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Modelling the demand for credit to the private sector in South Africa: An investigation of aggregate and institutional sector factors

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By

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DECLARATION

I certify that this study is my own work and that all the references have been accurately reported.

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Abstract

The recent global financial and economic crisis has brought about renewed interest in the nexus between credit markets and monetary policy. This research aims to contribute to the understanding of the factors that drive the demand for credit on an aggregate level, and the household and corporate sectors for the South African economy. The study assessed the equilibrium determinants of the aggregate and sectoral demand for credit in South Africa by making use of a cointegrated vector autoregression (CVAR) methodology. In addition, the periods of debt overhang and short-falls, at aggregate and sectoral levels in the credit market, are derived from these equilibrium levels.

The estimated models indicate the existence of long-run relationships for the aggregate credit demand equation, a classic demand-type relationship linking aggregate credit with gross domestic product (GDP) and the lending rate is established. For credit extended to the corporate sector, the results indicate that in the long-run it is determined by investment expenditure, operating surpluses and the lending rate. Whereas for credit extension to the household sector, it was found that the lending rate, disposable income and household debt were its important long-run determinants. All the results of the estimated equations are in line with a demand-type relationship and the traditional hypothesis that credit is demanded to finance real economic transactions, namely for liquidity purposes and to finance working capital.

The results of the short-term dynamics indicate that credit extension variables are the equilibrium variables, although the speed of adjustment parameter is found to be sluggish, which shows that the slow adjustment to equilibrium from shocks to the credit markets is attributable to the existence of stronger frictions and transaction costs in credit markets. These findings justify the persistent periods of credit overhang and short-falls in South Africa that this study derives from the equilibrium coefficient terms. The study shows that periods of credit overhang and short-falls are linked to the business cycle phases in South Africa.

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Chapter 1 Introduction

1.1. Background

It is generally accepted that financial conditions and developments have a significant impact on the economy. Literature emphasising the link between financial development and economic growth is of the view that the financial sector plays a fundamental role in the allocation of savings to productive enterprises, favouring economic efficiency and capital accumulation. In that context, credit growth can be the result of a financial deepening that will eventually benefit the economy (Kiss et al., 2006).

The main channel through which the financial sector contributes to economic growth is by collecting information and thereby improving the allocation of capital, sharing risk, pooling savings and raising the efficiency of financial intermediation. As a result, by easing financing constraints, increased bank lending can contribute to higher investment and consumption and, ultimately, a higher standard of living (Kiss et al., 2006).

Given the fact that the banking sector is a major source of funding for the non-financial and household sectors, and the fact that bank loans to the private sector are the biggest component on the asset side of banks and a major counterpart of money supply, it is important to understand developments in credit extended to the private sector. These developments also carry signals about the availability of, and demand for, funds that influence investment and spending decisions in the economy. Hence, growth in credit extension has important information about economic activity and prices (Calza, Manrique & Souza, 2001).

The recent financial crisis, the subsequent recession and the ongoing sovereign debt crisis were followed by different policy measures aimed at easing lending conditions so as to support credit extension and therefore real economic activity. This indicates the importance of credit extension to the household and corporate sectors in stimulating and driving economic activity.

Nonetheless, while credit extension is essential for economic activity and growth, debt overhang can be an impediment to investment and sustained economic activity. A number of authors assert that credit demand overhang has necessitated a need for a serious deleveraging process and balance-sheet repair across sectors (Dynan, 2012). This has resulted in credit demand short-fall of historic magnitude and has been one of the main contributors to the depressed or stagnant state of the real economy. Moreover, the synchronised deleveraging and balance-sheet repair process across sectors has resulted in depressed confidence levels, consumer spending, capital expenditure, business expansion and employment creation by the corporate sector, and all these factors have been a drag on the pace and sustainability of real economic recovery.

It is against this background that this study explores the determinants of credit extension at the aggregate and sectoral levels in South Africa. Moreover, the information content of the credit demand overhang and short-fall will be assessed in South Africa by making use of an equilibrium correction model.

For policymakers, credit developments across sectors are part of the information set that is monitored on a regular basis, given that they contain important information about financial and real economic activity. Thus, information about the sectoral determinants of credit extension at the households and corporate sectors, should be of the utmost importance for policymakers in general.

1.2 Research question

Contributions to studies on the credit-lending channel include works by Bernanke and Blinder (1988); Bernanke and Gertler (1995); Bernanke, Gertler and Gilchrist (1996); Kayshap and Stein (2000); Angeloni and Ehrmann (2003); Gambacorta and Mistruli (2004); Kishan and Opiela (2006); van den Heuvel (2002); and Grieber and Kok Sorensen (2006). These authors have established that developments in credit carry important information about economic and financial activity. Developments in credit impart signals about the availability or non-availability of funds to support economic activity.

Against this background, this study endeavours to assess the determinants of aggregate and sector-specific demand for credit extension in South Africa by making use of the CVAR method. In addition, the error correction technique is used to infer periods corresponding to loan demand overhang and short-fall. Thus, the study will attempt to answer the following questions:

- What are the determinants of aggregate and sector-specific demand for credit in South Africa?
- Which periods correspond to loan demand overhang and short-fall in South Africa?

The answer to the first question will necessitate the development of a long-term model for the demand of loan in South Africa using the CVAR approach. The model will be extended to its error correction representation in order to provide an answer to the second question where the sign of the error correction term will be used to determine periods corresponding to credit overhang or short-fall in South Africa (see Calza et al., 2003).

1.3 Value of the research

Credit extension to the private sector is the largest counterpart of money supply and is regularly monitored by the monetary policy authorities. Despite the banking sector being, by and large, the main source of funds for the household and corporate sectors (particularly small and medium enterprises), few studies have explored the determinants of aggregate credit extension in South Africa, let alone the determinants on a sectoral basis, given the fact that factors affecting the demand for credit by these sectors differ substantially. The value of the study is first and foremost to contribute to the South African research literature, as most studies of this nature have either modelled total credit extension but none has researched the sectoral demand for credit. Moreover, this study will extend the equilibrium model for the determination of loan demand to the identification of periods corresponding to credit overhang and short-fall in South Africa.

1.4 Research methodology

In order to assess the long-term relationship between credit extension to the private sectors and its determinants, the study will make use of the CVAR approach as suggested by Johansen and Juselius (1995). The variant of this methodology, the vector error correction model (VECM), will be used to discuss the issue of debt overhang or short-fall by assessing how dis-equilibrium in the credit market is corrected in South Africa.

Data used in this study was sourced from the South African Reserve Bank's (SARB) database. However, in conducting the research, given the fact that there is not sufficient data to disaggregate between the demand and supply factors, it is assumed that the demand for credit as measured by the credit aggregates is the actual level of credit extension to the private sector. The research will be confined to the asset side of the monetary sector and will focus on the analysis of outstanding amounts (levels or stocks) of loans.

1.5 Structure of the study

The remainder of the study is structured as follows: Chapter two presents the literature review on the determinants of the demand for credit. Chapter three discusses the South African credit markets. Chapter four presents the econometric technique used in the study, namely, the CVAR and the VECM.

Chapter five presents the data and conducts the econometric estimation. The CVAR approach will be used to determine the long-term equilibrium equations for a stable demand for credit in South Africa. Based on the determination of these loan demand equations, the VECM will be used to determine periods of credit overhang and short-fall from the error correction term. Lastly, Chapter six presents the conclusion of the study and policy implications derived from the results of the study.

Chapter 2 Literature Review

2.1 Introduction

In the classical models, financial markets in general have no bearing in the determination of real economic outcomes, namely whether financial markets exist is irrelevant to real economic activity. The financial side of the economy only becomes relevant to real economic activity to the extent that money is used and determines the absolute price levels but not relative prices and real quantities (Friedman & Kuttner, 1993).

Whereas in neoclassical models (including the Keynesian, neo-Keynesian and post-Keynesian) and monetarist models, the financial side of the economy does influence real economic activity through rigidities (imperfect flexibility) of, and relationships in, absolute prices. However, neoclassical models exclusively focus on money as the only financial quantity, that is, money is the only nominal quantity that varies given the imperfectly flexible prices and therefore the real economy or real quantities. In this framework all other assets are implicitly assumed to be imperfectly substitutable for money, although they are perfect substitutes for each other. Their demand is modelled implicitly by the description of the money demand function together with the determinants of the total wealth position (Friedman & Kuttner, 1993).

The credit models that followed distinguished themselves by recognising that households and firms have liabilities, and that these liabilities play a meaningful role in the determination of real economic activity. The role of these liabilities is introduced through the assumption that not all non-money assets are perfectly substitutable for one another, hence private agents have balance sheets. The existence of private balance sheets introduces stocks and flows (Baset et al., 2010).

The theoretical foundations for these models and the introduction of price rigidities or imperfect markets are mainly through the theory of imperfect information, the principal agent relationship theory, and the role of incentives and constraints embodied in contracts (contract theory). In this framework the monetary transmission

process begins when the central bank alters the actions of commercial banks by changing either the reserve requirements or the real level of reserves. Reserves have value because they are held against transactions deposits, which can only be issued by banks (Ramey, 1993).

The process of the transmission of monetary policy is set in motion when the central bank changes the ability of banks to lend. This is initiated by changing the reserves requirements, followed by interest rates, then deposits and credit extension and, ultimately, overall spending in the real economy. Thus, the central bank affects either the pricing or the volume of credit instruments or financial assets (Kuttner & Mosser, 2002).

The role of credit in the monetary policy transmission arises largely as a result of information asymmetries[1] and the related incentive problem in credit markets which accentuate the cash flow and liquidity effect, as banks may respond to the monetary restriction by restraining credit and also adopt more stringent lending policies for those customers that are perceived to be less creditworthy (Mishkin, 1996).

In extended models of credit markets, developments in credit markets affect the real economy through those circumstances in which borrowers are unable to obtain financing, hence such borrowers are faced with a quantity constraint on their ability to smooth consumption, investment and production inter-temporally. The presence of such a market failure encompassed in credit rationing models is motivated by events such as “credit crunches” and “occasional credit crunches”, and their impact on real economic activity and spending. Such market failures are therefore an extension of some behavioural elements that further make non-money assets not perfect substitutes for each other and private sector liabilities different (Friedman & Kuttner, 1993).

Further credit market imperfections are introduced through the adverse selection of projects to finance, and the moral hazard phenomena that arise with asymmetric information, and when agents act on behalf of principals, which induces market

[1] Essentially, the economics of imperfect information focus on the role of financial intermediaries and borrowers in solving information and incentive problems in credit markets.

situations in which potential lenders are unable to finance any projects at any interest rate, hence credit markets are unable to clear (Friedman & Kuttner, 1993).

With regard to the determinants of credit extension or credit demand, be it for the aggregate or sectoral level, there are mainly four categories into which empirical studies fall (Vera, 2002). Firstly, there are studies that estimate credit demand as a system due to the endogeneity coming from the interest rate. This leads to the estimation of a system using two reduced equations, namely one for credit demand and the other for the interest rate. Secondly, the equilibrium approach, which are those studies that assume as a starting point that the stock of loans is equivalent to the point of intersection of supply and demand. These studies therefore estimate the determinants of credit under equilibrium conditions as opposed to a credit demand equation per se. As a result, a single equation model (hence the simultaneous solution of credit supply and demand equations) is generated and supply and demand factors appear as explanatory variables.

Thirdly, is the dis-equilibrium approach, where studies estimate independent functions of credit supply and demand using maximum likelihood methodology. Thereafter, the estimated values are compared with actual data in trying to determine whether the supply or demand constraints exist. Lastly, there are those studies that estimate a demand curve via identification by parameter restriction (i.e., the separation of variables that affect the demand and supply sides of the market). The supporting assumption for this methodology is based on the fact that banks operate under imperfect market conditions, and that credit to economic agents is given by the demand side of the market and the level of interest rates charged by banks.

2.2. Studies that estimate credit demand as a system due to the endogeneity coming from the interest rate

Studies that estimate credit demand as a system due to the endogeneity coming from the interest rate, estimate a system using two reduced equations, namely one for credit demand and the other for the interest rate. In this regard, Melitz and Pardue (1973) assume a process of utility maximisation to generate the functional

specification of the demand for bank credit. This is usually referred to as the 'Fisherine approach' and considers the household as opposed to the firm as the basic unit of decision-making. As a result, in order to use this approach as an appropriate way to explain lending to the corporate sector, the utility framework has to be transformed and translated into that of a production function or behaviour.

Empirical investigation in this category is performed through a combination of single equation estimation, the examination of impulse responses of the estimated VARs and simultaneous equations of specific structural relationships. These estimations yield the following results: (i) both financial price variables and financial quantity variables have predictive power with respect to real economic activity, (ii) the predictive content of financial prices and financial quantities is not identical, (iii) these two dimensions of the credit market contain independent information about the subsequent fluctuations in real economic activity, where much of the information is contained in relative interest rates (i.e. the spreads), and (iv) monetary policy plays an important role in affecting both the credit markets and non-financial economic activity.

Fase (1995) explores the demand for commercial bank loans and the effect of the lending rate in the Netherlands. The author emphasises the fact that the lending rate is observed as a range as opposed to a unique and directly measurable market price, meaning that the aggregate loan rate charged by commercial banks at a certain point in time is a range rather than a point.

Fase estimates a two-equation structural model using the asymptotic least squares two-stage estimation procedure. The findings point towards fairly conclusive quantitative results that confirm the importance of the prevailing interest rate for bank credit and therefore that monetary policy directly affects credit through the lending rate as opposed to indirectly through monetary targets. The paper concludes that knowledge of the interest rate elasticity of credit demand is of strategic importance for monetary policy formulation.

2.3 Studies that estimate the determinants of credit under equilibrium conditions

Studies that use the equilibrium approach assume from the outset that the stock of loans is equivalent to the point of intersection of supply and demand and therefore estimate the determinants of credit under equilibrium conditions. In this instance examples of the work done by Rubaszek and Serwa (2012) apply a life-cycle model with individual income uncertainty to investigate the determinants of credit to households, and to assess how various macroeconomic factors affect the equilibrium value of household credit.

The model used describes the behaviour of consumers, who are heterogeneous in terms of age, income and financial assets. These consumers maximise the utility from consumption subject to the life-cycle budget constraint. Their savings are remunerated at the deposit interest rate, and the cost of borrowing is given by the lending rate. When young consumers work and receive wages that depend on an idiosyncratic, stochastic component and a deterministic life-cycle profile of productivity, the government collects taxes, pension system contributions and accidental bequests, and spends on public consumption, pensions and transfers. Perfectly competitive firms produce homogeneous goods using capital and labour. The model is calibrated to match some characteristics of the United States (US) economy and, subsequently, it is solved to compute the equilibrium level of capital, interest rates, or the aggregate level of credit to households. In the benchmark parameterisation the credit-to-GDP ratio equals 14 per cent and resembles the level of consumer credit in developed economies.The results show that the value of household credit-to-GDP ratio depends on (i) the lending-deposit interest rate spread, (ii) individual income uncertainty, (iii) individual productivity persistence and (iv) the generosity of the pension system.

2.4 Dis-equilibrium approach studies

Dis-equilibrium approach studies estimate independent functions of credit supply and demand using the maximum likelihood methodology. Thereafter, the estimated values are compared with actual data in trying to determine whether supply or

demand constraints exist. Bernanke (1983) marked the start of a revival of interest in the importance of financial frictions for the macro-economy. He showed empirically that financial factors held meaningful explanatory power over and above purely monetary explanations for the Great Depression. Key in these studies is the departure from the assumption of frictionless markets and this is captured through information asymmetry, which is endemic in financial market contracts.

These studies assume that borrowers are more informed than lenders with regard to the use of, and likely return on, borrowed funds, and this presents lenders with agency costs such as adverse selection, moral hazard and monitoring costs (Stiglitz & Weiss, 1981). These agency costs act as a friction against the supply of credit and can manifest themselves in two main ways, namely (i) an external finance premium where borrowers pay a premium for accessing external funding, increasing the price of finance, and (ii) non-price contract terms where lenders seek to alleviate agency problems through non-price aspects of financial contracts, such that borrowers are required to post minimum collateral (e.g., a loan-to-valuation ratio limit) or provide minimum documentation.

The need to meet these contract terms can restrict the quantity of finance available to borrowers. In turn, these credit frictions can have broad implications for the macro-economy, in particular, firstly, credit frictions affect real activity as they increase the marginal cost and reduce the availability of finance. In such cases credit supply is no longer perfectly elastic. This results in a smaller equilibrium capital stock in the economy. Moreover, credit supply may shift in a manner that amplifies the business cycle. A downturn in the real economy weakens firms' and households' balance sheets, leading to an increase in the external finance premium and tighter non-price terms in loan contracts, amplifying the initial shock. The reverse also holds, in that frictions are alleviated during periods of strong economic growth, providing additional stimulus to real activity. Moreover, credit markets through financial frictions can propagate shocks in the economy, and the credit market can also be a source of shocks.

Secondly, credit frictions play a part in policy transmission as they can give rise to an additional credit channel of monetary policy transmission. An increase in policy rates

lowers both asset values and cash flows to businesses and households, reducing their creditworthiness. In turn, this leads to a rise in the external finance premium and tighter contract terms, which amplifies the initial policy tightening.

Financial accelerator models have embedded these mechanisms in a general equilibrium setting. While the financial accelerator mechanism operates through the investment activities of firms, credit frictions may also affect aggregate demand through other components of expenditure. In particular, residential investment, consumption, trade and inventories may all be affected by the availability of credit (Pagan & Robinson, 2011).

Blundell-Wingnal and Gizycki (1992) explore the lending behaviour of financial intermediaries over the business cycle using theories that emphasise agency costs, that is, the potential importance of asymmetric informational problems that financial intermediaries need to overcome when operating in liberalised markets. These information problems may result in loan rationing, which would impart a causal relationship between credit and subsequent developments in economic activity. These theories emphasise the fact that during a credit crunch, loans from financial intermediaries are unobtainable at any price, so that credit may have a causal relationship in influencing economic outcomes in the short run.

Their findings suggest that such credit-rationing effects were absent when supply and demand functions were estimated for business loans over the period of financial liberalisation in Australia. Risks concerning the solvency of corporate clients appear to have been reflected in normal variations in the risk premia component of lending rates over the business cycle, rather than by credit rationing as such.

Moreover, the estimated business loan supply and demand equations highlight the influence of forward-looking variables. Demand was influenced by investment expectations, inflation expectations and the earnings-to-equity price ratio. Supply was affected by corporate net worth, cyclical risk premia and bank share price behaviour. In turn, all of these variables are influenced by expectations about future activity. Furthermore, business and total credit are both influenced by the loan rate, which is a key aspect of the monetary policy transmission mechanism.

Formal tests that analyse the temporal ordering of variables show that business credit has been an unambiguous leading indicator of investment since 1984, whereas two-way causation is present if data from the regulated era are included; this also improves the leading indicator properties of total credit for GDP. Furthermore, there is information in current GDP growth that is useful for forecasting future credit growth.

Ghosh and Ghosh (1999) use a dis-equilibrium approach to investigate a possible credit crunch in East Asian crisis countries (i.e., Indonesia, Korea and Thailand) during 1997–98. The authors solve the identification problem of a decline in credit that can be attributed to changes in the credit supply and credit demand function within a switching regression framework by imposing a priori exclusion restrictions such as that the banks' lending capacity affects the supply of credit and not demand.

Ghosh and Ghosh define a credit crunch as a situation in which interest rates do not equilibrate supply and demand for credit, and the aggregate amount is supply-constrained, hence, there is quantity rationing. In assessing whether the supply of, or demand for, has been the binding constraint, the authors estimate a credit supply function, which depends on interest rates, commercial banks' lending capacity and the level of economic activity. They also estimate a credit demand function, which depends on the interest rate, and indicators of current and expected economic activity. These estimated functions are then used to determine whether the supply or demand for credit was a constraining factor.

Their findings show that in all three countries rising interest rates and weakening economic activity lowered credit demand, with the exception of Indonesia in late 1997 where there is little evidence of quantity rationing at the aggregate level, although individual firms may have lost access to credit. Moreover, the results for all three countries suggest that while the supply of credit to the private sector declined, the estimated demand for credit declined even more sharply, hence, there is relatively little evidence of quantity rationing or a credit crunch.

Lopez and Steiner (2002) examined the slowdown in bank credit to the private sector

in Latin America, using eight countries (i.e., Argentina, Bolivia, Brazil, Chile, Colombia, Peru, Mexico and Venezuela. The authors estimate the system of supply and demand functions under the assumption that at a given point the credit market may either exhibit equilibrium or temporary excess demand or supply due to imperfect flexibility in the interest rate in the short run. The approach used in this study also allows for the assessment of whether a situation of excess demand of a credit crunch occurred during the episode of declining credit growth. The authors examine changes in bank balance sheets to determine whether the credit slowdown was merely a reflection of a downturn in bank deposits or changes in the asset side. They use macro-level data to identify the existence of a credit crunch and define it as a situation in which, for a given level of deposits, banks refuse to increase interest rates on their loans to market clearing levels, hence, excess demand for credit remains unsatisfied.

Their results show that, for all countries, the evolution of deposits is the most dominant factor both in credit expansion and slowing stages, with almost the entire expansion of credit explained by the increase in loanable funds which, in many instances, are associated with capital flows. For all countries, macroeconomic conditions significantly affect credit demand and, at times, credit supply. Lending capacity plays a key role in determining credit supply and alternative interest rates have an even more significant impact on the demand for credit. Credit risk and regulatory variables included in the supply function were significant for these countries, and the Emerging Markets Bond Index for Mexico and Peru was also significant, indicating substitution by borrowers from domestic to foreign sources. In all, both supply and demand factors appear to have played key roles, although their relative importance has varied across the three countries.

Following the recent experience during the financial crisis, Meeks (2009) in answering the question “do credit market shocks drive output fluctuations?, uses a structural VAR model identified using sign restrictions on the impulse response functions of credit variables. This is to capture the dis-equilibrium conditions in credit markets and their impact on financial variable such as corporate bond spreads and other macroeconomic variables. The author finds that credit market shocks cause a persistent decline in output, prices and policy rates. Moreover, historical

decompositions show the negative effect of adverse credit market shocks on output in the 2009 recession. The identified credit shocks are unrelated to exogenous innovations to monetary policy and measures of bond market liquidity, although they are related to measures of risk compensation.

Bayoumi and Darius (2011) establish that the impact of the dis-equilibrium in credit and financial markets is largely summarised in financial conditions indices on real economic activity. Bayoumi and Darius (2011), use a VAR methodology. Their findings suggest that under plausible specifications, credit conditions dominate market variables therefore highlighting the importance of credit supply. Moreover, the fact that direct measures of credit conditions are able to anticipate future movements in asset prices has important implications as a policy tool. Furthermore, the impact of credit conditions on growth compared to other market variables implies that credit supply drives other financial variables rather than responding to them, particularly as an amplifier of underlying changes in financial wealth.

Tamási and Világi (2011) estimate a Bayesian VAR model for the Hungarian economy to study the impact of the dis-equilibrium in credit markets as the credit or loan supply becomes constrained. They apply the sign restriction approach of Uhlig (2005) to identify macroeconomic and credit supply conditions. Their main findings show that credit supply disequilibria have played a role in the decline of the Hungarian economy over the crisis period that started in 2008 and therefore partly justify the importance of incorporating the financial intermediary sector into macroeconomic models.

Queijo von Heideken (2008) evaluates if information asymmetry and frictions in credit markets are important for business cycles in the US and the euro area. The author uses the dynamic stochastic general equilibrium (DSGE) financial accelerator model developed by Bernanke, Gertler and Gilchrist (1999) which is modified by adding frictions such as price indexation to past inflation, sticky wages, consumption habits and variable capital utilisation. The results suggest that financial frictions are relevant in both the US and the euro area. The results clearly show that the financial frictions are larger in the euro area and tend to have a significant bearing on economic activity.

Ceh, Dumicic and Krznar (2011) estimate a credit market dis-equilibrium model for Croatia in order to establish specific determinants of credit supply and demand, and to identify credit market dis-equilibrium periods. In order to identify specific determinants of supply and demand, and periods of credit market dis-equilibrium, the authors estimate a switching regression model where the credit market dis-equilibrium is defined as the difference between estimated credit supply and estimated credit demand that occurs when interest rates, mainly due to inflexibility, do not maintain an equilibrium between the supply of, and demand for, loans. As a result, growth in total credit is limited on either the supply or demand side. A credit crunch occurs in a situation of excess demand for loans, when loans cannot be obtained at current interest rates, regardless of whether the demand for loans has abruptly increased or the supply decreased.

In the paper, Ceh, Dumicic and Krznar (2011), reduced loan supply can be due to a lack of funds for granting loans, or the fact that banks are less willing to extend loans, which does not necessarily result in higher interest rates. Specifically, banks do not choose to raise interest rates (additionally) in order to eliminate the excess demand (despite the possible preparedness of clients to take on more expensive loans) because they do not believe this would eliminate the risk of a wrong choice of client, which arises from asymmetric information, and decide rather to ration the credit supply.

Their results indicate three characteristic sub-periods, differentiated by sources of bank credit activity dynamics. The first period, from 2000 to 2002, was marked by equilibrium between credit supply and demand, and gradual stabilisation of global financial markets and the domestic banking sector after the crisis in the late 1990s. In the second period, from the end of 2002 to the middle of 2009, encouraged by strong foreign capital inflows, banks were ready to supply more credit than demanded. The third period, marked by an abrupt halt in credit activity, started with an escalation of the world financial crisis during the third quarter of 2008 and lasted until the end of 2009. Such movements were the consequence of a credit supply shortage (a credit crunch).

2.5 Studies that estimate a demand curve via identification by parameter restriction

Lastly, studies that estimate a demand curve via identification by parameter restriction and the supporting assumption that banks operate under imperfect market conditions and that credit to economic agents is given by the demand side of the market and the level of interest rates charged by banks.

Hülsewig et al. (2001) use a structural VECM in modelling both demand and supply by considering, together with the conventional determinants of loan demand, some indicator of supply-related factors such as changes in holdings of securities by banks in the former, and the volume of banks' capital and reserves in the latter. The authors deal with the problem of identification by using restriction tests on the cointegration vectors to identify long-run supply and demand relationships in the credit markets. The authors identify two cointegrating vectors which they interpret as long-run loan supply and demand relationships. The results also show that monetary policy has a negative effect on both long-run supply and demand for loans. They interpret these as evidence of the bank lending channel, although monetary policy effects differ in magnitude on the supply and demand, where they are comparatively weak or small magnitudes on the supply side.

Using their results, the authors conclude that the credit channel is operating alongside the interest rate channel. Banks decrease their loan supply with an expected drop in their credit margin after a monetary policy shock, while loan demand declines with a drop in the output level and a rise in the loan rate. The decrease in loan supply occurs instantly and bottoms out gradually. The decrease in loan demand proceeds by degrees and continues more persistently.

Calza, Gartner and Souza (2001) explore the determinants of loans to the private sector in the euro area, using the Johansen methodology. The econometric investigation into the determinants of loans to the private sector in the euro area suggests that the behaviour of loans is highly influenced by developments of domestic factors such as real GDP and short- and long-term real interest rates. In the cointegration equation the coefficients of real short-term interest rates and long-

term interest rates suggest the existence of a demand-type relationship. Moreover, the coefficient of the long-term interest rate variable is significantly higher than that of the short-term interest rate, and this is interpreted to be consistent with evidence on the maturity structure of loans to the private sector in the euro area. The coefficient of the error-correction term in the equation for loans is statistically significant from zero, confirming the existence of a long-run relationship linking loans to real GDP and real interest rates.

Calza et al. (2003) extend their early work using a longer sample and a new measure of the cost of loans obtained as a weighted average of bank lending rates. The empirical analysis addresses the identification issue by means of modelling techniques conventionally used in money demand studies. Their study provides new evidence on the behaviour of euro area aggregate loans to the private sector. They find a cointegrating vector linking the real stock of loans to real GDP and prices. Their study then addresses the issue of the leading indicator properties of loans, and finds that the deviations of the real stock of loans from the equilibrium level implied by the model seem to contain information on future changes in inflation.

Pisu and de Mello (2009) test for the existence of a bank lending channel in the transmission of monetary policy in Brazil using a VECM approach. The authors find evidence of two cointegrating vectors, which are identified as (i) bank loan demand and (ii) supply functions by testing for a number of exclusion and exogeneity restrictions on the cointegrating relationships. Their results show that loan supply is negatively related to the interbank deposit certificate rate in the long term and this confirms the existence of a lending channel for monetary transmission. The short-term dynamics of the VECM show that loan demand is equilibrium-correcting and the short-term disequilibria in the supply of loans are corrected through changes in the interbank deposit certificate rate, suggesting that monetary policy plays a role in restoring the equilibrium in the credit market by affecting the borrowing rate faced by banks to raise non-deposit funds.

With regard to the determinants of the demand for credit extension on the aggregate and sectoral levels, a number of authors base their estimations on equilibrium conditions; for example, Hofmann (2001) analyses the determinants of credit to the

private non-bank sector in 16 industrialised countries since 1980, based on a cointegrating VAR. The study specifically addresses the coincidence of episodes of boom and bust in credit market cycles in economic activity and property markets in a formal way. The results of the cointegration tests suggest that the long-run development of credit cannot be explained by standard credit demand factors.

However, once real property prices – measured as a weighted average of real residential and real commercial property prices – are added to the system, the model is able to identify long-run relationships linking real credit positively to real GDP and real property prices, and negatively to the real interest rate. These long-run relationships are interpreted as long-run extended credit demand relationships, but may also capture effects on credit supply. Impulse response analysis based on a standard Cholesky decomposition suggests that there is significant two-way dynamic interaction between bank credit and property prices. The authors also find that innovations to the short-term real interest rate have a strong and significant negative effect on bank credit, GDP and property prices.

Calza et al. (2001) explore the determinants of loans to the private sector in the euro area, using the Johansen approach. Their results show one cointegrating relationship linking real loans, GDP and interest rates. The authors interpret this result as implying a long-run demand relationship. The authors use a VECM to model short-run dynamics of the demand for euro area real loans and find that developments in real loans to the private sector in the euro area can be reasonably explained by the model, as the model performs well in specification and stability tests.

Calza et al. (2003) extend their earlier work by including a new measure of the cost of loans calculated as a weighted average of bank lending rates and explore the issue of the leading indicator properties of loans. The extended study provides new evidence on the determinants and behaviour of euro area aggregate loans to the private sector. As with the earlier study, their results show that there is a cointegrating vector linking the real stock of loans to a set of macroeconomic variables. Furthermore, the study finds that the deviations of the real stock of loans

from the equilibrium estimated by the model contain information on future changes in inflation, although not on its level.

For sectoral or disaggregated estimations (by institutional sectors, i.e., household and companies, in some instances a distinction is made between financial and non-financial companies), studies by de Brandt and Jacquinot (1992); Odonnat, Grunspan and Verdelhan (1997); Focarelli and Rossi (1998); Panagopoulos and Spiliotis (1998); Vega (1989); Manrique and Saez (1998); Hofmann (2001); Jeanfils (2000); de Bandt et al. (2002); Fase et al. (1992); and van Els and Vlaar (1996), provide clear insight into the determinants of sectoral demand for credit.

Thomas (1996) found that for the United Kingdom (UK) the econometric analysis of money and credit at a sectoral level makes the interaction of these variables with interest rates and nominal economic activity much clearer as the determinants for these variables differ across sectors. Chrystal and Mizen (2005) also find a stable credit equation using the household sector data. Credit demand also affects investment and residential housing, cash flow and liquidity, which are related to financial wealth and the probability financial distress.

Sorenson, Ibanez and Rossi (2008) model the determinants of loans to non-financial corporations in the euro area using the Johansen approach. The authors identify three cointegrating relationships, which they interpret as long-run loan demand, investment and loan supply equations. Using the VECM, the authors estimate the short-run dynamics of loan demand for the euro area and perform a number of specification tests. Overall, the results suggest that developments in loans to non-financial corporations in the euro area can be reasonably explained by the model they have estimated.

The authors, furthermore, use the estimated model to analyse the impact of permanent and temporary shocks to the policy rate on bank lending to non-financial corporations. The main finding with respect to the impact of shocks to the policy rate on bank lending to non-financial corporations, that is, a permanent increase of 25 basis points in the policy rate, is that it causes a reduction in bank lending of about 1,4 per cent 5,4 per cent and 6,4 per cent after two, five and ten years

respectively. The second finding with respect to the reaction of bank lending to an increase in the risk premium on the bank lending rate suggests that, a 20-basis points increase in the risk premium reduces bank lending to non-financial corporations by about 0,6 per cent, 4,0 per cent and 5,1 per cent after two, five and ten years respectively.

According to Bernanke and Blinder (1998), aggregate loan demand by the private sector is specified as:

$$(Loans - p)_t = \alpha + \beta_1 y_t + \beta_2 R_t + \hat{\varepsilon}_t \qquad [1]$$

Where *loans* is aggregate total loans and advances to the private sector, p is the GDP deflator, y_t is real GDP and R_t is the lending rate.

Expected results from equation 1 are that there is a positive relationship between real GDP and the demand for credit based on the fact that economic agents demand credit for liquidity and financing working capital. There is also the impact of expectations of future economic activity and profitability which can also lead to higher demand for credit, and the fact that the demand for credit might include some countercyclical component in line with the smoothing of the impact of the business cycles on consumption expenditure and investment spending.

A negative relationship is expected between the demand for credit and interest rates. It is also worth noting that lending rates are the observable component of the true cost of loans but there are additional charges, other terms and conditions.

Implicit in the equation is the assumption that the data used in the estimation is a reflection of both demand and supply factors, and therefore equilibrium loans and interest rate. It is also acknowledged that there are causal relationships in the variables, where economic upward cycles are normally characterised by acceleration in credit and GDP, and low interest rates and inflation. The reverse applies in cases of downward cycles.

Nevertheless, Kasyap et al. (1993) indicate that this is an identification problem which does not prove the existence of causality and the direction thereof, hence favourable growth stimulates consumption and investment demand and therefore the demand for credit. In fact, research has established that credit and growth are mutually reinforcing, and their effects are further propagated by developments in asset prices through wealth and collateral channels of the transmission mechanism.

On the trend displayed by credit growth over the business-cycle phases, some studies indicate that it is not always according to theoretical foundations, that is, it is not always the case that credit trends downwards during downward phases in the business cycles and vice versa. This can partly be attributed to disruptions introduced by regulation in the credit markets which can distort the relationship between demand for credit and economic activity, the general lags that affect the relationship between the two variables, the questionable existence of a stable relationship between credit and economic activity, and arguments that there is a possibility of the existence of a negative relationship between credit and economic activity (Cottarelli et al., 2003).

In this regard, the main argument is that an increase in current productivity (as opposed to expected productivity) leads to a rise in output and, ultimately, profits. Therefore, during expansionary phases, companies might prefer to rely more on internal sources of funding and reduce the relative proportion of external funding (i.e., loans from banks or recourse to capital markets).

Similarly, households may want to take advantage of higher income in the expansionary phase to reduce their debt levels. In contrast, in recessions, when both disposable income of households and the profitability of firms are likely to decline, households and corporations may increase their demand for bank credit in order to smooth out the impact of lower income and profits (Kasyap et al., 1993).

Kiyotaki and Moore (1997a; 1997b); Kocherlakota (2000); Boissay (2001); and Chen (2001) show that, with asymmetric information and other capital market imperfections, equity plays an important role as collateral for loans and it influences asset prices by improving investment prospects. Nevertheless, the strength of equity

as collateral to solve asymmetric information problems will be affected by whether the economy is bank-based or market-based (Allen & Gale, 2000).

For the corporate sector, the understanding of the determinants of credit by the banking sector to companies provides a deeper understanding of the availability or non-availability of funding to the sector that allows or deters investment and spending decisions by the corporate sector. The understanding of credit developments to the corporate sector, particularly for small- and medium-sized enterprises, is of critical importance, given the fact that bank credit is one of their major sources of funds.

Based on Sorenson et al. (2009), the estimated equation for the demand for credit by the corporate sector is specified as:

$$(Loans - p)_t = \alpha + \beta_1 I_t + \beta_2 S_t + \beta_3 R_t + \hat{\varepsilon}_t \qquad [2]$$

Where *loans* is the credit extended to the private sector, p is the GDP deflator, I_t is investment (gross fixed capital formation), S_t is the gross operating surplus and R_t is the prime lending rate. It is expected that there is a positive relationship between the real demand for loans by the corporate sector and investment expenditure and operating surpluses (which are used as a proxy for internal sources of funding). A negative relationship is expected with the lending rate.

From a theoretical perspective, developments in credit demand by households are influenced by expenditure, income or economic activity and these variables are also proxies for the permanent income concept. Households can resort to the credit market to obtain funds with which to meet finance their consumption and investment decisions when the current level of income is insufficient. In addition, the business cycle may have an impact on financial institutions' lending policies and this impacts on their willingness to lend.

However, the cost of financing also impacts on the affordability and demand for credit. An important factor when assessing household creditworthiness, and

therefore the risks borne by financial institutions on extending credit, is the financial position of households – which is highly influenced by asset prices, in particular, real estate and financial investments wealth. Such wealth acts as collateral in a very large proportion of loans, making credit institutions willing to extend financing to households.

Demographic and labour market-related factors also determine household borrowing capacity. In this context growth in employment or by a change in demographic composition towards households with a greater propensity to indebtedness can influence appetite for credit and the level of household debt. These factors can also indirectly translate into a rise in household debt as the employment status tends to lift off the restrictions on the access to the credit market.

Other factors that directly and indirectly play a meaningful role in changes in borrowing relate to the development, deepening and liberalisation of the financial sector; the degree of risk appetite or aversion tolerated by financial institutions; and the level/degree of competition between banks and financial innovation. However, the measurement of these factors is complex and comprehensive time series data does not exist.

Following Freitzer and Reiss (2008), the household sector model to be estimated is specified as:

$$(Loans - p)_t = \alpha + \beta_1 Yd_t + \beta_2 Debt_t + \beta_3 R_t + \hat{\varepsilon}_t \quad [3]$$

Where $loans$ is the credit extended to the household sector, p is the GDP deflator, Yd_t is disposable income, $Debt_t$ is household debt and R_t is the lending rate.

The demand for credit by households, disposable income and the level of household debt (which is used as proxy for demand for credit extension by the household sector driven by purchases of residential and other durable goods) are expected to have a positive relationship, whereas the relationship between the demand for credit and the lending rate is expected to be negative.

A VECM can be used to infer the periods of credit overhang and short-fall. Following Calza et al. (2003), the error-correction term is scaled so that deviations from the long-term equilibrium relationship average zero over the sample period. Positive deviations from the zero horizontal line are interpreted as departures from the long-run equilibrium and are referred to as 'loan-demand overhang', whereas when the error-correction term is below the horizontal line, the level of loans to the private sector is below the equilibrium level implied by the model and therefore there is a loan demand short-fall.

2.6. Conclusion

The role of credit in monetary policy has varied overtime and has been influenced by economic theory, monetary policy regimes, degree of regulation, technological changes and financial development. Both money and credit came to feature less prominently in monetary policy formulation as inflation became the ultimate objective to target. Nevertheless, the 2007 global financial crisis has brought the role of credit, asset prices and financial markets back to centre stage of monetary policy formulation. In particular, the understanding of the dynamics that influence equilibrium and long-run and short-run deviations from equilibrium conditions – at both the aggregate and sector levels. The presence of bank lending, credit and balance sheet channels has been tested and established using different econometric methodologies, lending support to the role of credit in the transmission of monetary policy. Nonetheless, the lesson to come of the crisis is the importance of credit and financial intermediaries and the need to allow them to feature more prominently in policy formulation.

According to a number of authors (Bernanke and Blinder, 1998; Sorenson et.al., 2009 and Freitzer and Reiss, 2008) credit demand models vary according to institutions and sectors of the economy. Nonetheless, sectoral and aggregate incomes are among the most important determinants of credit demand.

Chapter 3 Credit Markets in South Africa

3.1 Introduction

This chapter presents some key aspects of credit markets in South Africa, including a brief overview of aggregate and sectoral credit extension developments. Salient

aspects of the credit markets, be it at aggregate and sectoral (household and corporate) levels, will be discussed in detail in this chapter.

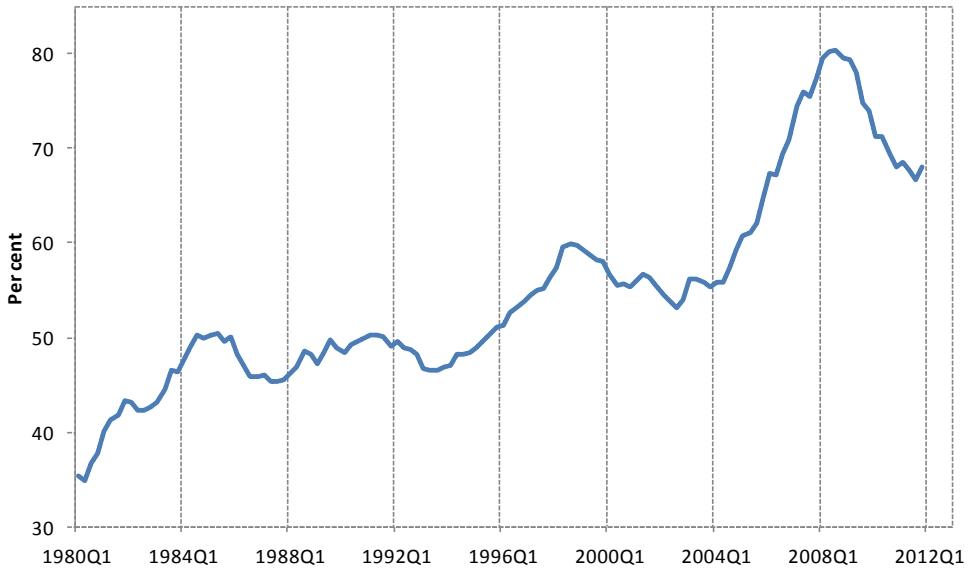
In the past 30 years financial intermediation and the role of credit in the South African economy were affected by regulatory and structural changes. The De Kock Commission's (De Kock Commission, 1985) final report on monetary policy in South Africa was a defining moment relating to financial liberalisation and the conduct of monetary policy. Starting with the implementation of the money supply targets in 1986, the commission's findings ushered in a new era of market-orientated policies. Along with these new policies came changes ranging from the removal of interest rates and credit controls, the reduction of banks' required cash reserves and liquid asset ratios, mergers and acquisitions in the banking sector, and to the gradual relaxation of exchange controls. All these measures allowed for increased financial flows, deepening of the financial sector and financial innovation (Stals, 1997).

The domestic financial sector has liberalised massively over the years and has become an integral part of the global financial system. Gradual exchange control relaxation, changes in the financial regulatory environment, changes in the corporate tax structure, innovation and technological advancement, and the implementation of the Financial Sector Charter and Black Economic Empowerment policies are also among the factors that have contributed to structural changes in the financial markets and the economy in general. The implementation of the charter has allowed greater access to financial markets for the previously unbanked masses, and has allowed for greater opportunities for borrowing and saving as well. The National Credit Act which came into effect in 2007 was also instrumental in altering lending behaviour (SARB Annual Economic Report, 2007).

Under the conditions of rapid expansion of the balance sheets of banks and economic growth, the ratio of bank credit to GDP has risen substantially over the past 28 years. Relative to GDP, South African banking sector credit extension increased from an average of 45 per cent in the 1960s to 67 per cent in the 2000s.

As shown in Figure 3.1, as a percentage of GDP, credit decelerated steeply in 2009, although it remains at levels above those recorded in the early parts of the 2000s.

Figure 3.1: Credit to GDP



Factors such as innovation and technological advancement, and the implementation of the Financial Sector Charter and Black Economic Empowerment policies have contributed to the surge in credit extension and alternative funding mechanisms devised by the corporate sector in recent years; for instance, innovations that have allowed consumers to borrow to finance primary homes, vacant land, holiday homes, home improvements and homes for investment purposes; efficiency gains associated with the granting of pre-approval certificates; and online and telephonic applications have transformed the landscape of the mortgage market. The entrance of mortgage originators has seen the relationship between estate agents and banks taking second place (SARB Annual Economic Report, 2009).

Nevertheless, the South African financial system remains centred on banks, particularly for the household sector and small and medium enterprises. The public sector has been the dominant role-player in financing its borrowing requirements in the bond market, whereas, the equity financing aspect is dominated by large corporate players. Therefore, the banking sector is one of the most important channels of funds to support credit extension and the transmission of monetary policy actions. As shown in Table 3.1, deposits remain the main source of funding for banks and the use of other sources of funding has grown over the years, in particular

the issuance of instruments in the primary bond market which is seen as evidence of the use of credit market innovations to diversify credit risk exposures and increase lending.

As shown in Table 3.1, the increase in the private sector and securitisation transactions initially coincided with a decline in the issuance by the public sector but this ceased to be the case at the beginning of 2003, in line with increased corporate bond activity in other emerging markets, Australia and Europe (SARB, 2001). Nonetheless, subsequent to the 2007 global financial crisis, activity in credit markets remains highly subdued.

Table 3.1: Funding base of banks

Period	Deposits	Loans and advances		Issues in the primary bond market	Other financial instruments	Securitisation of assets	Total funding liabilities (R million)
		Rand	Foreign currency				
1992–1995	87	8	5	–	–	–	271 267
1996–2000	86	7	5	2	–	–	529 018
2001–2005	85	8	3	2	1	1	991 099
2006–2007	83	7	3	3	2	2	1 865 196
2008–2011	86	3	1	3	6	1	3 160 681

Source: DI900, BA900 (SARB, 2012)

The breakdown of credit by type of asset funded by banks is shown in Table 3.2. It is clear that mortgage advances remained the main drivers of credit extension and grew in line with conditions in the property market. At the height of this credit cycle, growth in mortgage advances paid out increased from about R7 billion to R18 billion per month, resulting in 12-month growth rates of between 15 per cent and 31 per cent. The same trend was observed in the 12-month growth in instalment sales and leasing finance credit between 13 per cent and 22 per cent, in line with consumption expenditure on cars and durable goods. Other loans and advances, mainly driven by the corporate sector, also grew at annual growth rates of between 11 per cent and 37 per cent.

Table 3.2: Credit by type

	Mortgage advances	Instalment sale and leasing	Other loans and advances	Total (R million)
1992–1995	45	18	37	222 015
1996–2000	43	17	40	427 972
2001–2005	45	17	38	737 119
2006–2007	51	15	34	1 355 495
2008–2011	40	15	45	2 461 140

Source: DI900, BA900 (SARB, 2012)

Factors that contributed to the unprecedented growth in credit extension during this cycle included for the household sector

- compliance with the Financial Services Charter commitments, as the sector sought to increase access to financial services for the unbanked segment of population coupled with growing numbers of first-time home buyers;
- an improvement in disposable income on account of brisk economic activity and rising employment;
- reductions in income taxes, including moderate reduction in the transfer duty payable on fixed property transactions;
- wealth effects emanating from increases in house prices (partly encouraging the withdrawal of equity) and equities; and
- interest in the purchase of second homes and “buy-to-let” property investments, fuelled by the healthy capital gains on residential real estate.

Moreover, research in this market indicates that mortgage originators account for 60 to 70 per cent of new business, with the remainder processed by banks through direct distribution channels to estate agents and developers. Mortgage originators are seen as having contributed to the increase in the residential market share of the banks that embraced them in their strategy to increase business volumes (SARB Quarterly Bulletin, 2010).

In South Africa mortgage bond rates on outstanding mortgage debt are mostly a floating rate and respond immediately to changes in the repurchase rate. This therefore has a significant impact on mortgages financed by mortgage debt and, in

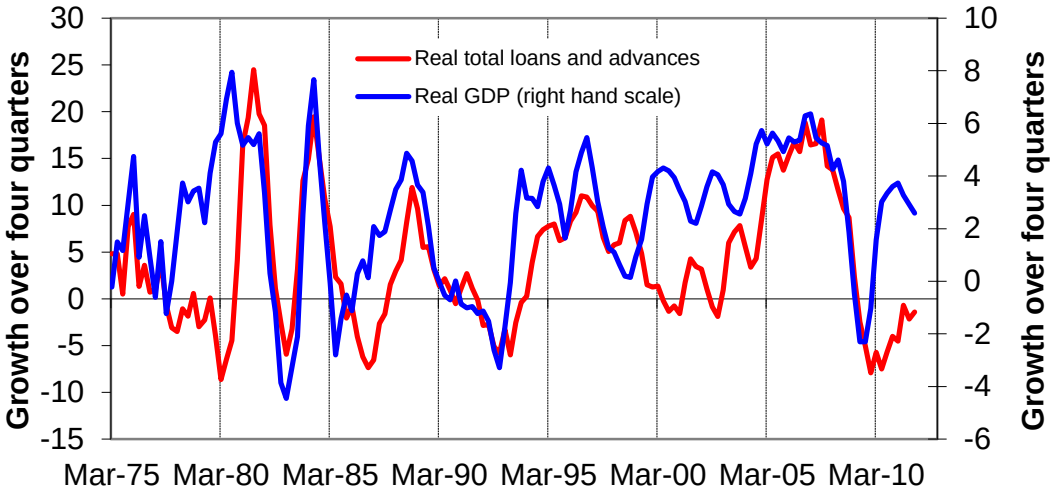
turn, other asset prices (e.g., house prices), and housing wealth and consumption. It is worth noting that growth in mortgage advances and developments in the property market were also aligned with developments in household savings and assets. The asset price channel played a role in the growth in credit extension and this also had an impact on savings by the household sector. Growth in savings has been declining since the 1990s and is currently negative (SARB Annual Economic Report, 2011).

On the part of the corporate sector, growth in credit extension was mainly driven by the funding of broad-based black economic empowerment deals, higher inventory levels and fixed capital formation. However, subsequent to the 2007 global financial crisis, other loans and advances have been driving growth in credit as the profitability of housing has waned (SARB Annual Economic Report, 2006).

The fact that the other loans and advances credit category is the second largest, and is mainly used by the corporate sector, indicates the importance of bank loans as a means of external finance for the corporate sector, although it also happens to be the most volatile category.

Looking at the evolution of the annual growth rates in GDP and total credit extension, the positive and reinforcing relationship becomes clearer as shown in Figure 3.2. It is also evident in that the growth differential has been persistent, although it is narrowing somehow, since 2010. This is partly explained by the confidence crisis following the financial crisis and the subsequent recession. These developments are also reflected in fairly subdued (and even depressed) asset prices and, hence, constrained balance sheets across sectors and the collateral and wealth channels.

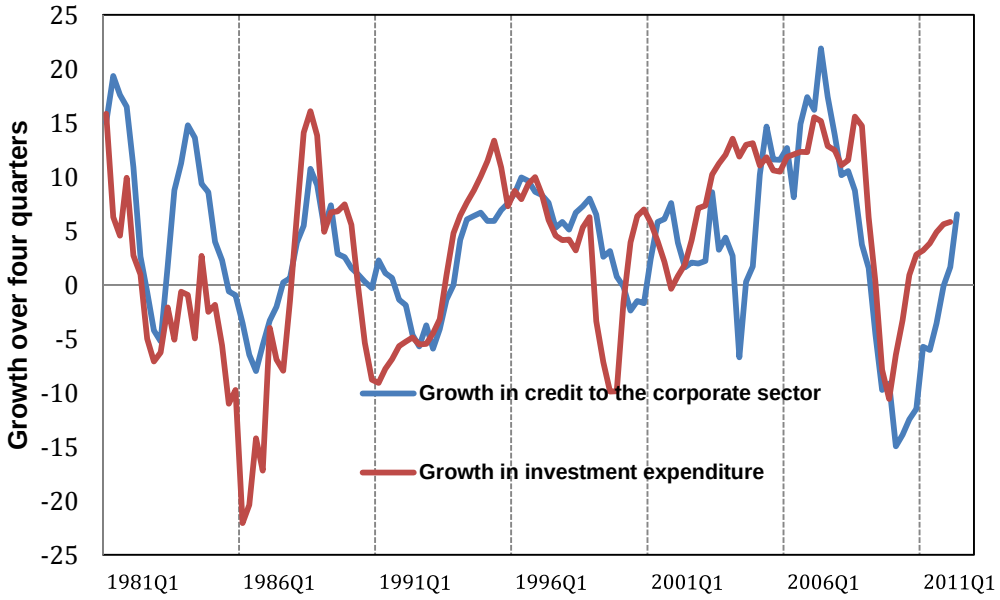
Figure 3.2: Annual growth in GDP and total credit extension



The graphic representation of the growth in credit to the corporate sector and investment expenditure, as shown in Figure 3.2, shows that these variables are highly correlated and that it is highly possible that the developments in credit extended to the corporate sector will have information content about the actual and expected economic activity.

For the household sector, however, during 1998/99, household debt levels were around R300 billion compared with R430 billion in 2001–03. Debt levels were increasing at quarterly levels ranging between R0,3 billion and R8,6 billion for the period 1998/99; and R4 billion to R20 billion for the period 2001–03. During this credit cycle debt levels were around R500 billion and R800 billion, increasing at levels of between R20 billion and R58 billion on a quarterly basis. The contribution of bank credit to the household sector's debt accounted for increases of between 87 and 92 per cent for the period 2003 to the present – implying that the bulk of household expenditure was financed through bank credit.

Figure 3.3: Credit extension to the corporate sector and investment expenditure

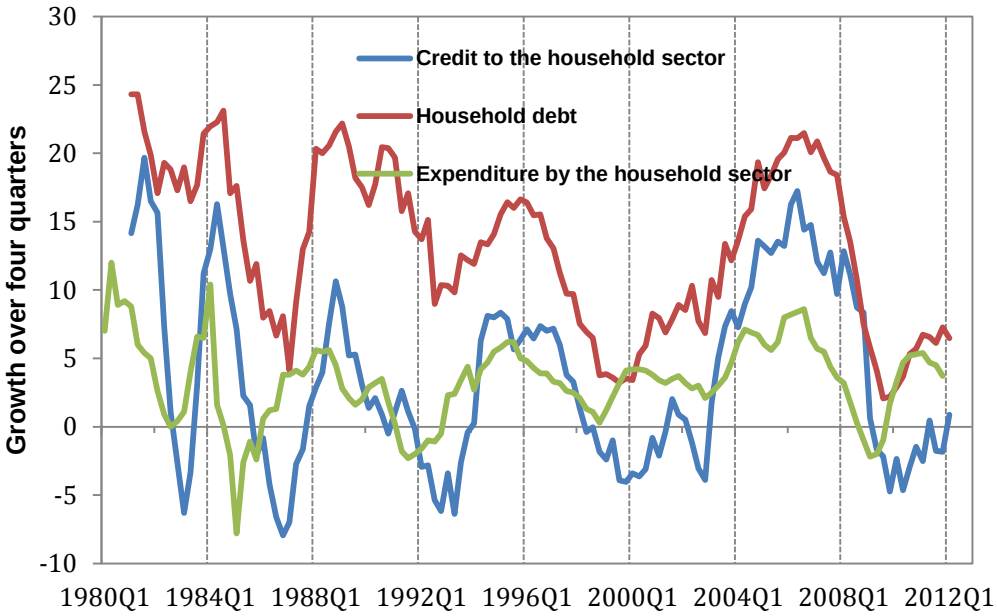


Over this period, the cost of financing household debt increased by 64 per cent during 2005 and 2008. As shown in Figure 3.4, credit extension to the household sector is highly correlated with household debt and consumption expenditure by the household sector.

Non-performing loans or credit impairments[2] are one of the indicators of the state of the economy and the health of bank's balance sheets (asset quality) and the probability of bank failures. It is well researched and documented that if the problem of non-performing loans is not adequately addressed, it can contribute to economic stagnation or decline.

[2] Impaired loans and advances are defined as the total value of the advances on which an impairment was raised. As a minimum, an advance is considered to be impaired when objective evidence exists that the bank is unlikely to collect the amount due.

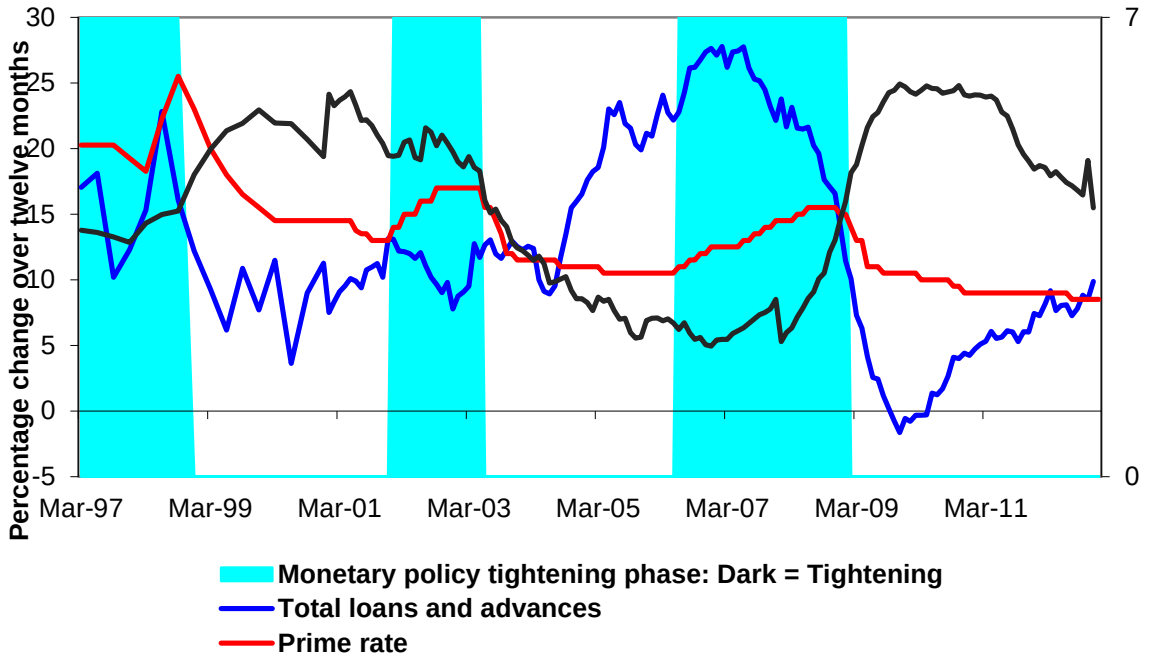
Figure 3.4: Credit to the household sector, debt and expenditure



Containing and eliminating the problem are some of the fundamental conditions to improve economic activity and efficiency. The developments in credit extension, non-performing loans or impaired advances and other economic indicators of credit and monetary policy cycles are therefore important explanatory variables of the state of credit demand

Figure 3.5 presents developments in credit extension, the prime rate and non-performing loans or impaired advances over monetary policy cycles. In response to the 1997/98 South East Asian crisis the prime lending rate increased from 18,3 per cent in May 1998 to 25,5 per cent in September 1998 – an increase of 7,25 percentage points in five months. The growth rate in total loans and advances lagged in responding to tight monetary conditions but eventually responded and declined precipitously. The growth rate decelerated from an average of 15,6 per cent in 1998 to low single digit until double digit growth rates were registered in early 2001.

Figure 3.5: Credit conditions



Following a prolonged period of easy monetary conditions, policy tightening started in 2006. The prime lending rate increased from historic low levels of 10,5 per cent in April 2005 to 15,5 per cent in November 2008. By August 2007, the prime lending rate had already been increased by a cumulative 300 basis points when the global financial crisis started.[3] Policy tightening continued and the prime rate peaked at 15,5 per cent in November 2008. Growth in total loans and advances during this cycle accelerated at levels above 15 per cent from November 2004 until November 2008.

In all these cycles non-performing loans as a ratio of gross loans responded to the tighter monetary conditions with a lag. For the 1997–99 period, non-performing loans increased for 32 months and peaked around 6 per cent of gross loans. The 2001–03 tightening cycle came within a very short period following the previous tightening as

[3] The start of the global financial crisis is dated August 2007, this is also referenced as the first stage of the crisis when risk was re-priced and the liquidity in the money market deteriorated. This was also evident in the interbank overnight rates when central banks had to intervene by conducting extra-ordinary liquidity injections. The collapse of Bear Sterns marked the deepening of the crisis and what is believed to be the deepest stage was the failure of Lehman Brothers in September 2008. The crises manifested itself in a severe US dollar liquidity problem which was transmitted to European and emerging-market banks, with funding problems in both uncollateralised and collateralised markets. The ensuing period, October to November 2008, was marked by the loss of confidence triggered by the Lehman bankruptcy, followed by the deterioration in the economic conditions and outlook, and uncertainties with regard to measures adopted by central banks to ease financial market conditions (BIS, 2009)

non-performing loans were declining. As a result, the declining trend was halted and non-performing loans as a ratio of gross loans moved sideways and averaged 5 per cent between January 2002 and May 2003. In this cycle impaired loans rose for 36 months and the latest data available suggests that they peaked at around 6 per cent.

The slowdown in credit extension in this cycle is the most severe on record which, over and above other economic developments, points to the fact that there are elements of a credit crunch at play. If the credit crunch is defined as a phenomenon that occurs as non-performing loans escalate and economic activity slows down, then banks become reluctant to lend and to take on new risks. During such periods, the interest rate does not serve as the main determinant of credit approval but rather a host of other facts such as increased capital-adequacy requirements, and risks posed by falls in asset prices bring to the fore the effects of the collateral and wealth channels. Therefore, during periods of high levels of non-performing loans, banks tend to prioritise measures that improve their asset quality rather than lending, to raise the provisions for loan losses and this, in turn, reduces revenue and funds available for new lending.

Figure 3.6: Household debt and non-performing loans

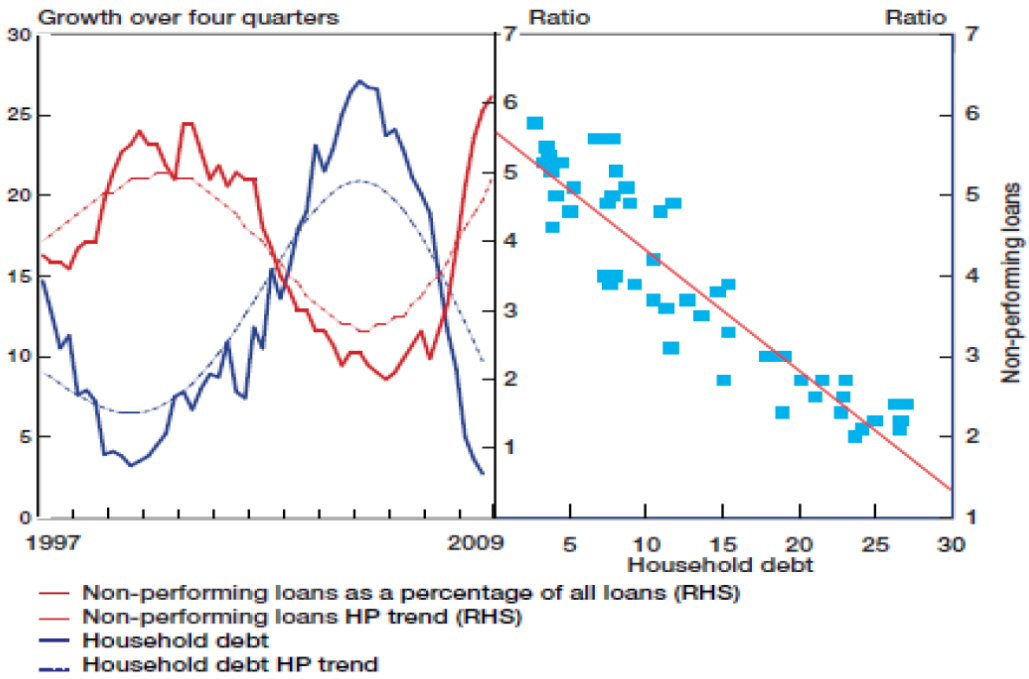


Figure 3.6 provides a trend on household debt and non-performing loans over the periods 1997–2009. It confirms the negative relationship between growth in household debt and non-performing loans, and also provides evidence of pro-cyclical lending behaviour, where banks tolerate and take on more credit risk during economic boom periods, and avoid it during economic slowdown in line with consumption expenditure and the business cycle in general. The estimated correlations (right-hand side of Figure 3.6) give an estimate of a negative relationship between household debt and non-performing loans for the entire sample period.

The overall assessment is therefore that, particularly for the household sector, it is possible that in proactively making sure that the levels of defaults were minimised by rescheduling, restructuring debt and re-pricing risk, these measures also compromised balance sheets (the cost of debt was effectively increased) thereby curtailing demand for credit going forward. Furthermore, implying that creditworthy consumers that were saved by banks at the height of the policy-tightening cycle and the financial crisis are already tied in, and taking advantage of the easing of monetary policy to repair their balance sheets, the appetite for debt is at low levels. New entrants are either not creditworthy or are postponing incurring debt due to uncertainty, given the labour market conditions and the economic outlook in general.

Moreover, it may be inferred from these observations that banks learnt from the previous financial crisis and credit busts, to the extent that measures were taken to minimise default levels as well as the introduction of the National Credit Act and consumer protection under the Act. These measures helped to artificially maintain growth in credit extension at high levels and prolonged the lag with which credit extension would normally have responded to monetary policy tightening and real economy slowdown. Nevertheless, these measures have also contributed to the current state of bank credit extension and have, to some extent, distorted the transmission of monetary policy decisions to the real economy.

3.2 Conclusion

This chapter highlighted the fact that major structural changes have occurred in South Africa over the years with a defining moment relating to financial liberalisation triggers by the implementation of the market-oriented recommendations of the De Kock Commission reports. The domestic financial sector has liberalised massively over the years and has become an integral part of the global financial system. Gradual exchange control relaxation, changes in the financial regulatory environment, changes in the corporate tax structure, innovation and technological advancement, the implementation of the Financial Sector Charter and Black Economic Empowerment policies are also amongst the factors that have contributed to structural changes in the financial markets and the economy in general. The implementation of the Charter has allowed greater access to financial markets, for the previously un-banked masses and has allowed for greater opportunities for borrowing and saving as well. The South African banking sector has continued to grow and evolve into a sophisticated and financially sound industry that compares favourably to those in developed countries. The industry remained resilient in a changing domestic socio-economic and political landscape, turbulent international financial markets and has kept abreast with international banking developments

The corporate debt and securitisation markets grew over the years in line with those in other emerging markets but remain negligible relative to the equity market. The bulk of the funding, particularly for the small-medium enterprises, is sourced from banks and is mainly funded by deposits. This therefore, makes the banking sector an important transmitter of monetary policy actions to the real economy.

Chapter 4 Methodology

4.1 Introduction

In order to determine the long-term relationship between credit extension and its determinants this study makes use of the cointegrated VAR model. In addition, the VECM is used to assess the cyclical aspects of credit extension in South Africa, that is, to assess whether there is an overhang or short-fall of credit extension at certain points of the cycle.

Based on the foundations laid by Granger (1981), and Engle and Granger (1987) for econometric modelling and testing economic relationships, the concept of cointegration in macroeconomics is well established and originates from the observation and idea that there is a stochastic trend i.e. an I(1) process Z, underlying two or more processes X and Y as shown below:

$$X_t = \gamma_0 + \gamma_1 Y_t + \epsilon_t \qquad (4)$$

$$Y_t = \delta_0 + \delta_1 Y_t + \eta_t \qquad (5)$$

Where ε_t and η_t are stationary, I(0) with mean 0. X_t and Y_t are both I(1), and there is a linear combination of them which follows a stationary process as shown below:

$$\delta_1 X_t - \gamma_1 Y_t + \text{const} \sim I(0) \qquad (6)$$

With a vector (δ_1, γ_1) rendering a process $Z_t = (X_t, Y_t)$ stationary. It is important to note that in its general form, a VAR system consists of a vector with a set of *K* endogenous variables such as $Yt = (y_{1t}, \cdots y_{kt}, \cdots, yK_t)$. The VAR(*p*)-process is defined as:

$$Y_t = A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + u_t \ , \qquad (7)$$

where A_i are (K x K) coefficient matrices for i = 1, …, p and u_t is a K-dimensional process with $E(u_t) = 0$ and time invariant positive definite covariance matrix $E(u_t u_t^T) = \Sigma_u$ (white noise).

One of the key characteristics of a VAR(p) process is its stability, meaning that it generates stationary time series with time invariant means, variances and covariance structure. Such that if the solution to equation 8 below:

$$\det(I_k - A_1 z - \cdots - A_p z^p) \neq 0 \; for \; |z| \leq 1 . \quad (8)$$

has a root for $z = 1$, then either some or all the variables in the VAR(p)-process are integrated of order one, that is, I(1) and that cointegration exists between the variables hence, in this instance the analysis can be better performed in the context of a CVAR.

The dynamic properties of the process can be investigated by calculating the roots of the VAR process where the model can be extended to contain a vector of deterministic components, such as a constant, seasonal dummies and intervention dummies. The autoregressive formulation is useful for expressing hypotheses on economic behaviour, whereas the moving average representation is useful when examining the properties of the process. When the process is stationary, the moving average representation can be found directly by inverting the VAR model so that it is expressed as a function of past and present shocks and possible deterministic components. The issue of the roots of the VAR process is explored in sections Chapter 5.

4.2. The unrestricted VAR

If Y_t process presented in equation 4 is cointegrated, then the VAR representation is not the most suitable representation for analysis because the cointegrating relations are not explicitly apparent in that format. The cointegrating relations become apparent if the levels of VAR are transformed to a cointegrated VECM. The unrestricted VAR model can be given different parameterisation without imposing any binding restrictions on the model parameters, that is, without changing the value

of the likelihood function. This is done through the vector (equilibrium) error-correction model which gives a convenient reformulation of the VAR in terms of differences, lagged differences and levels of the process. According to Juselius (2003), such a formulation has several advantages in that:

- the multicolinearity effect which is strongly present in time-series data is significantly reduced in the error correction form (variables in differences are much more orthogonal than those in levels);
- all information about long-run effects are summarised in the levels matrix Π which can therefore be given special attention when solving the problem of cointegration;
- the interpretation of the estimates is much more intuitive, as the coefficients can be naturally classified into short-run effects and long-run effects; and
- in trying to understand the dynamics in the dependant variable over time, the error correction model (ECM) formulation answers this question directly.

4.3. The cointegrated VAR model

The presence of unit roots in the unrestricted VAR model corresponds to non-stationary stochastic behaviour which can be accounted for by a reduced rank $(r < p)$ restriction of the long-run levels matrix $\Pi = \alpha\beta^{\intercal}$. Given that cointegration implies that certain linear combinations of the variables of the vector process are integrated of lower order than the process itself, cointegrated variables are therefore driven by the same persistent shocks, so that, if the non-stationarity of one variable corresponds to the non-stationarity of another variable, then there is a linear combination between them that becomes stationary. Alternatively, when two or several variables have common stochastic and deterministic trends, they will show a tendency to move together in the long run. Such cointegrated relations can often be interpreted as long-run economic steady-state relations and are of considerable economic interest.

Based on equation 7, a VAR(2) model with its vector error-correction (ECM) specification may be presented as in equation 9.

$$\Delta y_t = \alpha\beta^{\intercal} y_{t-1} + \Gamma_1 \Delta y_{t-1} + \cdots + \Gamma_{p-1} \Delta y_{t-p+1} + u_t \ , \quad (9)$$

with

$$\beta_i = -(I - A_1 - \cdots - A_i), \qquad i = 1, \cdots, p-1. \qquad (10)$$

and

$$\Pi = \alpha\beta^{\intercal} = -(I - A_1 - \cdots - A_P) \, . \qquad (11)$$

In the VAR model the cointegration hypothesis can be formulated as a reduced rank restriction on the β_i matrix. The β_i matrices contain the cumulative long-run impacts, hence, the CVAR specification is signified by a long-run form. The dimensions α and β are *K* x r, and *r* is the cointegration rank, that is, how many long-run relationships between the variables y_t exist. The matrix α is the loading matrix and the coefficients of the long-run relationships are contained in β. Equation 11 also applies to the specification in equations 12 and 13:

$$\Delta y_t = \alpha\beta^{\intercal} y_{t-1} + \Gamma_1 \Delta y_{t-1} + \cdots + \Gamma_{p-1} \Delta y_{t-p+1} + u_t \ , \quad (12)$$

with

$$\Gamma_i = -\left(A_{i+1} + \cdots + A_p\right) \ i = 1, \cdots, p-1. \qquad (13)$$

However, the Π matrices in equations 11 and 13 differ since the Γ_i in equation 13 measures transitory effects and the specification is signified as a transitory form as opposed to the cointegration matrix $\Pi = \alpha\beta^{\intercal}$ in equation 11 which is of reduced rank.

4.4. The dynamic properties and the roots of the characteristic VAR function

Macroeconomic models are extremely difficult to take data characterised by unit root, non-stationarity and breaks. The CVAR approach offers a way of handling unit roots,

structural breaks and feedback dynamics in the data, and can therefore be used to discriminate between empirically relevant and irrelevant hypothesis (Juselius, 2010).

The CVAR models are consistent with a world where unanticipated shocks cumulate over time to generate stochastic trends which move the economic equilibria (i.e., the pushing forces) and where the deviations from these equilibria are corrected by means of the dynamics of the adjustment mechanism (i.e., the pulling forces). Thus, the CVAR model has a multivariate, path-dependent data-generating process that is relevant for dynamic macroeconomic theories. Because of its ability to structure the relevant data into economically meaningful directions without subjecting them to prior restrictions, the CVAR can be thought of as providing broadly defined confidence intervals within which empirically relevant models should fall (Johansen, 2012).

The CVAR approach starts from an unrestricted VAR model, which is just a representation of the co-variances of the data. By imposing (testable) reduced rank restrictions on the VAR model, it is formulated as a vector equilibrium ECM of the first order or the I(1) CVAR model, or second order or the I(2) CVAR model. The first order or the I(1) CVAR model is appropriate to describe an economy where growth rates and deviations from equilibria are stationary. Whereas, a second order or the I(2) CVAR model is most appropriate where the variables are unit root non-stationary (Juselius & Juselius, 2012).

In the I(1) model, deviations from static equilibria are stationary, implying that a static equilibrium relation holds as a stationary relation; for example, rational expectations hypothesis- (REH) based models would allow real exchange rates to move away from Purchasing Power Parity values albeit in a stationary manner and the speed of adjustment back to equilibrium would be described as in section 4.4.1. Whereas in the I(2) model, deviations from equilibrium can exhibit a pronounced persistence, implying that the nominal exchange rate can move away from equilibrium values for extended periods. This, however, requires that the movements away are compensated by something else. The Imperfect Knowledge Economics (IKE) theory predicts that a long swing in the real exchange rate requires a compensating movement in the real interest rate differential and the process of adjustment can be as described in section 4.4.2 (Juselius, 2012).

Following examples in Juselius (2010), sections 4.4.1 and 4.4.2, derive the definitions and structural decompositions of the I(1) and I(2) models.

4.4.1 The I(1) model

To illustrate the structuring of data into pulling and pushing factors, Juselius (2010) uses a simple three-dimensional VAR model for $x_t^{'} = [p_1, p_{2,} s_{12}]$, where the three variables describe domestic and foreign prices, and the nominal exchange rate. The model is structured around $p - r$ stochastic trends (i.e., the pushing or exogenous forces) and r cointegration relations (i.e., the pulling or equilibrating forces). Considering the case where $(r = 1, p - r = 2)$, the pulling force is formulated as the vector equilibrium error correction model, $\Delta x_t = \alpha\beta^{'} x_{t-1} + \varepsilon_t$, that is, as:

$$\begin{bmatrix} \Delta p_{1,t} \\ \Delta p_{2,t} \\ \Delta s_{12,t} \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} \beta^{'} x_{t-1} + \cdots + \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \varepsilon_{3,t} \end{bmatrix} \qquad (14)$$

where $\beta^{'} x_t$ is an equilibrium error and α_i is an adjustment coefficient describing how the system adjusts back to equilibrium when it has been pushed away, $\beta^{'} x_t = p_{1,t} - p_{2,t} - s_{12,t}$ would describe, for example, an economy where purchasing power parity holds as a stationary condition. The α_i coefficients tell whether it is prices or exchange rates or all three variables that take the adjustment when unanticipated shocks, $\varepsilon_{i,t}$, have pushed the system out of equilibrium. The pushing forces are analysed in the moving average form of the CVAR model, describing the cumulated effects of the exogenous shocks, $u_{i,t,}$ on the variables:

$$\begin{bmatrix} p_{1,t} \\ p_{2,t} \\ s_{12,t} \end{bmatrix} = \begin{bmatrix} \beta_{\perp,11} & \beta_{\perp,21} \\ \beta_{\perp,12} & \beta_{\perp,21} \\ \beta_{\perp,13} & \beta_{\perp,21} \end{bmatrix} \begin{bmatrix} \Sigma_{i=1}^{t} & u_{1,i} \\ \Sigma_{i=1}^{t} & u_{2,i} \end{bmatrix} + \cdots + \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \varepsilon_{3,t} \end{bmatrix} \qquad (15)$$

Where $u_{1,t} = \alpha_{\perp,1}^{'} \varepsilon_t$ and $u_{2,t} = \alpha_{\perp,2}^{'} \varepsilon_t$ are two autonomous common shocks that have a permanent effect on the system and $\alpha_\perp = [\alpha_{\perp,1}, \alpha_{\perp,2}]$, is a 3 x 2 matrix, orthogonal to

α, defining the two common shocks as linear combination of the VAR residuals $\hat{\varepsilon_t}$ and $\beta_\perp = \left[\beta_{\perp,1,}, \beta_{\perp,2}\right]$, is a 3 x 2 matrix orthogonal to β describing the steady-state effect of a structural shock to the system.

In this case, for example, $\alpha'_{\perp,1} = [1, -1, 0]$ and $\alpha'_{\perp,2} = [0,0,1]$ would describe an economy where shocks to relative prices and shocks to the nominal exchange rate are the main exogenous driving forces. The case $\beta'_{\perp,1} = [a, a, 0]$ and $\beta'_{\perp,2} = [b, c, b - c]$ would define a stationary real exchange rate:

$$\begin{bmatrix} p_{1,t} \\ p_{2,t} \\ s_{12,t} \end{bmatrix} = \begin{bmatrix} a & b \\ a & c \\ 0 & b-c \end{bmatrix} \begin{bmatrix} \Sigma_{i=1}^{t} & u_{1,i} \\ \Sigma_{i=1}^{t} & u_{2,i} \end{bmatrix} + \cdots + \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \varepsilon_{3,t} \end{bmatrix} \quad (16)$$

4.4.2 The I(2) model

The I(2) model is useful to describe an economy where the persistency in the data is one degree higher than in the I(1) world. To account for this, the I(2) model is formulated in acceleration rates, medium-run relations between growth rates and dynamic relations. In turn, it has a richer and more complicated structure. The vector x_t in this case is integrated of order 2 and the $p - r$ stochastic trends are divided into s_1 first order and s_2 second order stochastic trends $p - r = s_1 + s_2$. The r cointegration relations, $\beta' x_t$ are generally integrated of order 1, that is, they cointegrate from I(2) to I(1) and become stationary by adding a linear combination of the growth rates, $\delta' \Delta x_t$. In addition, there are s_1 linear combinations, $\beta'_{\perp,1} x_t \sim I(1)$ which can become stationary exclusively by differencing, that is $\beta'_{\perp,1} x_t \sim I(0)$. Thus, the I(2) model contains $p - s_2$ relations, $\tau' x_t$ which cointegrate from I(2) to I(1), where $\tau = \beta + \beta_{\perp 1}$.

Based on Juselius (2012), considering a case (r = 1; s_1 = 1; s_2 = 1) implies one equilibrium relation and two stochastic trends. The difference is because the equilibrium relation needs to be combined with a growth rate to become stationary and one of the common stochastic trends is an I(2) trend whereas the other is an I(1)

trend. The former could, for example, describe price shocks and the latter exchange rate shocks.

Under this assumption, the vector equilibrium error correcting model for I(2) data can be formulated as $\Delta^2 x_t = \alpha(\beta' x_{t-1} + \delta' \Delta\chi_{t-1}) + \zeta\tau' \Delta\chi_{t-1} + \varepsilon_t$, where, $\tau = [\beta, \beta_{\perp 1}]$. The system of prices and exchange rates would therefore take the form presented below:

$$\begin{bmatrix} \Delta^2 p_{1,t} \\ \Delta^2 p_{2,t} \\ \Delta^2 s_{12,t} \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} (\beta' x_{t-1} + \delta' \Delta x_{t-1}) + \begin{bmatrix} \zeta_{11} & \zeta_{21} \\ \zeta_{12} & \zeta_{22} \\ \zeta_{13} & \zeta_{23} \end{bmatrix} \begin{bmatrix} \beta' \Delta x_{t-1} \\ \beta'_{\perp 1} \Delta x_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \varepsilon_{3,t} \end{bmatrix} \quad (17)$$

Where, $\beta' x_{t-1} + \delta' \Delta x_{t-1}$ describes a deviation from a dynamic equilibrium relation, and $\beta' \Delta x_{t-1}$ and $\beta'_{\perp 1} \Delta x_{t-1}$ describe deviations from two medium-run equilibrium relations among growth rates; for example, if $\beta' x_{t-1} + \delta' \Delta x_{t-1} = (p_{1,t} - p_{2,t} - s_{12,t}) + \delta_1 \Delta p_{1,t}$,] then this would describe an economy where deviations from PPP exhibit type I(1) persistence, which is compensated by a similar persistence in country 1 inflation rate. The common stochastic trends are analysed in the moving average form of the VAR model, $x_t = \beta_{\perp 2} \Sigma\Sigma u_s + \beta\Sigma u_i + \cdots + \varepsilon_t$. For the price and exchange rate system it can be formulated as follows:

$$\begin{bmatrix} p_{1,t} \\ p_{2,t} \\ s_{12,t} \end{bmatrix} = \begin{bmatrix} \beta_{\perp,21} \\ \beta_{\perp,22} \\ \beta_{\perp,23} \end{bmatrix} \left[\sum_{i=1}^{t} \sum_{s=1}^{i} u_{1,s} \right] + \begin{bmatrix} b_{11} & b_{21} \\ b_{12} & b_{22} \\ b_{13} & b_{23} \end{bmatrix} \begin{bmatrix} \sum_{i=1}^{t} u_{1,i} \\ \sum_{i=1}^{t} u_{2,i} \end{bmatrix} + \cdots \quad (18)$$

Where, $u_{1,t} = \alpha'_{\perp,2} \varepsilon_t$ is an autonomous shock that cumulates twice over time, $u_{2,t} = \alpha'_{\perp,1} \varepsilon_t$ is autonomous shocks that accumulate once over time, $\alpha_\perp = [\alpha_{\perp,1}, \alpha_{\perp,2}]$, is a 3 x 2 matrix orthogonal to α; defining the two shocks as a linear combination of the VAR residuals $\widehat{\varepsilon_t}$ and $\beta_{\perp 2}$ is a 3 x 1 vector orthogonal to $\{\beta, \beta_{\perp,1,}\}$ describing the steady-state effect of a structural I(2) shock to the system. If $u_{1,t}$ is a relative price shock, and $\alpha'_{\perp,2} = [1, -1, 0]$ and $u_{2,t}$ a nominal exchange rate shock, then $\alpha'_{\perp,1} = [0,0,1]$. Assuming that only the two prices are affected by the I(2) trend, the system could be described by:

$$\begin{bmatrix} p_{1,t} \\ p_{2,t} \\ s_{12,t} \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} \left[\sum_{i=1}^{t} \sum_{s=1}^{i} u_{1,s} \right] + \begin{bmatrix} b_{11} & b_{21} \\ b_{12} & b_{22} \\ b_{13} & b_{23} \end{bmatrix} \begin{bmatrix} \sum_{i=1}^{t} u_{1,i} \\ \sum_{i=1}^{t} u_{2,i} \end{bmatrix} + \cdots \quad (19)$$

Thus, prices would be type I(2), but relative prices and the nominal exchange rate type I(1). The real exchange rate would generally be I(1) unless $b_{13} = b_{11} - b_{12}$ and $b_{23} = b_{21} - b_{22}$.

4.5 Dummy variables and the VAR

Based on Juselius (2004), a number of, and quite significant, interventions and reforms frequently show up as extraordinary large (non-normal) shocks in the VAR analysis, thus violating the normality assumption. There is therefore a need for intervention dummies in the analysis of the data that is, using dummies to account for extraordinary mean shifts, permanent blips and transitory shocks. Therefore, a VAR model can be reformulated as:

$$\Delta x_t = \Gamma_1 \Delta x_{t-1} + \alpha\beta' x_{t-1} + \Phi_s Ds_t + \Phi_p Dp_t + \Phi_{tr} Dtr_t + \alpha\mu_0 + \varepsilon_t,$$
$$\varepsilon_t \sim N_{iid}(0, \Omega), t = 1, \cdots, T \quad (20)$$

where $\boldsymbol{Ds_t}$ is $d_1 \times 1$ vector of mean-shift dummy variables (...0,0,0,1,1,1,...), $\boldsymbol{Dp_t}$ is a $d_2 \times 1$ vector of permanent blip dummy variables (...0,0,1,0,0,...) and $\boldsymbol{Dtr_t}$ is a $d_3 \times 1$ vector of transitory shock dummy variables (...0,0,1,-1,0,0,...). Because the VAR model contains both differences and levels of the variables, the role dummy variables (and other deterministic terms) the role of dummies tends to be more complicated than in the usual regression model. In this case

- an unrestricted mean shift dummy accounts for a mean shift in Δx_t and cumulates to a broken trend in x_t;
- an unrestricted permanent blip dummy accounts for a large blip (impulse) in Δx_t and cumulates to a level shift in x_t ; and
- an unrestricted transitory blip dummy accounts for two consecutive blips of opposite signs in Δx_t and cumulates to a single blip in x_t (Juselius, 2004).

To understand the role of the dummies in the CVAR, the dummy effects can to partition into an α and an $\beta_\perp$ component as shown below:

$$\Phi_s = \alpha\delta_0 + \delta_1, \qquad (21)$$

$$\Phi_p = \alpha\varphi_0 + \varphi_1 \qquad (22)$$

$$\Phi_{tr} = \alpha\psi_0 + \psi_1 \qquad (23)$$

To investigate the dynamic effects of the dummies for a model that defines x_t as a function of $\varepsilon_i, i = 1, \dots, t$, the dummy variables $Ds_t, Dp_t \text{ and } Dt_t$ and the initial values $\widehat{X_o}$. For equation 17 the dynamic effects of the dummies and the initial values are given by:

$$x_t = C\sum_{i=1}^{t-1}\varepsilon_i + C\Phi_s\sum_{i=1}^{t-1}Ds_i + C\Phi_p\sum_{i=1}^{t-1}Dp_i + C\Phi_{tr}\sum_{i=1}^{t-1}Dt_i + C^*(L)\left(\varepsilon_t + \mu_0 + \delta_0 Ds_t + \Phi_p Dp_t + \psi_1 Dt_1\right) + \widetilde{X_0} \qquad (24)$$

where,

$$C = \beta_\perp\left(\alpha_\perp' \Gamma \beta_\perp\right)^{-1}\alpha_\perp' \qquad (25)$$

and $C^*(L)$ is an infinite polynomial in the lag operator L. The summations in equation 21 respectively represent (i) the common stochastic trends generated by the ordinary shocks to the system (ii) a broken linear trend in x_t , (iii) a shift in the level of the variables associated with the permanent extraordinary large shock and (iv) a blip in the variables. From equation 22 only the $\beta_\perp$ components of equation 18 to 20 enter with a non-zero coefficient in the summation of the dummy components in equation 21, whereas the α components will have a zero coefficient and will therefore disappear. Therefore, dummy variables that are restricted to being in the cointegration relations do not cumulate in x_t .

Therefore, in equation 21 a large shock at time *t*, accounted for by the dummies Dp_t or Dtr_t, will influence the variables with the same dynamics as an ordinary shock unless the dummies enter the model with lags, such that, if a dummy variable needs a lag in the model, the corresponding intervention shock is considered to be inherently different from the ordinary shocks. Whereas, if the dummy is needed only

once, on the day of the news, it is considered a big and ordinary shock. There is therefore a need to distinguish between extraordinary intervention shocks with a permanent effect, for example, as a result of central bank or government interventions, and ordinary large shocks, for example, as a result of market (over)reaction to different news.

According to Juselius (2003), conceptual distinctions can be made between

- ordinary or normally distributed random shocks;
- extraordinarily large permanent random shocks ($|\widehat{\varepsilon_{i,t}}| > 3.3\widehat{\alpha_{\varepsilon,}}$) which are described by a blip dummy without lags;
- intervention shocks (large permanent shocks, $|\widehat{\varepsilon_{i,t}}| > 3.3\widehat{\alpha_{\varepsilon,}}$, related to a well-defined intervention), which are described by a blip dummy with lags; and
- transitory large shocks, outliers (such as typing mistakes), which are described by a +/- blip dummy.

The occurrence of transitory shocks in the VAR model, whether large or small, will produce some, albeit usually small, residual autocorrelations in the model and, hence, violate the independence assumption of the VAR model. Because transitory shocks appear unsystematically, this problem cannot be solved by increasing the lag length of the VAR or by including a moving average term in the error process. To some extent, it can be accounted for by the inclusion of transitory intervention dummies in the model. However, only the very large transitory shocks will generally be accounted for by dummies and the empirical model is therefore likely to exhibit some minor autocorrelations in the residuals.

Similarly, the same arguments hold for the trend and the constant term in the VAR model in the case of intervention dummies. The intervention may influence several variables in such a way that the intervention effect is cancelled in a cointegration relation. Alternatively, the intervention may only have affected one of the variables (or several variables but not proportionally with β), so that the effect does not disappear in a cointegration relation.

4.6. Identification and over-identification in a CVAR

Although VARs have many uses in data description and forecasting that do not require the identification of shocks underlying them, nonetheless, it becomes necessary to identify the parameters of such a system for policy consideration. Furthermore, when the empirical model is estimated with data that are non-stationary in levels there are two different identification problems, namely the identification of the long-run structure, that is, of the cointegration relations and the identification of the short-run structure (i.e., of the equations). The identification of the long-run structure refers to imposing long-run economic structure on the unrestricted cointegration relations, whereas, the short-run structure refers to imposing a short-run dynamic adjustment structure on the equations for the differenced process.

This can take various forms ranging from (i) assuming that the macroeconomic system can be represented as a set of simultaneous equations that recursively determine economic variable, (ii) assume non-recursivity with the requisite identifying information as the inertial restrictions, for example, that monetary policy has no impact on real variables for some quarters, and (iii) imposing long-run restrictions or incorporating qualitative and quantitative information such as the use of either sign restrictions of other prior information on the impulse responses (Fry & Pagan, 2007).

In practice the joint identification of the long- and short-run structure is immensely difficult. The identification process starts with the identification of the long-run structure in the reduced form and proceeds to the identification of the short-run structure keeping the identified long-run structure fixed. It is therefore necessary to distinguish between all aspects of identification and in three different meanings, namely

i. generic (formal) identification, which is related to a statistical model;
ii. empirical (statistical) identification, which is related to the actual estimated parameter values, and

iii. economic identification, which is related to the economic interpretability of the estimated coefficients of a formally and empirically identified model.

For identification to be empirically useful, all three conditions for identification have to be satisfied in the empirical problem which, as a crucial part, involves the choice of data. It is also useful to distinguish between just identifying restrictions and over-identifying restrictions. Just identifying restrictions is achieved by linear combinations of the relations (equations) and, hence, does not change the likelihood function, whereas, the over-identifying restrictions constrain the parameter space and therefore change the likelihood function (Juselius, 2003).

As a rule of thumb, Juselius (2003) suggests that for identifying restrictions, it holds that rank $(R_i'\beta) \geq r-1$, and if equality holds, the *i*th relation is exactly identified; if inequality holds, then the ith relation is over-identified. The system is exactly identified if rank$(R_i'\beta) = r-1$ for all i, and over-identified if it is identified and rank $(R_i'\beta)$ $r-1$ for at least one *i*. As a starting point and a general procedure, it is useful to start with a just-identified system and then impose further restrictions if the estimated parameters indicate that a further reduction in the statistical model is possible.

The results for the identification of the long-run structure apply to the short-run structure, meaning that an identified short-run adjustment structure should satisfy the conditions for generic, empirical and economic identification as for the long-run structure. However, the residual covariance matrix plays an important role in the identification of the short-run structure, whereas the long-run covariance matrix of the cointegrating relations was not part of the identification process. It is therefore for this reason that the two identification problems differ from each other.

The identification of the short-run structure is facilitated by keeping the properly identified cointegrating relations fixed at their estimated values, that is, treating $\beta' x_t$ as predetermined stationary regressors similar to Δx_{t-1}. The statistical justification is that the estimates of the long-run parameters $\tilde{\beta}c$ are super consistent, that is, the speed of convergence towards the true value β^c is proportional to t as $t \rightarrow \infty$,

whereas the convergence of the estimates of the short-run adjustment parameters is proportional to √t.

Given that the CVAR model is a reduced form model in the short-run dynamics, implying that potentially important current (simultaneous) effects are not explicitly modelled but are left in the residuals. Thus, large off-diagonal elements of the covariance matrix Ω can be a sign of significant current effects between the system variables. However, in some cases the residual covariances are small and of minor importance, and can be disregarded altogether.

Since the reduced form is always generically identified, all further restrictions on the short-run structure are then over-identifying. While a simplification search in the reduced form VAR model is quite simple, this is generally not the case when the covariance matrix Ω is part of the identification process.

In discussing identification of the short-run adjustment parameters it is first and foremost assumed that the cointegration relations have been properly identified in the first step of the identification scheme; for example, in a case of imposing identifying restrictions on the short-run parameters it is assumed on an identified $\beta = \tilde{\beta}c$. Multiplying the VAR model with a non-singular (p × p) matrix A_0 does not change the likelihood function, but introduces p×(p−1) new parameters (assuming that the diagonal elements of A_0 are ones and that the residual covariance matrix is unrestricted). Therefore, at least p×(p−1) needs to be imposed as just-identifying restrictions to obtain a unique solution.

When assessing for generic identification of the short-run structure, the same rank condition for the long-run structure can be used.

For the sake of this study, a CVAR method will be used to identify the cointegrating vector that defines the aggregate and sectoral equilibrium demand for credit in South Africa. Moreover, an identified VECM method will be used to infer the periods of debt overhang and short-fall in South Africa.

4.7. Conclusion

Estimation of all equations in the study will be through Johansen-type vector error-correction model (VECM) or a cointegrating vector autoregressive model (CVAR). The motivation behind using a VECM approach is its ability to link cointegration provided by VARs and error-correction models (ECMs), thereby allowing for the investigation of both long-run and short-run dynamic relationships. Moreover, these models have capabilities to incorporate endogeneity i.e. the capability of handling a system where variables affect each other therefore capturing feedback effects within the transmissions mechanism scenario.

Moreover, the Johansen, (1988) cointegration procedure also allows for the estimation of multiple long-run relationships between a set of non-stationary variables. Cointegration implies that certain linear combinations of the variables of the vector process are integrated of lower order that the process itself. Normally cointegrated variables are driven by the same persistent shocks such that when variables have common stochastic and deterministic trends, they show a tendency to move together in the long-run – hence these cointegrated relations are often interpreted a long-run economic steady state relations (Juselius, 2003). Thereafter, the identified VECM method will be used to infer the periods of debt overhang and short-fall in South Africa

Chapter 5 Econometric estimation, analysis and findings

5.1 Introduction

This study endeavours to assess the determinants of equilibrium aggregate and sectoral credit extensions in South Africa. Moreover, periods corresponding to debt overhang and debt short-fall are inferred from this equilibrium. The study makes use of the CVAR approach to this end. This chapter will discuss the data used in the study, the estimation of the model and the findings of the study. The determinants of the aggregate and sector credit extensions are estimated based on equations 2.1 to 2.3 as discussed in Chapter two.

5.2 The data set

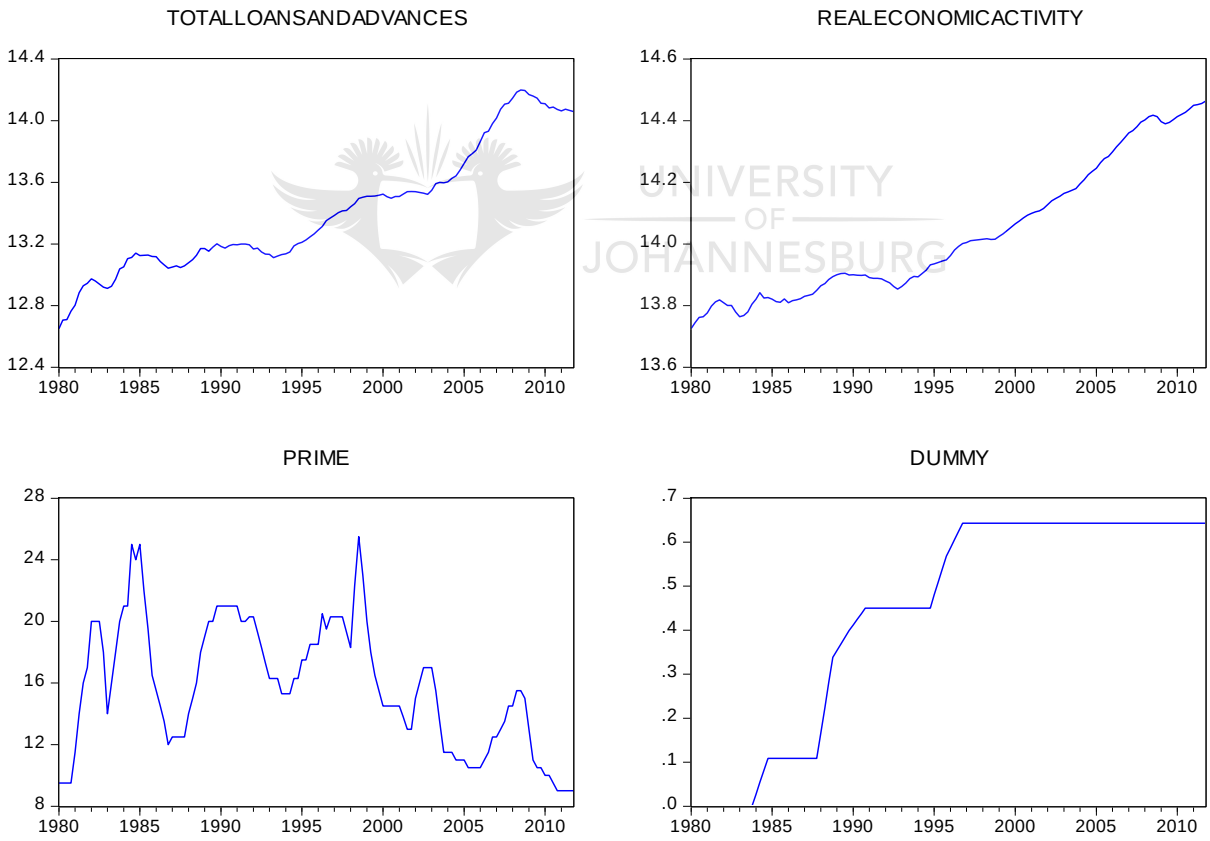
The study makes use of quarterly data and covers the periods 1980 to 2011. All the data are sourced from the SARB database. The origin of the sample corresponds to the beginning of financial liberalisation in South Africa. Nonetheless, the paper makes use of the spline dummy variable, as suggested by Aron and Muellbauer (2002)[4] to account for progressive financial liberalisation. Aron and Muellbauer (2002) argue that a flexible technique linking institutional information with behavioural responses is most appropriate to proxy financial liberalisation, hence, their contribution is to treat financial liberalisation as an unobservable indicator entering both household debt and consumption equations. The authors make use of a spline function to derive the dummy variable that represents financial liberalisation in South Africa. The estimated dummy variable reflects the key institutional changes

[4] The data for the dummy variable was sourced from Aron J and Muellbauer J, 2002, Estimating Monetary Policy Rules for South Africa ,and can be accessed from the website address: http://www.csae.ox.ac.uk/resprogs/smmsae/datasets.html

in the credit markets in South Africa, it shows strong rises in 1984, 1988 and 1995, with more moderate increases in 1989, 1990 and 1996 as in Figure 5.1.

The data set used for the estimation of the aggregate credit extension (loan demand) as in equation 2.1 in Chapter two is displayed in Figure 5.1, where total loans and advances are represented by the logarithm of the real total loans and advances deflated by the GDP deflator (*Loans*), real economic activity is proxied by the logarithm of real GDP (*GDP*), the lending rate is represented by the prime rate (*Lendingrate*) and the spline dummy (*Dummy*) variable is used in all the estimated equations.

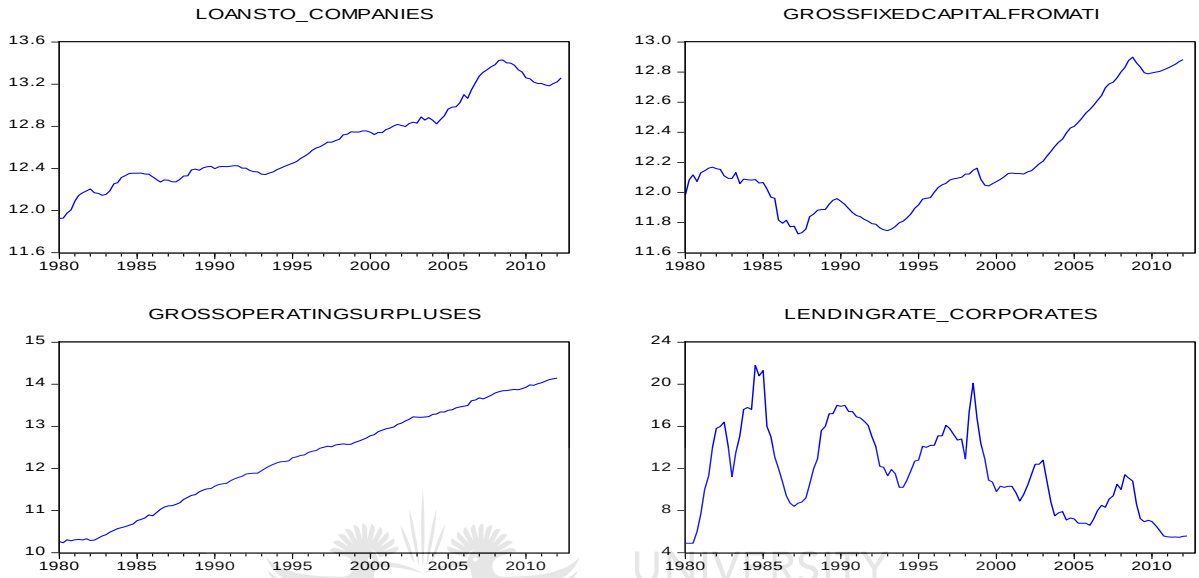
Figure 5.1: Total loans and advances, real economic activity, prime rate and the dummy variable



Moreover, a graphic representation of the variables used in the estimation of the corporate sector demand for credit (equation 1.2 in Chapter two) is displayed in Figure 5.2. Loans to companies is represented by the log of real credit to the corporate sector deflated by the GDP deflator (*LoansC*), gross fixed capital formation

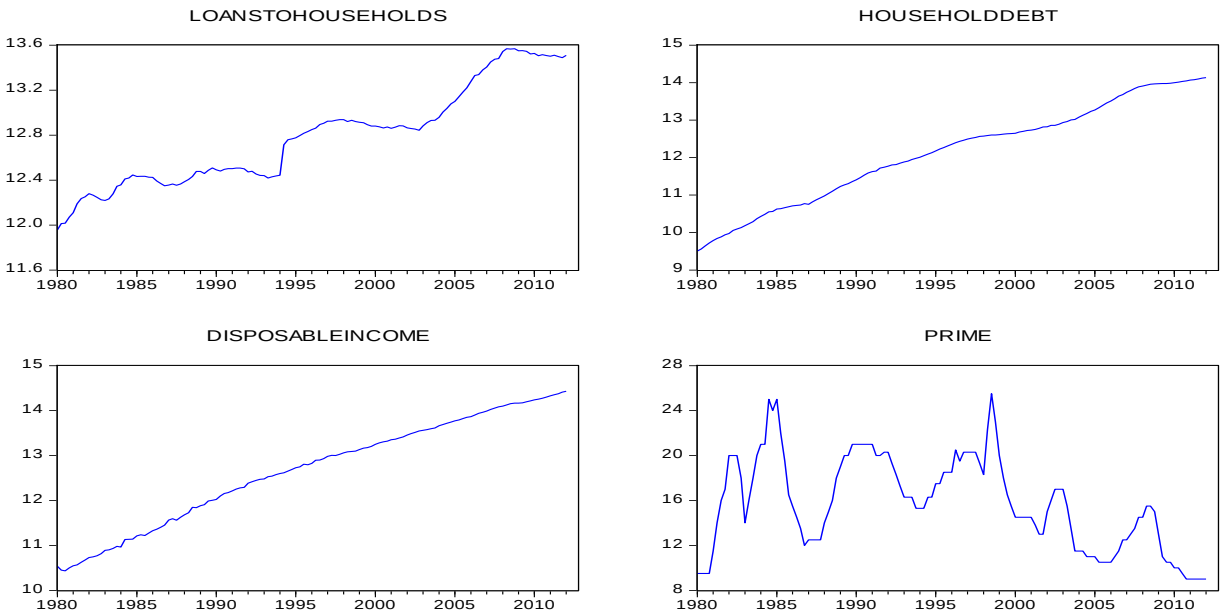
is denoted by the log of real gross fixed capital formation (*invest*), gross operating surpluses are represented by the log of gross operating surpluses (*GOS*), and the lending rate is denoted by the prime rate (*Lendingrate*).

Figure 5.2: Total loans and advances to companies, gross fixed capital formation (GFCF), gross operating surpluses (GOS) and the lending rate



A graphic representation of the variables used in the estimation of the household sector demand for credit (equation 5.3) is displayed in Figure 5.3. Loans to households is the log of credit extended to the household sector deflated by the GDP deflator (*LoansH*), household debt is denoted by the log of household debt (HHDebt), disposable income is represented by the log of household disposable income (HHYd) and the lending rate by the prime rate (*Lendingrate*).

Figure 5.3: Total loans and advances to households, household debt, disposable income and the lending rate



5.3 Unit root and stationarity tests

Given that most time series generally exhibit a trend or non-stationary behaviour and that if a series is non-stationary, unless it is combined with other non-stationary series to form a stationary cointegration relationship, then the regressions based on these series can result in the spurious regression. Many statistical approaches can be used to examine the stationarity of time series data, and the most popular are the Augmented Dickey–Fuller (ADF) test, Phillips–Perron test (PP), and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS, 1992) test. Most of the unit root and stationarity tests provide conflicting results, and that is the reason why this study chooses to use the ADF and KPSS tests. The two tests formulate their null hypothesis differently. While the null hypothesis of the ADF indicates that variables have unit roots, the null hypothesis of the KPSS denotes that variables are stationary, Ya Xu and Yuntan Sun, (2010).

The unit root and stationarity test results of the ADF tests and the KPSS tests are reported in Tables 5.1, 5.2 and 5.3. Table 5.1: Unit root tests for the aggregate equation variables presents the tests for variables included in the aggregate loan equation. The results of the ADF test show that the null hypothesis of a unit root (non-stationarity) in levels for all the variables could not be rejected. Moreover, the null hypothesis is rejected at first difference. This indicates that all the variables are integrated of order 1 (I(1)). The results are confirmed with the KPSS

test whereby the null hypothesis of stationarity is rejected at level and not at first difference.

Table 5.1: Unit root tests for the aggregate equation variables

Variables	ADF	KPSS	ADF	KPSS
	Level	Level	1st difference	1 st difference
Loans	0.2273	11.6761***	-3.7060**	0.2679
GDP	0.2707	12.0266***	-3.9895**	0.8514
Lendingrate	2.6790	2.0333***	-3.9729**	0.1275

The null hypothesis of the ADF is that the series does contain a unit root (non-stationary process) against the alternative of stationarity. Whereas, the null hypothesis of the KPSS test is that a series is a stationary process against the alternative of the non-stationary process. In all cases, ***/**/* indicate rejection of the hypothesis at the 1/5/10 per cent level of significance.

Similar results are reported for variables used in the corporate and household credit extension equations as in Table 5.2 and Table 5.3.

Table 5.2: Unit root tests for the corporate sector equation

Variables	ADF	KPSS	ADF	KPSS
	Level	Level	1st difference	1st difference
LoansC	0.7044	11.8156***	-3.6320**	0.2027
Invest	2.3622	8.6424***	-3.5009**	0.1383
GOS	0.4492	2.2728***	-3.9780**	0.1063
Lendingrate	-1.51089	2.5494***	-3.8491**	0.0218

The null hypothesis of the ADF is that the series does contain a unit root (non-stationary process) against the alternative of stationarity. Whereas the null hypothesis of the KPSS test is that a series is a stationary process against the alternative of the non-stationary process. In all cases, ***/**/* indicate rejection of the hypothesis at the 1/5/10 per cent level of significance.

Table 5.3: Unit root tests for the household sector equation

Variables	ADF	KPSS	ADF	KPSS
	Level	Level	1st difference	1st difference
LoansH	0.7044	1.0108***	-3.6320**	0.1370
HHDebt	2.3622	1.9477***	-3.5009**	0.3036
HHYd	0.4492	2.2165***	-3.9780**	0.0318

The null hypothesis of the ADF is that the series does contain a unit root (non-stationary process) against the alternative of stationarity. Whereas, the null hypothesis of the KPSS test is that a series is a stationary process against the alternative of the non-stationary process. In all cases, ***/**/* indicate rejection of the hypothesis at the 1/5/10 per cent level of significance.

5.4 Empirical results

Now that it is known that all the variables are I(1), one can proceed with the Johansen cointegration technique. It is worth noting that this cointegration technique can be applied only if variables are I(1).

The study makes use of the trace and maximum eigenvalue tests of cointegration to determine the cointegration ranks in each of the equations. The tests are conducted with a trend in the VAR equation to account for the deterministic trends in most of the variables, as in the figures above The results of the cointegration test for the aggregate equation are reported in Table 5.4 and show that both the trace and maximum eigenvalue tests support the presence of one cointegrating relationship among the variables.

Table 5.4: Johansen cointegration test for the aggregate credit extension

Ho	Ha	Eigenvalue	Trace test	Probability
r = 0	r = 1	34.53340*	3.2.32187*	0.0251
r = 1	r = 2	17.74106	15.49471	0.1367

* denotes rejection of the hypothesis at the 0.05 level

The estimation is therefore conducted on the results of one cointegrating relationship in the data for real total loans and advances, real GDP and the lending rate. The equation includes the dummy as an exogenous variable.

The results for the corporate sector equation (equation 5.2) are presented in Table 5.5. The results reported in **Table 5.5** show that there is one cointegrating equation. Therefore, the estimation of the corporate sector equation is conducted on the results of one cointegrating relationship in the data for real total loans and advances to the corporate sector, real gross fixed capital formation, gross operating surpluses and the prime rate.

Table 5.5: Johansen cointegration test for the corporate credit extension

Ho	Ha	Max. eigen stat	Trace stat	Probability
r = 0	r = 1	25.4591*	51.21154*	0.0234
r = 1	r = 2	15.9335	15.49471	0.1367

* denotes rejection of the hypothesis at the 0.05 level

The results for the household sector equation are presented in **Table 5.5**. The results indicate that both tests confirm the existence of one cointegrating relationship. The estimation is therefore conducted on the results of one cointegrating relationship in the data for real total loans and advances to the household sector, real household disposable income, household debt and the prime rate.

Table 5.6: Johansen cointegration test for the household credit extension

Ho	Ha	Max eigen stat	Trace stat	Probability
r = 0	r = 1	34.53340*	66.45386*	0.0004
r = 1	r = 2	17.74106	31.92046	0.280

* denotes rejection of the hypothesis at the 0.05 level

Once the number of cointegrating relationships is determined and the cointegrating vectors (β) are estimated, identification restrictions are needed to ensure uniqueness of those vectors. These restrictions are based on economic theory. Identification is achieved when the number of restrictions is larger than or equal to r^2, where r is the cointegration rank. Therefore, in the context of a single cointegration relationship, as indicated in most of the findings, one restriction is applied, based on economic theory. This can be obtained by normalising one of the variables, which are loans (i.e., aggregate, corporates and households). This is in line with the demand for credit extension or money. Moreover, restriction can be applied to the adjustment parameter, α, to test for exogeneity (weak-exogeneity) of a specific variable in a given cointegrating relationship.

5.5 Estimation of the CVAR and VECM

The estimated long-run relationship or cointegrating vector for the aggregate demand for credit is reported in Table 5.7. The relationship can be expressed as

$$Loans = 1.6896\,GDP - 0.0101\,Lendingrate \qquad [5.1]$$

The estimates describe a classic demand-type relationship, where the demand for credit is positively related to real GDP and negatively related to the lending rate.

Table 5.7: Estimation of the cointegrating vector for aggregate demand for credit

Variables	Coefficients
Loans	1
GDP	-1,6896*
Lendingrate	0,0101*

Note: * and ** denote significance at 1% and 5% level, respectively.

The results of the VECM estimation of the restricted VAR are presented in Table 5.8The coefficient of the term $\beta' y_{t-1}$, also referred to as 'the adjustment coefficient' provides the estimate of the adjustment coefficient that indicates which variable adjusts to restore the common trend when a deviation occurs. The results reported indicate that loans restore the long-run equilibrium to a shock that distorts this equilibrium, although the adjustment to equilibrium is slow. This is comparable with results found in studies such as Calza, et al. (2001; 2003); Hofman (2001); Hulsewig et al. (2001); Brozoza-Brzezina (2005); and Saase et al. (2007), where the slow adjustment of real credit is attributed to the existence of stronger frictions and transactions costs in credit markets.

Table 5.8: Estimates of the VECM specification for the aggregate demand for credit

	Dependent variables		
Regressors	$\Delta loans_t$	ΔGDP_t	$\Delta Lendingrate_t$
CointEq1	**-0,0461***	**-0,0061**	**-5,4649**
$\Delta loans_{t-1}$	0,5473	0,0289	3,0215*
$\Delta loans_{t-2}$	0,1630	-0,0104	-2,0866
ΔGDP_{t-1}	0,3751	0,4987	-1,9562
ΔGDP_{t-2}	0,1802	0,0213	7,9259
$\Delta Lendingrate_{t-1}$	0,0018*	0,0002	-0,0814
$\Delta Lendingrate_{t-2}$	-0,0099	0,0034	0,0384
C	0.0019	0,0024*	-0,0498
Dummy	0,0027	0,0090	3,1395

Note: * and ** denote rejection of the null hypothesis at 1% and 5% level of significance.

Table 5.9 presents the results for the cointegrating vector of the corporate demand for loan equilibrium. Given the cointegrating vector reported, the equilibrium relationship for corporate demand for loan can be expressed as:

$$LoansC = 0.1236GOS + 0.5635\,Invest - 0.0190\,Lendingrate \quad [5.2]$$

The long-run equation shows that credit to the corporate sector is positively related to capital formation and gross operating surpluses (a proxy for source internal financing), whereas it is negatively related to the lending rate. This finding indicates that corporates with high gross operating surplus have a tendency to demand more loans. A high lending rate will refrain corporates from demanding loans.

Table 5.9: Estimation of the cointegrating vector for the demand for credit by the corporate sector

Variables	Coefficients
LoansC	1
GOS	-0.1236*
Invest	-0.5635*
Lendingrate	0.0190*

Note: * and ** denote significance at 1% and 5% level respectively

The results reported in Table 5.10 show that loans to corporates adjust to any shock that disturbs the equilibrium demand for credit by corporates in South Africa. In summary, the results suggest that the adjustment of bank lending to the corporate sector towards its equilibrium level involves investment spending, gross operating surplus and the cost of funding. These factors traditionally explain growth in corporate sector credit extension fairly well.

Table 5.10 Estimates of the VECM specification for the demand of credit by the corporate sector

	Dependent variables			
Regressors	$\Delta loansC_t$	$\Delta Invest_t$	ΔGOS_t	$\Delta Lendingrate_t$
CointEq1	**-0,0648***	**-0,0524**	**-0,0406**	**-3,6378**
$\Delta loansC_{t-1}$	0,1539*	0,1950*	-0,2234*	2,6704
$\Delta loansC_{t-2}$	0,3220*	0,0760	0,0177	5,2810
$\Delta Invest_{t-1}$	0,1699*	0,0765	-0,0032	2,5473
$\Delta Invest_{t-2}$	0,0416	0,0059	-0,0575	-7,0257
ΔGOS_{t-1}	0,1009	0,0390	-0,0190	-1,4341*
ΔGOS_{t-2}	0,1962*	0,1384	0,1501*	3,0814
$\Delta \Pr ime_{t-1}$	0,0004	0,0018	-0,0014	-0,0487
$\Delta \Pr ime_{t-2}$	-0,0009	0,0039	0,0023	0,0658
C	-0,0156	-0,0322*	0,0402*	-1,0685*
Dummy	0,0224	0,0650	-0,0245	2,9681*

Note: * and ** denote rejection of the null hypothesis at 1% and 5% level of significance.

Table 5.11 presents the results for the equilibrium demand for credit by households in South Africa. The relationship can be expressed as:

$$LoansH = 0.5135\,HHDebt - 0.1027\,Lendinrate + 0.7424\,HHYd \qquad [5.3]$$

The demand for household credits is positively related to the level of household debt (a proxy for the borrowing to finance household expenditure on durable and non-durable goods, including housing), positively related to household disposable income in line with the Keynesian description of the consumption function where household spending and financial health are directly linked to disposable income.

Table 5.11: Estimation of the cointegrating vector for the demand of credit by the household sector

Variables	Coefficients
LoansH	1
HHDebt	-0,5135*
Lendingrate	0,1027*
HHYd	-0,7424*

Note: * and ** denote significance at 1 per cent and 5 per cent level respectively

Finally, the cost of lending coefficient is negative, consistent with the fact that in South Africa mortgage bond rates on outstanding mortgage debt are mostly floating rates and respond immediately to changes in the repurchase rate. This therefore has a significant impact on mortgages financed by mortgage debt.

Loans to households and the equilibrium variables are confirmed by the results reported in Table 5.11. It is important to note that the coefficients are stable for all the estimated CVARs, which supports the use of a linear model as in this study.

Table 5.12: Estimates of the VECM for the households sector

Dependent variables				
Regressors	$\Delta loansH_t$	$\Delta HHDebt_t$	$\Delta HHYd_{t-1}$	
$\Delta \Pr ime_t$				
CointEq1	**-0.0281***	**-0.0098**	**0.0191**	**-1.9727**
$\Delta loansH_{t-1}$	0,1598*	0,0977*	-0,0904*	5,9172*
$\Delta loansH_{t-2}$	0.0333	0.0132	-0,0042	-0,3417
$\Delta HHDebt_{t-1}$	0,1736	0.1156	-0,1214	-0,6488
$\Delta HHDebt_t$	0,2198	0,4122*	0,3168*	2,9951
$\Delta HHYd_{t-1}$	0,0245	0,1453*	-0,2788*	1,7091*
$\Delta HHYd_{t-2}$	-0,0209	-0,0329	-0,1820*	1,8918
$\Delta Lendingrate_{t-1}$	0,0038	0,0002	-0,0007	0,3286*
$\Delta Lendingrate_{t-2}$	-0,0013	0,0083	0,0021	0,1327
C	-0,4632*	0,0034	0,0239*	-3,3256*
$Dummy$	0,0913*	0,0123	0,0223	5,9013*

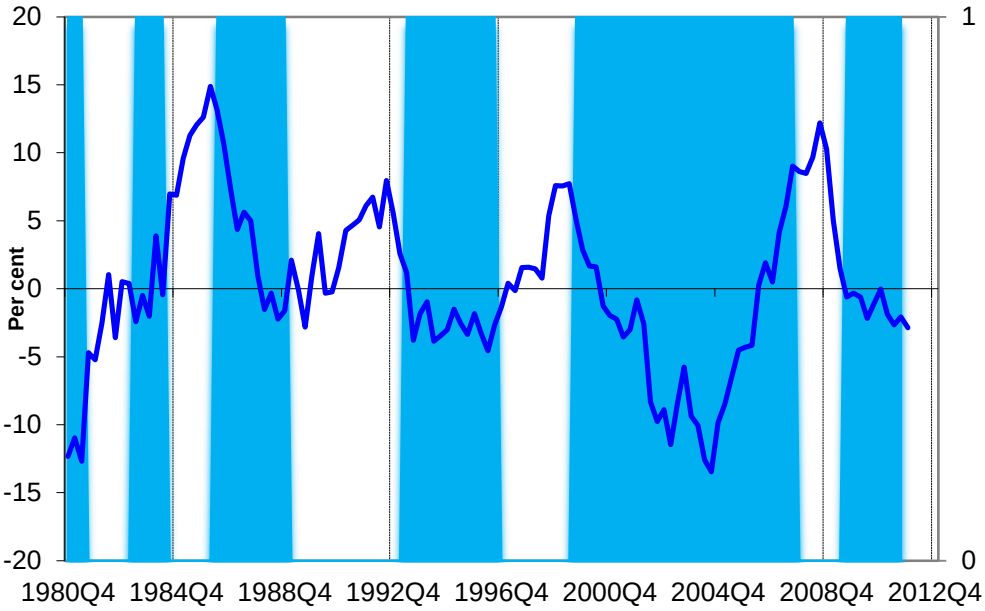
Note: * and ** denote rejection of the null hypothesis at 1% and 5% level of significance.

5.6 Information content of credit demand overhang/short-fall

The VECM models estimated above are used to provide an estimate of how much credit extension deviates from its long-run determinants over the sample period. The error correction terms corresponding to the respective cointegration relationships should inform one on periods of debt overhangs or short-fall. These periods are concomitant with the deviation from the equilibrium relationship of the demand for credit in general (Calza et al., 2003). Positive deviations from the equilibrium level implied by the estimated models are interpreted as loan demand overhang, whereas negative deviations are interpreted as credit demand short-fall.

Figure 5.4 gives a plot of the deviations derived from equilibrium aggregate demand for credit in South Africa. From the graph it is clear that on an aggregate basis the demand for credit has been consistently above the equilibrium implied by the model since 2006Q2 and reached a peak in 2008Q3. Thereafter, the loan demand overhang declined sharply and has remained in negative territory (loan demand short-fall) since 2009Q3.

Figure 5.4: Aggregate credit demand overhang/short-fall



The error-term deviations suggest that during the recent peak, the deviation amounted to as much as 12 per cent, whereas the current credit demand short-fall is around 3 per cent. The estimates are consistent with developments in real economic activity in recent years, as the South African economy entered a brief but sharp recession in 2008–09. Figure 5.4 confirms that periods of recession correspond to debt overhang in South Africa, while most of the equilibrium, and ultimately debt short-fall, happen during the peaks in South Africa. This reality may indicate that during peaks, although corporates increase their demand for credit, they also make use of other sources of financing such as retained profit.

Figure 5.5 gives a plot of the deviations derived from the equilibrium demand for credit by corporates. The deviations suggest that the demand for credit by corporates is above its equilibrium level during recessions and drops considerably during peaks. This is consistent with the fact that corporates use internal sources of financing during peak periods rather than during recessions, as explained above.

Figure 5.5: Corporate sector credit demand overhang/short-fall

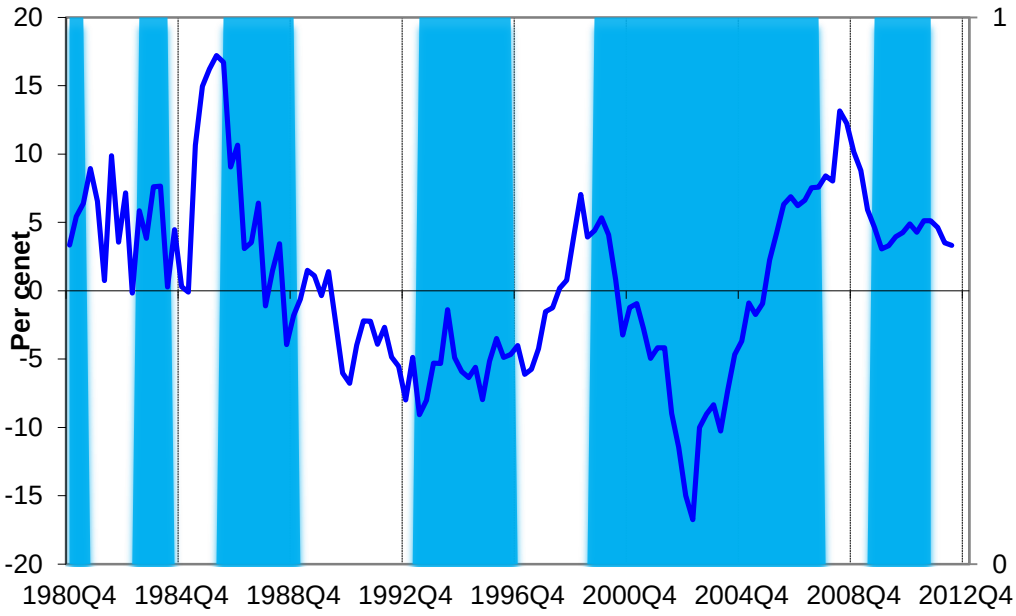
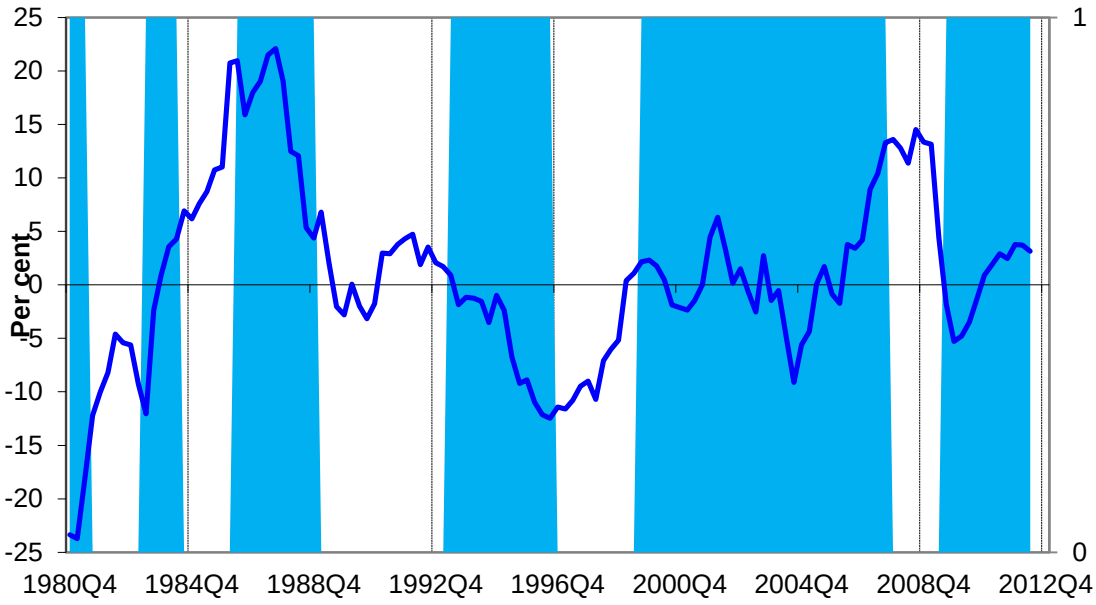


Figure 5.6 presents the deviations derived from the equilibrium demand for credit by households. The trend displayed by the household sector deviations is similar to that of the aggregate model. This is in line with the fact that in many episodes of credit lending booms correspond to the decrease of the purchasing power of household caused by recession.

Figure 5.6: Household credit demand overhang/short-fall



5.7. Conclusion

The long-term estimation of the different models for credit extension suggests the existence of a long-run relationship demand type among the different determinants of credit demand. Nonetheless, the short run dynamics indicate sluggish adjustments towards the equilibrium and this is comparable with results from other studies summarised, where the slow adjustment of real credit relative to money demand is attributed to the existence of stronger frictions and transactions costs in credit markets. The error-correction terms which are interpreted here as deviations from the equilibrium conditions and used to infer periods of credit demand short-fall and overhang, suggest that these periods are related to the business cycle in South Africa.

Chapter 6 Conclusions and recommendations

6.1 Conclusion

The recent global financial and sovereign debt crisis has brought about renewed interest in the nexus between money, credit and monetary policy. For policymakers, credit developments at an aggregate level and across sectors are part of the information set that is monitored on a regular basis, given that they contain important information about financial and economic activity. In South Africa credit extension sourced from banks is a major component in the asset side of banks' balance sheet and is a significant counterpart to the monetary aggregates. The empirical understanding of the main structural factors that determine total, household and corporate sector demand for credit is of critical importance. The research conducted in this thesis attempted to fill in the gaps in South African research on the demand for credit extension, both on aggregate and sectoral levels.

This study was aimed at assessing the equilibrium determinants of the aggregate and sectoral demand for credit in South Africa by making use of the CVAR methodology. In addition, the periods of debt overhang and short-fall, be it at aggregate and sectoral level of the credit market, are derived from those equilibrium levels.

The background, research problem and the importance of the study were discussed in Chapter one. Chapter two presented a comprehensive literature review on the determinant of credit demand from an international perspective and set the ground for the choice of variables that determine credit demand. Chapter three discussed in detail the credit market in South Africa and Chapter four presented a discussion on the methodology of the CVAR. The empirical analysis was conducted in Chapter five, where the different models of credit demand were estimated.

The estimated models indicate the existence of long-run relationships, linking aggregate credit with GDP and lending rate. Moreover, the study finds that credit to the corporate sector is determined by investment expenditure, operating surpluses and the lending rate. For credit extension to the household sector, it is found that the

lending rate, disposable income and household debt are its important determinants. All the results of the estimated equations are in line with a demand type and the traditional hypothesis that credit is demanded to finance real economic transactions, that is, for liquidity purposes and to finance working capital.

The results of the short-term dynamics indicate that loans or credit extension variables are the equilibrium variables and justify their normalisation in the long-term equilibrium equations. Nonetheless, the speed of adjustment parameter was found to be sluggish, showing the slow adjustment to equilibrium from shocks to the credit markets. These results are comparable with those found in similar studies which attribute the slow adjustment of real credit demand to the existence of stronger frictions and transactions costs in credit markets. These findings justify the persistent periods of credit overhang and short-fall in South Africa that this study derives from the equilibrium coefficient terms. The study shows that periods of credit overhang and short-fall are linked to the business cycle in South Africa.

6.2 Policy implications and recommendations

The results of the estimated equations therefore imply that the demand for real credit on an aggregate and sector basis can be largely explained by the standard credit demand factors. Furthermore, developments in real credit yield information about the availability and the demand for funds supporting or deterring investment and spending decisions economy-wide and by the corporate sector. Moreover, the adjustment of the demand for credit at the aggregate and sectoral levels towards the equilibrium involve GDP, household disposable income, investment demand and the level of debts, especially by households. These results imply that policymakers have to evaluate credit market developments as an integral part of economic activity, household finances, asset prices, capital outlays and the policy rates. The overall observation from the findings of the research is that monetary authorities through the policy rate are able to affect developments in the demand for credit. Moreover, regulations that control the level of household debts can also contribute to a greater extent to maintain equilibrium in the credit market.

6.3 Further areas for research

As a point of departure, papers conducting research in the area of demand for credit are unable to disentangle the effects of demand and supply in the data, this is therefore one of the major areas for further research.

The weakness of the ECM and VECM approaches has been documented, and it might therefore add value for further research to estimate these functions using new techniques such as a Bayesian ECM in the light of the new developments in the global credit markets. As per the observations of Bean (2009), the New Keynesian and New Classical DSGE models and the need to put credit and financial intermediaries back into macroeconomics in a meaningful way, focusing on the dynamics brought about by the inter-temporal decision-making in the face of a variety of adjustment costs and impediment price adjustment.

Model specifications that introduce financial frictions, coupled with the complex nature of financial intermediaries, incentive distortions, the evolution of bank's balance sheets and a role for capital. Furthermore, a call to reintroduce the financial intermediation sector as a source of shocks (models in which credit creation and destruction play a central role) rather than merely acting as an amplifying mechanism as is treated in the broad credit channel.

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