more than 10 years. The real yield on government bonds is the nominal yield deflated by change in inflation. This variable is included to represent the influence of an alternative means of finance. In terms of the prime rate, although market participants pay nominal interest rate on loans, the study uses the real prime overdraft rate since real interest rates are more significant in economic analysis (Botha, 1997:549-550). The real prime rate is the difference between the nominal prime rate and the change in the GDP deflator as Calza *et al.* (2001a) have done in their study.

The model includes CPI inflation and real GDP in order to capture the effects of the macroeconomic environment. Specifically, real GDP captures the influence of income and industrial production. The data on GDP is readily available in constant terms (at 2000 prices). When data is in constant terms it implies that the effects of inflation are adjusted for, thus GDP is in real terms. The demand for bank credit refers to credit to the private sector by the banking institutions. The data is readily available in constant terms.

#### **4.4 THE COINTEGRATION, ERROR-CORRECTION METHODS**

The empirical studies employ different methods in order to estimate the demand for bank credit model. A summary of the empirical results in Table 3.4 above shows that the dominating approach for estimating the demand for bank credit is the cointegration, vector error correction approach.

This study employs the cointegration, vector error correction approach as the recent empirical studies in this field have, in order to estimate equation (1). Cointegration analysis, which is a method for specifying, estimating and testing dynamic models, is regarded as perhaps the most revolutionary development in econometrics since the mid-1980s (Seddighi *et al.*, 2000:251). It is an important tool when modelling data with trends (Frances, 2001:577), as it can avoid the problem of spurious regression (Miller, 1991:141; Gujarati, 2003:822) and can be used to test for the validity of the underlying economic theories (Seddighi *et al.*, 2000:251).

The idea behind cointegration analysis is that although individual economic time series of the variables may be individually non-stationary, a suitable linear combination between these trending variables could remove the trend component and make the linear combination stationary (Johansen, 2000:361; Seddighi *et al.*, 2000:251; Chakraborty and Basu, 2002:1063). This implies that the dynamic paths of those variables are influenced by any deviation from the steady state equilibrium, which therefore characterises a cointegrated system by some error correction process (Chang, 2000:9).

According to Chakraborty and Basu (2002:1063), most empirical studies on cointegration tests use two main tests<sup>17</sup>. These are the residual-based test suggested by Engle and Granger (1987), and the multivariate vector autoregressive (VAR) approach known as the Johansen cointegration approach.

The Engle-Granger (1987) residual-based test involves three steps. According to Arize (1994:3), the first step is to determine the order of integration. The second

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<sup>17</sup> There are other approaches, such as the residual-based test for the null hypothesis of cointegration by Shin (1994) and the Durbin-Watson Cointegration Regression test (CRDW) that are also commonly used in cointegration analysis. The detailed discussion on these approaches is outside the scope of this research paper. However, this study does not apply any of these approaches because using single equation modelling in cointegration analysis is problematic and can lead to misleading results if there are more than two regressors in the model, particularly if  $n-1$  of these regressors are not weakly exogenous (Harris, 1995:72).

step is the estimation of the cointegration regression by regressing the dependent variable on a constant and the independent variable using OLS, if the time series are of the same order of integration. The third step is to test that the residuals are integrated of order zero by using the Augmented Dickey-Fuller (ADF) test.

Even though the Engle-Granger cointegration test has been frequently used in empirical studies, it has several shortcomings. The first problem pertains to inefficiency. In the same manner as other single equation modelling techniques such as the CRDW, it may be inefficient if there are more than two regressors in the model because there can in fact be more than one cointegrating vector, such that the regressors are part of more than one equilibrium relationship (Harris, 1995:72). Secondly, the Engle-Granger approach can give misleading results in the sense that, even if there is only one cointegrating relationship, estimating a single equation may result in the loss of information due to the inability of the model to treat all variables as potentially endogenous (Chakraborty and Basu, 2002:1063).

Due to the problems of the Engle-Granger approach, along with other single equation models, and the advantages of the Johansen approach, this study will use the Johansen approach. The Johansen approach is a reliable test for cointegration and has better sample properties than other commonly used cointegration tests (Arize, 1994:4). Unlike the Engle-Granger approach, it provides a multivariate framework and allows for more than one cointegrating vector in the estimated model, which prevents any loss of efficiency (Chakraborty and Basu, 2002:1063). It also allows for causality among the variables (Bahmani-Oskooee and Brooks, 1999:121; Bahman-Oskooee and Shin, 2002:121).

Moreover, the Johansen test has been generalized to accommodate structural breaks of unknown timing (Arai and Kurozumi, 2005:2). The undetected structural breaks, which often occur due to factors such as economic crisis,

changes in institutional arrangements and policy changes (for example, fiscal policy or monetary policy), also need to be taken into account when regressing. This is mainly because if any form of structural changes is present in the data generating process, but are not allowed for in the specification of the model, the results may be misleading (Perron, 1989, 1997, and Leybourne and Newbold, 2003 in Pahlavani *et al.*, 2005:1).

#### 4.4.1 The Johansen procedure

The Johansen approach is based on a linear system:

$$Z_t = \sum_{i=1}^k A_i Z_{t-i} + \phi D_t + \mu_t \quad t = 1, \dots, T \quad (2)$$

where  $Z_t$  is the vector with  $n$  variables, in this case, CPI inflation, real bank credit, real prime rate, logarithm of real GDP and the real yield on long term government bonds, assuming that,  $Z_t \sim I(d)$  with  $d \leq 1$ ,  $\mu_t$  is a white noise error term  $\mu_t \sim N(0, \epsilon)$  (Hubrich, 1999:84). The  $A_i$ s are coefficient matrices,  $k$  is the lag length and  $D_t$  is a dummy that can contain a constant, a linear term or seasonal dummies (Johansen, 2000:362).

In order to use the Johansen test, the study reformulates the VAR ( $k$ ) model in equation 2 into a vector error correction model that takes the following form:

$$\Delta Z_t = \Pi Z_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Z_{t-i} + \phi D_t + \mu_t^{18} \quad i = 1, 2, \dots, k-1 \quad (3)$$

with an error correction term,  $\Pi Z_{t-1}$ , without any loss of information. An error correction term implies that a “*proportion of the disequilibrium from one period is corrected in the next period*” (Dritsakis, 2004:114). It measures the proportion by which the long term imbalance in the dependent variable is corrected in each short run period (Hondroyannis, 2004:328).  $\Pi$  represents an  $n \times n$  coefficient

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<sup>18</sup>For detailed derivation of the VECM refer to Enders (1995: 389-390).

matrix that can be factorized according to the number  $r(0 \leq r \leq n)$  of linearly independent cointegrating vectors such that  $\Pi = \alpha\beta'$  (Hubrich, 1999:85).  $\alpha(n \times r)$  is the matrix of the speed of adjustment coefficients that characterizes the long run dynamics of the system (Brooks, 2002:404; Chang, 2000:11). When the value of  $\alpha$  is large, it means that the system will rapidly adjust to a deviation in the equilibrium, while a small value implies that it will adjust slowly. However, when  $\alpha = 0$  for some equations, it implies that the corresponding variable is weakly exogenous and does not respond to equilibrium error (Chang, 2000:11). Chang (2000:11) also states that it is important that at least one  $\alpha$  must be non-zero ( $\alpha \neq 0$ ) in a cointegrated system.

On the other hand,  $\beta'(r \times n)$  is the matrix of cointegrating or long-run vectors (Hubrich, 1999:85). If  $\beta'xt = 0$ , it implies that the system is in equilibrium, but if it assumes any other value, it represents the equilibrium error or deviation from long-run equilibrium and is stationary in a cointegrated system (Johansen and Juselius, 1990, in Chang, 2000:11).

The application of the Johansen procedure is based on the above concepts, and its analysis may be done in three stages, as outlined by Hondroyannis (2004:324). The first step is to determine the order of integration of each variable in equation 1. It is important to test for the order of integration of each variable in a model in order to establish whether it is non-stationary and how many times the variable needs to be differenced to result in a stationary series (Harris: 1995:27). The second step is to test for cointegration using the Johansen maximum likelihood approach. The third step involves the use of the VECM.

#### **4.4.1.1 Testing the order of integration**

The order of integration is commonly investigated by means of both standard unit root tests and stationarity tests. This study will employ the two prominent unit root tests, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. However, the paper will plot the time series before delving into these tests, since

the plots give information about the likely nature of the time series (Gujarati, 2003:807).

The ADF test is conducted by adding the lagged values of the dependent variable (lnBc) in the model. The lagged values are included to 'soak up' any dynamic structure present in the dependent variable, and this ensures that the residuals ( $\varepsilon_t$  in equation 4 below) are not autocorrelated (Brooks, 2002:380; Gordon, 1995:188). The standard procedure that is available in econometric software packages, such as, SHAZAM 6.1, TSP 4.2 and EViews 5<sup>19</sup> is to apply the ADF test of the form:

$$\Delta y_t = \beta_1 + \beta_2 T + \delta y_{t-1} + \sum_{i=1}^{p-1} \alpha \Delta y_{t-i} + \varepsilon_t \quad (4)$$

Where  $\varepsilon_t$  is a pure white noise error term ( $\varepsilon_t \sim IID(0, \sigma^2)$ ),  $\Delta$  is the difference operator, T is a time trend,  $\Delta y_{t-i}$  ( $\Delta y_{t-1} = y_{t-1} - y_{t-2}$ ;  $\Delta y_{t-2} = y_{t-2} - y_{t-3}$ ...) are lagged differences, while  $\beta_1$ ,  $\beta_2$ ,  $\sigma$ , and  $\alpha$  are the parameters to be estimated.

As mentioned earlier, the null hypothesis tested in the ADF test is whether there is a unit root ( $\alpha < 0$ ), against the alternative hypothesis that the time series is stationary ( $\alpha < 0$ ) (Gujarati, 2003:817). The null hypothesis is estimated based on the 't-statistic' value of the estimated  $\sigma$  in equation 4, which is called the ADF statistic (Gordon, 1995:188). The ADF does not have the standard t-distribution, but applies the critical values of the  $\tau$  (tau) statistic that are similar to those in the DF test (Gordon, 1995:188). *"If the computed absolute value of the  $\tau$  statistic exceeds the DF or Mackinnon DF absolute critical  $\tau$  values, then we do not reject the hypothesis that the given time series is stationary. If on the other hand, it is less than the critical value, the time series is non-stationary"* (Aziakpono, 2000:135).

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<sup>19</sup> The EViews 5 package will be used to estimate all the equations in this section.

The major problems with using the ADF test have to do with choosing the correct form of the ADF model and determining the optimal number of lags of the dependent variable to include. The problem of choosing the suitable form of the ADF test is compounded by the size<sup>20</sup> and power<sup>21</sup> properties of unit root tests, especially concerning the small sample properties of these tests (Harris, 1995:39). Poor size and power properties respectively refer to a tendency to over-reject the null-hypothesis when it is true and under-reject it when it is false.

The use of different lag lengths often results in different outcomes with respect to rejecting the null hypothesis of non-stationarity (Harris, 1995:39). Failure to use the optimal number of lags, for example, including too few lags of the dependent variable in the test regression, changes the size of the test in an unknown manner and will not remove all the autocorrelation, while using too many will reduce the power of the test by increasing the coefficient standard errors (Gordon, 1995:188; Brooks, 2002:380). According to Brooks (2002:380), the latter effect arises because an increase in the number of parameters uses up the degrees of freedom, which ultimately reduces the absolute values of the test statistics.

There are some approaches that have been developed in the literature on how to choose the optimal lag length. The two common approaches are based on some summary statistic criterion for  $\epsilon_t$  in equation 4. These are the Schwartz Information Criterion (SC) and the Akaike Information Criterion (AIC). The other approaches are respectively based on the highest significant lagged value of the autocorrelation function (ACF) for the first differenced series (Brooks, 2002:380; Gordon, 1995:188) and on the frequency of the data. In the case of the latter, if the data are quarterly, one could use four lags and twelve lags if the data is monthly (Brooks, 2002:380).

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<sup>20</sup> Size of a test refers to the level of significance.

<sup>21</sup> Power of a test refers to the probability of rejecting the null hypothesis when it is false.

Another method of testing for unit roots is the Phillips-Perron (PP) test. Unlike the ADF test, which takes care of possible serial correlation in the error terms by adding lagged difference terms of the regressand, the PP test uses non-parametric statistical methods and does not add any lagged difference terms (Gujarati, 2003:818). The test is carried out using the t-statistic following more or less the same procedure as the ADF. It often gives the same conclusion as the ADF and suffers from the same important limitations as the ADF test (Brooks, 2002:381).

Before proceeding onto the next step, which is testing for cointegration, a suitable model has to be identified. This implies that a decision has to be made as to which deterministic components should be included in the multivariate model. In order to select the deterministic components, Johansen (1992, in Chakraborty and Basu, 2002:1068) and Harris (1995:81) suggest that a joint hypothesis of both the rank order and the deterministic components should be tested. The tests are made from the most restrictive alternative ( $r = 0$  and model with constant) to the least restrictive alternative ( $r = n - 1$  and model with a trend in the cointegration vectors). As a decision criterion, the trace statistics or the maximal eigenvalue statistics are compared to the critical values until the first time that the null hypothesis is not rejected (Chakraborty and Basu, 2002:1068). In addition, an appropriate lag length has to be decided on. The optimal lag length will be chosen on the basis of the lag length that is mostly selected by lag length selection criterion, such as the AIC and SC.

#### **4.4.1.2 Testing for cointegration**

Once the order of integration and the identification of the cointegrating model are determined, the next step is to apply the Johansen-Juselius maximum likelihood procedure to determine whether there is a long run relationship between these variables, that is, whether the variables are cointegrated. It is important to note that cointegration analysis is only possible if the variables are non-stationary and have the same order of integration (Dritsakis, 2004:114). Testing for

cointegration in the Johansen framework amounts to finding the number of  $r$  linearly independent vectors in the matrix  $\Pi$ , which is equivalent to testing whether the last  $n-r$  columns of  $\alpha$  are insignificantly small (Harris, 1995:87).

As aforementioned, in order to test if the variables in the model are cointegrated, the study will apply the Johansen maximum likelihood procedure to a VAR version of the demand for bank credit model (equation 1). This step involves the application of the trace statistics ( $\lambda_{trace}$ ) and the maximum eigenvalue statistic ( $\lambda_{max}$ ). These Johansen approaches for testing for cointegration are based on the sequential likelihood ratio (LR) tests of the null hypothesis that there are at most  $r$  cointegration vectors, which amounts to  $n-r$  unit roots, against the alternative of  $n-r-1$  unit roots (Garone, 1996:14).

$\lambda_{trace}(r, n) = -2 \log(Q) = -T \sum_{i=r+1}^k \log(1 - \hat{\lambda}_i)$  where the number of cointegrating vectors under the null is  $r = 0, 1, 2, \dots, k-1$ ,  $T$  is the number of observations used for estimation,  $Q$  is the outcome of the restricted maximised likelihood divided by the unrestricted maximised likelihood and  $\hat{\lambda}_i$  is the  $i$ th largest estimated eigenvalue from  $\Pi$  matrix (Dritsakis, 2004:115). The larger the  $\hat{\lambda}_i$  the more negative will be  $\log(1 - \hat{\lambda}_i)$ ; hence the larger will be the statistic.

$\lambda_{trace}$  is a joint test where the null hypothesis is that the number of cointegrating vectors is less than or equal to  $r$ , where  $r$  is  $0, 1$ , or  $2$ , against an unrestricted or general alternative that there are more than  $r$  cointegrating variables (Arize, 1994:4), that is,  $H_0: rk(\Pi) = r$  against  $H_1: rk(\Pi) = r + 1$ . This test statistic either rejects the null hypothesis of no cointegration among the variables ( $r = 0$ ) or does not reject the null hypothesis that there is one cointegrating relation between the variables ( $r \leq 1$ ). It starts with  $p$  eigenvalues and then successively the largest is removed until the null hypothesis is not rejected anymore. If the test

statistic is greater than the critical value, the null hypothesis of no cointegration vectors is rejected.

The limitation of the  $\lambda_{trace}$  test if the Osterwald-Lenum (1992) asymptotic critical values are used, is that, if one includes the dummy variable in the deterministic component of the multivariate model,  $D_t$  in equation 2, the Osterwald-Lenum (1992) asymptotic critical values will only be indicative (Harris, 1995:88). In addition, if the sample size of the observations in  $Z_t$ , in equation 2, is small, problems regarding the power and size properties of the trace test are encountered when the asymptotic critical values are used (Harris, 1995:88).

$\lambda_{\max}(r, n+1) = -T \ln(1 - \hat{\lambda}_{r+1})$  is similar to  $\lambda_{trace}$ , except for the fact that the alternative hypothesis is explicit.  $\lambda_{\max}$  is based on the largest eigenvalue and conducts separate tests on each eigenvalue (Garone, 1996:14). It tests the null hypothesis of no cointegration  $r = 0$ , against the alternative hypothesis that  $r = 1$ ,  $r = 2$  and so on, that is,

$$\begin{array}{lll}
 H_0: rk(\Pi) = r = 0 & \text{Versus} & H_1: rk(\Pi) = 0 < r \leq g \\
 H_0: rk(\Pi) = r = 1 & \text{Versus} & H_1: rk(\Pi) = 1 < r \leq g \\
 \cdot & & \cdot \\
 \cdot & & \cdot \\
 \cdot & & \cdot \\
 H_0: rk(\Pi) = r = g - 1 & \text{Versus} & H_1: rk(\Pi) = r = g
 \end{array}$$

The first test involves testing a null hypothesis of no cointegration vectors, which corresponds to  $\Pi$  having zero rank. If the null hypothesis is not rejected, it would be concluded that there are no cointegrating vectors and the testing would be completed. However, if  $H_0: r = 0$  is rejected, the null that there is one cointegrating vector ( $H_0: r = 1$ ) would be tested. The value of  $r$  is continually increased until the null hypothesis is no longer rejected (Brooks, 2002: 405-406). If the test statistic is smaller than the critical value, the null hypothesis that  $r = 0$  cannot be rejected, this implies that there are no cointegrating vectors.

These likelihood ratio tests may not always give results that lead to the same conclusion. For example, one test may indicate that there are 2 cointegrating vectors, while the other detects 1, due to the different economic theories that determine the different relations among a set of variables (King et al., 1991, in Bahmani-Oskooee and Brooks, 1999:124).

Some suggestions, although contradictory, have been made to assist the practitioner to decide on the cointegration rank in such instances. Banerjee *et al.* (1986, 1993 in Chakraborty and Basu, 2002:1063), suggest that one should rely on the results given by the maximum eigenvalue test, since its results are more reliable in small samples. Conversely, Cheung and Lai (in Harris, 1995:89) suggest that more emphasis should be placed on the trace test since it shows more robustness to both skewness and excess kurtosis than the maximal eigenvalue test in the Monte Carlo experiments.

When the conclusion is reached concerning the number of cointegrating vectors present in the model, the next step is to determine what these cointegrating vectors are and whether they inform one about the structural relationship underlying the long-run model. In this case,  $\alpha$  and  $\beta$  coefficients are then estimated through the Johansen technique (Chakraborty and Basu, 2002:1069). The different structural relationships can then be identified among the relevant variables and the unique set of  $\beta$  vectors can then be chosen by imposing restrictions based on economic theories. Harris (1995:95) emphasises that testing for unique cointegration vectors is necessary because the reduced rank regression procedure only gives information on the number of cointegration vectors in the cointegration space, but does not inform one of the vectors in  $\beta$  that are unique.

It is also important to determine which variables should be excluded from the cointegration space since the results could be sensitive to the variables that are included in the model (Bahmani-Oskooee and Shin, 2002:91). In order to

determine which variable(s) should be excluded from the model, the hypothesis that  $H\alpha_{ij} = 0$  for  $J = 1 \dots r$ , that is, row  $i$  contains zeros is tested. This test is done by imposing row restrictions<sup>22</sup> on  $\alpha$ , which will result in a new restricted model. If all the values of  $\alpha$  are zero in the different columns, this indicates that the cointegration vectors in  $\beta$  do not enter the equation determining  $\Delta Z_{it}$ . This implies that there is no loss of information about the long-run  $\beta$  from not modelling the determinants of  $\Delta Z_{it}$ . Therefore, this variable is said to be weakly exogenous to the system and can validly enter on the right-hand side of the VECM, although its short-run dynamics will not be modelled because of its exclusion from the vector on the left-hand side of the equation (Harris, 1995: 98).

The likelihood ratio test involving the restricted and unrestricted models can then be used to ascertain whether the restrictions are valid. This is done by comparing the likelihood ratio test statistic with the chi-square distribution with  $(r \times (n-m))$  degrees of freedom in order to obtain the significance level for rejecting the null hypothesis (Harris, 1995: 101). If the chi-square distribution exceeds the likelihood ratio test, then the null is not rejected. In terms of the likelihood ratio test, if the null of exclusion cannot be rejected, this implies that the variable is weakly exogenous.

It is important to carry out the likelihood ratio test for weak exogeneity since the results could be sensitive to treating all the variables as endogenous (Bahmani-Oskoei and Shin, 2002:91), as the Johansen procedure would have been doing so far. Testing for excludability of the variables or weak exogeneity is also a significant precondition for the next step, which is estimating the VECM, since *“it is usually not valid to condition the VECM on the independent variables unless*

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<sup>22</sup> “The form of restrictions is determined by specifying an  $(n \times m)$  matrix  $A$  of linear restrictions, where  $(n-m)$  equals the number of row restrictions imposed on  $\alpha$ , such that the null hypothesis amounts to testing whether  $\alpha = A\alpha_0$ . Imposing the restrictions reduces  $\alpha$  to an  $(m \times n)$  matrix  $\alpha_0$ . It is also useful to note that these same restrictions in  $A$  could be imposed by specifying an  $(n \times (n - m))$  matrix  $B$  such that  $B'\alpha = 0$ . Both matrices  $A$  and  $B$  are used in the mechanics of restricting the Johansen reduced rank regression model, thereby obtaining  $n-1$  new eigenvalues ( $\lambda_i$  hat\*) for the restricted model, which are used in the LR test” (Harris, 1995:101).

*they are weakly exogenous in the full system”* (Harris, 1995:100). In addition, testing for weak exogeneity on the variables in the model helps one to validate the assumption regarding the endogeneity-exogeneity of the variables included in the model (Chakraborty and Basu, 2002: 1067).

On the basis of this long-run exclusion test, the study will proceed by restricting the variables that were found to be excludable and then re-estimate the system including variables that are significantly different from zero. However, in order to sustain inference, some diagnostic tests such as the White test for heteroscedasticity, the LM test for autocorrelation and the Jarque-Bera test for normality need to be run.

The White test for heteroscedasticity operates by obtaining the  $R^2$  from the auxiliary regression and multiplying it by the number of observations  $T$  ( $TR^2$ ).  $TR^2$  follows a chi-square distribution with  $m$  (number of regressors) degrees of freedom. The null hypothesis that is tested in this approach is that all the coefficients of an auxiliary regression are equal to zero. If the chi-square test statistic is greater than the corresponding value from the statistical table, then the null hypothesis that the errors are homoscedastic is rejected, which implies that there is significant evidence of heteroscedasticity (Brooks, 2002:150).

The Jarque-Bera normality test is based on the property of a normally distributed random variable that the entire distribution is characterized by the mean and the variance (Brooks, 2002:179). It also considers the third and fourth moments of a distribution and refers to them as its skewness and Kurtosis. *“Skewness measures the extent to which a distribution is not symmetric about its mean value and kurtosis measures how fat the tails of the distribution are”* (Brooks, 2002:179). The Jarque-Bera test statistic asymptotically follows a chi-square distribution and tests the null hypothesis that the distribution of the series is symmetric and mesokurtic (Brooks, 2002:182). If the null hypothesis is rejected, it implies that there is a violation of the normality assumption.

#### **4.4.1.3 Estimating the Vector Error Correction Model**

Once cointegration among the variables in the VAR model is established, the next procedure is to analyse the short-run adjustment behaviour of the variables in response to a random shock by analysing how each variable in a cointegrated system responds to the error from the cointegrating vector (Chakraborty and Basu, 2002:1064) using the VECM. The VECM enables one to specify both the short-run and long-run dynamics of the model and captures the potential endogeneity of the determinants of credit demand (Calza *et al.*, 2001a:13).

In the same manner as in the test for cointegration, the decision has to first be made regarding the deterministic components (dummies, intercept and trend) that should be included in the model. Following this step, the VECM can then be estimated using the (Gaussian) residuals from the cointegration vector. According to Chakraborty and Basu (2002:1064), the estimation of the VECM in the Johansen procedure involves reparameterising equation 1 to take the form of an error correction model (equation 3) with the identified cointegration relationships explicitly included as residual terms and the identification of the unique cointegration vectors that reflect structural economic relationships underlying the long-run model.

The results of the VECM model will give results from which one can recognise how each variable in the cointegrated system corrects itself to the residual from the cointegrating vector. The misspecification tests, Lagrange-multiplier test for autocorrelation, the Heteroscedasticity test and the Bera-Jarque normality test will then be applied to the estimated model. Following this, weak exogeneity tests will be performed on the equations of the dependent variables in equation 1 in order to determine whether it would be legitimate to specify the demand for credit as a single equation model instead of a system through the general-to-specific approach. This test is performed by assessing the statistical significance of the coefficient of the error correction term in each of the equations of the system other than the equation for bank credit demand. *"If the error correction term is*

*found not to be significant in a specific equation, this implies that there is no information loss from excluding that equation from the system (Calza et al., 2001a:13).*

#### **4.4.1.4 Limitations of the Johansen procedure**

In the same vein as other approaches, the Johansen cointegration analysis also has some disadvantages. Besides the limitations that were mentioned in the above discussion at the different stages of the Johansen procedure, the major shortcoming of the Johansen procedure lies in the number of decisions that have to be made, compared to other approaches. The steps as outlined in Harris (1995:76-77) include:

- Setting the appropriate lag-length of the VAR in order to ensure the error terms are Gaussian, that is, not autocorrelated or non-normal, in the vector error correction model (VECM).
- Determining whether the system should be conditioned on any predetermined  $I(0)$  variables, including dummies, to take account of possible policy intervention(s).
- Testing for reduced rank, including the issue of whether the system should be treated as an  $I(2)$  rather than an  $I(1)$  system.
- Identifying whether there are trends in the data and therefore whether deterministic variables (a constant and trend) should enter the cointegration space or not.
- Testing for weak exogeneity, which leads to the modelling of a partial system with exogenous variables.
- Testing for a linear hypothesis on cointegration relations.
- Testing for unique cointegration vectors.
- Joint tests involving restrictions on  $\alpha$  and  $\beta$ .

#### 4.4.2 Impulse response analysis

Since this study is intended to find out how long it takes for the changes in the prime rate to affect the demand for bank credit, the impulse response within the cointegration framework will be employed. According to Ganey *et al.* (2002:32), the most common approach is the use of orthogonalized impulse responses referred to as the Sims approach. The major limitation of this approach is that it imposes severe restrictions on the variables by assuming a particular ordering. In order to avoid this problem, studies employ the generalized impulse responses (GIR) approach that has been proposed by Koop, Pesaran and Potter and applied to VAR models by Pesaran and Shin (1998).

The generalised impulse response uses the moving average of the undifferenced VAR of the VECM of equation 3:

$$X_t = \phi_1 X_{t-1} + \dots + \phi_k X_{t-k} + \psi w_t + \varepsilon_t \quad (5)$$

where  $X_t$  is an  $(m \times 1)$  vector of jointly determined  $I(1)$  variables,  $W_t$  is  $(q \times 1)$  vector of deterministic variables and each  $\phi_i$  and  $\psi$  are  $(m \times m)$  and  $(m \times q)$  matrices of coefficients to be estimated using a  $(t = 1, \dots, T)$  sample of data,  $\varepsilon_t$  is an  $(m \times 1)$  vector of error terms with a zero mean and non-diagonal covariance matrix,  $\Sigma$  (Osei *et al.*, 2003:11), which is presented as:

$$X_t = \varepsilon_t + A_1 \varepsilon_{t-1} + A_2 \varepsilon_{t-2} + \dots + \sum_{i=0}^{\infty} A_i \psi w_{t-i} \quad (6)$$

The impulse response is then computed by subjecting a selected equation to a one-standard-deviation forecast error shock. It is therefore measured as the effect of one standard shock to the  $j$ <sup>th</sup> equation at time  $t$  on  $X_{t+n}$  as follows:

$$\phi_j^s(n) = \delta_{jj}^{-0.5} A_n \Sigma e_j \quad (7)$$

Where  $\Sigma e_j$  is an  $(m \times 1)$  vector that identifies the source of the shock, and unity is the  $j_{th}$  element with zeros elsewhere (Osei *et al.*, 2003:12). According to Osei *et al.* (2003:12), this will then show the time profiles of the impact of the unit shock to elements of  $\varepsilon_t$  on the level of  $x_t$ , taking into account the knock-on and feedback effects that characterise the variables in a dynamic system. The limitation of this approach is that one needs to know the causality of the economic structure before the impulse response results.

#### **4.5 Conclusion**

The derived South African bank credit demand model used in this study has the following determinants: real prime rate, real yield on government bonds, inflation and real GDP. In order to achieve the second sub-objective, which is the analysis of these determinants, giving greater emphasis to the relationship between prime rate and bank credit, the study employs the Johansen procedure of cointegration, error correction modelling. This approach has several advantages over other cointegration modelling techniques employed in the literature. It provides a multivariate framework and allows for more than one cointegrating vector in the estimated model, which prevents any loss of efficiency, allows for causality among the variables and accommodates structural breaks of unknown timing when modelling.

It involves three steps. The first step is to determine the order of integration of each variable in equation 1. The second step is to test for cointegration, using the Johansen maximum likelihood approach and the third step involves the use of the VECM.

The last part of the chapter briefly explained the generalised impulse response analysis. It is employed in order to answer the question: 'how long does it take for the real prime rate to have an impact on the demand for bank credit', which addresses the third sub-objective.

## **CHAPTER 5**

### **EMPIRICAL RESULTS**

#### **5.1 INTRODUCTION**

While the previous chapter was dedicated to modelling the demand for bank credit and explaining the Johansen cointegration procedure, this chapter will practically employ the Johansen procedure and the impulse response analysis in order to achieve the second and third sub-objectives of this study, respectively.

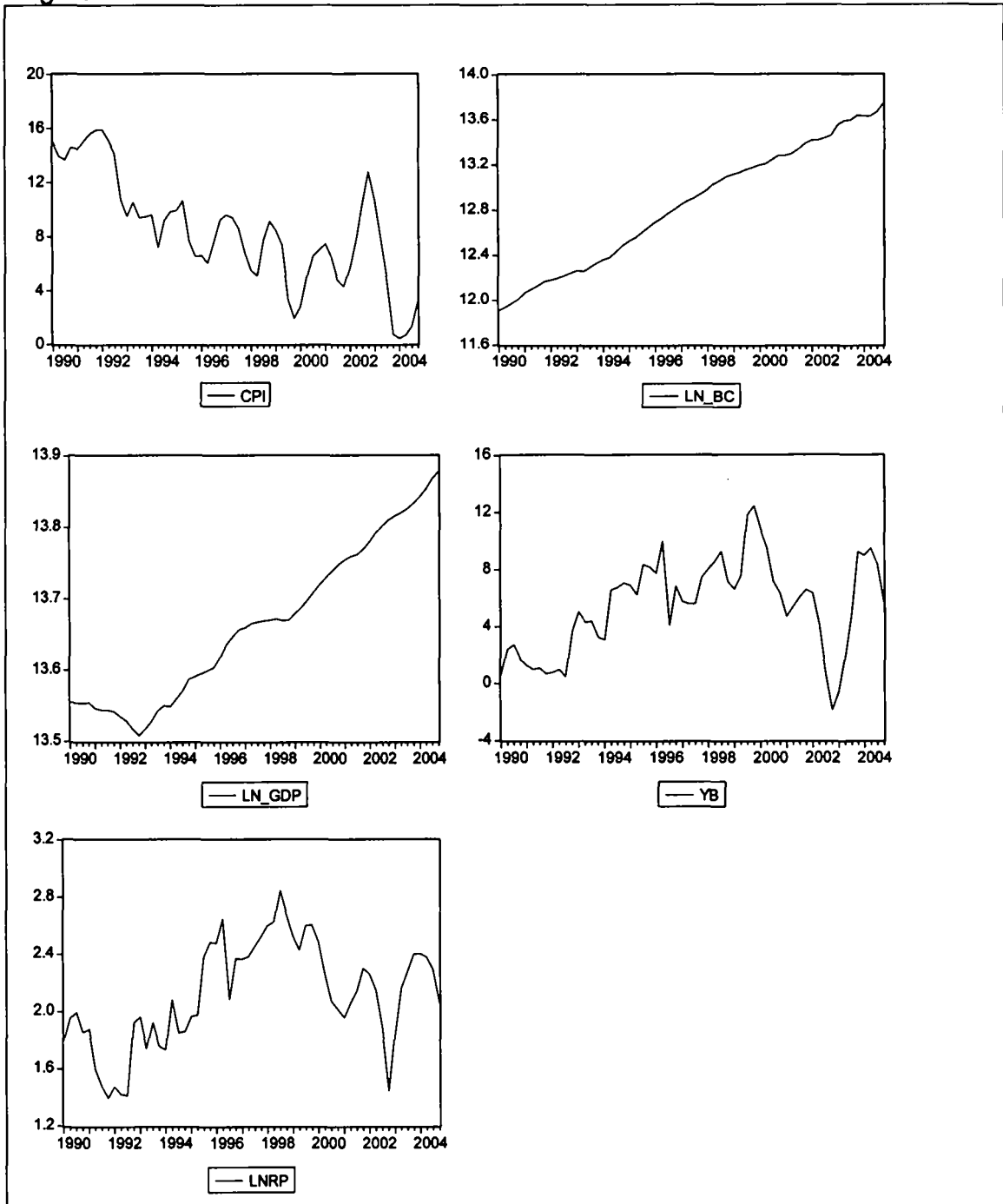
The research results will be presented, interpreted and evaluated against theory and results of other studies. The potential impact of these results for monetary policy transmission or monetary policy *per se* will be discussed.

#### **5.2 TIME SERIES PROPERTIES OF DATA**

As explained earlier, it is important to first make plots of all the variables to be used in the model before estimating. The plots enlighten one concerning the properties of the data, for example, whether there are any structural breaks or trends in the data or whether the data is stationary.

The plots of the variables show that all the variables have an intercept. The logarithm of bank credit extension graph and the graph of the logarithm of real GDP steadily trend upwards. Their movements suggest that they may be non-stationary. The CPI plot also reflects some trend (downward). The yields on bonds and real prime rate curves fluctuate a lot and have prominent kinks around 1998 and 2002.

Figure 5.1: Plots of the time series.



The unit root tests for stationarity, the ADF and PP tests are performed on both levels and first differences for all the variables in the model. Table 5.1 reports the

ADF and PP test statistics for the stationarity of all the variables over the period 1990:1 to 2004:4.

**Table 5.1 Unit root tests for stationarity**

Variables	ADF test		PP test	
	Levels	1 <sup>st</sup> differences	Levels	1 <sup>st</sup> differences
cpi	-2.3575	-3.9412 *	-2.9241	-4.6201 *
lnbc	-1.6537	-5.5872**	-1.8117	-5.3156**
lngdp	-3.0497	-3.8069 **	-2.7041	-3.4873*
rp	-2.2557	-7.5692**	-2.3405	-7.5690**
yb	-2.4283	-5.8968**	-2.4283	-6.5670**

The tests were performed including both an intercept and a trend in the regression and using the longest lag at which the t-statistic was significant.

(\*) and (\*\*) denote rejection of null-hypothesis of unit root at the 5% and 1% level of significance, respectively.

The calculated ADF and PP statistics show that the variables are non-stationary in levels but stationary in first differences, that is, they are all integrated of order one.

### 5.3 COINTEGRATION ANALYSIS

The next step in the analysis is to test whether or not there is a long-run relationship among the variables in equation 1, which were found to be integrated of order one. However, the Johansen procedure requires that an appropriate lag length be chosen first. Since the data on the series used in the study is quarterly, the selection for the lag length was drawn from a maximum of four lags. The results in Table 5.2 show that the different information criteria chose three different lag lengths. The SC chose one lag, the LR chose four lags and both the AIC and FPE chose two lags. The different lags were explored and the SC was chosen over the others, since it produced results that were economically sensible.

**Table 5.2 Lag selection criterions**

VAR Lag Order Selection Criteria  
 Endogenous variables: LNBC LNGDP INF LNRP YB  
 Exogenous variables: C  
 Date: 01/21/06 Time: 11:37  
 Sample: 1990Q1 2004Q4  
 Included observations: 56

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-107.9747	NA	3.89e-05	4.034811	4.215646	4.104920
1	237.8301	617.5086	4.13e-10	-7.422504	-6.337494*	-7.001848
2	280.2087	68.10840	2.27e-10*	-8.043167*	-6.053982	-7.271964*
3	296.5001	23.27341	3.27e-10	-7.732145	-4.838786	-6.610396
4	327.4626	38.70320*	2.96e-10	-7.945094	-4.147559	-6.472797

\* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

In the next step, the Johansen maximum likelihood procedure was carried out, in order to determine the number of cointegration relationships in equation 1 using the lag length of one. The two approaches used are the trace and maximum eigenvalue statistics that were explained earlier. As can be observed from Table 5.3, the two tests show conflicting results.

**Table 5.3 Johansen test for cointegration**

Date: 01/21/06 Time: 12:01  
 Sample (adjusted): 1990Q3 2004Q4  
 Included observations: 58 after adjustments  
 Trend assumption: Linear deterministic trend (restricted)  
 Series: LNBC LNGDP INF LNRP YB  
 Lags interval (in first differences): 1 to 1

**Unrestricted Cointegration Rank Test (Trace)**

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.477529	102.3510	88.80380	0.0037
At most 1 *	0.403946	64.69829	63.87610	0.0426
At most 2	0.267627	34.68771	42.91525	0.2581

At most 3	0.200808	16.62268	25.87211	0.4436
At most 4	0.060535	3.621772	12.51798	0.7959

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

#### Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.477529	37.65273	38.33101	0.0597
At most 1	0.403946	30.01058	32.11832	0.0885
At most 2	0.267627	18.06503	25.82321	0.3722
At most 3	0.200808	13.00091	19.38704	0.3280
At most 4	0.060535	3.621772	12.51798	0.7959

Max-eigenvalue test indicates no cointegration at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

The trace test was chosen over the maximum eigenvalue test because it is more robust in the presence of either skewness and excess kurtosis (Cheung and Lai in Harris, 1995:89). The trace test rejects the null hypothesis of no cointegration because the trace statistic, 102.35, exceeds the critical value, 88.80. In the next step, which is the test for the null of at most one cointegrating vector, the trace statistic, 64.70, which still exceeds the 5% critical value of 63.88, leads to the rejection of one cointegrating vector. However, in the test for the null of at most two cointegrating vectors, the trace statistic, 34.69, is less than the critical value of 42.92, which indicates that there are two cointegrating equations.

Taking the first cointegrating vector and normalising on bank credit, the following long-run relationship was found. The table of results is in appendix 1.

$$\ln BC = -0.06INF + 0.02\ln GDP - 0.11\ln RP - 0.031YB$$

(0.083)      (\*)      (\*)      (0.205)      (6)

All the variables except the real yield on bonds enter the long-run equilibrium relationship with expected signs. The correct signs imply that the coefficients are consistent with theoretical considerations. On the basis of the signs of the coefficients, the study interprets this cointegration relation as describing the long-run demand for loans. The p-values of INF and YB are in parenthesis, while the algorithm could not converge to give the values for lnGDP and lnRP. This However, based on the significant cointegrating value of lnGDP, the study assumes that lnGDP is significant.

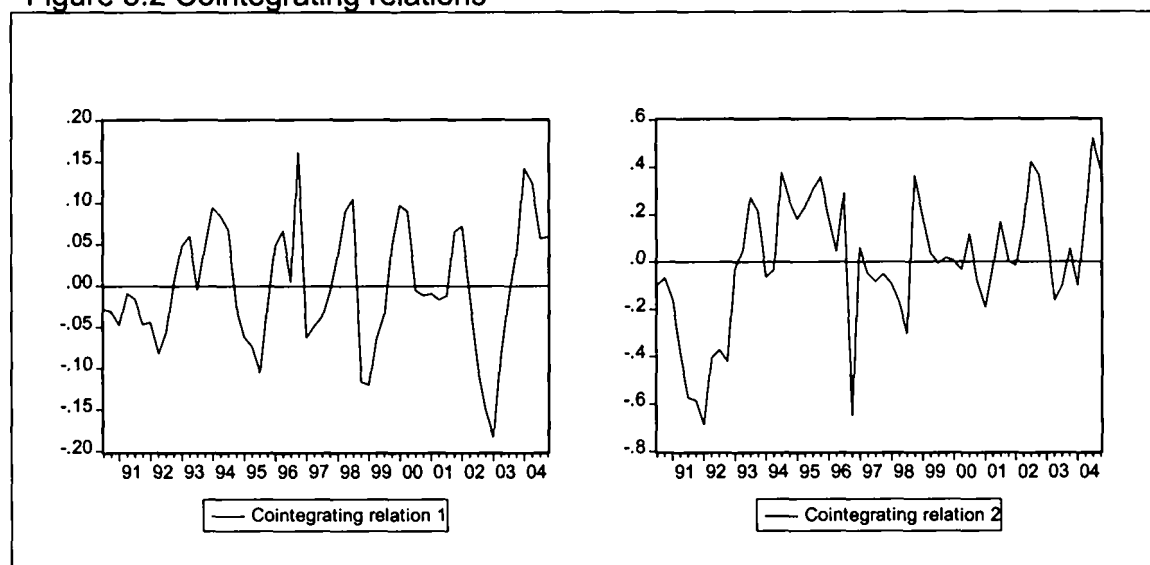
Although the coefficient on the yield on bonds has an unexpected sign, this sign is in line with other studies, such as Calza *et al.* (2001a) and Ogawa and Suzuki (2000). Moreover, its coefficient is close to zero (-0.03), which represents the lower boundaries of the expected range. The lnGDP coefficient indicates that there is a positive association between GDP and the demand for bank credit. The coefficient of lnGDP may be interpreted as the income elasticity and thus mean that an increase of 1% in GDP will lead to a 0.02% rise in the bank credit demand, everything else being equal. Studies by Ghosh and Ghosh (1999), Ogawa and Suzuki (2000), Calza *et al.* (2001a) and Melitz and Pardue (1973) also found that there exists a positive relationship between real demand for bank credit and GDP. In terms of inflation, a negative relationship is observed. The negative coefficient on inflation concurs with the theory that an increase in inflation might increase the risk of undertaking investment projects and discourage investment, which in turn reduces the demand for bank credit and the results of other studies such as Howells and Hussein (1999) and Pazarbaşıoğlu (1997) concur.

There is a negative relationship between the demand for bank credit and the real prime rate, such that as the real prime rate increases by 1%, on average, the demand for bank credit falls by 0.107%. Although the coefficient is relatively small, compared to other studies, its sign agrees with the findings of other

studies. Ikhide (2003), Ghosh and Ghosh (1999), Pazarbaşıoğlu (1997), Hewitson (1997), Fase (1995) and Caligiuri and Padoa-Schioppa (1974) all found that there is a negative association between the prime rate and demand for bank credit. This outcome is also similar to the result found by Smal and De Jager, who explored this relationship in the South African context in 1985, using data on both levels and percentage changes in the interest rates.

Before moving on to the next step, the restricted cointegrating vector 1, which represents the deviations of bank credit from its long-run equilibrium level and the cointegrating vector 2 are plotted in Figure 5.2.

Figure 5.2 Cointegrating relations



The plot of the cointegrating relation 1 and cointegration relation 2 suggest that, over the period of the study, the deviations of bank credit of the cointegration relation 1 from the equilibrium were stationary, which makes them useful as an error correction term (Calza *et al.*, 2001b:11). Cointegration relation 1 is more stationary, which justifies our choice for it over cointegration vector 2.

In the context of the demand for bank credit model, the negative difference between the actual bank credit and the equilibrium level implied by the model can be interpreted as a measure of the bank credit overhang and vice versa. The plot of cointegration relation 1 indicates that there were relatively large shortfalls over the sample period with the major one in 2002/2003. In the same manner, there were also relatively large overhangs, although not as huge as the shortfalls. Even in 2004, the graph suggests that bank credit to the private sector was significantly higher than other periods in the sample besides 1996/1997. As Calza *et al.* (2001a:113) explained, on the basis of models such as the one used in this study, such an overhang would be expected to contribute to slower growth of bank credit in the future, as the level of bank credit moves closer to the long-run equilibrium, although this is not certain, since it will also depend on the nature of the process by which bank credit adjusts to deviations from equilibrium.

**5.4 THE SHORT-RUN DYNAMICS OF THE DEMAND FOR BANK CREDIT**

As explained in section 4.4 of Chapter four, the presence of the cointegrating relationship among the variables that are non-stationary in levels means that there is a short-run error correction relationship associated to it. This relationship helps to characterise the process of adjustment towards the equilibrium (Calza *et al.*, 2001a:113). In this case, it represents an adjustment process by which the deviated demand for bank credit is expected to adjust back to its long-run equilibrium path. The parameters of the short-run relationship, as can be observed from equation (7) and appendix 1 are as follows:

$$\ln BC = 0.00004INF - 0.587 \ln GDP - 0.043 \ln RP + 0.002YB \tag{7}$$

(0.01)            (-1.16)            (-0.04)            (0.63)

The t-values of the coefficients are in parenthesis. The error correction coefficient is negative (-0.32) and statistically significant from zero at the 5% level of significance. This validates that the variables are cointegrated and suggests that the equation describes the demand for bank credit behaviour. The size of the

error correction term indicates the change in the demand for bank credit per quarter that is attributed to the disequilibrium between the actual and equilibrium levels. The adjustment speed of approximately 32% takes place in a quarter. This coefficient is higher than that found in the study by Calza *et al.* (2001:13).

The real yield on government bonds coefficient now has the expected sign. In the same manner, the coefficient of real prime rate has the expected sign but it is insignificant. This sign concurs with the findings of international studies and the findings of the study made by Smal and De Jager in 1985, who found the coefficient of the *level* of the prime rate to be negative and that of the *change* in prime rate to be positive. The long-run coefficient is greater than the short-run coefficient. This implies that the impact of the real prime rate on the demand for bank credit is greater in the long-run than in the short-run. The coefficient of inflation is positive, which is consistent with the results of the study by Ikhide (2003). The GDP coefficient is negative and greater than the long-run coefficient. This implies that the households prefer to finance their consumption through income or other means in the short-run and that the firms use their internal resources to finance production. However, all the variables are insignificant.

#### 5.4.1 Diagnostic tests

The tests for autocorrelation and normality do not indicate any statistical problems that may suggest that the model is misspecified. They are all insignificant at the 95% critical value. The results are presented in Tables 5.4 and Table 5.5. However, the heteroskedasticity test (Table 5.6) shows that there is some evidence of heteroscedasticity in the residuals. The existence of heteroscedasticity may be caused by omission of other important variables from the model (Gujarati, 1995:359).

**Table 5.4 Jargue-Bera normality test**

Component	Jargue-Bera	df	prob
joint	16.01343	10	0.0992

**Table 5.5 Lagrange Multiplier test (1)**

Lags	LM-Stat	Prob
1	18.54281	0.8185

**Table 5.6 Heteroskedasticity test**

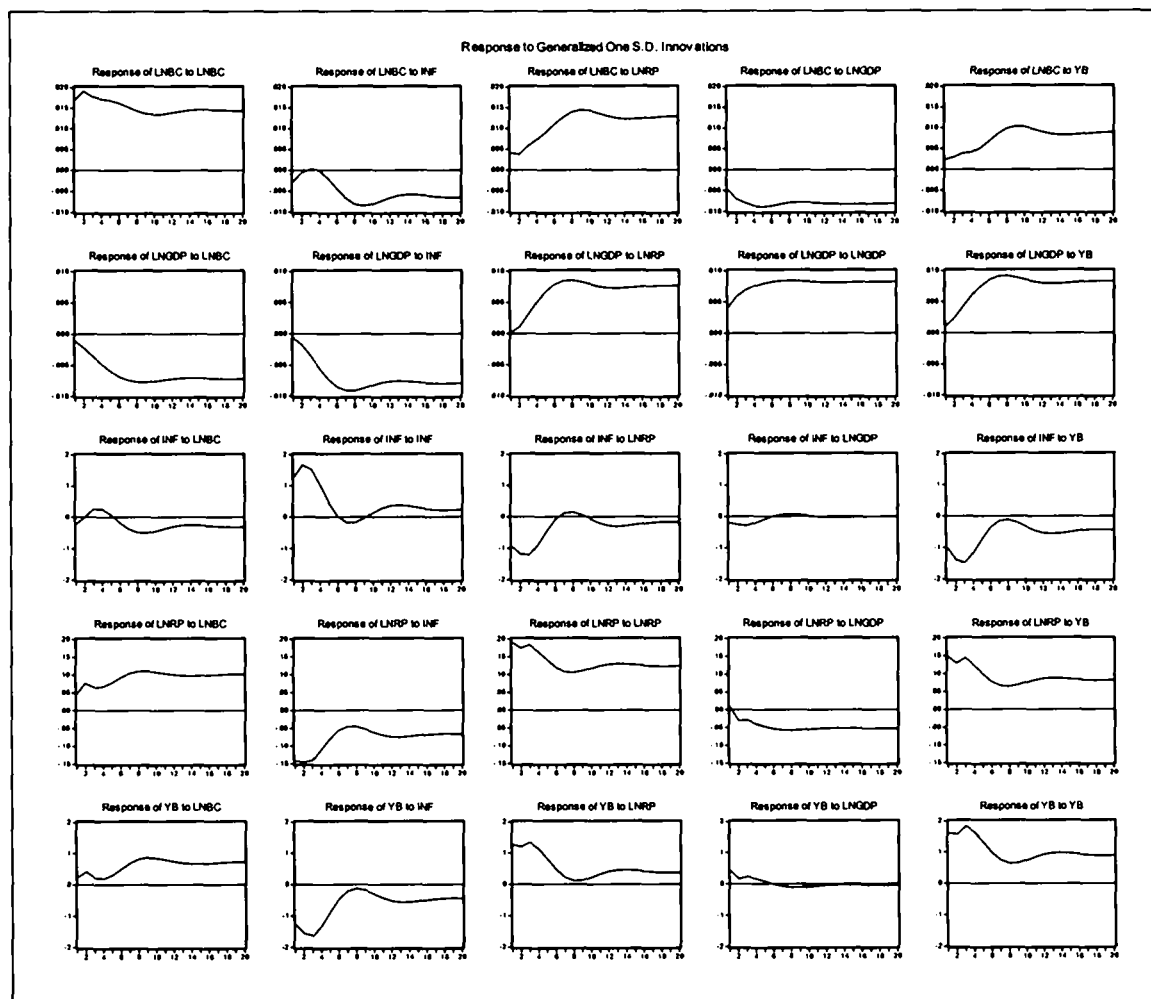
Chi-sq	df	Prob
248.7132	210	0.0347

## 5.5 IMPULSE RESPONSES

The various tests undertaken above fail to inform us of how long it takes for the effect of any of the bank credit determinants to work through the system. In order to obtain this information, the generalised impulse response analysis is employed. The point estimates of the impulse response function of the variables to a one-standard deviation shock to other variables are represented by the solid line.

The graphs of the response of  $\ln BC$  to the independent variables are shown in the graphs in the first row in Figure 5.3 below. The impulse responses are generally similar to the short-run coefficients, with the exception of  $\ln RP$  which now shows a positive association. These contrasting results may be explained by the presence of heteroscedasticity in the residuals. They should therefore be considered with caution.

Figure 5.3 Impulse responses



The results show that the innovations to GDP always have a negative impact on the real demand for bank credit, since the impulse response is negative and the impact of the shock on the real demand for bank credit does not die down even after 5 years. Inflation has a negative impact for the first quarter, but beyond that, the shock appears to have worked its way out of the system. The shock on lnRP seems to be instantaneous, that is, a unit shock in lnRP affects the demand for bank credit in the very first quarter. However, the influence is positive, which is contrary to both the short-run and long-run results. The impact of a unit shock on the real yield on government bonds is also instantaneous. A unit shock on YB impacts the demand for bank credit in the first quarter.

## **5.6 CONCLUSION**

In sum, the results of this study show us that the real prime rate negatively influences the demand for bank credit, both in the long-run and short-run as the monetary authorities in South Africa expect it to do. However, the impact of the real prime rate on the demand for bank credit is insignificant in the short-run but could not be determined for the long-run since the algorithm could not converge to give results. The generalised impulse response function shows that the effect of a shock in the real prime rate will affect the demand for bank credit instantaneously. However, this has to be accepted with caution since there is evidence of heteroscedasticity in the residuals.

## CHAPTER 6

### CONCLUSION, IMPLICATIONS FOR MONETARY POLICY AND RECOMMENDATIONS FOR FURTHER RESEARCH

#### 6.1 CONCLUSION

The study examined the response of the demand for bank credit to changes in the prime overdraft rate in South Africa, using quarterly data from 1990:1 to 2004:4. As explained in Chapter one, as part of achieving this objective, three sub-objectives were addressed in the study. Firstly, the relationship between the prime rate and the repo rate was briefly explored with the help of a graphical analysis. It was observed from the graph that a close positive correlation between prime rate and repo rate exists, such that as the monetary authorities increase the repo rate, the prime rate also increases.

In addition, the graph showed that there is a persistent margin between the repo rate and the prime rate, even though the mandatory margin between the prime rate and the repo rate no longer exists. The banks informally maintain this margin at an average range of three to four percentage points above the repo rate. This implies that the prime rate will, everything being normal, exceed the repo rate by about three or four percentage points. The relationship is therefore summarized as  $R_z = R_s + R_p$ , where  $R_z$  denotes the rate of interest on prime overdraft facilities,  $R_s$  is the repo rate and  $R_p = (R_z - R_s)$  is the gap or margin between the repo rate and the prime rate.

The second sub-objective, which is to analyse the determinants of bank credit, was first addressed by a review of the theoretical and empirical studies to first determine what the determinants of the demand for bank credit are. The theoretical literature, based on post-Keynesian views, suggest that the major determinants of the demand for bank credit are costs of production and increases in the demand for firms' output. Production costs include: wage bill, raw material

costs and tax payments. The Fisherine theory observes the preference for present relative to future consumption, interest rate and investment opportunities as the determinants of the demand for bank credit. Since the empirical studies draw from both theories in terms of the determinants of the demand for bank credit, some of these determinants were recognised in some studies. However, the determinants of the demand for bank credit that were commonly recognised in most studies are output or income, the interest rate on bank loans, fixed investment, inflation and the interest rate on alternative sources of finance.

Based on these common determinants, which are derived from empirical studies and theory, and the stylized facts about bank credit extension in South Africa, it was decided that the likely determinants of the demand for bank credit by the private sector in South Africa to include in the model are prime lending rate, yield on government bonds, GDP and inflation. In order to be in a position to make a detailed analysis of these determinants, which involves determining the response of the demand for bank credit to changes in the real prime rate, the study employed the cointegration, error correction framework. Specifically, the study used the Johansen procedure.

The study firstly tested the order of integration of all the variables using the ADF and PP tests. These tests showed that all the variables were non-stationary at levels, but stationary at first differences. Having established the order of integration, the study employed the Johansen cointegration tests. On the basis of the trace test results, it was found that there were two cointegrating vectors. The first cointegration vector was chosen over the second one.

With the existence of cointegration established, a vector error correction model was estimated. The error correction coefficient (-0.32) was found to be negative and statistically significant from zero at the 5% level of significance. This error correction term is higher than that found in the study by Calza *et al.* (2001a). The

value suggests that an adjustment speed of approximately 32% takes place in a quarter.

In terms of the determinants of the demand for bank credit, GDP was found to have a positive relationship with bank credit demand, while all the other variables were found to affect it negatively in the long-run. In the short-run, yield on government bonds and inflation coefficients have a positive association, while the coefficients of real prime rate and GDP are negative. The results confirmed the monetary policy authorities' expectation of a negative relationship between the demand for bank credit and the real prime rate. The coefficient for the real prime rate was -0.107 in the long-run, which suggests that increasing the real prime rate by 1%, will lead to a 0.11% fall in the demand for bank credit and -0.043 in the short-run. Although the coefficient is relatively small compared to other studies, its sign concurs with the findings of international studies and the findings of the study made by Smal and De Jager in 1985, who explored this relationship using South African data.

Finally, the third sub-objective was accomplished through the analysis of impulse responses. The results showed that demand for bank credit begins to respond to changes in the real prime rate by the first quarter, which implies that it takes a quarter for changes in the real prime rate to influence the real demand for bank credit.

## **6.2 IMPLICATIONS FOR MONETARY POLICY**

The adjustment coefficient of 32% implies that the pressure on the demand for bank credit to return to its long-run equilibrium is relatively moderate and the complete adjustment time is less than four quarters. This signifies that the impact of the independent variables on the demand for bank credit takes about three quarters and a month to complete, which shows that monetary policy is effective since it does not take years for the full impact to be absorbed by the demand for bank credit. In terms of policy making, the adjustment coefficient implies that,

when there is a deviation in the demand for bank credit from the equilibrium, it will be corrected in about ten months.

In addition, since the results are as expected by the monetary policy authorities, that is, the real prime rate has a negative influence on the real demand for bank credit; the study serves as further empirical evidence of the efficacy of the monetary policy authorities' implementation of monetary policy. The fact that the results confirm the precision of their policy strategies will improve the authorities' confidence in conducting monetary policy. In like manner, this will improve the confidence of the public who are interested in the implementation of monetary policy by the SARB. The results of this study will assure the public and the government that the monetary policy authorities are not only committed to maintaining price stability, but are able to achieve it through their monetary policy implementation approach. This will in turn increase the confidence of the public and the government with regard to the monetary policy authorities and improve the authorities' credibility in terms of curbing inflation. The credibility of the monetary policy authorities is vital for the effectiveness and continued success of the inflation targeting framework, which fundamentally depends on the confidence of the public in the monetary policy authorities' competence and commitment to price stability in order to be effective.

### **6.3 LIMITATIONS OF THE STUDY**

Since the demand for bank credit in this study is assumed to be the demand for bank credit extended to the private sector, the study does not completely capture the true demand for bank credit. However, the amount of bank credit extended to the private sector serves as the best available proxy to measure the demand for bank credit.

Secondly, the residuals were found to be heteroscedastic. Although the existence of this problem reduces the reliability of the results, the results obtained in this study are deemed to hold since what "often looks like

heteroscedasticity may be due to the fact that some important variables are omitted from the model" (Gujarati, 1995:359).

#### **6.4 RECOMMENDATIONS FOR FURTHER RESEARCH**

As the thesis discussed earlier, there have been some developments in the banking industry due to financial liberalisation and innovations, and these may have influenced the outcome of the demand for bank credit over time. This study did not consider the direct impact of these innovations when modelling the real demand for bank credit. Further research could contribute to this field of study by exploring the significance or impact of financial innovations in determining the outcome of the demand for bank credit in South Africa. In addition, other variables that were not included in the model used in this study could also be added to the model.

This study also needs to be viewed as ongoing research, since the results are prone to change as the structure of the financial system changes, particularly the banking sector, through which policy is mostly transmitted to the system. Continuous research on whether the relationship changes drastically with further developments in the financial sector and monetary policy implementation would also be important for monetary policy implementation.

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## APPENDIX

### Appendix 1: Vector Error Correction Estimates

Vector Error Correction Estimates

Date: 01/28/06 Time: 20:40

Sample (adjusted): 1990Q3 2004Q4

Included observations: 58 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegration Restrictions:

B(1,1)=1

B(2,2)=1

Convergence achieved after 1 iterations.

Not all cointegrating vectors are identified

Restrictions are not binding (LR test not available)

Cointegrating Eq:	CointEq1	CointEq2
LNBC(-1)	1.000000	0.021695
LNGDP(-1)	0.020241	1.000000
YB(-1)	-0.032009	0.130041
INF(-1)	-0.063196	0.270573
LNRP(-1)	-0.107889	-0.022584
@TREND(90Q1)	-0.038901	0.026024
C	-10.99479	-17.68039

Error Correction:	D(LNBC)	D(LNGDP)	D(YB)	D(INF)	D(LNRP)
CointEq1	-0.320238 (0.11330) [-2.82657]	-0.084717 (0.02766) [-3.06326]	0.701551 (10.8231) [0.06482]	13.15761 (8.50064) [1.54784]	-0.248269 (1.27888) [-0.19413]
CointEq2	-0.053242 (0.02042) [-2.60780]	-0.019307 (0.00498) [-3.87398]	0.445756 (1.95039) [0.22855]	0.358516 (1.53186) [0.23404]	-0.009835 (0.23046) [-0.04268]
D(LNBC(-1))	0.435280 (0.15624) [2.78595]	0.027820 (0.03814) [0.72943]	6.011807 (14.9257) [0.40278]	5.624454 (11.7228) [0.47979]	1.773515 (1.76365) [1.00559]
D(LNGDP(-1))	-0.586737	0.345397	-70.44722	44.07081	-7.711338

	(0.50729) [-1.15662]	(0.12383) [ 2.78926]	(48.4610) [-1.45369]	(38.0620) [ 1.15787]	(5.72626) [-1.34666]
D(YB(-1))	0.001556 (0.00248) [ 0.62644]	9.53E-06 (0.00061) [ 0.01571]	-0.205454 (0.23729) [-0.86583]	0.096881 (0.18637) [ 0.51983]	-0.022988 (0.02804) [-0.81986]
D(INF(-1))	3.85E-05 (0.00265) [ 0.01454]	-0.000417 (0.00065) [-0.64557]	-0.837234 (0.25270) [-3.31312]	0.965589 (0.19848) [ 4.86500]	-0.058558 (0.02986) [-1.96109]
D(LNRP(-1))	-0.042568 (0.02401) [-1.77296]	-0.006660 (0.00586) [-1.13638]	-2.968400 (2.29363) [-1.29419]	2.670044 (1.80145) [ 1.48216]	-0.256317 (0.27102) [-0.94575]
C	0.021296 (0.00524) [ 4.06075]	0.002829 (0.00128) [ 2.20954]	0.109827 (0.50100) [ 0.21921]	-0.402230 (0.39349) [-1.02220]	-0.018920 (0.05920) [-0.31959]

