

Credit growth, asset prices and financial stability in South Africa: A policy perspective

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DEDICATION

I would like to dedicate this thesis to the One nothing would have been possible without,
my Heavenly Father, best friend and Saviour Jesus Christ.

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1 Peter 4:11: If anyone speaks, let him speak as the oracles of God. If anyone ministers, let him do it as with the ability which God supplies, that in all things God may be glorified through Jesus Christ, to whom belong the glory and the dominion forever and ever. Amen.

ABSTRACT

The worldwide economic downturn and recession in the second half of 2008 were mainly the result of the crises that influenced the world's financial markets. After the financial crisis, the extended period of rapid credit growth that was driven by asset price increases, especially property prices, came to an end. This identified two problems central to the theme of this study. The first problem was illustrated through the recent crisis, which showed that problems in the financial sector have a potentially destabilising effect on the economy, to such an extent that they also affect the real economy. The second problem highlighted by the recent financial crisis pertains to the current macroeconomic framework, which indicates policy failure to detect and deal with financial sector instabilities.

The objective of this study was to develop a framework in which the influence that rapidly growing credit and asset prices have on financial stability could be determined. Two distinct empirical models were estimated in order to reach the main objective of this study. The first model established the influence that asset prices and credit growth have on the real economy. It concluded that a long-run relationship exists between inflation, real GDP, credit extended to the private sector, house prices and share prices. A bi-directional relationship was found between house and share price, which indicates the interdependence of asset prices in SA. The transmission channels assume that credit is influenced by interest rates, but the results also found that interest rates are largely influenced by credit.

The second model determined the influence of asset prices and credit on financial stability. A significant long-run relationship was found between financial stability, share and house prices, and between share prices, credit and financial stability. It was found

that credit and share prices can be used to signal financial instability, and share prices can help to determine future credit extended to the private sector. In addition, the empirical analysis indicated that a credit market squeeze will be experienced after a decrease in financial stability. Lastly, credit extended will increase as a result of shock to house and share prices and financial stability will decrease when there is a shock to share and house prices.

Keywords: *Asset prices, Causality, Cointegration, Credit growth, Financial stability, Impulse response analysis, Variance decomposition model, Vector error correction model*

UITTREKSEL

Die wêreld se ekonomiese afswaai en die resessie in die tweede helfte van 2008 was hoofsaaklik die gevolg van die krisis wat die wêreld se finansiële markte beïnvloed het. Ná die finansiële krisis het die verlengde tydperk van vinnige kredietgroei, wat deur bate-prysstygings, veral huispryse, gedryf is, tot 'n einde gekom. Gevolglik is daar twee probleme sentraal tot die tema van hierdie studie geïdentifiseer. Die eerste probleem is geïllustreer deur die onlangse krisis wat getoon het dat probleme in die finansiële sektor 'n potensieel destabiliserende uitwerking op die ekonomie het, tot so 'n mate dat dit ook die reële ekonomie beïnvloed. Die tweede probleem wat deur die onlangse finansiële krisis uitgelik is, is van toepassing op die huidige makro-ekonomiese raamwerk, wat dui op die nalating van beleid om finansiële sektor-onstabiliteit op te spoor en te hanteer.

Die doel van hierdie studie was om 'n raamwerk te ontwikkel waarin die invloed wat die vinnig groeiende krediet- en batepryse op finansiële stabiliteit het, bepaal kan word. Twee duidelike empiriese modelle is beraam om die belangrikste doel van hierdie studie te bereik. Die eerste model is ontwikkel om die invloed wat batepryse en kredietgroei op die reële ekonomie het, te bepaal. Die gevolgtrekking is gemaak dat daar 'n langtermyn verhouding tussen inflasie, reële BBP, kredietverlening aan die private sektor, huispryse en aandeelpryse bestaan. 'n Tweeledige verhouding is gevind tussen huis- en aandeelpryse wat op die interafhanklikheid van batepryse in SA dui. Die transmissiekanale aanvaar dat krediet deur rentekoerse beïnvloed word, maar die resultate het ook bevind dat rentekoerse grootliks deur krediet beïnvloed word.

Die tweede model bepaal die invloed van batepryse en krediet op finansiële stabiliteit. 'n Beduidende langtermyn verhouding is tussen finansiële stabiliteit, aandeel- en huispryse, en tussen aandeelpryse, krediet en finansiële stabiliteit gevind. Daar is bevind dat krediet- en aandeelpryse gebruik kan word om finansiële onstabiliteit te voorspel en aandeelpryse kan help om toekomstige kredietverlening na die

privaatsektor te bepaal. In die empiriese analise is aangedui dat 'n kredietmark-
“squeeze” na 'n afname in finansiële stabiliteit ervaar sal word. Laastens sal
kredietverlening as gevolg van 'n skok in huis- en aandeelpryse toeneem, en finansiële
stabiliteit sal afneem wanneer daar 'n skok in huis- en aandeelpryse is.

Sleutelwoorde: *Batepryse, Finansiële stabiliteit, Impulsweergawe-analises,*
 Kredietgroei, Oorsaaklikheid, Variansie-ontbindingsmodelle,
 Vektor-foutaanpassingsmodelle

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION AND PROBLEM STATEMENT	1
1.1 BACKGROUND	1
1.1.1 Defining the financial system	3
1.2 PROBLEM STATEMENT	7
1.3 OBJECTIVES.....	10
1.4 METHODOLOGY	10
a) Literature study	10
b) Empirical methods.....	11
1.5 DELIMITATION	11
1.6 LAYOUT OF THE STUDY.....	12
CHAPTER 2: ASSET PRICE, CREDIT GROWTH AND FINANCIAL STABILITY	13
2.1 INTRODUCTION	13
2.2 FINANCIAL STABILITY	13
2.2.1 Defining financial stability and financial instability.....	13
2.2.2 Sources of financial instability	17
2.2.2.1 <i>Financial institutions</i>	20
2.2.2.2 <i>Financial markets</i>	20
2.2.2.3 <i>Financial infrastructure</i>	21
2.2.3 Why financial stability is important	21
2.3 FINANCIAL STABILITY AND MONETARY POLICY	23
2.3.1 The conventional view	24
2.3.2 The new consensus	26
2.4 THE CRITICAL ROLE OF FINANCIAL INTERMEDIATION	29

2.5 FINANCIAL STABILITY AND ASSET PRICES	31
2.6 ASSET PRICES AND CREDIT GROWTH.....	36
2.6.1 House prices and credit growth	36
2.6.2 Stock prices and credit growth.....	40
2.6.3 Asset prices and financial stability	41
2.6.4 Do asset prices and credit threaten financial stability?	43
2.7 CHAPTER SUMMARY	44
CHAPTER 3: MONETARY POLICY.....	47
3.1 INTRODUCTION	47
3.2 A BRIEF HISTORY OF SOUTH AFRICAN MONETARY POLICY	47
3.2.1 Stage one	47
3.2.2 Stage two.....	48
3.2.3 Stage three.....	49
3.2.4 Stage four	50
3.2.5 Stage five.....	51
3.2.6 Stage six	52
3.2.7 Stage seven	53
3.3 THE CURRENT MONETARY POLICY FRAMEWORK	56
3.3.1 Functioning of the current monetary policy	56
3.3.2 Fundamental reasons why SA adopted inflation targeting	58
3.4 THE ULTIMATE OBJECTIVE OF MP IN SA	62
3.4.1 Why low inflation is important (see also sections 2.2.2 and 2.3)	62
3.5 HOW POLICY DECISIONS ARE MADE	64
3.5.1 Monetary policy rules	65
3.5.2 Limitations of linear Taylor rules.....	67
3.6 INFLUENCE OF POLICY ON ECONOMY.....	68

3.6.1 Theory on the monetary transmission mechanism	68
3.6.2 The importance of the monetary policy transmission mechanism	69
3.6.3 The asset price channel in the monetary transmission mechanism	72
3.7 FINANCIAL STABILITY VERSUS PRICE STABILITY (SEE ALSO SECTION 2.3.2)	74
3.7.1 Duality between monetary policy and financial stability policy	76
3.7.2 The monetary policy instrument problem in 2010	77
3.8 ASSET PRICES IN MONETARY POLICY RULES.....	79
3.8.1 Argument for including asset prices in the monetary policy	81
3.8.2 Argument for excluding asset prices in the monetary policy	83
3.9 LEAN VERSUS CLEAN DEBATE OF ASSET PRICE AND CREDIT BUBBLES.....	85
3.9.1 Macroprudential policies.....	87
3.9.2 Monetary policy.....	88
3.10 CHAPTER SUMMARY	91
CHAPTER 4: METHODOLOGY AND RESULTS	94
4.1 INTRODUCTION	94
4.2 RATIONALE BEHIND THE METHOD.....	95
4.3 DATA	96
4.4 DATA DESCRIPTIVES.....	97
4.4.1 Unit root test (Phillips-Perron test)	100
4.5 METHOD	102
4.5.1 Vector autoregression (VAR).....	103
4.5.2 Cointegration (Johansen)	106
4.5.3 Vector error correction (VEC) models	111
4.5.4 Granger causality test.....	112
4.6 RESULTS OF THE RELATIONSHIP BETWEEN ASSET PRICES, CREDIT GROWTH AND THE REAL ECONOMY	115

4.6.1 Impulse response analysis	122
4.6.2 Variance decomposition	128
4.7 FINANCIAL STABILITY, ASSET PRICES AND CREDIT.....	133
4.7.1 Impulse response analysis	142
4.7.2 Variance decomposition model	149
4.8 DISCUSSION OF RESULTS	152
4.9 CHAPTER SUMMARY	154
CHAPTER 5: CONCLUSION	156
5.1 INTRODUCTION	156
5.2 CONCLUSIONS.....	156
5.2.1 Conclusions with regard to financial stability	157
5.2.2 Conclusions with regard to the relationship between financial stability, asset prices and credit growth.....	159
5.2.3 Conclusions with regard to the current South African monetary policy.....	160
5.2.4 Conclusions with regard to the link between price and financial stability	161
5.2.5 Conclusions with regard to monetary policy's role in financial stability	162
5.2.6 Conclusions with regard to the link between asset prices, credit and the real economy	164
5.2.7 Conclusions with regard to the link between asset prices, credit and financial stability	166
5.3 LIMITATIONS AND RECOMMENDATIONS	167
5.3.1 Policy recommendations	167
5.3.2 Limitations	168
REFERENCES	170

LIST OF TABLES

Table 2.1:	Sources of risk to financial stability	18
Table 3.1:	A risk management matrix for the FOMC	79
Table 4.1:	Descriptive statistics of variables	99
Table 4.2:	Unit root tests of variables in levels and 1 st differences (Phillips-Perron)	101
Table 4.3:	Lag length criteria	109
Table 4.4:	Johansen cointegration test	110
Table 4.5:	VECM output	116
Table 4.6:	Granger causality tests.....	119
Table 4.7:	Variance decomposition table	129
Table 4.8:	Lag length criteria (model 1)	134
Table 4.9:	Lag length criteria (model 2)	135
Table 4.10:	Johansen cointegration test (model 1).....	136
Table 4.11:	Johansen cointegration test (model 2).....	136
Table 4.12:	VECM output (model 1).....	137
Table 4.13:	VECM output (model 2).....	138
Table 4.14:	Granger causality test (model 1).....	140
Table 4.15:	Granger causality test (model 2).....	141
Table 4.16:	Variance decomposition model (model 1)	149
Table 4.17:	Variance decomposition model (model 2)	151

LIST OF FIGURES AND DIAGRAMS

Figure 2.1:	European and US stock price indices	34
Figure 2.2:	Left: Total bank loan growth rate; Right: Stock price index.....	34
Diagram 3.1:	Monetary policy transmission mechanism	72
Figure 3.1:	GDP and CPI: 1994-2009	80
Figure 4.1:	Multiple graphs of variables in levels	98
Figure 4.2:	CUSUM test for structural break.....	104
Figure 4.3:	AR roots graph	105
Figure 4.4:	Impulse response to a monetary policy shock	124
Figure 4.5:	Impulse response to a credit shock.....	125
Figure 4.6:	Impulse response to a house price shock	126
Figure 4.7:	Impulse response to a share price shock	127
Figure 4.8:	AR roots graphs	134
Figure 4.9:	Impulse response to financial sector shock (model 1)	143
Figure 4.10:	Impulse response to credit shock (model 1).....	144
Figure 4.11:	Impulse response to a share price shock (model 1)	145
Figure 4.12:	Impulse response to financial sector shock (model 2)	146
Figure 4.13:	Impulse response to a share price shock (model 2)	147
Figure 4.14:	Impulse response to a house price shock (model 2).....	148

CHAPTER 1: INTRODUCTION AND PROBLEM STATEMENT

1.1 BACKGROUND

During the last six months of 2008, the global economy quickly approached a recessionary phase of which the nature of its extent was unknown. The economies of each of the G7 countries witnessed a decrease in their output from the second half of 2008 until early in 2009, and various other economies around the world also experienced a time of contraction in economic activity. The main cause of the economic downturn was a crisis that affected international financial markets as a result of the sub-prime United States (US) mortgage market losses as well as a decrease in the confidence of consumers and businesses, which resulted after the collapse of the Lehman Brothers (Hume & Sentance, 2009).

The long period of fast credit growth, propelled by an increase in asset prices, especially of property, came to an end with the financial crisis. The coherence between this particular financial crisis and the oncoming recession has put the focus on the rapid expansion of credit, which forewent both (Hume & Sentance, 2009). Large declines in asset prices, together with high leverage, can damage economies, as the recent global financial crisis served to remind. The United States, which was at the heart of the financial crisis, experienced a 25 to 30 per cent decline in house prices between 2007 and 2009, leading to the most severe decline in economic activity the country has experienced over the last 60 years (Bloxham, Kent & Robson, 2011).

South Africa (SA) did not see major bank bankruptcies on the same scale as, for example, the US, The United Kingdom (UK) and Germany. The country, however, did not escape all the effects of the crisis. Investec's exposure to sub-prime UK lender Kensington (Rose & Theobald, 2007) and the connection between ABSA and Barclays (Saayman, 2010) meant that South African banks did not escape the crisis without harm. The main effect, however, was that of a credit squeeze. The downfall of the Lehman brothers affected the capital markets and access to finance in SA negatively.

Investors looked towards safer economies for investment of their capital and this capital flight influenced the SA economy. The traded volume of shares fluctuated significantly during this period, contributing to a volatile capital market. SA's small securitisation market was also influenced negatively and the amount of new securitisation transactions declined during the crisis (Saayman, 2010). The local market is, however, small compared to the US and European markets, although there was increased activity in mortgage-backed and asset-backed securities, which were covered by instalment sale and leasing finance, before the crisis. According to Strydom (2009), mortgage-backed securities in SA that correspond with mortgages in the US supplied by Standard Bank in 2007 amounted to a total transaction value of R2,4 billion. In comparison, private banks in SA issued more than R30 billion of asset- and mortgage-backed securities in 2007. The provision of new asset-backed securities ended in 2008 and less than R2 billion of mortgage-backed securities were issued (SARB, 2009a).

It became evident that most of the world's large economies as well as other countries' economies were vulnerable to the crisis. Macroeconomic indicators, which are used to guide macroeconomic policy of output and inflation, failed to predict the crisis or indicate approaching economic trouble. Instead, the period up to 2007 was viewed as one with steady and sustained growth accompanied by low inflation. It was not only the advent of the crisis, but also the severity of it that caught policy-makers by surprise, although concerns over credit and asset price growth as well as financial imbalances were raised by many. It became clear that new and dramatic actions were required to stabilise the financial system and the global economy (Hume & Sentance, 2009).

The link between the financial system and the macroeconomy became a key concern. In general, macroeconomics raises questions such as what creates growth in aggregate output and income per capita in the long run and what causes short-run fluctuations in economic activity. Therefore, macroeconomics can be seen as the study of economic growth and business cycles. It can also be said that macroeconomics is interested in describing an observed time series for economic variables such as gross domestic

product (GDP), consumption, investment, prices, wages, the rate of employment and so forth (Sorensen & Whitta-Jacobsen, 2010).

Modern macroeconomics developed based on the work of Keynes in 1936. Probably the greatest influence of Keynes's work was the provision of a general equilibrium model that is able to predict output, interest rates, prices and inflation simultaneously. This is still the core of macroeconomic model in today's policy decision-making (White, 2009). Mankiw (1990) confirmed this by stating that Keynesian models, together with the expectations-adapted Phillips curve, are the primary instruments used by governments and businesses.

The majority of Keynesian-based empirical models fall short of predicting turning points in the business cycle. Even Keynes had his doubts about the competency of these models, given the uncertainty of the future economic behaviour on which expectations are build (White, 2009). Keynesian models also lack two factors that are suspected to contribute significantly to the most recent crisis: firstly, the intuition of the Austrian School and secondly, those of Hyman Minsky. Contrary to the Keynesian framework, Austrian theory valued money and credit creation highly in contributing to the volatility of the financial system over the years, while Minsky (1982) examined the function of the economy's financial institutions, building on the concepts of Fisher (1933). Fisher concluded that the economy's profitable opportunities resulted in an economic upswing, which stimulated investment, price increases and speculation. This brings about a debt finance increase, increasing the supply of money and prices. A point will be reached where debt cannot be repaid, resulting in the agitated sale of assets, decline in prices and bankruptcy, ensuring a loss in economic activity (Bordo *et al.*, 2003). Central to these arguments is the financial system that is further explained.

1.1.1 Defining the financial system

The financial system consists of a complicated arrangement structure and processes developing from unavoidable, countless and different investment behaviour,

disinvestment and monetary payments continually taking place throughout the economic system (Kelly, 1993:14). In the process, financial institutions channel funds from units where there is a surplus to units with a deficit. When the economy demands additional funds, they are supplied with the necessary. Financial institutions also manage markets in funds and assure the effective allocation and pricing of funds (Kelly, 1993).

The financial system has many interconnected parts, consisting of various types of private sector financial institutions, including banks, mutual funds, finance companies and investment banks, which are mostly controlled according to government principles or rules (Mishkin, 2007).

The main function of the financial system is to help assign and position economic resources, spatially and temporally, within a changeable environment (Merton, 1995). The following is included by Sinkey (1998):

- Channelling funds into the most productive investment opportunities.
- Supplying mechanisms for setting up payments.
- Combining surplus and deficit economic units by aggregating and disaggregating wealth and cash flows.
- Moving financial resources with regard to time, industries and space.
- Supporting diversification, management and trading of risk.
- Collecting, processing and broadcasting information to support organised decentralised decision-making.
- Inventing outcomes to master incentive and asymmetric obstacles that surface in financial contracting.

The real and financial sectors are well-known terms of the economy. Real pertains to the trade of tangible goods and services, while financial pertains to the trade of non-tangible financial instruments, also well known as financial claims or securities and financial assets. These instruments' value is influenced by conditions and they are

applied in real economy finance projects. It is well known that a crisis in the financial system will influence the efficiency of the real economy, which is also of largest interest to financial authorities (van Zyl, Botha, Skerrit & Goodspeed, 2009).

According to Fourie, Falkena and Kok (1999), the definition of the financial system points out four important elements in the financial system. Firstly, lenders and borrowers, in other words, the non-financial economic units; secondly, financial institutions, which are largely intermediaries for the lending and borrowing process; thirdly, financial instruments, which were developed to fulfil the variety of needs of the participant; and lastly, the financial markets, in other words, the institutional systems and conventions that are there for trading and the release of financial instruments. Each of these role-players is subsequently reviewed.

a) Surplus units and deficit units

Surplus units are those households (alone individuals), firms, non-profit organisations and government or public sector entities, whether within a country or international, that have surplus funds to serve their needs. As a result, they have unused savings, which they can use to invest. Deficit units refer to those households (alone individuals), firms, non-profit organisations and government or public sector entities, whether within a country or international, that have a shortage of funds to fulfil their needs (Kelly, 1993).

Business deficit units, on the one hand, require funds to enlarge and finance trade and industrial volume enlargement. On the other hand, household deficit units require mortgages to buy household assets, i.e. instalment sale contracts to finance long-lasting goods, for example a vehicle. Government and public corporations have large deficit units that need large funds to maintain and develop social and capital infrastructure elements (Kelly, 1993).

b) Financial intermediaries

Financial intermediaries are involved with the transformation of financial assets by buying one type of asset from a borrower and selling another kind of asset to savers. They include the following (van Zyl *et al.*, 2009):

- Deposit-taking institutions, for example commercial banks.
- Insurance companies and pension funds, i.e. contractual savings institutions.
- Investment intermediaries, for example mutual funds and asset managers.
- House financing and motor vehicle securitisation.

This transformation of financial assets involves activities of institutions that take deposits, such as banks that take short-dated deposits as well as funds creating maturity intermediation, or borrow in a certain currency and lend in a different one. The outcome this has for the depositor is to receive a claim directly on the bank which is different to the claim that the bank has on the funds' borrower (van Zyl *et al.*, 2009).

c) Financial markets

The financial markets supply the routes through which fund holders have a surplus to their needs. These surplus funds can be offered as financial claims to those who need them, directly or indirectly, through financial intermediaries. Surplus units and deficit units include individuals, households, organisations, businesses, financial institutions or the government. The price and interest rate at which these securities are exchanged reflect the current as well as the expected future relationships between the demand for surplus funds (deficit units) and the amount of funds offered (surplus units) (Kelly, 1993).

d) Financial instruments

From the procedures to obtain funds from a lender and financial intermediation a variety of financial instruments are developed in the financial system of SA. In general, "a financial instrument or claim be defined as a claim against a person or institution for the payment of a future sum of money and/or a periodic payment of money" (Fourie *et al.*,

1999:10). In many cases, periodical money payments do not take place, for example Treasury bills, while on the other hand, they do exist, for example long-dated bonds, interest payable after six months overdue debt. Likewise, there might only be a periodical payment instead of a guaranteed amount of money in the future, for example an undated bond. The more simple instruments implicate that the issuer has the responsibility to pay periodical interest and has to pay off the claim on the day as agreed. Probably the most essential aspect of financial claims is reversibility or marketability. This relates to the effort it takes for claim holders to retrieve their investments, which can either be by refuge to the issuer or by refuge to a secondary market where the holder trades his claim.

1.2 PROBLEM STATEMENT

From the introduction above, it is evident that there are two main matters that are currently under hot dispute, namely (i) the influence of the financial sector on the real economy, and (ii) policy reactions to financial sector shocks.

The former is illustrated through the recent crisis that showed that the problems in the financial sector have a potentially destabilising effect on the economy, to such an extent that it also affects the real economy. Financial instability occurs when there is a shock to the financial system that prevents an adequate flow of information; therefore, the financial system fails to channel funds into the most productive investment opportunities. The inability to access these funds results in a decrease in the spending of individuals and firms, causing a slowdown in economic activity. To understand why financial instability has a destabilising effect on the economy, four categories of fundamental factors that are said to cause financial instability can be identified. They are: increases in interest rates, increases in uncertainty, asset market effects on balance sheets, and problems in the banking sector (Mishkin, 1998). In terms of the effect of asset prices, the International Monetary Fund (IMF) (2003) studied the consequences of sharp asset price reversals and found that frequent share price reductions are related to large declines in GDP. They showed that periods of financial

instability were, in many cases, caused by quick and enduring credit growth in combination with large, extended increases in asset prices. In this regard, it can be argued that, when the economy booms, there is an increase in credit growth. When household income increases and credit is easily accessible, the demand for houses increases, causing an increase in house and other asset prices (Assenmacher-Wesche & Gerlach, 2008). This trend continues on its own path and house prices move further away from a realistic equilibrium level, sustained by an excrescence of credit. As time elapses and the excessive strain on borrowers increases, the more vulnerable they become to macroeconomic conditions as well as the availability and cost of credit. This process can arise as a result of a minor shock, causing asset prices and credit growth to tumble down and possibly causing a long period of financial instability and macroeconomic weakness (Assenmacher-Wesche & Gerlach, 2008).

The second problem highlighted by the recent financial crisis pertains to the current macroeconomic framework, which indicates policy failure to detect and deal with financial sector instabilities. The current macroeconomic policy in SA is one of income and price stability. Despite the successes of these policies in normal economic and financial circumstances, they were not as successful in predicting and dealing with the adverse effects of the recent crisis (Agénor & da Silva, 2011). Therefore, further investigation is necessary to determine where the policy shortfalls are and how they can be adjusted to better forecast destabilising financial conditions as well as steering the country's economy back into a less volatile environment.

In the current policy framework of price and income stability, there is very little focus on the possible trade-off between the aims of financial stability and macroeconomic stability. The one argument is that when prices are stable, or price stability is achieved, it decreases the chances of an unstable financial sector (Agénor & da Silva, 2011). To support this view, some academics and policy-makers (see for example, Borio & Lowe, 2002) hold that even with achieved price stability, financial instability may occur. Over-optimism about future outlooks or higher risk incentives may lead to a low and stable inflation rate, causing asset price bubbles to form. This renders price stability an

inadequate pre-condition for financial stability. Simultaneously, some observers (for example, Khoo, 2012) argue that the success of stabilising asset prices as such may be debatable for several reasons, especially since it is nearly unheard of to determine whether asset value changes are caused by changes in non-fundamental factors, fundamentals or both. Accordingly, it may be more valuable for central banks to determine the consequences of the movements in asset prices on credit growth, aggregate demand and inflationary pressures rather than the degree in which asset price changes reflect the movement in the fundamentals of the economy (Agénor & da Silva, 2011).

Central banks allow excessive expansionary monetary policy for extended periods of time and monetary policy-makers do not take surpluses of the mortgage and housing markets into account by enabling the action of expansion and breaking down to go its own way. It is, however, argued that it may be better for central banks to counteract asset price bubbles through a tighter monetary policy by managing asset prices when the increases in prices are too drastic and easing the hold when asset prices fall. This response must, however, be 'over and beyond' what the changes in the price of assets mean for the route of aggregate demand and inflation (Borio & Lowe, 2002; Cecchetti, Genberg, Lipsky & Wadhwani, 2000).

Arguments against reaction to financial instabilities include that financial instability may be either the reason for or the result of macroeconomic instability and it is not always clear. Financial stress can be caused by macroeconomic shocks, for example due to a decrease in the inflation rate or a decline in the price level. Since debt agreements are often signed in fixed rate, nominal terms, a price level decline increases the servicing cost of outstanding debt in real terms. This may increase the failure of loans, since debtors are unable to meet the financial obligation of the loans, thereby putting pressure on lenders and leading to bankruptcies. Unexpected deflation can cause panic among borrowers, because revenues are lower compared to no decline in the inflation rate (Bordo, Dueker & Wheelock, 2003). The specific research question that this study will

address is: What is the relationship between asset prices and credit growth in South Africa and how does it affect the real economy and financial stability?

1.3 OBJECTIVES

Given that the recent financial crisis highlighted the role of financial instability in the economy, the main objective of this study is to examine the link between asset price growth, credit growth and financial stability in SA as well as their influence on key macroeconomic variables. It will, furthermore, critically evaluate the current monetary policy of the South African Reserve Bank (SARB) in order to assess whether more formal policy actions should be taken based on financial stability.

In order to reach the main objective, the following secondary objectives are formulated:

- To determine, from a theoretical point of view, what is necessary for a sound financial environment and what causes financial instability.
- To verify, from theory, the influence of credit growth and asset prices on financial stability.
- To describe the current South African monetary policy framework and determine the link between price and financial stability.
- To assess the current policy and evaluate current debates on when and how monetary policy should react to various asset price and credit bubbles.
- Empirically examine the effect of asset prices and credit growth on financial stability and the real economy in the South African economy.

1.4 METHODOLOGY

The methods that will be used in this study include the following:

a) Literature study

The aim of the literature study is to identify the factors responsible for financial instability as well as the prerequisites for financial stability with special attention to the influence of growth in credit and asset prices, from a theoretical viewpoint. It will

elaborate on the importance of financial stability as pointed out by Yilmaz (2007) (see section 2.2.3) and the link between financial stability and monetary policy, for example (Borio & Lowe, 2002). In addition, the importance of financial intermediation will be discussed, as suggested by Rosengren (2011), as well as the relationship between house prices, stock prices and credit growth, for example (Oikarinen, 2008). Furthermore, literature on the current monetary policy will be evaluated critically.

b) Empirical methods

The findings of the literature study will be tested empirically using data for SA. The series used in this study is of interrelated nature. As a result, this study will apply a vector autoregressive (VAR) model to determine the influence that randomised shocks or disruptions have on the different variables. Granger causality tests will also be performed to determine the direction of spillover flows between the variables. In addition, impulse response analysis will be performed to determine what influence a shock in one variable has on the other variables and a variance decomposition model that divides the variation of variables into component shocks (QMS, 2009:470). See Chapter 4 for a complete discussion of the methods used. Data obtained from the South African Reserve Bank and International Financial Statistics will be used in this study, and all estimations will be done using EViews.

1.5 DELIMITATION

This study is restricted to South Africa and only takes into account the influence of asset prices (house and stock prices) and credit growth on financial stability. Although the National Credit Act (NCA) was implemented in the time period of concern (June, 2007), it is not explored separately as a theme, since this is a topic on its own and the data available since the implementation of NCA is very limited. It was implemented to enhance an even and non-discriminatory market place; controlling consumer credit and improving the standard of information available to the consumer; eliminating unjust credit and credit marketing practices; encourage credible conceding and usage of credit; forbid foolish allowance of credit; supply restructuring of debt in situations of too

much debt; regulation of credit information and establishing the National Credit Regulator and the National Consumer Tribunal (Klinkenberg, 2012). The NCA influences anyone involved in the credit industry, whether as a credit grantor, a credit guarantee or an intermediary. Since the NCA broadly defines credit agreement it is applicable to anyone connected in a credit agreement. The NCA defines a credit agreement as an agreement where goods and services are bought and can be paid with instalments after delivery, including any money extension, for example home loans, personal loans, credit cards, store cards and short-term loans (Klinkenberg, 2012).

1.6 LAYOUT OF THE STUDY

Chapter 1 discussed the background against which the study unfolds. The next two chapters will form the literature study. Chapter 2 starts by defining financial stability and evaluates the literature on the causes of financial instability and the influence that asset price and credit growth have on the financial sector and real economy globally. The duality between financial stability and monetary policy will also be discussed, as well as the role of financial intermediation.

Chapter 3 discusses the historical and current monetary policy framework and assesses its effectiveness in the light of the recent financial crisis. In addition, the monetary policy decision-making process will be discussed as well as the influence it has on the economy. Furthermore, the relationship between monetary policy and financial stability policy will be handled. It will continue to discuss where policy can improve in the light of the recent financial crisis by proposing different arguments, as well as whether to include or exclude asset prices in the monetary policy.

Chapter 4 will present the data, discuss the methods used in this study and present the results of the empirical analysis. Chapter 5 will consist of a conclusion and recommendations.

CHAPTER 2: ASSET PRICE, CREDIT GROWTH AND FINANCIAL STABILITY

2.1 INTRODUCTION

From Chapter 1, it is evident that the recent financial crisis indicated that the financial sector has a potentially destabilising effect on the real economy. Since financial stability is a main theme within this context, this chapter will investigate the theory behind financial stability and financial instability as well as the factors that influence stability in the financial sector. It will further investigate the influence of two specific factors that affect financial stability, namely credit growth and asset prices. Asset prices will be broken down into house prices and financial asset prices.

This chapter serves as a means to achieve the main objective of the study by evaluating the theoretical relationship between asset price growth, credit growth and financial stability, and empirical methods will be used in Chapter 4 to test the significance of these relationships. The objective of this chapter is to determine the conditions that promote a sound financial environment and the factors leading to financial instability as well as verifying the role that asset prices and credit growth play in causing financial imbalances or crises.

2.2 FINANCIAL STABILITY

During the past ten years, dealing with financial instability became one of the most important topics in national and international policy schedules. During this period, central banks and policy-makers allocated increasing resources to monitor possible threats to financial stability, and expanded the framework to efficiently deal with the imbalances. The increased concern about financial stability increased peoples' attempts to define it, although there still seems to be a wide variety of views on its definition.

2.2.1 Defining financial stability and financial instability

Rosengren (2011) defined financial stability as an indication of the financial system's quality to achieve systematic provision of credit intermediation and payment services that are required in the real economy, in order for the economy to continue on the same

path of economic growth. On the other hand, financial instability is a situation where obstacles or difficulties within markets, institutions, payment systems, or the general financial system significantly decrease the effectiveness of credit intermediation service supply – considerably affecting the expected route of real economic activity (Rosengren, 2011).

There are three features of the definition that are important to take note of: Firstly, it is concerned with practical matters. For this reason, the view is limited to financial institutions. It is assumed that highly volatile asset prices and exchange rate troubles in government's balance sheets, households and non-financial enterprises can individually have a significant impact on output, even when the financial sector is not largely affected. Examples of this type of event can be complete sovereign and exchange rate crises. However, including them could debatably extend the definition of financial stability too much for an operating perspective. According to Borio and Drehmann (2009), it is most likely better to define financial stability mandates narrowly in terms of the financial sector, to prevent broadening the view of regulation too far.

Secondly, the definition sees periods of financial distress as events, as opposed to financial instability/stability as properties or characteristics of the financial system. By their type, properties are more difficult to identify than events, for they possibly include an appeal contrary to fact (Borio & Drehmann, 2009). For example, the financial system may be unstable even when there is no financial distress for a certain time period (See section 2.2.2 for a more complete discussion).

Lastly, financial distress should develop in the presence of a normal shock and not an abnormally large shock. It is inordinate to require an effectively functioning financial system irrespective of the size of the exogenous shock that affected the system (Goodhart, 2006).

Ferguson (2002) took a different view and defined financial stability by defining the opposite, financial instability. According to Ferguson (2002), financial instability has the

following characteristics: (i) a certain group of financial asset prices deviate from the basic values or principles, which leads to (ii) a significant distortion of credit accessibility and efficient market functioning both locally and abroad, with the outcome (iii) that aggregate spending is not in line with the production capacity of the economy.

Mishkin (1991) also used financial instability to define financial stability. Issing (2003:26) adapted Mishkin's (1991) definition by defining "financial stability as the prevalence of a financial system which is able to ensure in a lasting way, and without major disruptions, and efficient allocation of savings to investment opportunities. How close an economy is to the break point, exceeding that which would impair the efficient allocation of savings, would be labelled the degree of financial fragility." Kontonikas and Ioannidis (2005:2) added to the Mishkin's definition by narrowly defining financial stability "as the degree of interest rate smoothness in the economy, and not widely, as the prevalence of a financial system that continuously ensures the efficient allocation of savings to investment opportunities, then a trade-off between monetary stability and financial stability may arise."

In South Africa, the South African Reserve Bank (SARB) (2012) broadly defined financial stability as having both stable key financial institutions as well as financial markets in which they function. For financial institutions, this implies having adequate capital to take up normal losses and ample liquidity to supervise procedures and volatility in usual circumstances. Financial market stability entails that volatility is less damaging and not as inordinate, contributing to an overall positive effect on the real economy. Additionally, the SARB (2012) views a well-functioning infrastructure including laws, regulations, standards and practices that form a robust environment for financial regulation to contribute to financial stability. Public confidence and an effective macroprudential observation process are other factors supporting financial stability. Within this framework, financial stability is mostly thought of as handling systemic financial risk to prevent financial crises. "A systemic risk is a risk that an event will trigger a loss of confidence in a substantial portion of the financial system that is serious enough to have adverse consequences for the real economy" (Taylor, 2009:1).

Foot (2003) defined financial stability as a situation where the following are present:

- Monetary stability (explained in more detail in section 2.3).
- Achieving levels of employment approximate to the natural rate of employment.
- The assured functioning of core financial institutions and markets in the economy.
- No movements in the real or financial asset prices in the economy that will counteract monetary stability or employment levels close to the natural unemployment rate.

With respect to the first three factor names, there is no controversy or disagreement. Referring to the first two elements, it is highly unlikely that financial stability will be evident within an environment of rapid inflation or a period with high unemployment and low inflation, for example the mid-1930s period in the US. Considering the third element, it would also be highly unlikely to experience financial stability in a period when banks are failing or when the normal functioning of long-term borrowing and saving in corporate as well as personal sectors are not performing their regular functions. A situation where these conditions are present will lead to a loss in confidence in intermediaries by the participants. This will most probably harm economic growth by the inaccessibility or the high cost of intermediation.

The fourth condition for financial stability identified by Foot (2003:3) is not always found in other definitions and is the particular focus of this study.

Foot (2003) identified four channels through which the real economy may be affected by asset prices:

a) *Changes in the wealth of households and as a result consumption.*

For example, the rise and fall in house prices the UK experienced from the middle of 2007 to the present. These fluctuations in house prices are related to the strengthening or weakening of consumer demand. This is the result of changes in banks' compliance to give credit when collateral value changes.

b) Share price changes.

Share price changes have an influence on the corporate sector's market value of assets relative to the replacement cost and therefore the need for investment. When these changes are significant, they are able to influence spending in the personal sector directly.

c) The change in share prices has an influence on firms' balance sheets, which in turn may affect corporate spending.

For example, in 2003, the falling UK share prices affected companies' final salary pension funds.

d) Capital flows are influenced.

For example, capital inflows in the US dot.com boom strengthened the domestic currency.

Having discussed the definitions of financial stability and financial instability it is important to take note of the various sources that cause financial instability.

2.2.2 Sources of financial instability

Schinasi (2004) concluded that financial stability has three significant characteristics. Firstly, the financial system supports and ensures a smooth allocation of resources between savers and investors and the allocation of economic resources in general. Secondly, expected financial risks are evaluated, given a relative accurate price and supervised successfully. Thirdly, the financial system must be able to easily absorb financial and real economic shocks. When one or any of these characteristics are not achieved, the financial sector is vulnerable to instabilities (Fell & Schinasi, 2005).

These characteristics have both exogenous as well as endogenous elements. It is important to take note of the potential factors that can have a destabilising effect on the

financial sector, in order to successfully monitor financial stability. The following are the most significant causes of financial instability (Fell & Schinasi, 2005).

Table 2.1: Sources of risk to financial stability

Endogenous	Exogenous
<i>Institutions-based:</i>	<i>Macroeconomic Disturbances:</i>
Financial risks	Economic environment risk
Credit	Policy imbalances
Market	
Liquidity	<i>Event risk:</i>
Interest rate	Natural disaster
Currency	Political events
Operational risk	Large business failures
Information technology weaknesses	
Legal/integrity risk	
Reputation risk	
Business strategy risk	
Concentration risk	
Capital adequacy risk	
<i>Market-based:</i>	
Counterparty risk	
Asset price misalignments	
Run on markets	
Credit	
Liquidity	
Contagion	
<i>Infrastructure-based:</i>	
Clearance, payment and settlement system risk	
Infrastructure fragilities	
Legal	
Regulatory	
Accounting	
Supervisory	
Collapse of confidence leading to runs	
Domino effects	

Source: Houben, Kakes and Schinasi (2004)

The operational process of monitoring financial stability involves a systematic designation and investigation of the causes of risk and exposure that can threaten stability in the environment in which the measurement is carried out. For example, Table

2.1 above, which includes a broad scope of risk causes. There are two main categories, i.e. endogenous causes and exogenous causes (Fell & Schinasi, 2005).

There is a significant operational difference between endogenous risk that exists in the financial system and exogenous risk sources that may arise from outside the financial domain. Endogenous risk sources can either develop in financial institutions, financial infrastructures, and financial markets, or in a combination of the three sources of risk. For example, credit, liquidity or market risks can exist in financial institutions that, when they become a reality, can affect the reallocation of financial resources among investors and savers. Beyond the financial system, the macroeconomy can pose as an exogenous risk source for financial stability, as a result of its power to affect the financial and economic players (companies, households, Government) to respect their financial responsibilities. The measurement of financial stability must imply a procedure of systematic and periodical supervision of every one of the risk sources, jointly and individually, by considering cross-sectional and cross-border connections (Fell & Schinasi, 2005).

An example of an exogenous risk is unsustainable macroeconomic policies. Currency crises models, for example by Krugman (1979), focus on these unsustainable macroeconomic policies. Countries experienced currency crises in these models for they showed a lack of consistency and endurance in the policies. Classic monetary and fiscal policies are expanding too quickly, and are therefore becoming larger and inconsistent with the currency peg. Countries' governments handle banks in such a way that they absorb the public debt problems in markets, in order to desperately finance government deficits. This will increase the likelihood of banking crises. Imbalances in the macroeconomy are the largest cause of crises, with reference to this specific case. However, the closest or immediate inductions might be transmission effects or unwisely low foreign exchange reserve levels (Eichengreen, 2004).

This study will only focus on the endogenous causes of financial instability. Endogenous risk factors can be divided into three groups, as indicated in Table 2.1 (Fell & Schinasi,

2005). The column on the right presents the exogenous risk factors and the one on the left hand side presents the endogenous risk factors, which will be discussed below.

2.2.2.1 Financial institutions

Financial institutions may, for example, experience potential credit, market or liquidity risks, but if they become a reality they can prevent financial resource reallocation between savers and investors. An example of financial institutional risk is *institutional weaknesses*. When there are weaknesses in the corporate and public sector, the government tolerates high risk decisions causing the corporate financial structures to be exposed. This is especially true when government spending depends highly on debt instead of shares (assets), and there is unreasonable reliance on borrowing over the short run. The appropriate solution would be to fortify creditor and shareholder rights, amend corporate governance and financial transparency, and point out acceptable restrictions on the official safety net prolonged to financial institutions (Eichengreen, 2004).

2.2.2.2 Financial markets

Financial markets are possibly an endogenous risk instigator because they create additional sources of financing for non-financial sectors, but they also serve as a link between different financial institutions and directly between investors and savers. An example of financial market risk is *fragile financial systems*. From a few recent crises, it is evident that macroeconomic factors are not the only reason for financial instability, for example the Asian crisis. Work done by Goldstein and Turner (2003) stressed the importance of currency mismatches in the financial system as a fundamental cause of financial instability. When banks' assets are in the local currency, but the liabilities are for example in dollars, concern of a crisis will cause the currency to depreciate. This is as a result of the weak exchange rate's inability to service or pay off outstanding debt or liabilities. When banks are consistent with how their assets and liabilities are composed, lending and borrowing in dollars, however, their clients have rand incomes but liabilities in dollars, they will be forced into bankruptcy if the local currency depreciates. This will

cause the financial system to fail. As a result, this viewpoint demands a strengthening of prudential regulation and superintendence as the main instrument to reduce financial instability (Eichengreen, 2004).

2.2.2.3 Financial infrastructure

Financial infrastructure is an endogenous risk factor as a result of the connections between market participants and in addition it also supplies the institutional framework where financial institutions and markets function; for example, flaws in international financial market structure. In this case, financial instability in emerging markets is connected to the structure and functioning of the international financial system and the structure is not within control of individual countries. Profound arguments of this point of view accentuate the spread of asymmetric information in international financial markets, which stimulates crowding by investors and increases unexpected stops and turnarounds of capital flows, which may result in crises independent of circumstances in the stricken economies. In this situation, the problem lies with how mobile capital is. The instability of capital flows can be the result of a wide variety of other distortions. The appropriate answer would be to maintain control of capital flows (Eichengreen, 2004).

2.2.3 Why financial stability is important

During the past ten years, consciousness has increased with regard to the influence that financial shocks have on economic growth, the propagating effect of shocks in the real economy due to unstable financial sectors, the velocity at which financial shocks disseminate to other sectors as well as the connections between various countries' financial systems. Since the crisis in the 1990s, where there were large declines in real estate and share prices of banks, it has become more evident that the financial activity has a significant influence on the performance of an economy. Simultaneously, central banks and other organisations have become more aware of their purpose in adding to financial stability (Chant, 2003).

World financial markets became more integrated and underwent an extreme transformation process as a result of the process of liberalisation and deregulation. Financial markets became more sophisticated and demanded that every role-player in the market increased his/her focus on risk management. Policy-makers were forced to tighten supervision for the identification of developments and risk in the markets. This shift in the participants' focus is of great importance, considering that previous crises informed policy-makers on how damaging and troubling financial instability can be and how efficient risk management can prevent future crises (Yilmaz, 2007).

From the definition of financial stability, it is evident that there is a wide consensus that financial stability is influenced by the relationship between savings and investment. When there is a deviation from the optimum plan for savings and investment, there is a welfare cost. This may be the result of inefficiencies in the operation of the financial system or the system's inability to handle instabilities. The welfare frictions are different in behaviour, but they are interconnected. There is also a possible trade-off from time to time between the financial system's operation inefficiency and the system's inability to handle instabilities. For example, when there is an increase in competition in the financial sector, it may emphasise the exposure of shocks to the financial system, while conversely assurance of the system's protection as a whole may decrease its effectiveness. Financial system frictions are potentially worrisome to public policy. This may potentially rationalise public policy intervention, which has been reflected in the authority of central banks (Haldane, Hoggarth & Saporta, 2001).

Financial instability's welfare costs are regularly related with monetary instabilities. Since financial stability has already been defined, it is necessary to define monetary stability, for there is a link between them. Monetary stability is also known as price stability (Issing, 2003). Price stability presents a stable price level or low inflation levels and not individual price stability. Relative price changes undoubtedly play an essential and positive role in individual actors' decision-making and economic adjustment. Inflation costs may be partly related to the concept that these relative price signs will be less visible the higher the inflation rate is. Despite the controversies about the structure

and measurement of the price index and the best technique to define price stability, it is generally and widely accepted and simple to handle (Issing, 2003).

Monetary instabilities may cause financial system inefficiencies and instabilities to arise, for example the Great Depression where financial instability was caused by monetary instability. The number of banks in the USA decreased by 50% from 1929 to 1933 (Bernanke, 1983) during which time money income (for example long-term investments) fell by 53% and real income by 36% (Wood, 1999).

It is, however, difficult to determine exactly what the relationship between financial inefficiency and monetary stability is. Work done by English (1999) provides a better understanding of this relationship. He observed that economies that experienced high inflation or hyperinflation had growing financial sectors. He used the example of Germany where bank employees doubled from 1920 to 1923, when hyperinflation was at its highest, before stabilising to its 1924 levels. This happens when agents leave money balances that do not earn interest, to better utilise bank services during periods when the inflation rate increases. There is, however, no social gain, since financial service resources could have been used more productively. When the inflation rate is high, the financial sector is not at its social optimum level. English estimated a welfare cost of 1.25 per cent of GDP through the channel of the financial sector when there is a ten percentage point increase in inflation. This non-trivial cost is an example of monetary instabilities causing welfare inefficiencies from a financial system viewpoint (Haldane *et al.*, 2001). This increases concern on what exactly the relationship between financial stability and monetary policy is and whether there is some form of trade-off between the two. This forms the theme of the next section.

2.3 FINANCIAL STABILITY AND MONETARY POLICY

When studying the relationship between financial stability and monetary policy, it is important to ask two questions of broad interconnected scope (Borio & Lowe, 2002): Firstly, to what degree does monetary stability, a situation of low and stable inflation,

contribute to financial stability? Secondly, which kind of monetary policy would probably ensure a good combination between monetary- and financial stability? There are two views with regard to this relationship, which will subsequently be reviewed.

2.3.1 The conventional view

Bordo *et al.* (2000: 27) summarise the relationship between monetary and financial stability by stating that “a monetary regime that produces aggregate price stability will, as a by-product, tend to promote stability of the financial system”. This is generally widely accepted, especially since the contrary, that a volatile inflation rate can cause financial instability, has been found. It is not only sudden increases in inflation that cause financial distress, but an unforeseen decline in the inflation rate causes an increase in the real outstanding debt value, increasing the probability of defaults. Therefore, when there are declines in inflation, especially when they are related to restricted monetary or fiscal policies, it increases the likelihood of stresses in the financial system, compared to stable inflation periods. Likewise, the financial system's vulnerability measurement stretches over a few years, and is likely to increase when inflation is higher than predicted, especially when macroeconomic policies become tighter to reduce inflation. Moreover, high stable inflation can potentially threaten financial stability, especially when it promotes leveraged asset acquisitions and resource misallocations (Borio & Lowe, 2002).

Empirical work done by Hardy and Pazarbasioglu (1999) supports this view. They found that a sudden sharp fall in inflation, after a period of increased inflation, significantly raises the chance of a financial crisis, while on the other hand, Demirguc-Kunt and Detragiache (1997) concluded that countries with high current inflation levels are more prone to a financial crisis. Bordo *et al.* (2000) also determined that in the 18th and 19th centuries, periods of financial distress took place in a disinflationary environment in the United States after years of inflation. The question that should be addressed is what the conventional view says the trade-off is between monetary and financial stability.

The conventional view questions the existence of a trade-off. This is as a result of inflation being one of the largest contributors to financial instability. This supports the opinion that inflation causes a misperception of possible future returns. A written agreement where a lender borrows money to a borrower constitutes certain legal rights and obligations for both parties involved. Besides the promise of the borrower to repay the lender plus interest in a certain time period, the contract can be altered by two factors. In the first instance is the uncertainty of the investment that questions the ability of the borrower to repay and secondly, the possibility of non-agreement of the contract. These two factors are considered as the problem of asymmetric information. When interests clash, there will be disputes if it influences the profitability of the lender (Bebczuk, 2003).

When the interest rate of the loan payback increases, the lenders' expected yield on the loan also increases. This causes an increase in non-payments from borrowers and therefore increases the potential monitoring cost to the lender. This successively develops an asymmetry in the payoff functions of borrowers and lenders that can possibly cause credit rationing. As a result of this asymmetry, it might be impossible for the interest rate of the loan to change so that the market can clear in order for the borrower to be unable to receive a loan in equilibrium (Claus & Grimes, 2003).

The asymmetric information problem between borrowers and lenders can be exacerbated by inflation. High inflation and high inflation volatility are often correlated, which makes predicting real returns problematic, as it influences the purchasing power of money. A boom in the business cycle, accompanied by high inflation, is generally an environment where asset price bubbles and real overinvestment bloom. Redundant liquidity that the central bank provides is one of the main elements responsible for developing non-strict lending standards. Credit growth larger than what is realistically expected is often the basis for financial instability. Therefore, stable prices and a monetary policy concentrated on achieving price stability play an important role in stabilising financial markets (Issing, 2003).

There are three forms of asymmetric information in financial markets. Firstly, adverse selection when a lender is unable to differentiate between projects' risk when lending money; for example, two projects with the same expected value but the lender would favour the safer one above the riskier one, but the borrower is just the opposite case. Therefore, borrowers exploit a lender's information deficiency by attempting riskier projects and concealing the project's nature. Secondly, moral hazard is when a borrower uses the funds for other purposes than agreed on in the contract who is handicapped by an information deficiency and control over the borrower. Lastly, monitoring costs are connected to 'hidden action' by the borrower, who capitalises on having more information than the lender to announce earnings that are lower than his actual earnings (Bebczuk, 2003).

2.3.2 The new consensus

The second view on the link between financial and monetary stability is the new consensus. The first argument is that stable prices assure financial stability, so that monetary policy does not have to be concerned on a daily basis with financial stability and asset prices. The central bank is only to intervene by behaving as a lender of last resort when a financial crisis occurs. The second argument is that price stability can trigger financial instability, and therefore the central bank must have full knowledge of the financial situation of the economic system's daily procedures. In the last situation, asset prices play a crucial role in monetary policy-making (Tymoigne, 2006). These two arguments are further explored below.

2.3.2.1 Price stability brings forth financial stability

According to Schwarz (1998), lenders and borrowers have the same degree of uncertainty in evaluating a project. Within this framework, he concludes that asymmetric information is not the main problem faced by borrowers and lenders. However, when monetary authorities try to over-stimulate the economy above its normal level, they create inflation. In doing so, the central bank promotes optimism about the future expected nominal income by borrowers and lenders (Tymoigne, 2006). Therefore,

inflation rate changes have a greater influence on the economy during periods of high inflation, and in such a situation even disinflation may be destructive by causing the gains from nominal income to decline and increasing the real burden of debt. This is the case for bankers and entrepreneurs whose “perceptions of credit and interest rate risk on both the upswings and the downswings of price movement” are twisted (Schwartz, 1988:42).

Therefore, Schwarz (1988) stated that by encouraging stable prices, the central bank would contribute more to financial stability than restructuring deposit insurance or re-regulation. It goes without saying that price stability policy is to maintain low inflation levels, since the variation in relative price changes increases when the overall inflation rate rises. Through this action, central banks stimulate economic growth and encourage financial stability by decreasing volatility of nominal interest rates and easing banks' access to borrowers' creditworthiness. Therefore, lending booms and recessions are less likely to happen, for lending booms are brought on by high inflation, and recessions by unexpected deflation or disinflation (Tymoigne, 2006).

The Schwartz Hypothesis, explained above, which states that anticipated price stability enhances financial stability was tested by Bordo *et al.* (2000) and Bordo and Wheelock (1998) and it was found that there is a positive association between price instability and financial instability. However, no causality was found and therefore the following argument can be put forth: The fully detailed evidence is mostly in line with the Schwartz hypothesis. Minimally, the historic connection between severe financial instability and price level fluctuations would support the views of those who favour a price stability mandate for monetary policy (Bordo & Wheelock, 1998). Bernanke and Gertler (1999) supported this view and said that price stability and financial stability should be viewed as highly complementary and uniform reciprocal objectives.

2.3.2.2 Price stability may spark financial instability

In accordance with the inflation targeting framework, the existing view has been criticised. Accordingly, it was shown that the connection between price stability and financial stability is not as straightforward as indicated in the preceding section.

McGee (2000) and Bean (2003) proved that stable output prices and steady growth might contribute to the development of optimistic financial market prospects. This will develop optimism about future outlooks by raising the collateral's value. This can possibly spark a credit boom that supports the optimistic financial market. Therefore, when the central bank stabilises prices successfully, it does not necessarily mean it is successful in creating a stable financial environment. In contrary, it may stimulate financial instability.

According to Borio and Lowe (2002, 2003) and Tymoigne (2006), there are four reasons why price stability may not promote or cause financial stability:

- A sound monetary policy may increase the expectations of good future outcomes of economic agents by improving the future prospect of long-term planning. Asset prices will be influenced by this optimism, especially house prices, which will be carried over to the credit market. The credit market boom, caused by less strict creditworthiness standards, may promote financial instability when borrowers' beliefs about the future do not realise.
- A positive shock to supply, for example better technology to increase productivity, might lead to an increase in profits and positive future expectations. The rising asset prices, high economic growth and low inflation combined may cause a situation of over optimism about the future, promoting significant asset and credit market increases, not within a reasonable scope compared to the original productivity increase (Borio & Lowe, 2002).
- An extremely credible monetary policy can secure inflation prospects to such an extent that wages and prices of long-term agreements may not act quickly to pressures in demand, which is problematic in the inflation targeting framework. This property of prices to be fixed may lead to increases in enterprises' profits when they

are able to increase their sales price above the inflation rate. Furthermore, when borrowers and lenders have increased trust in the central bank to keep prices stable, while restricting economic downturns, their uncertainty about future outcomes will decrease causing an increase in borrowing, lending and asset prices. Eventually, this will leave the economy more vulnerable (Tymoigne, 2006).

- In association with the previous ideas, inflation expectations may firstly reveal itself in lending contracts, even when inflation is not present. Borio and Lowe (2002) concluded that inflationary pressures firstly show in asset markets, rather than goods markets. This makes borrowers and lenders more dependable on the clear understanding of a certain inflation level.

From the above it is clear that the channels through which financial stability are affected are on the one hand when there is an increase in asset prices and credit growth and on the other hand an increase in sales prices and increased borrowing. From these channels it is evident that credit growth and borrowing have a large influence on financial stability and the possibility that price instability will trigger financial instability is high. From the above, it can also be seen that credit creation and borrowing are key components of financial stability; therefore, it is important to know what the role of financial intermediaries is in financial stability.

2.4 THE CRITICAL ROLE OF FINANCIAL INTERMEDIATION

In Chapter 1 (section 1.1.2 b), it was shown that banks are examples of financial intermediaries and that they fulfil an important role in the economy by matching borrowers and lenders. They take the funds of the investors and depositors and lend them to those individuals and firms that have businesses and employ people in the real economy; therefore, they have higher return potential opportunities (Rosengren, 2011).

Depositors (surplus units) normally need regular access to their funds, while the borrowers (deficit units) need the funds for extended time periods. Here, the so-called “maturity transformation” is at play; from short maturity for depositors to longer maturity

for borrowers. In addition, depositors want low risk safe deposits for their funds, while the investment opportunities of borrowers mostly involve credit risk¹. Therefore, financial intermediaries carry out a “risk transformation” so that firms with higher potential return opportunities can get funds from safer, short-term investments of investors and depositors (Rosengren, 2011).

Financial intermediaries’ knowledge and skills on identifying investment opportunities with an acceptable credit rating, keeping record of investments and receiving diversification benefits have to be exceptional. In everyday circumstances, depositors or investors can access their funds with little or no notification through the financial intermediaries, for the intermediaries draw their funds from numerous depositors who are unlikely to demand all of their funds at the same time. Therefore, financial intermediation is a critical part of a well-operating economy, allowing many funds of depositors to be grouped and channelled to long-term riskier investment projects that strengthen real economic activity (Rosengren, 2011).

A disturbance in intermediation may therefore have significant negative effects on the macroeconomy. Reinhart and Rogoff (2009) pointed out that when the economy recovers from a crisis where financial intermediation has been badly affected, it may take a long period of time to recover and may be even more mismatched than would be the case with a crisis with no disruption in intermediation. Rosengren (2011) concluded that when individuals or groups of financial institutions fail, but there is no significant impact on intermediation, financial stability is not affected. Rosengren (2011) implicitly proposed in his definitions that when individual financial institutions or institutional groups fail, but financial intermediation stays relatively unchanged, then financial stability is not significantly affected; for example, when intermediation services are effortlessly substituted so that borrowers are able to change to other intermediation services at low cost.

¹ “Credit risk is most simply defined as the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms” (Basel, 1999:4).

Another point of interest in intermediation is central banks' role as lender of last resort (see section 2.3.1 on the conventional view). Besides their role to manage and control monetary policy, a critical role for central banks is to fulfil their function as lender of last resort (LOLR). The foundation of the LOLR objective is to keep financial instability from happening or to restrict the consequences by providing liquidity support to individual financial institutions or financial markets. The fundamental assumption of liquidity shortages, which implies that institutions are unable to get enough money or ways to pay at low cost, can result in institutional failures. This could have been prevented, resulting in spillover effects flowing widely over to the financial sector, affecting the real economy. The central bank can present its purpose of restoring the system's confidence by preventing 'fire sales' of assets to support a well-functioning market (Cecchetti & Disyatat, 2010). Having discussed why intermediaries are important in financial stability, as well as the central bank's role as LOLR, the focus now turns to the relationship or link between financial stability and asset prices.

2.5 FINANCIAL STABILITY AND ASSET PRICES

The relationship between asset prices and financial stability dates back to Veblen (1904) who presented the positive relationship between asset prices and collateral borrowing. From 2005 to 2008, asset prices grew at a fast rate in the economies of Asia, but declined during the onset of the global financial crisis (2008-2009) (Khoo, 2012).

The downturn influenced the income of households, confidence, as well as credit accessibility. After the Asian economies recovered, house prices resiled achieving record levels in various countries. Property markets have a tendency to move in cycles, partly as a result of short-term supply inelasticity. This cyclical nature is made worse by two factors (Khoo, 2012): Firstly, property is simultaneously an investment good as well as a consumption good. Under normal circumstances, higher prices lead to lower consumption. However, expecting future price increases may bring on higher

investment demand. Valuations are normally set according to the most recent transactions price, causing price momentum to intensify (Khoo, 2012).

Secondly, housing markets tend to be highly leveraged. The majority of people buying homes finance their purchases by borrowing up to 90 per cent of the property value. Banks are willing to lend at high loan-to-value ratios, because mortgage loans have collateral and low default rates. In a growing market, banks tend to lend more as collateral value increases. Easily accessible credit may add to additional house price increases. However, this process will rapidly turn around when prices decrease. Covering standards will be tightened by lenders in this situation. Additional downward pressure on prices may be caused, where current housing loans reverse to negative equity and borrowers are forced to sell their assets as a result of small equity buffers (Khoo, 2012).

According to Duca, Muellbauer and Murphy (2012), many observers connect the boom and bust of the last ten year in the US to an unsustainable relief in mortgage credit standards. However, there are only a few empirical house price models that consider changes in credit standards, for they are difficult to measure. This problem is overcome by integrating a reasonable or valid measure of mortgage credit standards, which is the average loan-to-value (LTV) ratio for people buying their first home, into an inverted housing model that explains the house prices in the US (Duca *et al.*, 2012).

In the time of the subprime boom, mortgage loans were made accessible to borrowers who are more prone to risk, to whom it would have been refused before. A large number of these loans were variable rate mortgages, which especially gained from the low interest rate environment at the time. Many people were deceived, thinking the house price increase, caused by the changes in credit supply and interest rates, will be sustainable. In 2003, fundamentals changed when the interest rates normalised and high building rates increased the total number of houses. At the same time, house prices became overvalued at an increased rate. When the magnitude of bad loans were

revealed, the fundamentals changed once more as credit supply of mortgages was reduced, and previous house price rises relaxed (Duca, Muellbauer & Murphy, 2011).

There was no clear evidence that LTV movements, which changed in a modest manner between 2001 and 2005, were responsible for or could explain the recent house price boom in the USA. However, the average LTV ratio is regrettably highly endogenous. It disguises various tendencies in the LTV ratios of former owner occupiers and first-time buyers. Former owners gained from the boom in house prices, because their LTV average fell as they moved over their capital gains to a new property. On the other hand, the average LTV ratio of a first-time buyer increased with a spike of 88 per cent in the 1990s to a high of 94 per cent in 2005. This is why shifts in mortgage credit standards are measured by LTV ratio for first-time home buyers instead of all buyers (Duca *et al.*, 2012).

Alessi and Detken (2009) proposed that global credit growth levels are better when forecasting a potential financial crisis than the national credit growth. This implies that a central bank should not only evaluate variables in the country to determine threats to financial stability. The global recession and financial recession of 2008 indicated that mortgage lending in excess in the US caused financial distress in Europe. According to these authors, institutions in Europe that have interest in European financial stability should have taken the problems of the US into account when their own policy was established. The variables in the euro area, however, make up a large and crucial part of global averages; therefore, it is important to take euro variables into account, for they reflect potential financial stability risks. Concentrating on asset prices and credit growth, valuable information can be obtained by monetary authorities about developments that may threaten financial stability. The 2007 crisis example is discussed and shown below in Figure 2.1 and Figure 2.2.

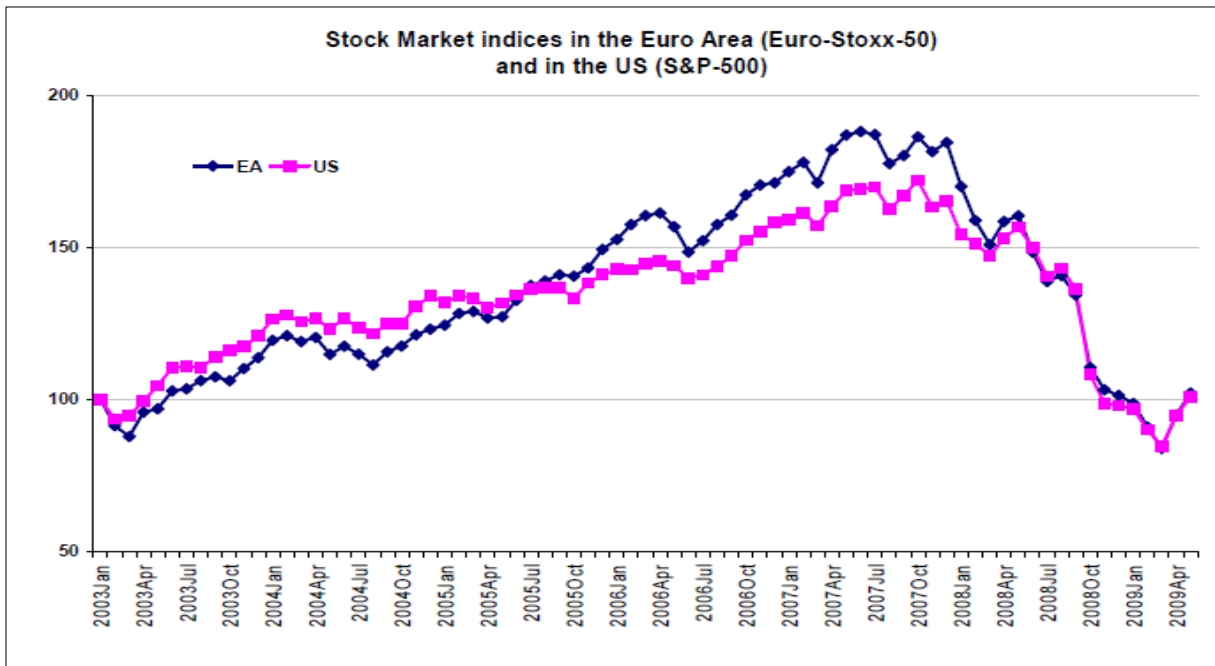


Figure2.1: European and US stock price

Source: Grauwe & Gros (2009)

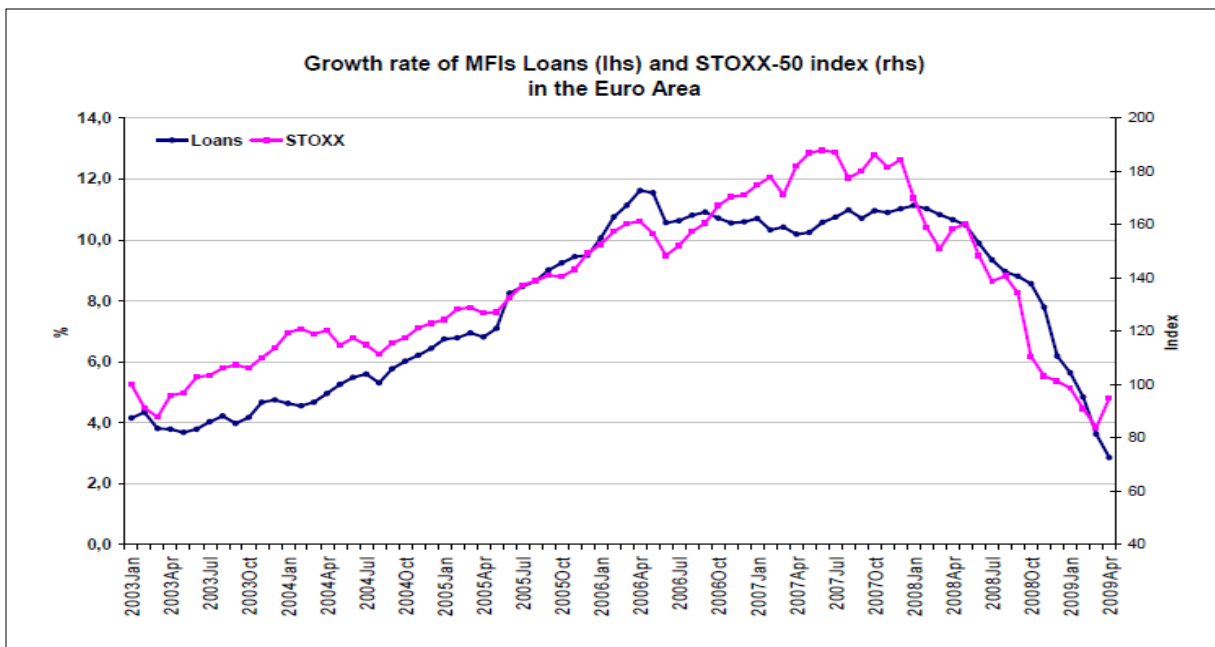


Figure 2.2: Left – Total bank loans growth rate. Right – Stock price index

Source: Grauwe & Gros (2009)

Figure 2.1 shows the stock prices in the euro area and in the US. From 2003 up to middle 2007, there was an increase in stock price indices, which suggests a bubble formation, which is followed by a sharp drop in the case of the US. There was evidence of a bubble in the euro areas as well as in the US.

The stock price bubble seems to have happened simultaneously with fast accelerating bank credit from 2003 onwards. Euro area evidence is shown in Figure 2.2. It seems that total bank loans' annual growth rates, which were less than 4 per cent per year in 2003, grew above ten per cent per year between 2006 and 2007. This was the time period in which stock prices reached their highest point. Therefore, from 2003 to 2007 during the euro stock market bubble, stock prices nearly increased twofold and bank credit in the euro areas increased by 60 per cent (Grauwe & Gros, 2009).

Therefore, from 2003 to 2007, there was statistical evidence at hand to help determine the factor that can harm financial stability. The time between 2003 and 2008 proved that the classic asset price booms driven by excess bank credit combination at the end contribute to a system crash and a financial crisis. Grauwe and Gros (2009) concluded that central banks are able to monitor the risk of a financial crisis by concentrating on certain indicators, in other words on stock price indices, housing prices and bank credit. Why then do central banks so often fail to detect pending financial crises?

According to Grauwe and Gros (2009), the inability of detecting financial instability by central banks is most likely influenced by various elements. However, one factor stands out. Academically, macroeconomic models intellectually educated central bankers. These models were developed under the assumption of fully informed, extremely rational agents unable to make systematic errors and who have a good understanding of the world's complexity. Within these dynamic stochastic general equilibrium models (DSGE models), commonly used by central banks, bubbles and crashes are unable to take place. Underlying basic principles are at all times reflected by prices. It is not necessary to control asset prices within these models (Grauwe & Gros, 2009).

These models instruct policy-makers to concentrate on price stability and the proper functioning of all the other factors, for example price and stability will be assured by efficiently operating markets. This intellectual framework can obstruct the ability of policy-makers to identify potential financial market problems, because it operates as an intellectual device in which these problems are unable to exist. However, if they arise, they are considered as exogenous shocks, unable to make predictions (Grauwe & Gros, 2009).

As indicated above, and as previously discussed in Borio and Lowe's (2002) definition of financial instability, it is evident that enduring fast credit growth and large asset price increases has a significant influence on financial stability. It is therefore crucial to elaborate on this statement to have a better understanding of the relationship between asset prices, credit growth and financial stability.

2.6 ASSET PRICES AND CREDIT GROWTH

Asset prices can be divided into two groups, i.e. house prices and stock prices. This section will theoretically describe the relationship between these two asset price groups and credit growth. It will furthermore establish the influence of asset prices and credit growth on financial stability, which forms the theme of this study.

2.6.1 House prices and credit growth

Theoretically, house prices are influenced by the accessibility of credit. The demand for houses will increase if credit is more accessible, especially when households are encouraged (given incentive) to borrow. However, house prices may greatly affect the borrowing by households through several wealth effects (Oikarinen, 2008). Supporting the theoretical view, housing cycles and credit cycles occurred simultaneous in various countries (IMF, 2000). There are a number of reasons why the relationship between house prices and household credit is important. One reason is when the link between house and credit market is taken into account, more accurate predictions can be made for movements in house prices and changes in household borrowing. This is not only

important for banks and companies in construction, but also for monetary and fiscal policy. This connection between the house market and credit will probably increase the boom-bust cycles in the economy and cause a fragile financial sector (Oikarinen, 2008).

Goodhart and Hofmann (2007) suggest that making both house and credit markets' boom and bust cycles stronger, increases the probability of a fragile financial system in the future. Therefore, when house and credit prices vary from their long-term trend, it is considered to be a good indicator of potential distress in the banking sector in the future. It is therefore critical for monetary policy-makers to have extensive knowledge of the influence that asset markets have on the transmission mechanism, so that the correct policy instruments are set in place. However, the relationship between house prices and credit and the direction of causality has not extensively been researched (Oikarinen, 2008).

House prices as well as other asset prices are determined by the expected stream of future discount cash flows. If credit becomes more accessible, the lending rate will decrease, thereby stimulating current and future economic activity. Therefore, increased availability of credit might decrease discount rates and increase cash flows in the future, causing house prices to increase. Probably more significant is the fact previous borrow-constrained households that gain increased credit accessibility will likely increase the demand for houses. The demand increase will be shown by the increase in house prices. Stein (1995) also stressed the important influence that credit restrictions have on house prices.

The connection between credit and house prices is addressed by Mian and Sufi (2009) by using micro-data, and they found that the mortgage credit expansion was more likely a driver of the growth in house prices than a reaction to it. Duca *et al.* (2012) found that movements in credit standards help to describe the boom and bust in US house prices, in line with historic inverted demand results for the UK (Cameron, Muellbauer & Murphy, 2006; Meen, 2001; Muellbauer & Murphy, 1997) together with the house price-to-rent results of the US (Duca *et al.*, 2011).

According to Oikarinen (2008), the compilation of household debt may expose anticipated information about the factors driving house prices. Firstly, it will provide a reflection of households' doubt about future income. When uncertainty is high, households will be more likely to save, in other words, borrowing will decline. It is also expected that present and future interest rates will influence borrowing, since changes in borrowing of households are expected to reveal expected income and interest rate, including income uncertainty.

By contrast, changes in house prices might affect household borrowing. There are three different ways that the wealth of households can influence the credit demand of households (Goodhart & Hofmann, 2007). Firstly, the high value of the collateral when buying a house ensures that credit is more accessible as a result of increased wealth. For example, the influence that household wealth improvement has on the amount of debt through the collateral effect (Iacoviello, 2004). Secondly, household wealth changes may have an important influence on the perceived wealth of households' lifespan. When the perceived wealth of a household's lifespan increases, it encourages present consumption to spread consumption equally of the lifespan, thereby increasing credit demand. Lastly, changes in house prices impact the supply of credit through the alleged balance sheet effect. When house prices increase, banks are more willing to allow loans, for it increases the value of bank capital (Oikarinen, 2008). Goodhart and Hofmann (2007) noticed that the bi-directional causality between borrowing and house prices might strengthen both house and credit market cycles.

Regardless of the possible influence, there has not been extensive empirical research on the link between credit and property markets. Some research found a causal relationship between the credit market and house prices, where other results suggest an undetermined direction of causality from the housing market to the credit market. Hofmann (2004) concluded from his empirical research that there exists a cointegrating relationship between real house prices, real credit to the private sector, real GDP and

the real interest rate in a sample of 16 developed countries². Goodhart and Hofmann (2007) used 17³ industrialised countries in the analysis and the house price index included housing and commercial property. A significant two-way causality between house prices and bank lending (credit) was found. Lamont and Stein (1999) concluded that house prices were more sensitive to specific shocks in cities with high leverage. This implies that loan-to-value (LTV) variations can influence the dynamics of house prices, especially the volatility of prices. However, Hort (1998) used Swedish panel data and found that the relation between net household borrowing and disposable income has no significant influence on house prices.

Duca *et al.* (2012) concluded that changes in credit standards had a significant, if not the most significant, influence in driving the recent US house price boom and bust. Most time series models do not take mortgage credit standards into account, and therefore they are incorrectly specified and lack stability over extended time periods. They are also incapable of tracing house prices accurately, as opposed to the measures of mortgage credit standards used by Duca *et al.* (2012), which are cyclically adjusted LTV ratios for first-time homebuyers.

The findings of Duca *et al.* (2012) confirm the view that, in many cases, asset bubbles are driven by unsustainable increases in credit availability or by using weak financial practices. It is also suggested to put macroprudential policies in place to specify maximum LTV ratios or demand lenders to fund high LTV mortgages with bank capital being more regulative, as proposed by the Hong Kong experience (Wong, Fong, Li & Choi, 2011).

² US, Japan, Germany, France, Italy, United Kingdom, Canada, Australia, Spain, Netherlands, Belgium, Ireland, Switzerland, Sweden, Norway and Finland (Hofmann, 2004).

³ US, Japan, Germany, France, Italy, the UK, Canada, Switzerland, Sweden, Norway, Finland, Denmark, Spain, the Netherlands, Belgium, Ireland and Australia (Goodhart & Hofmann, 2007).

2.6.2 Stock prices and credit growth

The second asset class is stock prices. Stock prices can have an important interaction with household borrowing. Arguments on the relationship between credit and stock markets are similar to those between the house and credit market. The link between borrowing and the stock market is probably not as strong as the link between credit and the house market. On the other hand, shares' collateral value is substantially lower than that of the house market and housing dominates household portfolios. Therefore, the influence of a house price increase on households' perceived lifespan wealth, results in an expected higher consumption and savings rate when compared to stock appreciation. Additionally, the accessibility of credit is anticipated to be significantly influenced by housing demand, because debt is responsible for the largest part of financing when buying a house, particularly for the first-time home buyer. Generally, households do not use large debt financing when buying in the stock market (Oikarinen, 2008).

Studies of the potential connections between stock prices and credit are more limited than those of house prices and credit. In 2008, there was only one study to test the link between the stock market and credit market. Goodhart and Hofmann (2007) found a stronger relationship between real estate (housing and commercial) and credit than share (stock market) and credit. It can therefore be concluded that the relationship between the house market and credit has more significance and will be the core focus of the study. In section 2.5, the importance of monitoring asset prices became evident due to their influence in identifying potential financial instabilities. Therefore, the next section will discuss the relationship between asset prices and financial stability, as well as the possibility of monitoring these price changes.

2.6.3 Asset prices and financial stability

One of the new consensus debates addresses the function of the central bank with respect to asset prices when there is evidence of an asset price bubble⁴ and the financial system is exposed. On the one hand, it was debated whether the central bank should try to burst a bubble and under what circumstances. On the other hand, it was argued that asset price bubbles were not the main concern, but rather the fragility of the financial system (Tymoigne, 2006). These concepts are further explained below.

a) Central banking and asset price bubbles

When bubbles burst, they can cause great harm to the economy, because they bring forth a change in expectations and cause a decline in the collateral's value. This increases asymmetric information among borrowers and lenders, causing a credit contraction and recession. As a result, Kent and Lowe (1997) questioned whether bursting the bubble might have a desirable influence on the economy and financial system. It was suggested to burst the bubble early to minimise damage. Interest rates can be increased by the central bank to assist in collapsing the bubble. Kent and Lowe (1997) emphasised that it may cause a small contraction or stagnation, but it decreases the likelihood of prominent large medium-term swings in inflation and output, if the bubble was not managed.

Cecchetti, Genberg, Lipsky and Wadwani (2000) agreed with this statement, stating that asset price misalignment information is available to central banks. Bordo and Jeanne (2002) argued that bursting the bubble is only preferable under the following situations: (i) when the bubble is small and the bubble is not likely to burst without interference over the next year; (ii) when the possibility of a bubble is sensitive to interest rates; (iii) when efficiency losses with respect to the bubble increase as the bubble becomes larger; and (iv) the end of the bubble is anticipated to happen over a certain time period instead of a sudden burst.

⁴ Asset price bubbles are defined as “a deviation of the market price from the asset’s fundamental value” (Scherbina, 2013:3).

This would mean that central banks can evaluate the influence of a burst on the economy by measuring misalignments. When future growth expectations are well grounded in actors of the financial market minds, to such an extent that economic decision-making is established on them, large swings in interest rates will be required to burst the bubble, which is not recommended. When the financial system is not well balanced, large interest rate variations can cause great harm to the economy (Tymoigne, 2006).

Central bankers and most authors in the new consensus disagree with the existing view (Mishkin, 1988; Goodfriend, 1998, 2000; Issing, 1998; Cogley, 1999). It is argued that financial markets are well functioning, and it is therefore risky for central banks to claim they have more knowledge than the financial market. The central bank is unlikely to observe the development of a bubble before the market does, and when the market observes a bubble, the misalignment will automatically be adjusted. These authors conclude that bursting the bubble by the central bank under the so-called preferable circumstances is not viable, for large interest rate variations are necessary, which will damage the economy.

b) Asset prices and financial fragility

From the above, it became evident that the economy is sensitive to asset prices, which is an important point of interest. According to Borio and Lowe (2002, 2003), and Musa (2003), asset price levels are an insignificant objective. Financial imbalances are more important and also measured in a different way than bubbles do. The measurement of these imbalances can be done by observing credit growth, investment growth and asset price growth. Thresholds can be added to these measures according to previous values that will determine whether an unsustainable boom is present in the economy (Tymoigne, 2006). Central banks should focus on inflation targeting and financial imbalances; therefore, they will prefer unreasonably high interest rates based on the short-term inflation viewpoint when financial imbalances are present; for example, rapid credit growth combined with fast rising asset prices (Borio & Lowe, 2003).

Bean (2003) and Bordo and Jeanne (2002) agree that everyday central bank policy should consider financial imbalances even when there is no agreement on the way it should be implemented. However, Bean (2003) argued that this is useable with a flexible inflation targeting framework. Financial asset prices must not be included by using them in a rule, but rather as 'additional' central bank interests.

Mishkin and White (2002, 2003), Bernanke and Gertler (1990), Gertler (1998), Illing (2001) and Schwartz (2003) agreed that financial fragility is important; however, they might not concur with the conclusions from Borio and Lowe's outcomes. Some said central banks are unable to measure financial balances accurately and fast. Instead, they suggest that financial imbalances should be allowed to grow and burst, rather than protecting the private sector and the financial sector in particular from the busts (Mishkin & White, 2002, 2003). Additionally, central banks should promote orderly decline by behaving as the lender of last resort. What can then be concluded on the link between asset prices and financial stability?

2.6.4 Do asset prices and credit threaten financial stability?

Asset price developments are understudied in most empirical literature that evaluates the determining factors of crises in the financial system. Asset prices were not viewed as important in these studies; however, credit was extensively investigated. A robust result from literature that surfaced on the leading indicators of the banking crisis is that rapidly growing domestic credit increases the probability of a problem. Eichengreen and Arteta (2000) found that when domestic credit growth increases by one percentage point (measured at mean credit growth rate), it increases the chances of a banking crisis in the year to follow by 0.056 per cent. Studies that lagged credit growth with two years, qualitatively found generally the same results (Borio and Lowe, 2002).

However, these outcomes support the belief that credit booms increase the probability of problems in the financial sector. There are also no clear practical suggestions about the configuration of results that materially increase the chance of instability, nor are the

reasons for credit growth included. This is a result of a shortage of data and the way the empirical models are designed. The majority of research does not take cumulative effects or stocks into consideration, but only the influence of one year's rapidly growing credit data and states a simple increasing link between credit growth in that particular year and the possibility of financial problems. Furthermore, the links between credit, asset prices and the real economy are generally disregarded (Borio & Lowe, 2002).

Borio and Lowe (2002) concluded that, from a practical viewpoint, the relationships between numerous imbalances are especially important. Fast credit growth on its own might not endanger financial stability; the same is also true for rapid asset price increases or an investment boom. History suggests that it is rather a combination of events, especially when rapid credit growth, rapid asset price increases and in some situations high investment levels occur at the same time, than a single event alone (Borio and Lowe, 2002).

Policy-makers are more concerned about the combination of events in the financial and real sectors that exhibit financial sector vulnerabilities, instead of determining whether there is a bubble in a certain asset price. Though determining whether there is a bubble draws attention, it is extremely difficult to respond with an answer. Furthermore, even if authorities were convinced of their opinion, important problems in the political economy are probable if the policy actions are specifically stipulated on that opinion. A better action would be to rather focus on a complete evaluation of risks that the financial system faces (Borio & Lowe, 2002).

2.7 CHAPTER SUMMARY

The main objective of this study is to determine the relationship between asset price growth, credit growth and financial stability, as well as the influence of asset price and credit growth on the real economy in South Africa. In order to reach the main objective, this chapter commenced by defining financial stability and instability and discussed the channels through which asset prices may influence the real economy. Having the

knowledge and meaning of financial instability and stability, it is important to identify the sources of risk to financial stability. There are both exogenous and endogenous risk factors, but this study only focused on the endogenous factors. Three groups of endogenous factors were identified that may threaten financial stability, i.e. firstly, financial institutions that may be vulnerable to credit, market or liquidity risks; secondly, financial markets may instigate endogenous risk, because it creates an additional source of finance for the non-financial sector. Financial markets additionally create a link between several financial institutions and between savers and investors. Lastly, financial infrastructure may be a source of risk due to the connections between the different participants in the market. In addition, the importance of financial stability was highlighted due to the influence that financial shocks had on the real economy in the last decade.

The two distinct views on the relationship between monetary policy and financial stability were discussed in order to gain an increased understanding of the trade-offs and relationship between price and financial stability. Due to the many financial institutions in the world and South Africa, the influence of financial intermediation was discussed to understand how these institutions, for example banks, can support or damage financial stability. In section 2.5, the relationship between asset prices and financial stability was discussed and it became evident that not only large asset price increases cause financial stability, but rather large asset price increases in combination with fast credit growth. Therefore, section 2.6 elaborated on the relationship between asset prices and credit growth where a distinction was made between house and share prices and credit growth. Literature, for example Goodhart and Hofmann (2007), suggested that when house and credit prices deviate from their long-run trend, it is a good indicator of potential instability in the banking sector. On the other hand, the literature suggests that the relationship between stock prices and credit is similar to that of house prices and credit, but the link is probably not as strong as the link between house prices and credit.

In addition, two arguments were proposed on the role of central banks in periods of bubbles in the asset market. On the one hand, it was suggested that central banks should burst asset price bubbles when they are observed early in order to minimise the damage to the economy and, on the other hand, it was suggested that financial markets are well functioning and will observe the development of a bubble before central banks. Therefore, proponents of this view suggested that the asset price misalignments will adjust automatically due to market forces. After establishing the influence of asset prices and credit growth on financial stability and the different sources of financial instability, Chapter 3 will commence with a discussion of the South African monetary policy and the influence of monetary policy on financial stability.

CHAPTER 3: MONETARY POLICY

3.1 INTRODUCTION

The previous chapter revealed the important influence of asset prices and credit growth for financial stability. This chapter will investigate South Africa's monetary policy from a historical perspective as well as the current policy. Since the focus of this study is on financial stability, this chapter will further determine the effectiveness of monetary policy in dealing with previous crises. It will investigate whether monetary policy should react to financial instability and under what circumstances. This chapter will serve as a mean to reach the third and fourth objectives of the study.

The primary objective of monetary policy is to attain and keep prices stable to ensure enduring and 'balanced' growth and development for the country's economy (SARB, 2013). SA has a forward-looking monetary policy, because changes in the policy rate (repo rate) only influence inflation with a lag period of 18 to 24 months (Mboweni, 2000). In order to understand the current monetary policy, it is necessary to provide a brief overview of the history of monetary policy in South Africa. This forms the theme of the next section.

3.2 A BRIEF HISTORY OF SOUTH AFRICAN MONETARY POLICY

The De Kock Commission (RSA, 1984:151-158) divided the time between the Second World War and the presentation of the findings on the Monetary System and Monetary Policy of South Africa in 1984 into five stages. In addition, the time period from 1984 to 1997 was divided into two additional stages by Mollentze (2000). Each stage is briefly covered below.

3.2.1 Stage one

The first stage was called the Conventional Approach to Money and Credit. This stage was implemented for the first decade after the War. Throughout this time period, monetary policy was established on the assumption that money fulfils a vital role in affecting the economy's demand and that retail banks were the only role-players

responsible for money creation. Monetary policy proposed to control the creation of money in the economy and managing a static exchange rate. This contradicted the prevalent view of the world at the time that the economy was not affected or almost unaffected by the monetary policy (Saayman & Styger, 2011).

3.2.2 Stage two

The second stage, known as conservative Keynesianism, unfolded between the late 1950s and the early 1960s. During this time period, monetary policy was both influenced by Keynesian theory and macroeconomic quantification. During this stage, special importance was placed on controlling aggregate demand effectively. South Africa also applied monetarism during this period, although not extensively. Money stock was seen as the crucial factor in South Africa compared to the rest of the world under the Keynesian influence. The increased importance placed on money supply and the economic implications was in line with the Monetarist's view. On the other hand, one of the components of the Monetarists' view, namely targeting monetary aggregates, was not seen as important. Increased importance was placed on the following facets of money supply (Mollentze, 2000):

- A higher supply of money was a precondition for an increase in income, prices and expenditure.
- It was generally viewed that interest rates were significantly affected by money supply, which may influence consumption and investment.
- Authorities discovered a casual connection between a higher supply of money and general credit accessibility.
- The impression that when the supply of money changes it can directly influence expenditure was widely accepted.

Monetary policy was in line with commercial banks' capacity to create money and credit. Accordingly, the South African Reserve Bank (SARB) attempted to manage the total money stock by managing the cash reserves and liquid assets of commercial banks. Monetary policy had two main instruments during this phase, moral suasion and

rediscounting. Under the Bretton Woods, the stability of the exchange rate was also of utmost importance (RSA, 1984:144).

3.2.3 Stage three

The third stage began in 1961 and ended in 1964 and is called 'the approach of the technical committee'. This stage was a reflection of how SA reacted to the Radcliffe Report in the United Kingdom and the publishings in 1956 and 1960 by Gurley and Shaw (1956, 1960) in the USA. They concluded that money was only one of several liquid assets and its function should not be exaggerated, as retail banks and other financial institutions have the same basic principles. As a result, retail banks ought not to be the solitary focus of monetary policy attempts. The Technical Committee was developed in 1961 in response to conclusions on bank and building society legislation. It was suggested that amplifying the idea of 'money' intended for use by monetary policy should be expanded to include deposits and other assets as alternative to coins and notes (quasi money). Additionally, the concept of banks was also to be expanded to include other deposit-taking organisations. This viewpoint is mostly Keynesian based, with money's effect on prices disregarded and increased emphasis was directed at liquid assets as a monetary policy instrument (Saayman & Styger, 2011).

Romer and Romer (2002:12) concluded that, in the 1960s, "more formal but faulty models" were used in the economy with a lasting inflation and unemployment trade-off, which can supposedly be applied for output stabilisation and to increase output and employment over the long run. South Africa followed the Keynesian approach, which concentrated on fiscal policy to attain macroeconomic policy objectives (economic growth). Monetary policy was crucial for South Africa, since interest rates were managed at relatively low levels and credit ceilings were widely used. In addition, prerequisites for liquidity assets or indirect or direct interest rates were subsidised to certain sectors, for example home owners, exporters and agriculture (Franzen, 1970:113-114).

3.2.4 Stage four

In the fourth stage, direct monetary control standards were implemented as the main monetary policy and this lasted until 1980. Within this time, the Bretton Woods international exchange rate system showed instability and monetary policy activities were directed to stabilise the exchange rate. A list of several different exchange rate policies was tested before deciding on the managed floating policy in 1979. Among the direct measures implemented were private sector credit restrictions on credit extension (1965 to 1972 and 1976 to 1980), deposit rate control (From March 1965 to July 1966, December 1969 to August 1970 and March 1972 to March 1980), foreign exchange control, managing imports, property rental agreements and control over consumer credit (RSA, 1985:A5). This step was distant from the proposed market-based instruments and the De Kock report concluded that the low level of South African financial market development attributed to this decision. Additionally, budget deficits were evident in the central government, regularly financed by domestic bank credit. The most vital part of this stage was still Keynesian based (Saayman & Styger, 2011).

Changing prerequisites for reserve assets as a monetary policy instrument was of great importance from 1965 to 1980 when monetary policy was oriented on semi-market instruments, for example changing prerequisites for asset and cash reserves. Besides the use of direct controls on bank credit, authorities sought control of banks' ability to create credit and therefore the supply of money by functioning on their liquidity base. This was done by making changes to the real full amount of banks' liquid assets and changing the proportions of the prerequisite liquid assets. This method was used instead of focusing on banks' cash base, for example open market procedures and changing demand for cash reserve ratios (Gidlow, 1995).

When the Bretton Woods System of fixed exchange rates disintegrated, authorities were pressured to change the country's exchange rate regime. On 27 June 1975, authorities changed the exchange rate policy as a result of risky assaults on the rand. It was decided that the rand-dollar rate was to be kept fixed for extended time periods and was only to be changed when the domestic or international stance was threatened. This

exchange rate regime was utilised under strict exchange control measures. Residents as well as foreign investments returning to the country of origin's transactions were restricted. In addition to exchange control, extra direct monetary measures were implemented, in order to maintain the parity of the rand as well as sustainable low interest rates for mortgage bonds and loans for agriculture. Restrictions on bank credit to the private sector, control of deposit rates, import deposits and hire-purchase controls were included in direct control measures. Banks were several times necessitated to extend credit on a chosen basis. It then became evident that the system of direct monetary controls caused non-achievement of price stability and in addition resulted in non-achievement of balance of payments equilibrium, optimal and non-volatile economic and employment growth objectives (Van der Merwe, 2003).

3.2.5 Stage five

The fifth stage stretched from 1980 to 1984 and the SARB aimed at being market-oriented in its monetary policy. Direct measures were removed, including credit restrictions, deposit rate control, non-residential exchange control, and increased importance was placed on determining the interest rate (market-based). Additionally, a more elastic discount policy and an increased amount of open market transactions were applied to determine interest rate movements. There were no intermediate goals for monetary aggregates and as a result this was considered as the stage that moved from direct controls to market measures (Saayman & Styger, 2011).

The Keynesian trend remained present, although waning, and monetarist enthusiasm declined when monetary authorities modified the Keynesian approach with some characteristics of monetarism. Spending was controlled to manage inflation and to ensure a stable balance of payments. In addition, controls were put into place to manage the supply of money (Khabo, 2002). Therefore, the combination of monetary policy used in South Africa can be considered as "conservative Keynesian demand management and pragmatic monetarism" (De Kock Commission, 1985:13).

3.2.6 Stage six

In the early stages of the 1980s, the suggestions of the De Kock Commission of Inquiry into the Monetary System and Monetary Policy in South Africa were implemented in the operational process. In March 1986, the Minister of Finance proclaimed in his Budget Speech that the government accepts the crucial proposal from the De Kock Commission that the SARB, with the concurrence of the Minister of Finance, will implement certain growth rate targets for one or several monetary aggregates. The motivation behind the implementation of monetary targeting is to support monetary authorities' policy and to direct or determine the supply of money to help fight inflation. The main monetary policy objective in the majority of this period was to combat inflation. Nevertheless, there was a short priority change between 1985 and 1987 when economic recovery and growth were promoted to the primary monetary policy goal. Dr De Kock's years as Governor also saw monetary policy react to other elements and influences over the short run, for example exchange rate behaviour and balance of payments. After the foreign debt crisis in 1985, the SARB stimulated economic growth by decreasing upward pressure on interest rates and creating significant cash reserves for banks that had a shortage of cash reserves. In other words, banks' cash need was met by creating reserves. When the assets and liabilities of banks increased, the need for reserves also increased (Mollentze, 2000).

Monetary policy followed the guidelines of the De Kock Commission by announcing precise monetary growth targets and guidelines for M3 every year from 1986 to 1998. The announcements prior to the coming year's monetary targets were to be reached indirectly by managing interest rates. Short-term interest rates became the primary instrument for monetary policy, for the Bank's discount rates were used to affect the next day cost of collateralised lending, as well as the market interest rate. The bank rate was increased to decrease the demand of bank credit. Banking institutions were provided with accommodation at the discount window by the Reserve Bank at the lowest interest rate. Numerous measures, for example open-market transactions, were applied to affect the overall private sector liquidity and credit extension. Monetary control functioned indirectly by reducing money demand (Casteleijn, 2001).

This resulted in the expansionary monetary policy that extended until March 1988 when the SARB terminated the policy and the bank rate was increased by one percentage point (SARB, 1988:36). In turn, managing inflation became the primary policy objective once more. With the point of view that inflation is unable to occur without a drastic increase in money supply, the bank rate was increased on a regular basis between 1988 and 1989. At this specific point in time, it was conceived that a higher bank rate will adequately suppress the inflationary effect (Mollentze, 2000).

3.2.7 Stage seven

This stage was also known as “The application of monetary policy after the appointment of Dr CL Stals as Governor of the South African Reserve Bank in August 1989” (Mollentze, 2000: 10). Dr CL Stals described the philosophy of monetary policy in the 1990s as follows (Stals, 1997:7): “The Reserve Bank’s policy is a ‘monetarist’ approach based on the direct control of the money supply.” Initially, there was no significant difference between Dr Stals and Dr De Kock’s approach of money market intervention. The total money market shortage was continually influenced by the SARB through their open market policy and periodically implemented strict rules to accommodate the banks (SARB, 1990:6-12). There was, however, two points of difference between Dr Stals and Dr De Kock’s time as governor: Firstly, monetary stability was exclusively targeted and, secondly, the SARB requires independence instead of a good relationship and policy coordination with the Treasury. However, the largest difference between the two Governors’ approaches was that in the time of Dr Stals, the SARB had one monetary policy objective and that was to protect the internal and external value of the rand (SARB, 1991:33). Since then, referring to the ‘internal and external’ value of the currency was terminated, because it is excluded from South Africa’s final constitution of Act 200 (1993).

In the 1990s, monetary policy noticeably changed almost exclusively as a result of maintaining good monetary discipline. The SARB’s mission statement aimed for

financial and monetary stability as medium-term objective with the following elements (Stals, 1992: 1-2 and ABSA Bank, 1995: 3):

- Serving general price stability by reducing the increased rate of money stock.
- Increasing bank credit rates moderately at levels below the inflation rate.
- For these objectives to be successful, the inflation rate should be lower than interest rate levels.
- Keeping foreign exchange and gold at levels sufficient to back three months of imports.
- A non-fluctuating exchange rate of the rand.
- Effectively functioning foreign exchange markets, money and capital.
- Banks and other financial institutions that are well organised.

Since then, the policy was adjusted and the following was omitted (Stals, 1997 9):

- Supporting the highest enduring economic growth and development; and
- keeping the inflation rate low (defending the value of the monetary unit).

Financial liberalisation and development in structure in the 1990s caused a change in the relationship between money supply growth, output and prices, and decreased money supply targets' utility. These targets were later on formally supplemented by wider range of indicators. The following indicators were included: exchange rate, asset prices, the output gap, the balance of payments, wage closures, total extension in credit and the fiscal stance. These indicators were accounted for in the previous time period but did not play an important part in setting the targets. In early March 1998, a new monetary accommodation system started with daily liquidity bids through repurchase transactions. Guidelines for money supply were still used; however, they were less important than with the short-term policy formulation (Casteleijn, 2001).

The SARB changed back to a market-orientated approach, managing money supply in relation to prevalent economic circumstances. To prove how flexible monetary authorities are, they changed the terminology from 'monetary targets' to 'monetary guidelines' (Nattrass, 2000:231-233). This proposes that there is no allegiance of

achieving a specific expansion or contraction rate of money supply (Khabo, 2002). “The SARB will therefore at this juncture continue with the existing policy of using changes in money supply as the most important monitor for its decisions regarding the implementation of monetary policy” (Stals, 1994:25).

Monetary policy became more transparent, targeting a more credible and easily noticeable influence on inflation expectations. Starting March 1998, informal inflation targets of one to five per cent were set for the first time and M3 growth guidelines were set every three years. This monetary system attempted to manage liquidity by limiting the amount of liquidity. From the beginning of this specific monetary policy, the SARB implemented a new monetary accommodation system to indicate their aim of short-run interest rates by the daily tender amount for repurchase transactions. When there is a liquidity shortage, it would imply that the repurchase rate will most likely increase, and *vice versa* (Casteleijn, 2001).

In the case of SA, money stock growth guidelines were used rather than growth targets since the early 1990s. This was replaced with an eclectic monetary policy framework in 1996. Therefore, a wide range of economic indicators was implemented for different uses of monetary policy decisions. The consistent application of monetary policy since the 1980s had the desired effect: the inflation rate of 14.5 per cent decreased annually to 1.4 per cent in 2004 (SARB).

Despite the successes of the old South African monetary policy, the need for improvement encouraged advances and changes to the old monetary policy. New Governors also meant different views and opinions on the conduct of monetary policy and history proved that certain policies were effective or ineffective in order to empower monetary policy decision-making. Having discussed the history of the South African monetary policy since the Second World War and the late 1990s, the next section will discuss the development of South African monetary policy since the year 2000 to date.

3.3 THE CURRENT MONETARY POLICY FRAMEWORK

On 23 February 2000, it was proclaimed that SA had adopted inflation targeting as the new monetary policy framework and government targeted inflation between three and six per cent since 2002. However, mortgage interest costs in metropolitan and other urban areas were excluded, in other words a stochastic variable of the headline inflation rate (van der Merwe, 2003). The headline inflation rate was not applied, since it was directly influenced by the repo rate of the SARB with short time lags. According to Van der Merwe (2003), the range of three and six per cent for the inflation target was set, since it allows freedom to judge or act for the central bank according to the position of monetary policy. This monetary policy, applicable today, is different from the monetary policy discussed above, which can also be seen as the old new monetary policy. The monetary policy in place today will be discussed on the basis of the following two subsections: The functioning of South Africa's current monetary policy and the fundamental reasons why South Africa implemented inflation targeting.

3.3.1 Functioning of the current monetary policy

The implementation of this new policy meant that the central bank should still act with a firm purpose to reach their aim. However, it is necessary for monetary authorities to use their freedom to act or judge on their own. The SARB consequently supervises the development in the economy to ascertain the beginning and possible influence that a subversive shock may have on their ultimate goal of obtaining price stability. Large supply shocks are allowed and it will be publicly announced if they occur, as well as the aftermath of achieving the inflation target (Smal & de Jager, 2001). An escape clause was built into the inflation targeting framework, allowing the SARB to vary from the original targets under specified situations, under the condition that they stipulate how these targets will be attained in the future. Prudence in these situations is crucial to prevent costly losses in output and employment. The objective ultimately remains the reaching of the inflation target and the integral discipline of inflation targeting is not excluded when discretion is applied in specific situations (Van der Merwe, 2003).

The public is informed about the position and stance of the monetary policy through the publication of a statement of the monetary policy after every meeting. Twice a year a Monetary Policy Forum gathers in the largest centres of the country to discuss current monetary policy matters. Additionally, a Monetary Policy Review is released two times a year for increased transparency in applying monetary policy (Smal & de Jager, 2001).

The implementation of inflation targeting in South Africa does not imply that the SARB is not interested in achieving sustainable high economic growth and employment. The primary objective of the SARB, which is clearly stated, means that monetary policy is unable to directly influence economic growth and creating new jobs. The development of a sound financial environment and monetary policy is needed to meet a necessary prerequisite for achieving economic development (Van der Merwe, 2003). The current mission of the SARB is to “achieve and maintain price stability in the interest of balanced and sustainable economic growth in South Africa” (SARB, 2013).

Financial stability may be altered when the exchange rate adjusts sharply. Some countries (originated in New Zealand) implemented inflation targeting together with a highly controlled exchange rate regime as a result of the influence on flexible exchange rates. When this approach is used, the concern is how authorities will respond when the objectives of price and exchange rate stability clash, for instance when upward pressure on the exchange rate exists, but the inflation rate is outside the target (Van der Merwe, 2003). As a result of the potential clash in objectives as well as increasing monetary policy credibility, SA preferred inflation targeting together with a flexible exchange rate. The SARB is, however, still interested in the exchange rate, for a change in the value of the rand has an influence on inflation. This does mean that there is no specified target by the central bank for the rand exchange rate and the exchange rate is settled by the supply and demand of the country for an international currency. The SARB does not have a specific target or range for the rand exchange rate; therefore, they do not buy and sell foreign currencies in the market (Van der Merwe, 2003).

In October 2008, there was a slight change in the specification of inflation targeting. Where the initial focus was previously on the CPIX, it was announced that inflation targeting was going to focus only on the CPI from January 2009 onwards, with the same target range. The difference between the CPIX and the CPI is the fact that the CPIX excludes mortgage rates (Rossouw, 2009). The year 2009 created new challenges for South African monetary policy. Since inflation targeting was introduced in 2000, this was the first time that monetary policy had to be applied in a domestic recession and in the setting of a world economy experiencing an intense downturn. Simultaneously, inflation continued to stay higher than the highest end of the targeted range of inflation, regardless of the negative forces; inflation's intensity only decreased at a rather slow rate (Mboweni, 2009:1-3). Despite the fact that inflation was higher than anticipated or targeted, monetary policy was eased, but the Monetary Policy Committee (MPC) being aware of the economic downturn still applied flexible inflation targeting (Madubeko, 2010).

3.3.2 Fundamental reasons why SA adopted inflation targeting

With the previous monetary policy of informal inflation targeting, meaningful results were obtained in terms of price stability by decreasing the inflation rate. Despite the successes of the previous monetary policy, changes in the financial system of SA caused a change in the transmission mechanism. The consumer price inflation wavered around 15 per cent in the late 1980s and the beginning of the 1990s. In December 1992, the consumer price index decreased below ten per cent and continued to decrease to 5.2 per cent in 1999 (Van der Merwe, 2004). The monetary policy of inflation targeting, formally implemented in 2000 brought inflation within SARB's target range. Exchange market intervention alteration empowered the currency to float and absorb large shocks in the absence of extreme changes in the interest rate. This absorption function was essential when the Lehman brothers collapsed (see section 1.1). This allowed monetary authorities to keep decreasing the interest rates as inflationary pressures declined, despite the fact that investors sold assets that were

dominated by the South African rand as a result of the perception that South African assets were a risk at the time (Kganyago, 2012).

The question that should be asked is why it was decided to move to a formal inflation-targeting framework if the informal framework was relatively successful? Inflation targeting has numerous advantages and Svensson (1999) stated that it results in an improvement in the output-inflation trade-off. According to Van der Merwe (2004:16), South Africa implemented inflation targeting based on the following four reasons:

- Inflation targeting improves the transparency of monetary policy and intermediate aims are eliminated. Anticipated inflationary developments directly affect the modifications to the policy.
- Inflation targeting results in better co-ordination and communication among monetary policy authorities and different economic policies that are supplied to ensure the target is in line with other aims and objectives. Within an inflation targeting framework, this improved co-ordination, in comparison with different monetary policy frameworks, is achievable by the highly organised structure of this framework's cognitive process in reaching a decision.
- Inflation targeting functions to make the bank more accountable and to discipline monetary policy. The central bank has to attain the specifically determined targets. When the real inflation rate differs from the determined targets, an explanation has to be given why the central bank did not meet the target. The central bank is hereby disciplined and more responsible, and the public also understands the logic behind certain conclusions made by the central bank.
- The use of inflation targeting influences the anticipated inflation rate, which ought to support a decrease in the inflation rate. The perception that inflation targets are credible exists, which sets the foundation for future wage and price setting. Theoretically, inflation targets would affect the rise in enterprises' operating costs and the establishment of prices.

Despite the fact that the past debate in South Africa was centred on the influence that inflation-targeting has on output, some additional benefits of the system were identified.

Aron and Muellbauer (2007) proved that there was a significant advancement in the transparency of monetary policy by applying the adjusted Geraats index⁵. It was also found that transparency improvement decreased the levels of uncertainty and increased investment levels, ensuring that better decisions are made. The potential for additional improvement in transparency highlighted that monetary policy can be predicted with more certainty. Aron and Muellbauer (2007), as well as Ballim and Moolman (2005), established that changes in the forward market expected repo rate have improved since the implementation of explicit inflation targeting in 2000 and it stayed credible with the recent repo rate and macroeconomic volatility. Rigobon (2007) showed that credibility has improved as indicated by the conduct of inflation anticipations. The simultaneous release of the SARB's Monetary Policy Review and Quarterly Bulletin improved communication with the initiation of Monetary Policy Forums held once a semester in South Africa.

According to Kahn (2008), South Africa struggled to manage supply-side and exchange rate shocks. Monetary policy decisions in reaction to the significant domestic and external shocks amended in a significant manner during the inflation targeting period (Aron & Muellbauer, 2007, 2009). As a result of the exchange rate and commodity price shocks, the MPC implemented a rather elastic strategy that did not seek to achieve the target range in the shortest time period. Generally, the MPC tried to oversee the influence of the shocks over the short term and rather focus on the outcomes of the second round. Interest rate smoothing was implemented in a small degree, as supported by evidence through the small changes implemented throughout the interest rate cycles (Kahn, 2008).

Regardless of the gains from inflation targeting stated above, it is still not clear whether inflation targeting is suitable in the circumstances of South Africa. Despite the fact that Inflation targeting has attained a number of benefits; it did not achieve any meaningful results in terms of reducing unemployment and promoting economic equity. In addition,

⁵ Geraats index was developed by Eijffinger and Geraats (2006) and is the standard (mostly used) measure for the transparency of central banks.

Epstein and Yeldah (2008) were in agreement with Heintz (2006) who concluded that creating job opportunities was not part of central banks' schedule globally, since international unemployment, underemployment and poverty are of main concern. Price stability alone is most unlikely to be sufficient to uphold 'true macroeconomic stability', for financial stability and employment growth will not be sustainable over the long term (see section 2.3.2) (Mashele, 2011).

Comert and Epstein (2011) were concerned that when the SARB concentrates solely on retaining commodity inflation at its lowest or stationary rate, whether or not it will negatively affect other policy objectives, for example unemployment, financial stability or stable asset prices? According to Mishkin (2007), the fact that numerous countries implemented inflation targeting as their main monetary policy strategy did not silence the debates on whether inflation targeting is meaningful. There is no consensus on the views whether central banks are in a more favourable position after the implementation of inflation targeting as the key mechanism in administering monetary policy.

According to Mminele (2012), monetary policy is unable to support long-run economic growth and employment creation, but in the presence of stable financial conditions, monetary policy meets a necessary prerequisite for achieving economic development. The reasoning behind managing inflation is the fact that low inflation lays the foundation for sustainable economic growth. The SARB is of the opinion that there is no long-run trade-off between unemployment and inflation. Flexible inflation targeting has some weaknesses, but in comparison to other possible monetary policies, it is most likely the closest to perfect, based on the present knowledge.

Having discussed the framework in which the monetary policy of South Africa functions, as well as the motivation behind the implementation of the current monetary policy, it is necessary to elaborate on the subject. Therefore, the next section will discuss what the ultimate objective of the South African monetary policy is, as well as its importance in the functioning of the economy.

3.4 THE ULTIMATE OBJECTIVE OF MP IN SA

The ultimate objective of South Africa's monetary policy is to attain and keep prices stable for the sake of even and enduring economic growth and development. When prices are stable, it decreases the level of economic uncertainty, thereby promoting desired conditions for creating new jobs and growth. In addition, low inflation assists in protecting the residents of the country's purchasing power, especially poor people who cannot defend themselves against continuous price increases (SARB, 2013:6).

3.4.1 Why low inflation is important (see also sections 2.2.2 and 2.3)

Low inflation is the main objective of the SARB policy actions. Low inflation implies that the value of money would decrease at a slower rate, if at all over extended periods of time. Money has three important purposes. Firstly, it serves as a means of payment. Secondly, it has a measurement function to determine the value of goods and services. Lastly, it stocks the value of a community's saving. Because of these three functions of money, it is crucial that money should keep its value as long as possible. Any modern market economy would malfunction if its currency continually depreciates (Rossouw, 2009).

According to Ellyne and Veller (2011), there are four theoretical reasons why stable and low inflation is monetary policy's main goal:

a) When the inflation rate is high, it is likely to decrease savings and investment:

High inflation is related to significant fluctuations in inflation that in turn lead to doubt about the anticipated level of prices, complicating the economic decision-making in the long run (Freedman & Laxton, 2009). Therefore, labour negotiations are made difficult due to uncertainty. This is exactly the case with South Africa and its labour market and all its unions.

b) Price distortion is caused by high inflation:

Unsynchronised price changes of firms will cause an inaccurate reflection of relative production costs and will distort the choices of consumers causing a loss in welfare (Sorensen & Whitta-Jacobsen, 2005). According to Lucas (1972) and Briault (1995),

inflation increases uncertainty about the anticipated price level and relative prices, therefore making it difficult for businesses and individuals to make the desired decisions and, in turn, economic efficiency decreases. The identification of the high costs of high inflation developed the perspective that low and stable inflation increases the productivity level of employed resources in the economy (Mishkin, 2011).

c) The poor is proportionately more affected than the rich:

Rich individuals can escape the negative effect of a rise in inflation by using inflation-linked financial instruments that the poor most likely does not have access to. The majority of their wealth is exposed to inflation, for example cash (Romer & Romer, 1998; Easterly & Fisher, 2001). Unforeseen inflation results in the redistribution of wealth and might increase borrowing costs. There are households that do not realise what effect a general price trend has (i.e. nominal illusion), and this complicates financial planning.

d) High inflation distorts un-indexed measures of accounting and taxes:

This results in an over-taxation of returns on nominal assets in comparison to real assets, and therefore affects investment decisions negatively (Sorensen & Whitta-Jacobsen, 2005). Additionally, when there is no change in income tax levels or classes when nominal incomes are increased by inflation, individuals will suffer under higher tax levels regardless of the fact that their incomes are unchanged. The function of money as exchange medium is weakened by high inflation rates, since it serves as a tax on retained cash. In addition, high inflation results in an overinvestment by the financial sector that extends to support firms and individuals to avoid some inflation costs (English, 1996).

Besides masked relative scarcity changes, the following inflation disadvantages are identified by Rossouw (2009):

- Savers are negatively influenced, because the capital value of their savings decreases as the value of money declines with rising prices.
- People with fixed incomes lose, for example pensioners, because their buying power decreases.

- Shifting the focus from production to investing in assets and other collectables as a form of price hedging.
- When hyperinflation conditions rule, resources are wasted, for example the inflation rate is higher than 1 000 per cent per annum (SA has never experienced), as prices have to be updated regularly and this is a costly procedure.

The SARB's strategy is to lend money to banks at an interest rate that will ensure that inflation is controllable. The SARB does not aim for interest rates to be unreasonably high, but at a level to be able to accomplish their inflation target of three to six per cent (Rossouw, 2009). Therefore, the next section will discuss how monetary policy decisions are made in order to reach their inflation target. As part of this section, interest rate rules will be discussed as part of monetary policy decision-making, as well as the downfalls of these rules.

3.5 HOW POLICY DECISIONS ARE MADE

Interest rates are used as an instrument to manage the behaviour of the South African economy. The repo rate, which is the rate at which commercial banks borrow from the SARB, are also determined by the SARB itself. The SARB applies a rule to decide whether interest rates should be increased or decreased. When the economy experiences excessive inflationary increases, interest rates will most likely increase and as a result increase the cost of money. With the higher cost of money, spending on goods and services by the public will decline, limiting demand and therefore the inflation rate will decrease. Spending is the anchor in any economy, and therefore the objective is to stimulate spending and economic growth in such a way that inflation is kept within its target. When inflation is within its target range, interest rates are likely to decline in order to stimulate spending and economic growth. When this happens, interest rates are used by the SARB as a means to achieve desired economic growth rates. Inflation reacts to policy and interest rate changes with a time lag; therefore, interest rates will be adjusted based on the expected future rate of inflation (Heistein, 2011). The next

subsection will describe the rules that monetary policy uses to make policy decisions, which is crucial to obtain the ultimate objective of price stability.

3.5.1 Monetary policy rules

Monetary policy rules or reaction functions explain the reaction of policy instruments to divergences in core macroeconomic variables from relative positions that monetary authorities view as optimum (Loayza & Schmidt-Hebbel, 2002). Research on monetary policy rules made an improvement with the ground-breaking work of Taylor (1993). For example, the policy rules where interest rates react to gaps in output and inflation are now called “Taylor rules”. In reality, various international central banks apply a short-term interest rate as policy instrument. Central banks react to gaps in output and inflation when deviating from targeted levels.

The two primary arguments in monetary policy reaction functions are these gaps or deviations. The first argument proposes that certain central banks respond to a key open-economy variable, for example the current account deficit or the exchange rate when determining the monetary policy. This is also a monetary policy rule, but different from the Taylor rule, because the Taylor rule does not include the current account deficit and the exchange rate. The second argument states that some policy rules incorporate previous values of the interest rate to reflect a degree of inactivity in the behaviour of central banks. Different central banks use different time dimensions for the variables in their reaction functions, for example some include current values of the gaps, others include estimated future or lag values or both (Loayza & Schmidt-Hebbel, 2002).

Taylor rules are seen as the fundament or essential rule in monetary policy decision-making. The normal Taylor rule determines that the central bank’s policy rate is a linear function of actual or expected inflation and the actual or expected output gap. The output gap is a measurement of how much output deviates from capacity or trend output (Aron & Muellbauer, 2000).

The monetary policy rule by Taylor (1993) is structured as follows:

$$i = \bar{r} + \pi + h(\pi - \pi^*) + b(y - \bar{y}), \quad h > 0, \quad b > 0 \quad (3.1)$$

The parameters h and b are directly determined by policy-makers under the Taylor rule, but it is affected by policy-makers' aversion towards inflation and output instability. Taylor considered it important that the value of h must be larger than zero in order for inflation to increase when the real interest rate increases. When $1 + h$ is smaller than one, an inflationary increase will decrease the real interest rate by $1 - \pi$, hence feeding inflation through the stimulation of aggregate goods demand, which causes financial instability. Taylor proposed that when $h = 0.5$ and $b = 0.5$ it will promote sound economic performance (Sorensen & Whitta-Jacobsen, 2010). The Taylor rule is represented by the following components: i is the nominal rate of federal funds, $\bar{r}$ represents the real interest rate, π is the real inflation rate, π^* the expected/targeted inflation rate, y the real GDP and $\bar{y}$ the potential GDP when the economy is at full employment of resources. $(y - \bar{y})$ represents the current production gap and h is the central bank's response coefficient that represents "the difference between the actual inflation and targeted inflation to the nominal interest rates, while b is the growth response coefficient of the central bank that reflects the difference between the actual nominal income and the potential national income to the nominal interest rate" (Çaglayan & Astar, 2010:3).

A peculiar example of the Taylor rule is when the weight on the output gap is zero, which is also known as pure inflation targeting. In this situation, the policy rate only reacts to expected inflation. A specific and commonly implemented modified Taylor rule is to allow the central bank's rate to partially adjust. This supports the view that most central banks want to keep their interest rates as stable as possible. Smaller economies, which are affected by international capital mobility, need larger modifications, because a country's interest rates will most likely pursue foreign rates. Over the long run, it is expected that nominal exchange rate changes pertain to differences in various countries' inflation rates. In other words, this means a small

country's real interest rate is supposed to generally pursue foreign real rates (Aron & Muellbauer, 2000).

3.5.2 Limitations of linear Taylor rules

Empirical literature points out the problems with the original Taylor rule. The first problem is that it relies largely on approximated variables, in other words the output gap and real interest rates are hard to determine in reality, despite being robust in concept. The second problem pertains to the difficulty in measuring a precise level of the equilibrium real interest rate, for this variable has the tendency to change over time (Adema, 2003). Additionally, the original Taylor rule received some critique for depending on *ex post* data. Thirdly, the best or most suitable measure of the potential output gap applied for calculating the output gap is not easily identified, because in reality the estimation of potential output varies over time as a result of data revision (Ncube & Tshuma, 2010).

Research exposed the fact that certain authors questioned the underlying premises of linear models, for example the existence of a quadratic loss function. Woglom (2003) revealed that estimating the original Taylor rule of the US Fed did not include the interest rate smoothing term; however, various central banks presently apply the lagged interest rate to demonstrate their preference for interest rate smoothing. Furthermore, the original Taylor rule does not include the influence of the exchange rate, which plays a significant part in economic development (Ncube & Tshuma, 2010). Lastly, Olmedo (2002) identified another downfall by querying these assumptions on the grounds that policy-makers will not include the business cycle stance when carrying out monetary policy. As a matter of fact, he suggests that central bank behaviour is asymmetric over the business cycle.

As indicated in section 3.5.1, interest rate reaction functions were usually developed by applying the linear Taylor Rule. This may have been assigned to the impression that linear models, in some situations, give a perception of providing sensible estimates to

the precise nonlinear interactions (Ncube & Tshuma, 2010). Research by Petersen (2007), Castro (2008) and Cukierman (2004) concentrated on nonlinear models in developed countries; however, there is a shortage of research in emerging markets, especially in SA. This created the possibility to apply nonlinear models to characterise the conduct of the SARB applying interest rate functions. Taylor (1993) stated that the Taylor rule accepts that interest rates decline with 0.5 percentage points for every percentage point that the real GDP decreases below its potential. This decrease in the interest rate will support sustained price stability and decrease the possibility of a recession.

Having more clarity on how monetary policy decisions are made and the rules central banks use as well as the downfalls of these rules, it is crucial to understand the following: How these decisions affect the economy as a whole and to establish how or if these decisions have spillover effects to asset prices, credit growth and ultimately financial stability. The next section will discuss the influence that monetary policy has on the South African economy by discussing the monetary transmission mechanism as well as the asset price channel of the transmission mechanism.

3.6 INFLUENCE OF POLICY ON ECONOMY

Monetary policy has an influence on financing terms in the economy (on the costs and credit availability or how willing banks are to presume particular risks) and in addition it also influence what is expected from inflation and economic activity. Monetary policy may influence goods prices, asset prices, exchange rates and investment and consumption (OENB, 2013). How this happens is described by the transmission mechanism, which will be discussed in the following three subsections.

3.6.1 Theory on the monetary transmission mechanism

Over the short term, monetary policy is an important instrument to stabilise output and inflation (Bernanke & Gertler, 1995). Mishkin (2007) stated that inflation expectations that are anchored by monetary policy ought to hold back increases in expected inflation

by interacting suitably with the output gap. The channels, through which the economy is affected by monetary policy, as well as the timing of these effects, should be clearly understood by policy-makers (Mishkin, 1995). Changes to monetary policy affect individual real variables with many lags and different durations (Bernanke & Gertler, 1995). According to Boivin, Kiley and Mishkin (2010), policy-makers should have extensive knowledge of the transmission mechanism that will support the evaluation of the current position of monetary policy, as well as the effectiveness of monetary policy in obtaining its objectives. The kind and relative magnitude of policy measures affect the magnitude of the effect on real economic activity (Brink & Kock, 2011).

The monetary policy transmission mechanism explains how and through which channels monetary policy influences the economy. This procedure is controlled by the monetary policy framework, financial system and the real economy (Mohanty & Turner, 2008). The dynamic characteristics of the economy and financial markets, institutional credit market alterations and the approach of monetary policy may compromise the transmission mechanism as well as its effectiveness. As a result, when practically analysing the transmission mechanism, it has to be done for a specific country.

3.6.2 The importance of the monetary policy transmission mechanism

Since the introduction of the new monetary policy framework, the SARB stressed the importance of the relative functions of interest rates and the exchange rate in the transmission of the monetary policy by focusing its research on it. As a result of the future expectation nature of the inflation targeting framework, it is a necessity to notice and understand the time lag between an action taken from the monetary policy until the effect shows in the real economy and finally on inflation. Long time lags exist in the transmission mechanism, for example a change in monetary policy will take time to affects the inflation rate. These time lags will differ for each country and also for different time periods for the same country. Differences in the financial structure contribute to asymmetries in the monetary policy transmission. Generally, lags varied from 12 to 24

months; however, with fast market innovations and globalisation, lags may change (Casteleijn, 2001).

Evidence from the industrialised countries of the world proved that the average time for reaction to monetary policy changes to have the optimum influence on demand and production is up to one year. Furthermore, it takes approximately two years for these changes in activities to have their greatest effect on the inflation rate. South African Reserve Bank research revealed that the South African transmission mechanism has international exposure. Nevertheless, it also confirmed that average time lags tend to differ from economy to economy and some degree of uncertainty between different points in time remains. This will depend on various elements, for example the stance of business, the level of confidence under consumers, the phase of the business cycle, present world economy events and future inflation expectations. Monetary policy authorities do not have direct control over these other influences, which merge with slow adjustments that guarantee a monetary policy with long, changing and changeable lags (Casteleijn, 2001).

The extent of change in a central bank's interest rate is not a sound indicator of the possible influence of monetary policy on the economy. When the rand exchange rate, market interest rates, credit or other asset prices do not respond significantly to official interest rate changes, monetary policy will have no meaningful effect on the economy, in other words the channels are obstructed or not functioning as they should (The Economist, 2001).

In South Africa, the influence of changes in the repurchase rate on the economy was explored by Smal and De Jager (2001). When the repurchase rate is changed by the SARB, it initiates a series of economic events, called the 'transmission mechanism of monetary policy'. The main connections in the monetary policy transmission mechanism are explained and illustrated below in Diagram 3.1. The repurchase or repo rate is seen as the primary instrument for monetary policy. Interest rates, the exchange rate, money and credit, other asset prices and decisions on spending and investment are directly

impacted by the repo rate. Therefore, when the repo rate is changed, it influences goods and services' supply and demand. The comparative pressure of demand and supply capacity of the economy is a crucial element that influences the country's inflationary pressures. Inflation develops from the labour market and/or the services and goods market, and in addition imported inflation that is affected by changing exchange rates (Smal & de Jager, 2001).

Interest rates are changed by central banks in order to stabilise the economy after shocks. Therefore, when the economy is successfully stabilised, inflation and output are more prone to remain stable, as opposed to the trend of fluctuating interest rates. This is firstly a result of interest rates being a tool to influence output and inflation, that the *ex post* relationship between interest rates, inflation and output's nature are uncertain. It is therefore often wrongly concluded that monetary policy instruments are weak and not needed in a stable economy. It was concluded that what seems to be a decrease in the monetary policy's impact is actually a statement of improvement in the control or management of monetary policy since 1980. Central banks' response improved by reacting quicker to changing economic expectations. Therefore, the influence of interest rate shocks was evened out and decreased the volatility in output and inflation (Smal & De Jager, 2001).

There are various steps in the South African monetary transmission mechanism that are presented below in Diagram 3.1. Firstly, when the SARB changes the repo rate, it influences market interest rates (deposit and lending rates), asset prices, nominal exchange rates and expectations. Secondly, when there are changes in these variables, it results in changes to consumption and investment due to the effect on the elements of net external and domestic demand (imports and exports). There are four distinct ways through which monetary policy-induced alterations in market interest rates, asset prices, exchange rates and expectations can influence the elements of aggregate demand. They are the exchange rate channel, interest rate channel, other asset prices channels and the credit channel (Sichei, 2005). In concurrence with Mishkin's (1995) opinion, the bank-lending channel can be described as follows. When the SARB increases the repo

rate, it inhibits banking deposits and the demand for loans, which are necessary to finance consumption and investment. National income or prices may also decline, but this will depend on aggregate demand and supply elasticity.

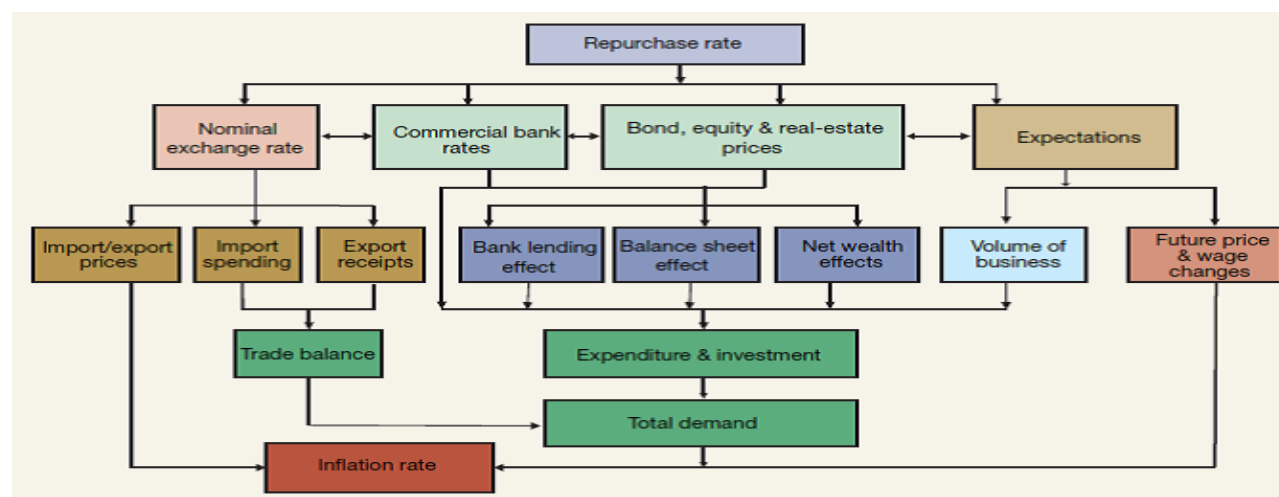


Diagram 3.1 Monetary Policy Transmission Mechanism

Source: Monetary Policy Review, May 2004

3.6.3 The asset price channel in the monetary transmission mechanism

Theoretically, an expansionary monetary policy will result in an increase of share prices increasing the attractiveness of investment, and therefore aggregate demand rises. As a result, the increase in share prices will in turn lead to an increase in wealth that first raises consumption and therefore aggregate demand. The relationship between a larger supply of money and increased share prices may be discussed from a monetarist or a Keynesian point of view. In the monetarist viewpoint, when money increases, it raises the wealth of consumers and asset prices and therefore household and enterprise expenditure on assets (Meltzer, 1995), as opposed to the Keynesian viewpoint where interest rates decrease, increasing the desirability of share markets (Loayza & Schmidt-Hebbel, 2002).

Asset prices and credit markets are fundamental in the monetary policy transmission mechanism. Credit markets support and encourage the exchange of funds to attain investment assets that will lead to the accumulation of wealth. Investments of this kind,

for example real estate and listed shares, are acquired when prices are expected to increase with the inherent assets serving as collateral. Investment that is funded by credit stimulates an increase in asset prices and as a result validates the anticipated increase. In addition, collateral values experience an increase and loan-to-value (LTV) ratios decreases. This leads to additional credit growth and reduces the perception of risk (Brink & Kock, 2011). Aglietta and Scialom (2009: 7) described “this circular process as a vicious circle of increasing asset prices leading to an increase in the ratio of share to debt with a concomitant decline in the probability of default and increased leverage.” It was concluded that credit markets’ tendency to proceed to extremes, closely correlated with asset prices.

In the case of SA, a practical approach analysis is made, handling matters related to bank credit, followed by broader credit market issues, the exchange rate and asset prices (Brink & Kock, 2011). Various studies argued that monetary policy is mainly carried through asset price and credit channels, with secondary incorporated anticipations, risk taking and international transaction channels. Inside the asset price channel, interest rates are a monetary policy instrument as well as a responsive variable. The latter mainly concerns the influence of prices and yields of debt instruments. Interest rates influence exchange rates, equities and house prices inside the asset price channel. The interest rate channel is improved by the credit channel and has an effect upon asset prices (Brink & Kock, 2011).

Financial disruptions influence the transmission mechanism and channels respond unlike those in the majority of central bank models. Leverage that is in excess and maturity information stimulate fast asset price increases and credit extension. With this relation’s terms reversed, shocks to liquidity and de-leveraging are the force behind financial instability and crises. Monetary policy-makers have the perception that asset prices and credit extensions are always responsive to interest rates. The global financial crisis proved the opposite, where de-leveraging and the collapse of asset prices took place in spite of ‘ultra-loose’ monetary policies in certain countries (Brink & Kock, 2011).

Landau (2011: 2) stated that before the crisis there was a built-up of excessive leverage and fast growing asset prices, in spite of reasonably high interest rates.

With this overview regarding the linkage between asset prices, credit and financial instability, the next section will commence with a discussion of financial stability versus price stability. In addition, the duality between monetary policy and financial stability policy will be discussed as well as the monetary policy instrument problem experienced in 2010.

3.7 FINANCIAL STABILITY VERSUS PRICE STABILITY (SEE ALSO SECTION 2.3.2)

The question that should be addressed is whether price stability is a sufficient prerequisite for financial stability (White, 2008). According to Guma (2009), in ordinary situations it is enough, and beyond the usual situations it is insufficient. This is why policy-makers should make some decisions based on their own discretion. Acting solely on the rules or stipulations of a constant policy position will most likely not achieve the optimum results when circumstances significantly change, for example the recession in 2009.

However, the suggestion that price stability and financial stability are not 'mutually exclusive', but surely are connected, is attracting interest. This is because the monetary transmission mechanism in contemporary, market-orientated economic systems is grounded on the following premises (Guma, 2009):

- Existence and efficient operation of credit markets.
- Central bank's policy rate is the main determinant of interest rates in the credit market.
- Stable, rational and foreseeable relationships between money and credit are evident and between a multitude of macroeconomic variables.
- Supply and demand of credit are balanced, partially by the interest rate.

When credit markets stop to function, or do not function optimally, one of the channels of conventional monetary policy ceases, or the channel becomes inefficient. It demands the regaining of financial stability, since financial instability can possibly cause large macroeconomic costs, including a negative influence on production, consumption and investment. Therefore, it damages the broad objectives of enduring economic growth, full employment and the development of the society. As a result, it may be essential for central banks to formalise the unstated premises above, with the objective of limiting financial instability and to stimulate monetary policy's effectiveness (Guma, 2009).

The International Monetary Fund (IMF), the Bank for International Settlements (BIS), and the G-20 stated that central banks should at least be capable of the following (Mnyande, 2009):

- Systematic threats should be identified at an early stage.
- Promote measures to minimise these threats.
- Formulate and examine plans for the occurrence of certain events and crisis preparation.
- In abnormal situations, safety-net standards should be implemented for systematically important financial institutions' backup.
- Financial market confidence should be preserved to ensure effectively functioning markets.

Prior to the global financial crisis, there was a general agreement or perception that price stability and financial stability complements one another, in other words monetary policy and financial stability policies are reciprocally empowering each other. However, the crisis demolished this perception. With the crisis, the global financial sector crashed in an environment of abnormal price stability (Subbarao, 2012). Therefore, it can be argued that price stability is necessary, but not always sufficient for financial stability.

On the other hand, Papademos (2009) stated that in normal circumstances, price stability and financial stability reciprocally reinforce each other, therefore the quest for the pertinent policy objective does not necessitate any trade-offs. Price stability

promotes financial stability in various ways. For instance, the majority of financial contracts are in nominal terms, therefore stable price environments keep arbitrary income and wealth redistribution among lenders and borrowers from happening, which may be the cause of unforeseen price developments and in turn results in financial stress and potential defaults. In addition, Papademos (2009) stated that when price stability is credibly maintained by the central bank, it supports financial stability. This is achieved by grounding the anticipated inflation rate to price stability, and as a result the risk of deflation will decrease.

According to Marcus (2010), there is yet no general understanding of what the central banks' role should be with regard to financial stability or what exactly the true meaning of financial stability is. There is, however, almost no question that central banks should not only be responsible for price stability but should also fulfil a function in financial stability. The question still remains whether financial stability should be the sole responsibility of central banks. In South Africa, the following bodies were established to promote financial stability: (i) the National Credit regulator was founded to ensure creditworthy and effective borrowing and lending in South Africa and in addition to keep irresponsible credit extension from happening; (ii) the Financial Services Board is in place to manage markets and insurance industry activities. Therefore, it will not be easy to define a financial stability objective for the central bank alone and, in addition, it will be hard for the central bank to have sole responsibility for financial stability functions. This demand for sharing the responsibility of financial stability (Marcus, 2010) is in line with the duality of monetary policy and financial stability policy.

3.7.1 Duality between monetary policy and financial stability policy

Central bankers were cognisant of the damaging effect that financial disturbances can have on the economy, even before the recent crisis. Therefore, various central banks published financial stability reports in addition to their monetary policy reports in order to consider threats to the financial system. Nevertheless, central banks' general equilibrium frameworks did not comprise financial frictions as a significant cause of

fluctuations in the business cycle. This resulted in the duality among monetary policy and financial stability policy where they are carried out individually. Monetary policy instruments will concentrate on keeping inflation and output gaps as low as possible. Prudential regulation and supervision will then have to preclude inordinate risk taking that may cause financial instability (Mishkin, 2011). According to Mishkin (2011), the majority of central bankers backed the duality among monetary policy and financial stability policy. However, some central bankers were of the opinion that monetary policy must handle problems with financial stability, especially in connection with the reaction to possible asset price bubbles (see section 3.8.1, 3.8.2 and 3.9). This leads to the question of which should be used.

3.7.2 The monetary policy instrument problem in 2010

The modern consensus that was applied before the financial crisis was most recognisably formulated by Bernanke and Gertler (1999). It was constituted that there should not be any *ex ante* reactions to asset market fluctuations over and above the effects that these variations have on inflation and real output expectations. In the modern consensus view of a flexible inflation targeting regime, Bernanke and Gertler (1999:19,22) state that price stability and financial stability complement one another.

There are several arguments for excluding asset prices as a clear-cut objective of monetary authorities' interest rate policy, but the extent of the global financial crisis urged for a revision of the 'mop-up-afterwards' approach of asset price bubbles (Mishkin, 2008; Blinder, 2008). There is now a clear distinction made between the different types of asset bubbles (see section 2.3.1 and 2.6), "with the old consensus still believed to be applicable to bubbles on the stock market and where bank credit played a small part ("share bubbles" in Mishkin's (2008) terminology)" (Du Plessis & Du Rand, 2011:5). This was not the case with asset bubbles, where the cheap supply of credit by banks fulfilled a key function ("credit bubbles" in Mishkin's (2008) terminology).

It is argued that the knowledge problem and the instrument problem in cases of credit bubbles are not as serious as previously thought. Central banks that fulfil regulatory and supervisory functions have more information on bank lending and discretion in comparison to the knowledge on essential back-up for stock market prices. Additionally, central banks possess the ability to regulate which may be used with sovereign power in credit lending that is supporting an asset bubble; tools to direct banks' way of conduct (Du Plessis & Du Rand, 2011).

Distinguishing between the types of asset bubbles is reasonable and acts as a means through which valid *ex post* interpretations of events, for example the Great Crash of 1929, the asset price boom and bust that Japan experienced, as well as the recent financial crisis (Mishkin, 2008) can be explained. Nevertheless, acting on credit bubbles demands an *ex ante* investigation of the bubble, and there is no supporting proof that the United States Federal Reserve System (US Fed) was capable of doing it with the recent crisis. Alan Blinder, US Fed Deputy Governor, viewed the possible risks to the different aspects of US monetary policy (in the time of the credit bubble) and summed it into a risk management matrix (Du Plessis & Du Rand, 2011). There were risks evident to inflation, employment and aggregate demand, and supply-side shock. Most importantly, he considered the risk level of the banking and credit sector as low, stable and supported by heavy risk management (Blinder, 2005) (see Table 3.1).

This misperception calls for improved monetary policy models to enable a person to identify the rising banking-sector and credit risks. In the absence of these adjustments, the difference between share and credit bubbles “brings central banks no closer to a practical engagement with the risks of asset bubbles” (Du Plessis & Du Rand, 2011: 6). This increases the incentive for the type of model that Cechetti and Kohler (2010) suggested. Cechetti and Kohler (2010) suggested that financial stability should be a key objective for monetary authorities.

Table 3.1: A risk management matrix for the FOMC

Risk category	Level of risk	Direction of risk	Quality of risk management
Macroeconomic risks			
Inflation risk	Moderate	<i>Increasing</i>	Strong, but with long lags
Employment risk	Moderate	<i>Increasing</i>	Acceptable, with lags
Supply shock risk	<i>High</i>	Stable	<i>Weak</i>
Demand shock risk	Moderate	<i>Increasing</i>	Strong, but with lags
Financial risks			
Banking sector risk	Low	Stable	Strong
Credit risk	Low	Stable	Strong
Other financial sector risk	Moderate (varies by sector)	Stable	Varies by sector
Stock market risk	Low	<i>Increasing</i>	<i>Weak</i>
Bond market risk	<i>High</i>	Stable	Acceptable

Source: Blinder (2005: 12)

The next section will discuss asset prices in monetary rules and proposes two main arguments in order to determine whether this can support financial stability as discussed in section 3.7. Firstly, arguments that suggest that asset prices should be included in the monetary policy of central banks and secondly, arguments that suggest that they should be excluded.

3.8 ASSET PRICES IN MONETARY POLICY RULES

For a casual review of the macroeconomic results under inflation targeting, Figure 3.1 shows the movement in the Consumer Price Index (CPI) versus the GDP growth from 1994 to 2009. Economic (GDP) growth in South Africa has been relatively consistent and positive between two and six per cent, except in 2009 when there was a crisis in the financial market that led to the global recession. Inflation only surpassed ten per

cent in 2008 when the world experienced a commodity boom cycle. It should be noted that, from 1994 to 2009, the peak inflation point and the lowest growth were linked with the movement of asset prices. Inflation targeting seems to be effective in managing inflation with the least possible negative influence on growth (Mudau, 2010).

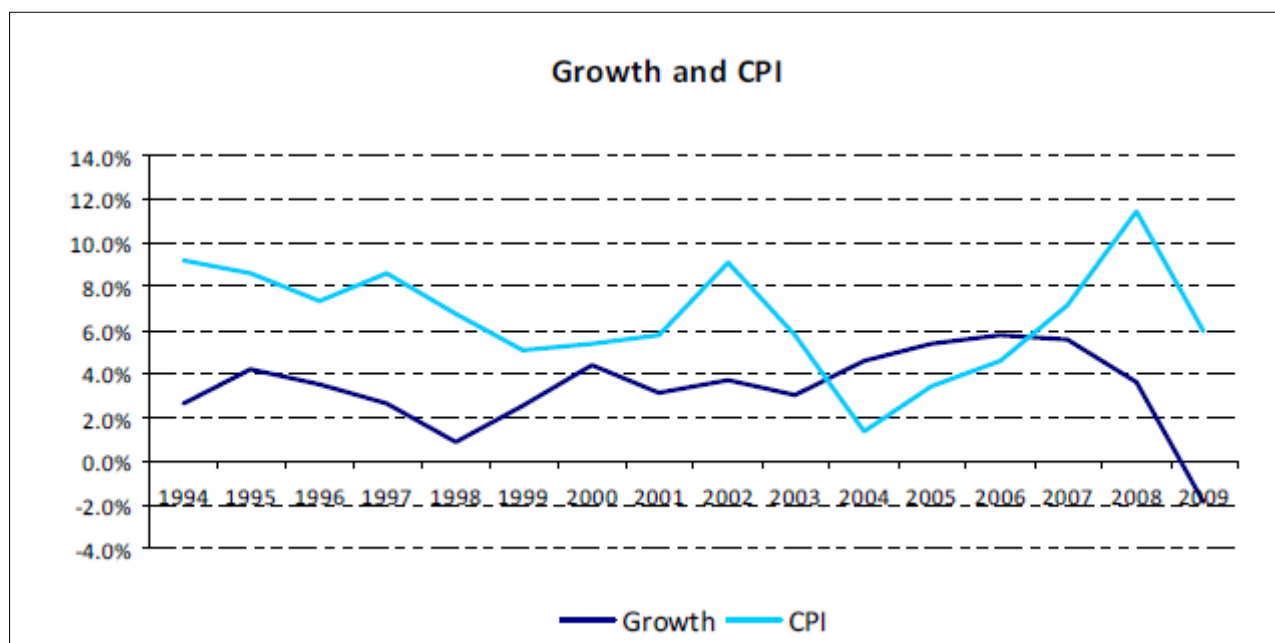


Figure 3.1: GDP and CPI: 1994-2009

Source: SARB Quarterly Bulletin

Regardless of the seeming positive influence that inflation targeting has in supporting macroeconomic stability, one of the downfalls is that it has a single goal, in other words asset prices are not controlled and fluctuate freely. According to Mudau (2010), this caused two debates against South Africa's current inflation targeting framework. Firstly, when the SARB targets the exchange rate, it will lead to low inflation environments with increased competitiveness. Secondly, to assure stable macroeconomic conditions and inhibit the influence that asset price shocks may have on growth, price stability and employment, it may be necessary to target asset prices explicitly. This study will only focus on the second argument, stating why monetary policy should include or act on asset prices or why it should not.

3.8.1 Argument for including asset prices in the monetary policy

A good theoretical argument is proposed for the inclusion of asset prices, for example stock and house prices, in monetary policy rules. Alchian and Klein (1973) argued that asset prices include useful information about future consumption. Their theory postulates that the measures traditionally used for inflation, for example Personal Consumption Expenditure, did not include the whole inflationary environment, since it did not include crucial wealth influence; and asset prices form part of the excluded information. Alchian and Klein (1973) used an inter-temporal consumption analysis and found that a price index used for inflation measurement has to include asset prices. Charles Goodhart is one of the acknowledged advocates of the theory that monetary policy should include asset prices for their capability to predict (Filardo, 2000). Goodhart (2005) was convinced that asset prices, especially house prices, consisted of prognostic information about the inflationary environment of the time yet to come.

Goodhart and Hoffman (2000) argue that asset prices and CPI are positively correlated and that asset prices, particularly house prices, help to predict inflation. Therefore, when asset prices are included into a broader inflation measure, named the Financial Condition Index, the central bank may amend inflation targeting and possibly output targeting. Goodhart and Hofmann suggest that by earlier tightening or relaxing its policy compared to the traditional monetary policy, inflationary pressures will be decreased by the central bank. This policy proposes more variations in the interest rate than the current monetary policy, therefore the protection of the banking sector will be needed (Goodhart, 1993). According to Tymoigne (2006), the IMF (2000) came to the same conclusion with their published report, *World Economic Outlook*, stating that the inclusion of asset prices into a broader inflation measure would empower inflation targeting.

Incorporating asset prices in a broader inflation measure entails that it would be excessive to include asset prices as an extra component in central banks' reaction function (i.e. the Taylor rule), since they are already part of the inflation measure. On the other hand, some believe that asset prices should have a solitary important role to

play in the reaction function (see for example Bryan, Cecchetti & O'Sullivan, 2002). It is argued that inflation targeting is amended by including expected inflation and asset price misalignments (Cecchetti *et al.*, 2000). Cecchetti *et al.* (2000) acknowledged that measuring these misalignments is not simple; however, they regard it no more difficult than calculating potential output. Cecchetti *et al.* (2000) reasoned that the central bank should therefore respond to all misaligned asset prices. This does not imply that the central bank must target asset prices or attempt to burst asset bubbles; it entails sovereignly adjusting interest rates to counter asset price misalignments, with the sole and primary objective of amending inflation targeting. As a result, the central bank will cause a decrease in the fluctuations or movement in inflation and output (Cecchetti *et al.*, 2000). Even so, conflicting with Goodhart, they do not suggest that the Fed should change the interest rate with rapid movements. A cornerstone of their suggestion is that interest rates should adapt step by step, reacting to asset prices deviating from fundamentals.

Mudau (2010) tested whether asset prices have the ability to predict inflation in SA by regressing the lag of asset prices on CPI. Monthly data from February 2000 to January 2010 from SARB's Quarterly Bulletins was used for a linear regression analysis of CPI against one and two lagged variables of JSE All Share Index and the Absa House Price Index percentage changes. Lagged CPI was used as dependent variable. The results indicated that the overall model explained 55 per cent of the variance in CPI, and the regressors were jointly significant. Therefore, Mudau (2010) concluded that stock and house price lags have the potential to predict inflation in SA.

Mudau's (2010) regression results confirmed that asset prices, especially stock and house prices, do include useful information about future consumption prices. These results are in line with other econometric studies that studied the same issues, for example, Goodhart and Hoffman (2000), who concluded that stock and house prices in England hold valuable information on future inflation.

3.8.2 Argument for excluding asset prices in the monetary policy

The primary perspective of the authors supporting the new consensus (see section 2.3.2) is that asset prices must only be included if they have the ability to amend inflation forecasting and output growth forecasting. However, the new consensus supporters, for example Bordo *et al.* (2000), Bordo and Wheelock (1998) and Schwarz (1988), either state that asset prices do not strengthen inflation forecasting or they conclude about the irrelevance of asset prices when suitable weights are assigned to inflation and output in the reaction function (Tymoigne, 2006).

Bernanke and Gertler (1999, 2001) argued that flexible inflation targeting with a proactive approach is sufficient to ensure price and financial stability. There are four reasons that support this viewpoint. Firstly, this policy has increased concentration on stabilising aggregate demand; therefore, a possible wealth effect is covered. Secondly, Schwarz (1998) proposed that if there is no disinflation or deflation it improves financial stability. Thirdly, when inflation decreases, interest rates and asset prices decline, thereby limiting the influence on the balance sheet of asset prices, decreasing the weight of liabilities and decreasing the degree of balance sheet sensitivity to asset prices. Lastly, the cognition of economic agents to respond to asset prices if there is a possibility that they may influence output price inflation decreases possible overreactions and bubbles. Furher and Moore (1992) found similar results by proving that more weight on asset prices decreases inflationary control by the central bank.

It is argued that including asset prices in the monetary policy will not ensure increased macroeconomic performance, since any valuable information that asset prices supply is already contained in output. Output is in many ways affected by asset prices that also influence the behaviour of firms, households and lenders. For example, when stock prices increase, investment becomes more appealing to firms and simultaneously encourages lenders to supply funds to these firms (Mishkin, 2007). Therefore, stock prices influence output through their effect on firms' investment. Furthermore, household wealth is also influenced by stock prices. This effect can be compared to the influence of increased real estate prices on households. When stock and house prices

increase, households are stimulated to increase spending, and therefore aggregate demand and output also increase. As a result, valuable information that is included in stock and house prices will also be included in investment, consumption and output, which are already accounted for in the Taylor type reaction rules used by the SARB (Mudau, 2010).

Additionally, Gilchrist and Leahy (2002) argue that asset prices and especially stock prices are influenced by several other elements that may not be relevant to future consumption and therefore they are not sufficient to indicate future consumption. Including asset prices in monetary policy rules may have spurious results and lead to incorrect policy actions. For instance, volatile stock prices can be the result of sudden outbursts (protests) and the actions of traders. These causes are not associated with future consumption in any way. This was Van der Merwe's (2004) primary argument, a former economist at the SARB. Circumstances or elements may change asset prices that are in no way associated with future consumption; therefore, it is not straight forward to determine the cause of the change in asset prices. Mishkin (2007) supported this view and verifies that the difficulty in determining the cause of asset volatility makes it dangerous for monetary policy to target asset prices, since it may lead to unwanted and destructive monetary policy responses to economic shocks (Mudau, 2010).

Viegi (2006) argues that monetary policy is unable to effectively handle shocks in asset prices without making a compromise in terms of its price stability objective. However, this is not always the case, as proven by recent history. In certain cases, monetary policy authorities have to react to changes in asset prices to isolate the real economy from the adverse effects. This raises the question as to what degree monetary policy should act on asset prices. This question is partially answered by Bernanke and Gertler (2001); they argue that there are two pre-conditions that should be met before monetary authorities can act on asset price fluctuations or significant increases. Firstly, fluctuations in asset prices must be the result of non-fundamental factors and secondly, these fluctuations must have an influence on the real economy. These conditions were evident with the financial crisis of 2008. The crisis developed with credit defaults, which

is a non-fundamental factor and caused a sustained international recession. However, Madau (2010) notes that asset prices experience regular boom-bust cycles, and it is hard to determine beforehand whether they will affect the economy.

The previous section discussed whether asset prices should be included in or excluded from the monetary policy of central banks. The next section will supplement the previous section by discussing whether central banks should react to asset prices when a bubble forms and will evaluate whether the cost of bursting the asset price bubble is higher than the cost of leaning against the bubble.

3.9 LEAN VERSUS CLEAN DEBATE OF ASSET PRICE AND CREDIT BUBBLES

Before the global financial crisis (GFC), economists believed that the cost of bursting an asset price bubble is lower than leaning against the bubble. Alan Greenspan proposed that monetary policy should rather clean up after the burst of an asset price bubble, instead of leaning against asset price bubbles (Greenspan, 2002). In this same vein, it is argued that bursting the bubble has severe effects on the economy, as was the case with Japan after their stock market and real estate bubble burst. However, Posen (2003) argued that Japan's subsequent policies were to blame rather than the bursting of the bubbles.

The GFC subverted one of Greenspan's doctrine keystones that the cleaning-up cost after a bubble burst would be low. On the contrary, it is now known that the cleaning-up cost after the burst of an asset price bubble may be abnormally high when it is accompanied by a financial crises. The GFC decreased aggregate output and as a result there are additional costs that increase the total cost of bursting the bubble: Firstly, slow economic growth develops as a result of the financial crisis and secondly governments' budget position disintegrates (Mishkin, 2011).

The large costs involved with bursting asset price bubbles resulted in reconsidering the lean versus clean debate. When the GFC began, the debate concentrated on the

possibility for monetary policy to react to possible asset price bubbles. Due to the link between the house price bubble and credit market in the time before GFC, it is necessary to differentiate between two distinct types of asset price bubbles. The first type of asset price bubble is known as a 'credit-driven bubble' and the second type is known as an 'irrational exuberance bubble'. Both are asset price bubbles; the one is, however, more damaging than the other.

Mishkin (2010) indicates that there is one type of bubble, known as a 'credit-driven bubble', which can be very damaging as proven by financial history and the crisis of 2007-2009. The bubble develops starting with exuberant expectations of economic outlooks or financial markets undergoing structural changes, which leads to a credit boom and increased asset demand causing an increase in asset prices. The asset price increases result in more lending, increasing demand and additional asset price increases. The feedback loop could bring a bubble into existence, relaxing credit standards, since lenders are less concerned about borrowers' repaying power, but rather rely on additional price increases of assets to protect them from losses (Mishkin, 2011).

When the bubble bursts, the sudden drop in asset prices causes a reverse feedback loop, where loans disintegrate, lenders limit credit provision, asset demand decreases and prices plummet. The consequent loan losses and asset price decreases deteriorate financial institutions' balance sheets, limiting credit and investment over a wide range of assets even more. Business and household spending declines significantly with the lending decline, which undermines economic activity and causes large macroeconomic credit market risk. In severe cases, the relationship between the well-being of financial systems and asset prices after an asset price burst may threaten the successful functioning of the entire financial system. The second bubble is an 'irrational exuberance bubble', which is not as threatening as the first. It develops with over optimistic expectations and is far less dangerous to the financial system than the first (Mishkin, 2011). This study focuses on the first type, namely credit-driven bubbles.

The recent GFC not only proved that bursting credit-driven asset price bubbles is very costly, but also proved that it is very difficult to clean up afterwards. In addition, this type of bubble can develop in a stable price and output environment, in the preceding time period. A stable price and output environment may indeed promote credit-driven asset price bubbles, since market participants underrate the degree of risk in the economy. Therefore, leaning against possible asset price bubbles became more attractive than cleaning up afterwards. White (2009) and Caglianrini, Kent and Stevens (2010) suggest not to lean against potential asset price bubbles, which include both credit-driven and exuberant bubbles, but rather to lean against all credit-driven bubbles only. White (2009) and Mishkin (2010) agreed that it is more difficult to detect asset price bubbles than to detect credit bubbles. Financial regulators and central banks are many times informed that lenders decreased their insuring standards, risk premiums are extremely low or that the rate of credit extension is increasing very rapidly. The proposal that asset price bubbles are difficult to determine is, however, not a credible debate against leaning against credit bubbles, according to Mishkin (2011). Credit bubbles are different from asset price bubbles; where asset price bubbles form in the market for assets, credit bubbles develop in the credit market. The next subsections will discuss possible policy actions designed to address credit bubbles, namely macroprudential policies and monetary policy.

3.9.1 Macroprudential policies

Despite the strong debate of leaning against credit bubbles, the question of what policy is the most suitable should be answered. Firstly, it is crucial to know that the foundation to develop efficient policies to lean against credit bubbles is whether they rectify market failures. Credit extension inevitably demands taking risks. When risk taking is inordinate as a result of market failures, the probability of credit bubbles developing is high. Identifying market failures is an obstacle; therefore, it would be common to use prudential regulatory measures to restrain credit bubbles. Macroprudential regulation manages the links between financial firms that encourages externalities and excessive risk taking, concentrating on the stance of aggregate credit markets. Microprudential

regulation does not take these elements into account, but only focuses on the stability and financial soundness of individual firms (Mishkin, 2011).

Macroprudential regulation is used to limit the connection between asset price bubbles and the supply of credit. For instance, according to Mishkin (2011), research revealed that an increase in asset prices accompanied by a boom causes higher capital buffers at financial institutions, supporting additional lending in circumstances of a benchmark for capital sufficiency that did not change; in the bust phase capital value might drop sharply and may require a decrease in lending. Different macroprudential policies to restrain credit bubbles are dynamic provisioning by banks, lower ceilings of loan-to-value (LTV) proportions or higher haircut prerequisites for repo lending during credit enlargements, and Pigouvian-type⁶ taxes on specific financial institutional liabilities (Mishkin, 2011).

Certain policies aimed at addressing risks to financial stability from asset-price bubbles can fulfil a standard function in the regulatory system and will be functioning continually – whether or not a bubble was present. Still, if particular or new types of market failures drive a certain credit bubble, discretionary prudential policies can be applied to restrict market failures in such a situation. For instance, during specific time periods, risks among institutions may become highly correlated; therefore, discretionary policy can act upon these higher stress environments to minimise systemic risk (Mishkin, 2011). Because market failures are difficult to determine and credit bubbles are likely to develop in a high risk environment, the SARB should consider combining prudential regulation with their current monetary policy in order to limit the relationship between credit supply and asset prices to decrease the probability of future financial instability.

3.9.2 Monetary policy

The reality that the Federal Reserve's low interest rate policies from 2002 to 2005 were related to unreasonably high risk taking proposes that overly easy monetary policy may

⁶ "A Pigouvian tax is a tax levied on an agent causing an environmental externality (environmental damage) as an incentive to avert or mitigate such damage" (OECD, 2013).

encourage or stimulate financial instability. Theoretical and empirical evidence proposes that monetary policy may have an influence in creating credit bubbles. Borio and Zhu (2008) named this mechanism the 'risk taking channel of monetary policy'. The literature supplies two sound reasons why low inflation rates may encourage high risk taking. Firstly, Rajan (2005, 2006) suggested that low interest rates may increase asset managers' propensities to seek higher returns and therefore increase risk taking. Secondly, risk taking can be encouraged through income and valuation effects. When financial firms borrow for short time periods and lend for long time periods, it results in increased net interest margins and the firms' values are increased. Therefore, firms' ability to increase their leverage and take on risks is improved as a result of low short-term interest rates (Adrian & Shin, 2009, 2010; Adrian, Moench & Shin, 2010). Furthermore, low interest rates could increase collateral values ensuring more lending.

Monetary policy may promote risk taking in two additional ways. Firstly, a predictable monetary policy will decrease uncertainty and add to the underestimation of risk by asset managers (Gambacorta, 2009). Secondly, a monetary policy that cleanses financial perturbations by decreasing interest rates may cause a kind of moral hazard where financial institutions anticipate monetary policy to support them to recuperate from bad investments (Keiser, 2010).

The main question to be answered is: Should monetary policy be applied to lean against credit bubbles? In addition to the remonstrations above, if monetary policy is applied to lean against credit bubbles, the Tinbergen (1939) principle is violated, since monetary policy is required to stabilise the financial sector and the economy. Since macroprudential supervision can be used to stabilise the financial sector, the question is whether monetary policy can solely focus on price and output stability (Mishkin, 2011). It may have been a solution if macroprudential policies were successful in doing what they are supposed to do, which is not the case as a result of political pressure, since it directly influences the bottom line of financial institutions. Therefore, financial institutions will be highly motivated in an attempt to influence politicians to deter macroprudential policies that would stop credit bubbles. Mishkin (2011) therefore concludes that the

chance that macroprudential policies could be finessed and therefore not have the ability to restrain credit bubbles, proposes that monetary policy should have a role to play.

However, Mishkin (2011) supports the argument that using monetary policy might not work to lean against credit bubbles, since a tight monetary policy may be insufficient in constraining a certain asset bubble due to market participants regularly anticipating high return rates on purchased bubble-driven assets. On the contrary, evidence on the risk-taking channel (see section 3.6.2 and 3.6.3) of monetary policy proposes that increasing interest rates may dampen lending growth and inordinate risk taking. In addition, it is suggested that when the public anticipates that the central bank will increase interest rates when there is a possibility of a credit bubble forming, expectations in the credit market will act to ensure an efficient working policy. The prospect is that rates will increase with higher risk taking and will make this sort of action not as profitable and therefore will decrease the chance of interest rates increasing. Moreover, anticipations that increased risk taking will be accompanied by increased rates imply that interest rates will not have to be increased to such an extent to achieve the desired effect (Mishkin, 2011).

Even so, applying monetary policy to lean against credit bubbles has to be considered with caution and should be thoroughly investigated. This can cause a weakened economy at certain stages, or inflation can decline below the target that monetary authorities anticipated. This proposes a monetary policy trade-off among the inflation forecast target and pursuing financial stability. When the focus of monetary policy is on financial stability as well as price stability, it may cause confusion regarding the central bank's dedication to the inflation target, with possible negative influences on economic outcomes. An additional threat related to having monetary policy as an instrument to encourage financial stability is that it could cause a tightened monetary policy when it is not necessitated to restrain credit bubbles. An environment of low interest rates does not necessarily suggest that monetary policy is encouraging inordinate risk taking. The most important factor to realise is that monetary policy-makers demand instruments to

evaluate whether credit bubbles are forming. Borio and Lowe (2002) and Adrian and Shin (2010) searched for measures to detect the possible formation of credit bubbles. High credit growth, increased leverage, low risk spreads, heaving asset prices and surveys to measure whether the underwriting standard of credit is relaxed, are found to be important indicators that may support central banks to determine whether the risk of credit bubbles is approaching. A future crucial action for central banks would therefore be to monitor conditions in the credit market and the most beneficial methods of monitoring will be of utmost future concern (Mishkin, 2011).

3.10 CHAPTER SUMMARY

The main objective of this study is to determine the relationship between asset price growth, credit growth and financial stability, as well as the influence of asset price and credit growth on the real economy in South Africa. In order to reach this objective, one of the secondary objectives is to describe the current South African monetary policy and to assess its success in dealing with the financial crisis and to determine whether it can be adjusted in order to improve reaction to similar crises. This chapter contributed to reach these secondary objectives by commencing with a brief history of the South African monetary policy since the Second World War to date. Furthermore, the current monetary policy was discussed extensively by elaborating on how the current monetary policy functions and why South Africa implemented inflation targeting as the main monetary policy.

In addition, the ultimate objective of monetary policy, which is price stability, was discussed as well as the importance of low inflation for the South African economy. The advantages of low inflation were revealed as well as the cost of too high inflation. The South African Reserve Bank lends money to banks at a certain interest rate to ensure that inflation is under control. The objective is not for interest rates to be very high, but at such a rate so as to obtain the inflation target of between three and six per cent. Furthermore, it was determined that the SARB uses interest rates as a tool to manage the behaviour of the economy. It revealed that the South African central bank applies rules to determine whether interest rates should be increased or decreased. These

monetary policy rules are known as Taylor rules, where interest rates respond to output gaps and inflation. The literature also revealed the downfalls of these Taylor rules and suggested how monetary policy can be adjusted in order to control for these downfalls of the linear Taylor rules.

This chapter continued with a discussion of how monetary policy has an influence on the economy, where the monetary transmission mechanism was the centre of the discussion. The theory on the transmission mechanism as well as its importance was determined. The last part of the transmission mechanism explained the asset price channel of the transmission mechanism and in addition how the credit market has a role to play. Additionally, the connection between asset prices, credit and financial stability was determined in the light of the transmission mechanism. The chapter proceeded by discussing the adequacy of price stability as a monetary policy, as well as the bi-directional relationship between monetary policy and financial stability. The issue of whether financial stability must be of concern for monetary policy was determined and how monetary policy must react to financial imbalances was discussed.

A discussion of the monetary policy instrument problem that the South African economy experienced in 2010 led to two main arguments against the current monetary policy of inflation targeting. Firstly, it was argued that asset prices should be included in monetary policy rules, because it was suggested by Alchian and Klein (1973) that asset prices include information on future consumption. On the other hand, it was argued that asset prices should be excluded from monetary policy, where it was suggested that asset prices should only be included if they improve inflation and output growth forecasting. Authors, for example Schwarz (1988), suggested that it does not strengthen inflation forecasting and therefore should be excluded from monetary policy.

The chapter concluded with the lean versus clean debate of asset price and credit bubbles. This section discussed whether monetary policy should lean against asset price bubbles or whether they should burst asset prices bubbles where the costs of leaning against the potential bubbles or busting the bubbles are the highest. In addition,

it was determined that monetary policy should rather focus on credit bubbles and the two different types of credit bubbles were discussed. Lastly, the roles of macroprudential and monetary policies were discussed in order to manage these harmful credit bubbles and to isolate the adverse effects on the economy. Chapter 3 presented all the literature and arguments on monetary policy and whether monetary policy is effective. Arguments for and against including asset prices in monetary policy were presented and whether monetary policy should rather react to credit bubbles. Therefore, the next chapter will empirically evaluate the relationship between asset prices, credit growth and financial stability and determine whether the results support the literature and how policy should react.

CHAPTER 4: METHODOLOGY AND RESULTS

4.1 INTRODUCTION

In Chapter 1, the relationship between asset prices, credit growth and financial stability, as well as the potential destabilising effect that asset prices and credit growth can have on financial stability were discussed. The previous chapter summarised the history and current monetary policy of South Africa and the role that monetary policy plays in financial stability. It also proposed arguments as to whether monetary policy should react to asset price bubbles or credit bubbles in order to isolate the adverse effects of a bubble bursting on financial stability and the real economy. This chapter investigates the link between asset prices, credit growth and financial stability empirically with the aim to shed light on the debate whether South African monetary policy should react on asset price bubbles or credit bubbles. Two distinct analyses will be performed. The first will evaluate the influence that asset prices and credit growth has on the real economy, for example inflation, interest rates and Gross Domestic Product, as well as the relationship between these variables. The objective of the first analysis is to determine how interest rates and inflation are affected when asset prices and credit growth rapidly increase. The second will determine the influence that asset prices and credit growth have on financial stability, as well as the link between these variables. The objective of the second analysis is to determine what role rapid increases in asset prices and credit growth play in periods of financial instability.

This aim of this chapter is therefore to examine the effect of asset prices and credit growth on financial stability and the real economy. This chapter will commence with a discussion of the rationale behind the chosen method, followed by a discussion of the data that are used in the conduct of the empirical analysis in order to determine what influence asset prices and credit growth have on financial stability and the real economy. It will further describe the methods used to do determine whether there is any relationship between the literature and previous empirical studies and the case of South Africa. This will be followed by the results of the empirical study and a discussion of the results within the context of the literature.

4.2 RATIONALE BEHIND THE METHOD

The empirical analysis of this study will follow the procedures of two studies done by Assenmacher-Wesche and Gerlach (2008) and Goodhart and Hofmann (2008). This investigation showed that a significant multidirectional link exists between house prices, broad money, private credit and the macroeconomy. It revealed that house prices influenced credit and money, and shocks to house prices, credit and money significantly influence economic activity and aggregate price inflation. It would show that shocks to CPI, GDP and interest rates have a significant influence on money, house prices and credit. It additionally showed that the influence of shocks to money and credit on house prices is more pronounced when house prices are booming. Assenmacher-Wesche and Gerlach (2008) studied the relationships between economic activity, monetary policy, inflation, residential house prices, share prices and credit in 17 OECD countries between 1986 and 2006 using quarterly data. The dataset that was used consisted of consumer prices, real GDP, credit, three-monthly interest rates, share prices and residential house prices. All the variables were logged, except for the interest rate. The concern in determining the movements in asset prices flows from their influence on periods of financial instability. Both studies used a panel vector autoregression model when conducting their studies. There were a few points of difference between the two studies.

Firstly, Assenmacher-Wesche and Gerlach (2008) included share prices in their analysis, whereas it was excluded from the empirical study of Goodhart and Hofmann (2008). The reasoning behind the inclusion of share prices is the fact that it also experienced bubble-like periods and is therefore important for policy-makers. Secondly, Goodhart and Hofmann (2008) included money in their model, whereas Assenmacher-Wesche and Gerlach (2008) argued that policy discussions are structured in terms of credit, instead of monetary aggregates. This limits the development of an excessively large system and helps to identify structural imbalances, for it is complicated to distinguish between credit and money shocks. The following results were obtained.

Assenmacher-Wesche and Gerlach (2008) firstly found that monetary policy shocks had a three times larger influence on real GDP in comparison to house prices. Secondly, they discovered that house and share prices react with various speeds to monetary policy shocks, but to more or less the same extent. This suggests that it would not be easy for policy-makers to stabilise share and house prices simultaneously. Thirdly, shocks to the credit market were found to significantly increase the price level, real GDP and share prices. This proposes that the majority of the credit growth's variation is associated with expected real economic activity changes. The belief that when an economy experiences fluctuating credit growth it causes property price shocks was not backed by their results. Fourthly, a shock to house prices was found to have a significant influence on all the variables. Lastly, a shock to share prices only influenced real GDP and credit. This is in line with the belief that share prices are mostly determined by the short-term expectations of firms that drive credit demand.

Goodhart and Hofmann (2008) found the following results: A significant multidirectional relationship between broad money, house prices, private credit and the macroeconomy exists. Growth in money significantly influenced credit and house prices, while credit influences house prices and money, and house prices influence both money and credit. They additionally discovered that house prices, credit and money shocks influenced economic activity and aggregate price inflation. House prices, credit and money were significantly influenced when GDP, interest rates and inflation were shocked. Their results showed that when money and credit were shocked in times of booming house prices, the effect was stronger compared to normal periods.

4.3 DATA

Quarterly data from 1980's first quarter to 2012's third quarter is used for the empirical study's estimations. Data is obtained from the South African Reserve Bank (SARB), ABSA Bank and from the database of the International Monetary Fund (IMF) (International Financial Statistics, IFS). The following variables are used, following the study done by Assenmacher-Wesche and Gerlach (2008): real gdp (rgdp), total credit extended to the domestic private sector (cred). The banking stability index (bsi), which

is used as a measure for financial stability, was also collected from the SARB and consists of the following financial soundness indicators: capital adequacy, asset quality, profitability, liquidity and foreign exposure. The consumer price index (cpi), three-monthly treasury bills (int) and the all share index (share) are obtained from the database of the IFS. The house index (hi) is obtained from ABSA's house price index. Contrary to the study done by Assenmacher-Wesche and Gerlach (2008) and Goodhart and Hofmann (2008), this study only focuses on South Africa and not a panel of countries. The logs of real GDP and credit to the private sector were taken in order to make them more comparable due to the large figures and to linearise any possible trend. The other variables were not logged for they are either already in fractions (cpi and int), or indices (hi and share).

Share prices were included in the study since it was discussed in section 2.6 that asset prices consist of house and share prices. In addition to the bubbles experienced in the housing market, the credit market experienced similar bubbles and periods of high volatility. The sample included 131 observations between 1980Q1 and 2012Q3. Before the methodology, a micro-analysis of the variables will be provided in order to have more information on the data.

4.4 DATA DESCRIPTIVES

This section will describe the data to increase an understanding of the properties of the data and possible problems with the data, for example non-stationary. EViews 7 (QMS, 2009) is the statistical software used to perform all the tasks of descriptive statistics, graphs and the estimations represented by Figure 4.1, Table 4.1 and Table 4.2. Figure 4.1 is a graphical representation of the variables' individual graphs. The x-axis represents the time in years and the y-axis represents the nominal values of each of the individual graphs.

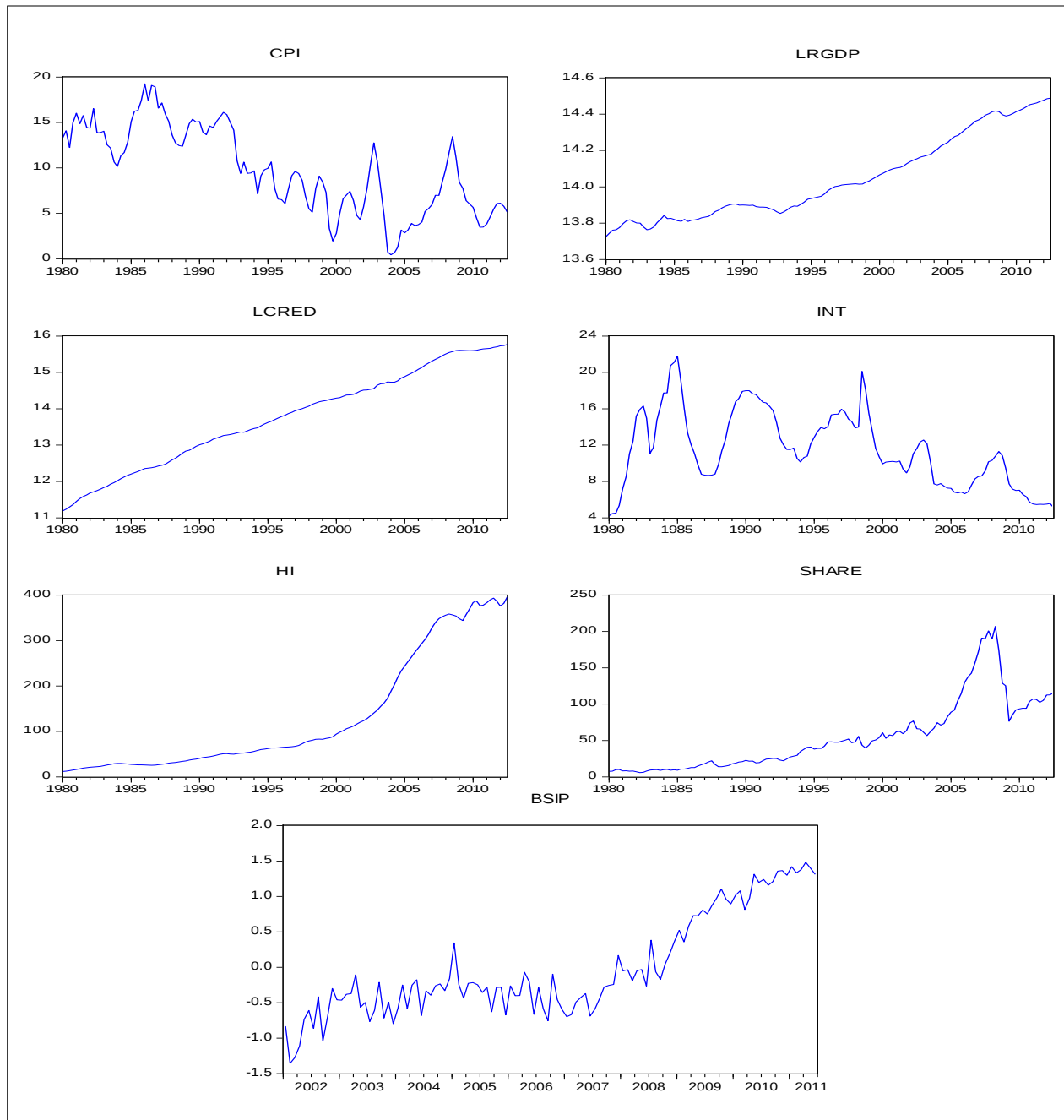


Figure 4.1: Multiple graphs of variables in levels

Source: Compiled by author

Figure 4.1 suggests a clear positive trend in lcred, lrgdp and hi. The variables, cpi and int, fluctuate, which can be as a result of monetary policy decisions made to influence the economy by adjusting the interest rate and consumer price inflation. The graphs also suggest a trend in the data, which calls for unit root tests to establish whether the

data is stationary. Before this, the next step is to elaborate on the descriptive statistics of the data to determine the data's distribution, skewness and kurtosis, which are represented in Table 4.1.

Table 4.1: Descriptive statistics of variables

VARIABLES	CPI	LRGDP	LCRED	INT	HI	SHARE	BSIP
Mean	9.771161	14.04194	13.74362	11.57873	130.3101	55.05968	-0.012763
Median	9.449275	13.98047	13.82200	11.06667	65.44199	43.53058	-0.251553
Maximum	19.25043	14.48786	15.76847	21.75000	396.2317	206.8654	1.481908
Minimum	0.437397	13.72567	11.19195	4.216667	11.83389	5.816932	-1.355540
Std. Dev.	4.682962	0.227296	1.322983	4.128719	128.4491	48.23991	0.714587
Skewness	0.032224	0.599968	-0.139873	0.280026	1.026886	1.299628	0.706081
Kurtosis	1.942896	1.985970	1.893471	2.276103	2.439666	4.184116	2.377935
Jarque-Bera	6.122193	13.47173	7.110376	4.572356	24.73689	44.53053	11.31053
Probability	0.046836	0.001188	0.028576	0.101654	0.000004	0.000000	0.003499
Observations	131	131	131	131	131	131	114

Source: Compiled by author

Kurtosis can be described as how peaked or flat the series is distributed, where a series that is distributed normally has a kurtosis of three. When the value is less than three, the series has a flat (platykurtic) distribution, relative to the normal and when the kurtosis is larger than three, it has a peaked (leptokurtic) distribution relative to the normal (QMS, 2009). In Table 4.1, it can be seen that the first five variables as well as the last have a kurtosis smaller than three, which suggests they are platykurtic, relative to normal and share prices have a kurtosis larger than three, which suggests it is leptokurtic relative to normal.

The next important indicator is skewness, which describes how the series is distributed around its mean. A series that is normally distributed has a skewness of zero. When skewness is positive, it is considered to have a long right tail distribution and when it is negative it has a long left tail distribution (QMS, 2009). Table 4.1 indicates that all the variables have a long right tail distribution (positive), except for lcred, which has a long left tail distribution. The Jarque-Bera is used to determine whether the series has a normal distribution. This is done by measuring the difference and kurtosis of the series with those of a normal distribution. The Jarque-Bera statistic has a null hypothesis,

suggesting that the data is normally distributed. Table 4.1 indicates that the null hypothesis of normal distribution can be rejected for all the variables at the 95% level of statistical significance, except for interest rates, which are rejected at the 90% level of significance.

4.4.1 Unit root test (Phillips-Perron test)

The next step is to test for the level of integration of each variable using the Phillips-Perron (PP) test. The reason for the use of the PP test instead of the Augmented Dicky-Fuller (ADF) test is because the possibility exists that the error term may be heteroskedastic. The PP test resolves serial correlation and heteroskedasticity in the error terms non-parametrically by adjusting the ADF test statistics (BATH, 2013). The PP test statistics may be seen as an ADF statistic that has been made robust to serial correlation using the Newey and West (1987) heteroskedasticity- and autocorrelation-consistent covariance matrix estimator. The PP test has a null hypothesis of non-stationarity, in other words the series contains a unit root.

Phillips and Perron (1988) suggested a nonparametric approach to control serial correlation when doing a unit root test. The PP test is based on the following equation (QMS, 2009):

$$\Delta y_t = \alpha y_{t-1} + x_t' \delta + \epsilon_t \quad (4.1)$$

Where:

- y_t is the dependant variable.
- x_t is an additional exogenous regressor that comprises of a constant and a trend, or only a constant;
- ρ and δ are parameters to be estimated; and
- ϵ_t is assumed to be a white noise⁷.

⁷ White noise is a random process or a random sample of variables (Diebold & Yielmas, 2007:324).

with an adjusted t -ratio and α coefficient in order to eliminate the influence of serial correlation on the asymptotic distribution of the test statistic. The PP test is grounded on the statistic:

$$\tilde{t}_{\alpha} = t_{\alpha} \left(\frac{\gamma_0}{f_0} \right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2f_0^{1/2}s} \quad (4.2)$$

Where the estimate is represented by $\hat{\alpha}$, the t -ratio of α is symbolised by t_{α} , $se(\hat{\alpha})$ is the standard error's coefficient and the test regression's standard error is presented by s . Additionally, γ_0 is a uniform estimation of the error variance in (4.1) (computed as $(T - k)s^2/T$, whereas k presents the number of regressors). Lastly, f_0 is the residual spectrum's estimator with a frequency of zero (QMS, 2009).

Table 4.2 shows the results of the unit root tests. The variables were tested using all three test criteria: trend, intercept and trend, and lastly none. The results below are, however, on the intercept criteria, but the other two criteria did not influence the 95% level of significance to reject or accept the null hypothesis. Table 4.2 represents the results of the variables in level format, as well as first differenced format.

Table 4.2: Unit root tests of variables in levels and first differences (Phillips-Perron)

	t-statistic	t-probability		t-statistic	t-probability
CPI	-1.504	0.5288	dCPI	-10.453	0
LRGDP	1.227	0.9982	dLRGDP	-6.095	0
LCRED	-2.708	0.0754	dLCRED	-6.098	0
INT	-2.501	0.1176	dINT	-6.949	0
HI	-1.92	0.9998	dHI	-3.788	0.0039
SHARE	-1.239	0.6562	dSHARE	-9.557	0
BSIP	-1.658	0.4496	dBSIP	-27.371	0.0001

Source: Compiled by author

As shown above at the 95% level of significance, one cannot reject the null hypothesis as all the variables are non-stationary in levels. The next step will be to determine the order of integration by performing the same tests as above on the first differenced level of each variable.

Table 4.2 (on the right-side of the table) indicates the 99% level of significance where the null hypothesis of non-stationarity can be rejected. In other words, all the variables are stationary in first differences; therefore, integrated of order one; $I(1)$. The next section will discuss the methods used in the empirical analysis conducted with EViews 7 in order to reach the main objective of the study, which is to determine what influence asset prices and credit growth have on financial stability.

4.5 METHOD

This subsection will discuss the methods used in the conduct of the empirical analysis of the study. It will elaborate on the theory of the methods and tests used, followed by a presentation and discussion of the results.

When determining the influence of various data series that are interconnected, a vector autoregression model is estimated to establish the dynamic effect that random disruptions or shocks have on the system of variables (QMS, 2009). This is also the case in this study; the variables are interrelated and it is difficult to determine the direction of causality. Furthermore, it may be possible that the independent variable is also explained by the dependent variable and *vice versa*, making it difficult to determine which variables are endogenous, and which are exogenous. According to Sims (1980), all variables should be treated as endogenous, which forms the basis for the development of VAR models. As a result of the difficulty to determine which variables should be exogenous and which should be endogenous, the VAR was chosen as the basic model of this empirical study and will be elaborated on in section 4.5.1.

4.5.1 Vector autoregression (VAR)

The empirical analysis is based on a VAR, which is presented as follows (Enders, 2010: 303):

$$y_{i,t} = A_0 + A_1 y_{t-1} + \dots + A_p y_{t-p} + \epsilon_{i,t} \quad (4.3)$$

An i -equation VAR, i -variable model is explained by lagged values of its own as well as current and past values of the remaining $i-1$ (endogenous) variables. There are two assumptions: firstly, that all the endogenous variables are stationary and secondly, that the errors are uncorrelated white noise.

The VAR model has three advantages and the three disadvantages. This first advantage is the fact that the model is relatively elementary, because all the variables are endogenous. Secondly, the model is easy to estimate, by estimating every equation on its own using OLS and lastly, good forecasts can be obtained from VAR models. The three disadvantages are: Firstly, VAR models are a-theoretical. Secondly, degrees of freedom are compromised and interpreting the results is complex. Lastly, the use of impulse response functions is difficult, because it is hard to determine how the dependent variable will respond when there is a shock in the error (Asteriou & Hall, 2007).

The ordering of the variables was chosen as follows: cpi, lrgdp, lcred, int and hi. The reason for the ordering of consumer price and output before the interest rate is standard from literature on the monetary transmission (Christiano *et al.*, 1999). The ordering of credit, house prices and share prices was based on the study by Assenmacher-Wesche and Gerlach (2008) and proposed the following argument. Credit is ordered before the interest rate, where house and share prices are ordered behind the interest rate. By enforcing a triangular identification framework, Assenmacher-Wesche and Gerlach (2008) presumed that output, consumer prices and credit respond only with a lag to shock in the monetary policy, where it is argued that house and share prices might react instantly. The same logical thinking was applied to different shocks in the system. For

example, when credit is shocked, output and consumer prices only react with a lag; whereas interest rates, house and share prices can respond to the shock within a quarter.

Before the VAR was estimated, an Ordinary Least Square estimation was performed in order to assess the data for any structural breaks. This was done to determine whether a structural or shift dummy should be included in the VAR as an exogenous variable. The test criterion that was used was the CUSUM test. The result is displayed in Figure 4.2 below. It shows that for the 95% level of significance there are no structural breaks, therefore no structural dummies are included. When the data has a short time dimension, dummies are likely to be included in the model and there is a small efficiency loss, because only a few dummies have to be included. In this case, the time dimension is large, which suggest that the inclusion of time dummies would have caused a substantial loss in efficiency (Goodhart & Hofmann, 2008).

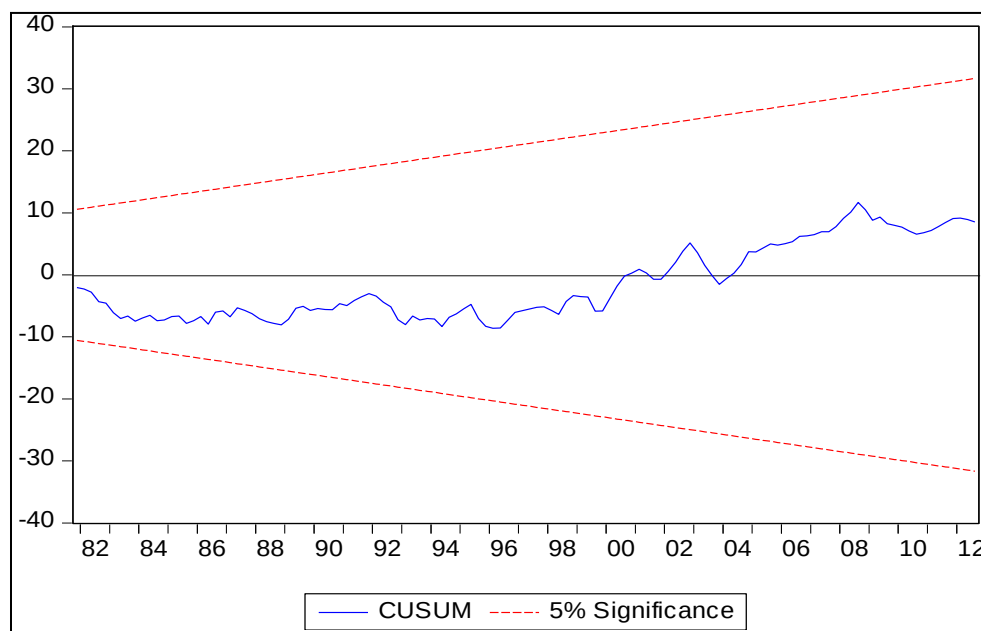


Figure 4.2: CUSUM Test for structural break

Source: Compiled by author

It is crucial to test whether the VAR is stable in order to determine whether we can proceed with the model. The AR roots table/graph describes the inverse roots of the

characteristic AR polynomial (Lütkepohl, 2005). The VAR that is estimated is stationary/stable when all the roots' modules are smaller than one and lie inside the unit circle. When the VAR is unstable, the impulse response standard errors are invalid. There will be kp roots, where p presents the largest lag and k the number of endogenous variables. When a Vector Error Correction (VEC) is estimated with r cointegrating relations, $k - r$ roots must be equal to unity (QMS, 2009).

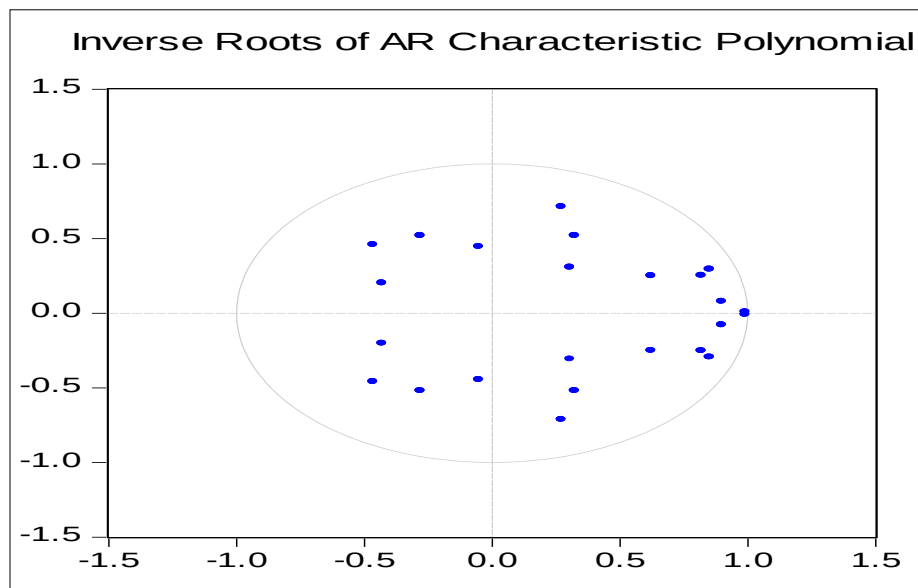


Figure 4.3: AR roots graph

Source: Compiled by author

As indicated in Figure 4.3 above, none of the roots lie outside the unit circle, therefore the VAR is stable and we may proceed with the model.

The next section will commence with the data analysis by continuing with the Johansen (1991) approach to cointegration, firstly determining the number of lags that should be included in the VAR. Secondly, it will discuss and test the presence of cointegration. This will be followed by the theory of the Vector Error Correction (VEC) model and causality tests, especially Granger causality tests.

4.5.2 Cointegration (Johansen)

The Johansen (1991) cointegration approach, which is a VAR-based approach, is used in the study. EViews 7 supports this test by using an estimated VAR or Group object. Consider a p order VAR (Hjalmarsson & Österholm, 2007: 6):

$$y_t = \mu + A_1 y_{t-1} + \dots + A_p y_{t-p} + \epsilon_t \quad (4.4)$$

where y_t is an $n \times 1$ vector of $I(1)$ non-stationary variables and ϵ_t is an $n \times 1$ innovative vector. Equation (4.9) can be rewritten as:

$$\Delta y_t = \mu + \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \epsilon_t \quad (4.5)$$

where:

$$\Pi = \sum_{i=1}^p A_i - I, \quad \Gamma_i = -\sum_{j=i+1}^p A_j \quad (4.6)$$

Granger's representation theorem states that when the coefficient matrix Π has a reduced rank, $r < n$, then $n \times r$ matrices, α and β , exist each with rank r so that $\Pi = \alpha\beta'$ and $\beta'y_t$ is stationary. The number of cointegrating relations is given by r and the cointegrating vector is given by every β column. The adjustment parameters of the VEC, which will be explained later, are also defined by the elements of α . It can be demonstrated that for a determined r , the β 's maximum likelihood estimator specifies a combination of y_{t-1} that gives the r maximum basic correlations of Δy_t , with y_{t-1} after controlling for present lagged differences and deterministic variables (Hjalmarsson & Österholm, 2007). Johansen suggests two different likelihood tests to determine the significance of the basic correlations and therefore of the reduced rank Π matrix. The trace test and the maximum eigenvalue test that is derived according to the following (Hjalmarsson & Österholm, 2007: 7):

$$J_{trace} = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \quad (4.7)$$

$$J_{max} = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (4.8)$$

Where:

- $\hat{\lambda}_{r+1}, \dots, \hat{\lambda}_p$ are the estimated $p - r$ smallest Eigenvalues.

The null hypothesis indicates that there is a maximum of r cointegrating vectors. Therefore, when the first null hypothesis $r \leq s - 1$ is rejected, it will suggest that $r \geq 1$, while the following null hypothesis $r \leq s$ will then be reduced to $r = s$. This process will continue until the null hypothesis is not rejected (Burke & Hunter, 2005).

With the L-max statistic, the null hypothesis of r cointegrating vectors $r = 0$, is tested against the alternate $r + 1$ cointegrating vector $r = 1$. The original $r + 1$ cointegrating vector ($r = 1$) is then evaluated against the other alternative $r + 1$ cointegrating vector $r = 2$, and so on (Burke & Hunter, 2005:100). The L-max statistic is illustrated as follows (Burke & Hunter, 2005:100):

$$-2 \ln Q = -T \ln(1 - \lambda_{r+1}) \quad (4.9)$$

The Johansen test in EViews 7 has five different trend specifications to choose from when determining how many cointegrating relationships there are in the VAR. The five deterministic trend cases can be summarised as follows (Johansen, 1995:80):

The first assumption omits a deterministic trend from level data y_t and no intercepts are included in the cointegrating equations. This is applied when the series has a mean of zero (QMS, 2009:687):

$$H_2(r): \Pi y_{t-1} + Bx_t = \alpha \beta' y_{t-1} \quad (4.10)$$

The second assumption omits a deterministic trend from level data y_t and intercepts are included in the cointegrating equations. This is applied to trended series (QMS, 2009:687):

$$H_1^*(r): \Pi y_{t-1} + Bx_t = \alpha(\beta' y_{t-1} + \rho_0) \quad (4.11)$$

The third assumption omits intercepts in the cointegrating equations, but applies a linear trend in the level data y_t . This is applied to stochastic trended series (QMS, 2009:687):

$$H_1(r): \Pi y_{t-1} + Bx_t = \alpha(\beta' y_{t-1} + \rho_0) + \alpha_{\perp} \gamma_0 \quad (4.12)$$

Level data y_t in the fourth assumption includes trends as well as cointegrating equations. This specification is applied to stationary trended series (QMS, 2009:687):

$$H^*(r): \Pi y_{t-1} + Bx_t = \alpha(\beta' y_{t-1} + \rho_0 + \rho_1 t) + \alpha_{\perp} \gamma_0 \quad (4.13)$$

The last assumption includes level data quadratic trends and the cointegrating equations contain linear trends. This has the ability to provide a good fit in the sample; however, it might lead to unrealistic estimates in the event of out-of-sample forecasts (QMS, 2009:687):

$$H(r): \Pi y_{t-1} + Bx_t = \alpha(\beta' y_{t-1} + \rho_0 + \rho_1 t) + \alpha_{\perp}(\gamma_0 + \gamma_1 t) \quad (4.14)$$

$\alpha_{\perp}$ is the deterministic term that cointegrating relationships exclude. According to Johansen (1995), the $\alpha_{\perp}$ term is the null space of α so that $\alpha' \alpha_{\perp} = 0$. EViews 7 places this term within the error correction term by regressing cointegrating relationships $\beta' y_t$ on a constant and linear trend (QMS, 2009:366).

Two different test criteria are calculated by the Johansen (1991) cointegration test in EViews 7 for the specified lag length to determine the existence of a cointegrating relationship among the different variables. The Trace and Maximum eigenvalue

statistics apply a consecutive process to test whether the rank of equations that are cointegrated (r) relies on the number of variables (p) within the cointegrating model and continues on the precondition that $r \leq p$ (Mitchell-Innes, 2006:63). This suggests that when the two test statistics are smaller than the t-values, the hypothesis will be rejected, with p (maximum) amount of hypothesis. For instance, when one rejects ($r = 0$), the consecutive testing process will proceed to the next hypothesis ($r \leq 1$), and to the alternate $r + 1$ cointegrating equations. This procedure will proceed for p cointegrating equations until one cannot reject the hypothesis, which implies the Trace and Maximum eigenvalue statistic is larger than the t-value (Mitchell-Innes, 2006).

The final step before the estimation of the cointegration/co-movement among the variables is to determine the suitable lag length of the VAR. In many cases, financial theory will lack decisiveness on the suitable lag length for the VAR and the time needed for changes in variables to move through the system. There are two distinct methods that can be used: firstly, cross equation restrictions and secondly, information criteria. This study will use information criteria. This test is performed using EViews 7. This test consists of the following five test criteria: Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion and lastly, the Hannan & Quinn (HQ) (Brooks, 2008). Four lags were included as the benchmark for the test because the study uses quarterly data.

Table 4.3: Lag length criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1809.963	NA	105935.3	28.59784	28.73222	28.65244
1	-369.7798	2721.606	2.64e-05	6.484721	7.425319	6.866875
2	-275.9275	168.4907	1.07e-05	5.573661	7.320485*	6.283375*
3	-240.3440	60.51999	1.08e-05	5.580220	8.133270	6.617493
4	-195.5884	71.89080*	9.60e-06*	5.442337*	8.801614	6.807171

* indicates lag order selected by the criterion
 LR: sequential modified LR test statistic (each test at 5% level)
 FPE: Final prediction error
 AIC: Akaike information criterion
 SC: Schwarz information criterion
 HQ: Hannan-Quinn information criterion

Source: Compiled by author

In Table 4.3 above, the LR, FPE and AIC tests suggest to include four lags, whereas the SC and HQ tests suggest two lags. Both two lags as well as four lags were included and examined to determine which would yield the most significant results. The model with four lags is more significant than the one with only two lags, which suggests that the LR, FPE and AIC criteria were adequate to determine the lag length. The next step is to determine the presence of cointegration and to estimate the model.

Firstly, the Johansen cointegration test results are shown in Table 4.4.

Considering both the trace statistic (Tr) and the maximum eigenvalue (L-max), the null hypothesis of no cointegrating vectors can be rejected (using the third and fourth test assumptions), because the statistics are larger than the t-value. On the other hand, H_1 cannot be rejected, which suggests that the VAR contains at least one cointegrating relationship.

Table 4.4: Johansen cointegration test

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	3	2	1	1	0
Max-Eig	1	1	1	1	0
*Critical values based on MacKinnon-Haug-Michelis (1999)					

Source: Compiled by Author

Having determined that one cointegrating relationship exists in the VAR, the next section will continue with the VEC. The VEC will be discussed from a theoretical point of view and then the VEC will be estimated and a discussion of the results will follow. The VEC will discuss the long-run relationship found by the Johansen (1991) cointegration test and will also supply us with a speed of adjustment estimation that will for example determine the time passed for house index as well as the other variables to react when there was a shock in the credit market.

4.5.3 Vector error correction (VEC) models

A VEC model is a restricted VAR developed for non-stationary series that have cointegrating relationships (QMS, 2009). A X_t process VAR model in first differences is given by (Johansen, 1998:232):

$$\Delta X_t = \Pi_1 \Delta X_{t-1} + \Pi_2 \Delta X_{t-2} + \dots + \Pi_k \Delta X_{t-k} + \mu_t \quad (\text{see equation 4.4 - 4.6}) \quad (4.15)$$

Where:

- $X_t = (n \times 1)$ is a vector of non-stationary $I(1)$ variables;
- $\Pi_i = (n \times n)$ $i = 1, 2, \dots, k$ presents a matrix of unidentified parameters that have to be calculated;
- μ_t presents the independent and identically distributed (i.i.d) $(n \times 1)$ vector of error terms; and
- $t = 1, 2, \dots, m$ consecutive observations.

Error Correction Models (ECM) have the advantage of incorporating a short-run and long-run effect in the model (Asteriou & Hall, 2007). In a two-variable system, X_t and Y_t can be presented as follows (Asteriou & Hall, 2007:312):

$$\Delta Y_t = \gamma_0 \Delta X_t - (1 - \alpha) \left[Y_{t-1} - \frac{\alpha_0}{1 - \alpha_1} - \frac{\gamma_0 + \gamma_1}{1 - \alpha_1} X_{t-1} \right] \quad (4.16)$$

Where:

- γ_0 refers to the short-run effect (impact multiplier) of Y_t after a change in X_t ;
- $\frac{\gamma_0 + \gamma_1}{1 - \alpha_1}$ refers to the long-run elasticity between X and Y ;
- it is assumed that $\alpha_1 < 1$ in order for the short-run model to convert to a long-run solution; and

- $(1 - \alpha_1)$ or π is the speed of adjustment needed (feedback effect or adjustment effect) in the case of a disequilibrium.

The estimation of α always lies between 0 and 1. When $\alpha = 1$ it suggests that 100 per cent of the adjustment will occur in one time period and when $\alpha = 0$ it suggests that no adjustment will occur (Asteriou & Hall, 2007).

By integrating $\Delta = (1 - L)$, with Equation 4.16, where L is the lag operator, it can define parameters to describe a following error correction system similar to equation 4.9 (Johansen & Juselius, 1990:170).

By including independent errors, Johansen (1991) developed the auto regressive process' maximum likelihood estimators of the cointegrating vectors. Johansen and Juselius (1990:169) exemplified that a $(n \times n)$ matrix Π can be given as the product of a β and α matrix each of rank r , so that $\Pi = \alpha\beta'$. Therefore, Equation (4.15) can be given as (Johansen & Juselius, 1990:171):

$$\Delta X_t = \sum_{i=1}^{k-1} \Gamma_i \Delta X + (\alpha\beta')X_{t-k} + u_t \quad (4.17)$$

4.5.4 Granger causality test

Spillovers from one market to another may be caused by financial instability or monetary policy decisions. To determine the direction of the spillovers' flow, it is crucial to understand the term causality. Causality is when the value of one variable can be determined by using past values of other variables (Asteriou & Hall, 2007:281). When you take two variables, for instance X_t and Y_t , and they influence one another with distributed lags, a VAR can capture the relationship. This influence can be presented by four possible outcomes (Asteriou & Hall, 2007:281):

- X_t causes Y_t ;
- Y_t causes X_t ;

- Bi-directional relationship may be evident; or
- The two variables are independent.

The downfall of the Granger (1969) causality test is that it can only test for bi-directional feedback. When a variable Z_t granger-causes variable Y_t , Y_t can be predicted more accurately by past values of the Z_t variables (Granger, 1969:424). The method's function is to incorporate previous values of the dependent and independent variable, *ceteris paribus*. The next equation shows the Granger (1969) causality relationship (Wooldridge, 2006:650):

$$E(Y_t/I_{t-1}) \neq E(Y_t/J_{t-1}) \quad (4.18)$$

Where:

- I_{t-1} contains past information on Y_t and Z_t ; and
- J_{t-1} contains past information on Y_t .

When Equation 4.18 is valid, the past values of Z_t and Y_t can be applied to predict Y_t . In addition, if this is the case, it can be concluded that Z_t granger causes Y_t (Wooldridge, 2006). To give an example of the Granger causality test, take the following two-variable VAR model into account (Asteriou & Hall, 2007:282):

$$Y_t = \alpha_1 + \sum_{i=1}^n \beta_i X_{t-i} + \sum_{j=1}^m \gamma_j Y_{t-j} + \varepsilon_t \quad (4.19)$$

and

$$X_t = \alpha_2 + \sum_{i=1}^n \theta_i Y_{t-i} + \sum_{j=1}^m \delta_j X_{t-j} + \epsilon_t \quad (4.20)$$

Where:

- Y_t and X_t present the dependent variables in Equation 4.19 and 4.19, respectively;
- X_t and Y_t present the independent variables in Equation 4.19 and 4.20, respectively;
- X_{t-i} presents the lag values of X_t ;
- Y_{t-j} presents the lag values of Y_t ;
- α_1 and α_2 present the intercept coefficients in Equation 4.19 and 4.20, respectively;

- β_i and γ_j present the slope coefficients in Equation 4.19;
- θ_i and δ_j present the slope coefficients in Equation 4.20; and
- ε_t and ϵ_t present the stochastic error terms in Equation 4.19 and 4.20, respectively.

Equation 4.19 corresponds with the unrestricted model, which is modified into Equation 4.20, which can be referred to as the restricted model (Asteriou & Hall, 2007). Additionally, Equation 4.21 incorporates only lagged Y_t values and is given by (Asteriou & Hall, 2007:282):

$$Y_t = \alpha_3 + \sum_{j=1}^m \gamma_j Y_{t-j} + \varepsilon_t \quad (4.21)$$

Where:

- Y_t presents the dependent variable;
- Y_{t-j} presents the lag values of Y_t ;
- α_3 presents the intercept coefficient;
- γ_j presents the slope coefficient; and
- ε_t presents the stochastic error term.

Having described the restricted and unrestricted models, the Residual Sum of Squares (RSS) can be found by calculating the F-statistic as follows (Asteriou & Hall, 2007:283):

$$F = \frac{(RSS_R - RSS_u)/m}{RSS_u/(n-k)} \quad (4.22)$$

Where:

- RSS_R is the residual sum of squares of the restricted model (Equation 4.19);
- RSS_u is the residual sum of squares of the unrestricted model (Equation 4.21);
- n is the number of observations;
- k is the number of explanatory variables; and
- $m = k - n - 1$.

When the F-statistic is calculated, the null hypothesis can be illustrated as follows (Asteriou & Hall, 2007:282):

$$H_0: \sum_{i=1}^n \beta_i = 0 \quad (4.23)$$

and

$$H_1: \sum_{i=1}^n \beta_i \neq 0 \quad (4.24)$$

Where:

- According to Equation 4.23, X_t does not cause Y_t ; and
- According to Equation 4.24, X_t does cause Y_t .

The null hypothesis implies that when the slope coefficient (β_i) is equal to zero, X_t does not cause Y_t . When the calculated F-value is larger than the F-critical value, H_0 is rejected (Asteriou & Hall, 2007).

4.6 RESULTS OF THE RELATIONSHIP BETWEEN ASSET PRICES, CREDIT GROWTH AND THE REAL ECONOMY

Following from the Johansen cointegration test results, a VECM was estimated (see Table 4.5). Table 4.5 below will show the results of the VECM with one cointegrating relationship, as determined in Table 4.4. The third test assumption was applied to the VAR, with four lags and one cointegrating relationship. The vector $X_t = [\text{cpi}, \text{lrgdp}, \text{lcred}, \text{int}, \text{hi}, \text{share}]$ was used in the VECM, and as discussed in section 4.5.1, Assenmacher-Wesche and Gerlach (2008) were followed in determining the ordering of the variables.

Table 4.5: VECM output

Cointegrating Eq:	CointEq1					
CPI(-1)	1.000000					
LRGDP(-1)	-260.8323 (71.9660) [-3.62438]					
LCRED(-1)	20.59712 (6.66928) [3.08836]					
INT(-1)	0.084517 (0.71346) [0.11846]					
HI(-1)	0.342517 (0.08521) [4.01946]					
SHARE(-1)	-0.407526 (0.10631) [-3.83333]					
C	3346.700					
Error Correction:	D(CPI)	D(LRGDP)	D(LCRED)	D(INT)	D(HI)	D(SHARE)
CointEq1	-0.028115 (0.00996) [-2.82403]	-7.09E-05 (6.4E-05) [-1.11035]	0.000377 (0.00014) [2.61921]	-0.005840 (0.00978) [-0.59713]	-0.045168 (0.02363) [-1.91132]	0.204080 (0.07420) [2.75033]
D(CPI(-1))	0.293977 (0.07810) [3.76402]	-6.94E-05 (0.00050) [-0.13846]	0.000501 (0.00113) [0.44337]	0.073542 (0.07672) [0.95853]	0.009685 (0.18539) [0.05224]	-0.487233 (0.58212) [-0.83700]
D(CPI(-2))	-0.087352 (0.08112) [-1.07689]	-0.000332 (0.00052) [-0.63740]	0.000441 (0.00117) [0.37580]	-0.078188 (0.07968) [-0.98123]	-0.202987 (0.19255) [-1.05422]	-0.208188 (0.60458) [-0.34435]
D(CPI(-3))	0.124068 (0.08000) [1.55085]	-0.000528 (0.00051) [-1.02830]	-0.000911 (0.00116) [-0.78757]	-0.203838 (0.07859) [-2.59374]	-0.037662 (0.18990) [-0.19833]	-0.155583 (0.59627) [-0.26093]
D(CPI(-4))	-0.598748 (0.07998) [-7.48637]	-0.000272 (0.00051) [-0.53003]	0.000905 (0.00116) [0.78232]	-0.034483 (0.07857) [-0.43890]	-0.157658 (0.18985) [-0.83044]	-0.135746 (0.59611) [-0.22772]
D(LRGDP(-1))	2.168737 (16.0258) [0.13533]	0.330266 (0.10283) [3.21189]	0.535754 (0.23175) [2.31180]	48.16079 (15.7430) [3.05918]	-0.152146 (38.0412) [-0.00400]	107.4305 (119.445) [0.89941]
D(LRGDP(-2))	-39.42224 (17.2805) [-2.28132]	0.046573 (0.11088) [0.42004]	-0.114981 (0.24989) [-0.46013]	-28.95944 (16.9756) [-1.70595]	-12.41455 (41.0195) [-0.30265]	27.88532 (128.797) [0.21651]
D(LRGDP(-3))	15.22967 (17.5541) [0.86758]	-0.060773 (0.11263) [-0.53957]	0.051911 (0.25385) [0.20450]	24.97148 (17.2444) [1.44809]	9.883836 (41.6691) [0.23720]	-6.493735 (130.837) [-0.04963]

D(LRGDP(-4))	7.392054 (16.1649) [0.45729]	-0.016092 (0.10372) [-0.15515]	0.141904 (0.23376) [0.60705]	12.24034 (15.8797) [0.77082]	9.599485 (38.3714) [0.25017]	84.32898 (120.482) [0.69993]
D(LCRED(-1))	6.376526 (6.66677) [0.95646]	0.070174 (0.04278) [1.64049]	0.273787 (0.09641) [2.83989]	19.74683 (6.54915) [3.01518]	14.06843 (15.8253) [0.88899]	41.69143 (49.6897) [0.83904]
D(LCRED(-2))	4.861580 (7.09208) [0.68549]	0.021105 (0.04550) [0.46380]	-0.114087 (0.10256) [-1.11242]	2.732642 (6.96696) [0.39223]	-15.56238 (16.8348) [-0.92442]	22.85745 (52.8596) [0.43242]
D(LCRED(-3))	5.694131 (6.98254) [0.81548]	0.029071 (0.04480) [0.64887]	0.068805 (0.10097) [0.68141]	-1.565579 (6.85935) [-0.22824]	27.70676 (16.5748) [1.67162]	-19.82616 (52.0432) [-0.38096]
D(LCRED(-4))	8.273901 (6.36569) [1.29977]	-0.077067 (0.04084) [-1.88685]	0.106229 (0.09205) [1.15399]	3.697036 (6.25338) [0.59121]	0.133976 (15.1105) [0.00887]	-9.970200 (47.4456) [-0.21014]
D(INT(-1))	0.012441 (0.10168) [0.12236]	5.45E-05 (0.00065) [0.08359]	0.002853 (0.00147) [1.94004]	0.285191 (0.09989) [2.85516]	-0.352879 (0.24136) [-1.46203]	-1.438508 (0.75785) [-1.89813]
D(INT(-2))	-0.091174 (0.10446) [-0.87285]	-0.000325 (0.00067) [-0.48460]	-0.000621 (0.00151) [-0.41138]	-0.093921 (0.10261) [-0.91529]	0.003741 (0.24795) [0.01509]	0.462337 (0.77854) [0.59385]
D(INT(-3))	-0.007242 (0.10364) [-0.06987]	-0.000581 (0.00066) [-0.87372]	0.001467 (0.00150) [0.97895]	-0.046565 (0.10181) [-0.45736]	-0.131714 (0.24602) [-0.53538]	0.521347 (0.77247) [0.67491]
D(INT(-4))	-0.241345 (0.09776) [-2.46872]	-0.001170 (0.00063) [-1.86549]	0.002310 (0.00141) [1.63394]	-0.042595 (0.09604) [-0.44353]	-0.307096 (0.23206) [-1.32334]	-0.414848 (0.72865) [-0.56934]
D(HI(-1))	-0.052401 (0.04320) [-1.21309]	0.000125 (0.00028) [0.45268]	0.000667 (0.00062) [1.06780]	-0.039441 (0.04243) [-0.92946]	1.046778 (0.10254) [10.2087]	0.659010 (0.32196) [2.04688]
D(HI(-2))	-0.028929 (0.05912) [-0.48931]	-0.000166 (0.00038) [-0.43779]	0.000401 (0.00085) [0.46864]	0.010785 (0.05808) [0.18570]	-0.685008 (0.14034) [-4.88097]	-0.464547 (0.44066) [-1.05420]
D(HI(-3))	0.002508 (0.06282) [0.03993]	0.000255 (0.00040) [0.63294]	0.000270 (0.00091) [0.29679]	-0.003289 (0.06171) [-0.05330]	0.230137 (0.14911) [1.54336]	0.289063 (0.46820) [0.61739]
D(HI(-4))	-0.007125 (0.04585) [-0.15539]	-2.09E-05 (0.00029) [-0.07092]	-0.000466 (0.00066) [-0.70247]	-0.038463 (0.04504) [-0.85400]	0.166662 (0.10883) [1.53138]	0.335290 (0.34172) [0.98119]
D(SHARE(-1))	0.027040 (0.01333) [2.02797]	0.000102 (8.6E-05) [1.18932]	-6.89E-05 (0.00019) [-0.35757]	0.014883 (0.01310) [1.13628]	0.008573 (0.03165) [0.27087]	0.010993 (0.09938) [0.11062]
D(SHARE(-2))	0.015696 (0.01315) [1.19347]	6.04E-05 (8.4E-05) [0.71549]	-3.40E-05 (0.00019) [-0.17884]	-0.003738 (0.01292) [-0.28932]	0.085162 (0.03122) [2.72800]	0.302338 (0.09802) [3.08444]
D(SHARE(-3))	9.91E-06	-9.36E-05	0.000368	-0.011639	-0.185526	0.112929

	(0.01387) [0.00071]	(8.9E-05) [-1.05154]	(0.00020) [1.83553]	(0.01363) [-0.85404]	(0.03293) [-5.63382]	(0.10340) [1.09216]
D(SHARE(-4))	-0.003011 (0.01664) [-0.18099]	-2.05E-05 (0.00011) [-0.19185]	0.000623 (0.00024) [2.58886]	2.28E-05 (0.01635) [0.00139]	-0.029358 (0.03950) [-0.74327]	-0.152958 (0.12402) [-1.23335]
C	-0.687651 (0.34724) [-1.98034]	0.001800 (0.00223) [0.80806]	0.015875 (0.00502) [3.16142]	-1.004100 (0.34111) [-2.94361]	-0.146068 (0.82426) [-0.17721]	-4.312151 (2.58808) [-1.66616]
Determinant resid covariance (dof adj.)						
Determinant resid covariance						
Log likelihood						
Akaike information criterion						
Schwarz criterion						

Source: Compiled by author

The first part of the VECM contains the results of the first step of the Johansen procedure. It additionally shows the long-run relationship of the equation, the coefficients of each variable, standard errors in () and t-statistics in []. All the variables show a significant long-run relationship, except for INT. All the t-statistics are larger than the critical 1.96 value. The coefficients of LCRED and HI are positive, while on the other hand, LRGDP and SHARE are negative. Therefore, when there is an increase in credit and house prices, inflation will increase, and when share prices and real GDP increase, inflation will decrease. The second part of the VECM reports the results of the second step VAR in first differences. The error correction term (named CointEq1) shows the speed of adjustment required, and is referred to as π . The π estimate is known as the error-correction coefficient or the adjustment coefficient (Asteriou & Hall, 2007). The first variable in the CointEq1 has to have a negative coefficient and significant t-statistic to show long-run convergence of the model, which is the case in Table 4.8. When there is a shock to the system, there is an adjustment of 2.81 per cent per quarter. In other words, it would take 35.58 quarters (8.9 years) for the system to be in equilibrium again. Only DCPI, DLCRED, DHI and DSHARE have significant t-statistics. The adjustment coefficients of these variables are rather small, except for DSHARE (0.204), DHI (-0.045) and DCPI (-0.028).

Based on the results, the direction of causality between the variables based on the Granger (1969) causality test is presented below. This is a second test for co-movement among the variables and will determine the direction of spillovers between the variables. It will also include the result of the study's test with a discussion.

Table 4.6 below illustrates the results obtained from the Granger causality tests, to determine what the direction of causality is between credit, house prices and share price as well as other monetary and economic variables and to shed light on the endogeneity of the variables included in the VAR.

Table 4.6: Granger Causality tests

VEC Granger Causality/Block Exogeneity Wald Tests			
Date: 02/15/13 Time: 19:00			
Sample: 1980Q1 2012Q3			
Included observations: 126			
Dependent variable: D(CPI)			
Excluded	Chi-sq	df	Prob.
D(LRGDP)	6.262412	4	0.1804
D(INT)	7.651627	4	0.1052
D(HI)	7.961108	4	0.0930
D(SHARE)	5.963084	4	0.2019
D(LCRED)	8.607558	4	0.0717
All	31.08968	20	0.0540
Dependent variable: D(LRGDP)			
Excluded	Chi-sq	df	Prob.
D(CPI)	2.809247	4	0.5902
D(INT)	6.176021	4	0.1864
D(HI)	0.980556	4	0.9127
D(SHARE)	2.535563	4	0.6383
D(LCRED)	6.627201	4	0.1570
All	28.04876	20	0.1083
Dependent variable: D(INT)			
Excluded	Chi-sq	df	Prob.
D(CPI)	11.65531	4	0.0201
D(LRGDP)	12.98767	4	0.0113
D(HI)	3.840568	4	0.4280
D(SHARE)	1.775712	4	0.7769
D(LCRED)	13.14161	4	0.0106

All	49.49846	20	0.0003
Dependent variable: D(HI)			
Excluded	Chi-sq	df	Prob.
D(CPI)	2.381102	4	0.6660
D(LRGDP)	0.254966	4	0.9925
D(INT)	4.630897	4	0.3273
D(SHARE)	40.74246	4	0.0000
D(LCRED)	4.167370	4	0.3838
All	57.81037	20	0.0000
Dependent variable: D(SHARE)			
Excluded	Chi-sq	df	Prob.
D(CPI)	1.353906	4	0.8522
D(LRGDP)	1.525327	4	0.8221
D(INT)	4.572132	4	0.3341
D(HI)	10.17965	4	0.0375
D(LCRED)	1.396646	4	0.8448
All	23.71151	20	0.2552
Dependent variable: D(LCRED)			
Excluded	Chi-sq	df	Prob.
D(CPI)	1.418462	4	0.8410
D(LRGDP)	5.815701	4	0.2133
D(INT)	7.938659	4	0.0939
D(HI)	7.443999	4	0.1142
D(SHARE)	11.24202	4	0.0240
All	36.04187	20	0.0152

Source: Compiled by author

There are six parts to Table 4.6:

- a) **Firstly:** D(CPI) is the dependent variable, therefore the null hypothesis is that D(LRGDP), D(INT), D(HI), D(SHARE) or D(LCRED) does not granger cause DCPI. The joint significance of D(CPI) is 0.054, which indicates that CPI is endogenous at a 90 per cent level of significance, with the causality likely running from the credit and the house index to inflation. Therefore, at the 90 per cent level of significance, D(LCRED) and D(HI) do granger cause D(CPI) and as a result D(CPI) can be predicted with greater accuracy by using past values of D(LCRED) and D(HI). The same actions are applied to the other five parts, each representing a different

dependent variable and a different null hypothesis, where the null hypothesis can be interpreted as the independent variables not granger causing the dependent variable. Therefore, the following conclusion can be made.

- b) **Secondly:** The null hypothesis cannot be rejected at a 95 per cent level of significance that any of the variables do not granger cause $D(LRGDP)$, and therefore real GDP cannot be predicted with greater accuracy using past values of the independent variables. The joint significance of 0.1083 also indicates that $D(LRGDP)$ is weakly exogenous.
- c) **Thirdly:** The joint significance of 0.0003 indicates that interest rates are endogenous with causality likely running from inflation, GDP and credit to interest rates. The null hypothesis can be rejected at a 95 per cent level of significance that $D(LCRED)$, $D(CPI)$ and $D(LRGDP)$ do not granger cause $D(INT)$; therefore, their past values can predict $D(INT)$ with greater accuracy.
- d) **Fourthly:** The joint significance of $D(HI)$ being weakly exogenous can be rejected at a 95 per cent level of significance and is therefore endogenous with causality likely running from shares to the house index. The null hypothesis that $D(SHARE)$ does not granger cause $D(HI)$ can be rejected at the 95 per cent level of significance, and therefore $D(HI)$ can be predicted with greater accuracy using past values of $D(SHARE)$.
- e) **Fifthly:** The null hypothesis that $D(SHARE)$ is weakly exogenous cannot be rejected. The null hypothesis that $D(HI)$ does not granger cause $D(SHARE)$ can be rejected at the 95 per cent level of significance; therefore, $D(SHARE)$ can be predicted with greater accuracy using past values of $D(HI)$. There is a bi-directional relationship between $D(HI)$ and $D(SHARE)$, because both granger cause the other.
- f) **Lastly:** The joint significance of 0.0152 suggests that credit is endogenous. Furthermore, the null hypothesis that $D(SHARE)$ does not granger cause $D(LCRED)$ can be rejected at the 95 per cent level of significance, and $D(INT)$ not granger causing $D(LCRED)$ can be rejected at the 90 per cent level of significance. Therefore, $D(LCRED)$ can be predicted with greater accuracy using past values of $D(SHARE)$ and $D(INT)$.

The Granger causality test carried out does not incorporate indirect effects running through other variables included in the system and does not give any information on the strength and direction of the effects (Goodhart & Hofmann, 2008). To get a better understanding of the dynamic interactions, the next section will discuss an impulse response analysis based on the estimated VECM.

4.6.1 Impulse response analysis

Impulse response analysis is used to indicate how responsive a dependant variable is to shocks in every other variable in the VAR framework (Brooks, 2008:299). Within the context of this study, impulse response analysis sheds light on the response of real economic variables to a one-standard error unit shock in the credit and asset markets. Therefore, the sign, relative size and continuity of responses in inflation, GDP and interest rates to shocks in credit and asset prices can be determined. When the i -th variable is shocked, it does not only influence the i -th variable directly, but is also carried over to the other endogenous variables as a result of the dynamic (lag) structure of the VAR. An impulse response function traces the influence of a time shock to one of the innovations on endogenous variables' current and future value (QMS, 2009).

When innovations ϵ_t (error term and equation in the VECM) are uncorrelated in the same period, interpreting the output of the impulse response is relatively simple. The i -th innovation $\epsilon_{i,t}$ is plainly when the i -th endogenous variable $y_{i,t}$ is shocked. Innovations on the other hand are mostly correlated and might be seen with a common element that cannot be related with a certain variable. To make the impulses interpretable, it is normal to implement a P transformation in order for them to be uncorrelated (QMS, 2009:467):

$$v_t = P\epsilon_t \sim (0, D) \quad (4.25)$$

Where D presents a diagonal covariance matrix. EViews 7 has several choices for P . This study uses Cholesky transformation that applies the inverse of the Cholesky factor

of the residual covariance matrix to orthogonalise the impulses. This choice enforces a variable ordering in the VAR and all the effects of any common element are assigned to the variable ordered first in the VAR. When using the d.f. adjusted selection it corrects small sample degrees of freedom when the residual covariance matrix is estimated to the Cholesky factor. The (i, j) -th element of the residual covariance matrix with degrees of correction can be written as follows (QMS, 2009:469):

$$\sum_t e_{i,t} e_{j,t} / (T - p) \quad (4.26)$$

Ordinary impulse response models have the assumption that the error terms are uncorrelated, which is a very restrictive assumption to make. When a hypothetical shock in only one equation is applied there is no realistic adjustment process response. In order to manage error term correlation, orthogonal impulse response sequences have to be applied. The concept is to adjust the construction of the moving average so that there is no residual correlation, in other words the residuals are orthogonal to one another. Therefore (Füss, 2007):

$$y_t = \sum_{k=1}^{\infty} \tilde{C}_k v_{t-k} \quad (4.27)$$

with $\tilde{C}_k = C_k \cdot G$, where G is a transformation matrix with the property $G^{-1} \hat{\Omega} G'^{-1} = 1$ (Cholesky-Decomposition). The adjusted system's error terms are given by $v_{t-k} = G^{-1} \varepsilon_{t-k}$. v_{t-k} is the variance-covariance matrix and is diagonal, as a result of the properties of G . Nevertheless, the Cholesky decomposition does not distinctly define the G matrix ($\hat{\Omega} = G^{-1} G'^{-1}$, where $\hat{\Omega}$ is the original variance – covariance matrix). The selected ordering assumes a causal relationship between the variables. The outcome of the impulse response is highly affected by the ordering of the variables, particularly when high correlation exists.

The Cholesky transformation is applied in order to deal with the uncorrelated assumption of error terms, which is limited in scope. Cholesky applies the inverse of the Cholesky factor in order to enable the residual covariance matrix to orthogonalise the

impulses. Therefore, Cholesky transformation is used as a result of the orthogonal impulse response that manages the correlation of the error term.

The figures below will present the impulse responses of monetary shocks, credit shocks, house price shocks and share price shocks. All the graphs include approximately two standard-error (95%) confidence bands. The shocks applied to all the impulse responses are one-standard deviation shocks.

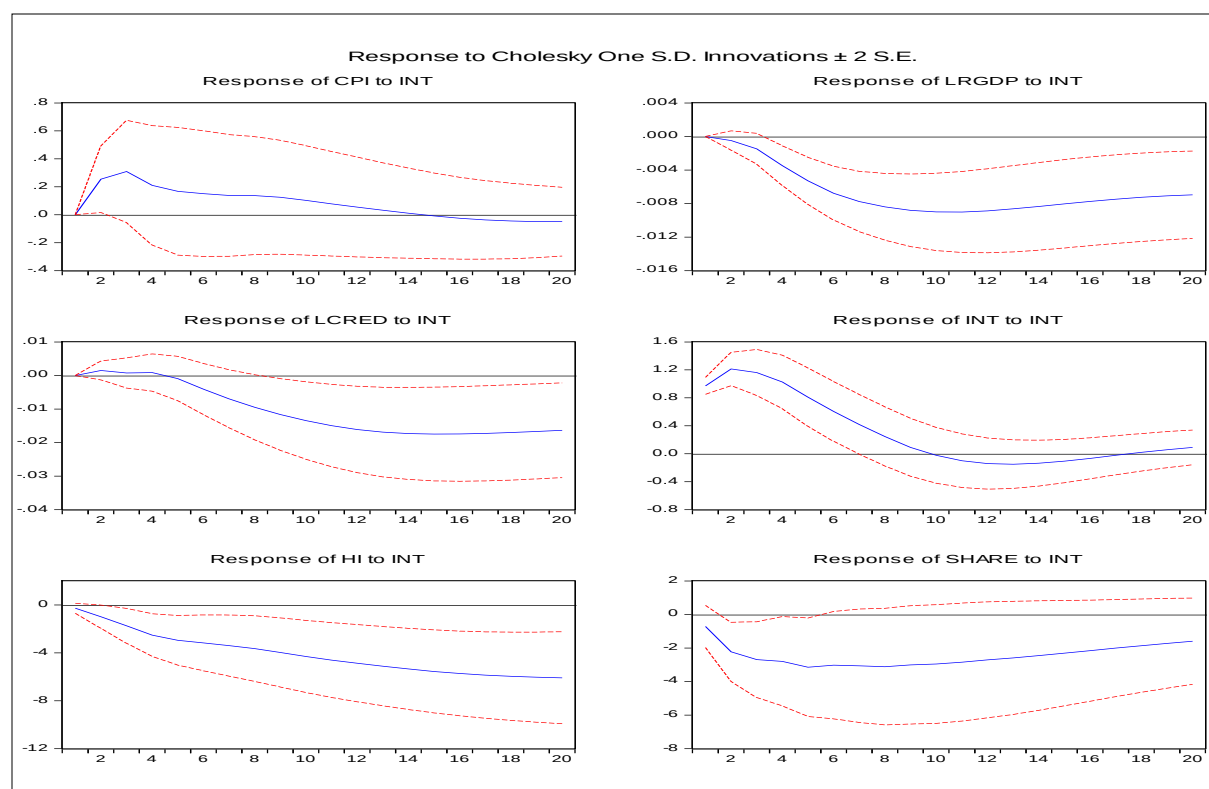


Figure 4.4: Impulse response to monetary policy shock

Source: Compiled by author

Figure 4.4 indicates the impulse responses of the variables to a monetary policy shock. The consumer price initially increases and then decreases after a monetary policy shock. In addition, output continues to decrease. Credit begins to drop after approximately four quarters, before attaining a trough after nine quarters. House prices begin to decrease and continue to slowly decrease for up to ten quarters. Share prices decrease immediately after the increase in interest rates and gradually start to increase

slowly after nine or ten quarters when GDP stabilises. The response of consumer prices and GDP to the monetary shock is in line with the literature of Christiano *et al.* (1999) and Angeloni *et al.* (2003). House prices, real GDP and credit follow more or less the same pattern as each other, where the consumer price index lags a bit and share prices move very slowly. Over a time period of two years, the house index has fallen by 3.7 and share prices by 3.1, respectively, where the real GDP had only fallen by 0.0084. The largest influence was on house and share prices, where house prices declined by more than four and share prices by more than two. The results are similar to those of Assenmacher-Wesche and Gerlach (2008), but it seems that the effect of a monetary policy shock was larger in South Africa when compared to their panel of countries. South Africa responded with longer time lags and the panel found a more pronounced effect on credit and real GDP.

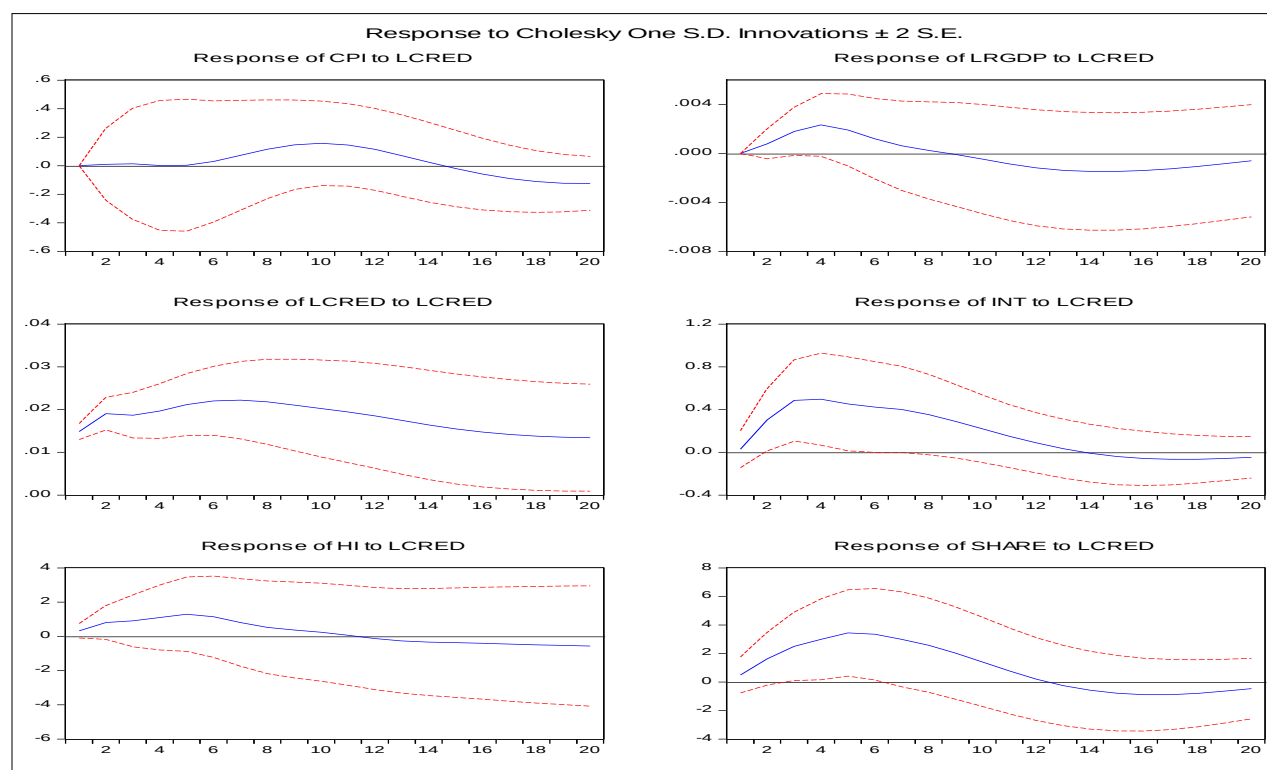


Figure 4.5: Impulse response to a credit shock

Source: Compiled by author

Figure 4.5 presents the impulse responses to a credit shock. When credit is shocked, consumer prices (inflation) remain stable for five quarters before they start to increase until their maximum value is reached in quarter ten. The credit shock also provokes an increase in the real GDP, reaching its maximum at four quarters. The influence on interest rates is initially positive before the decline begins in quarter four, which may suggest that it is a credit supply shock. House price also respond positively to the credit shock, increasing for five quarters, and the same result is obtained with share prices; however, with a more significant increase. The influence of a credit shock affected inflation, interest rates and share prices most significantly. The movements of the variables are due to credit shocks similar to those of Assenmacher-Wesche and Gerlach (2008).

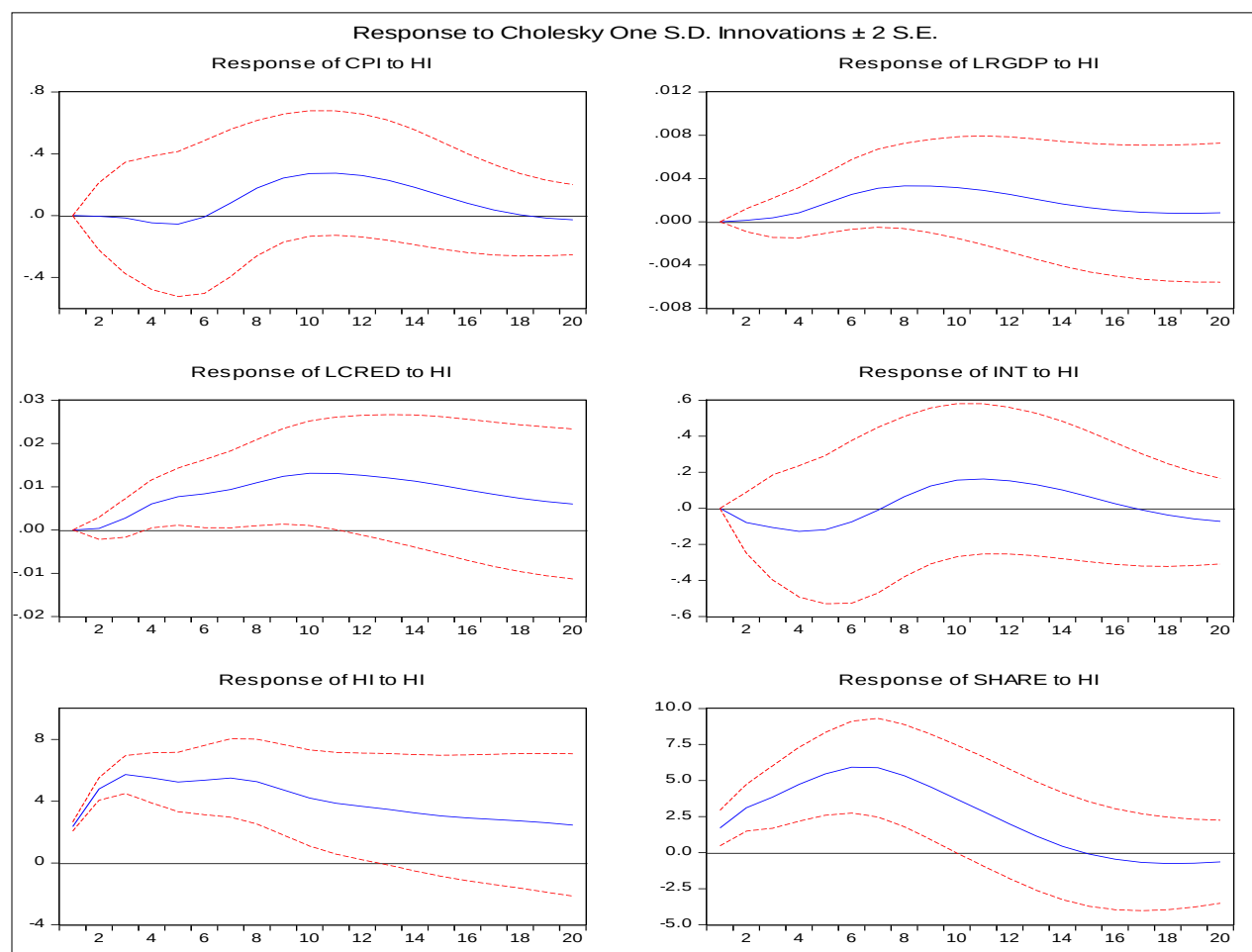


Figure 4.6: Impulse response to a house price shock

Source: Compiled by author

Figure 4.6 presents the impulse responses of a shock to house prices. Contrary to the other shocks, the house price shock is a lasting shock to the level of house prices. Share prices experience an immediate increase. All the other variables experience a meaningful increase after the shock, except for CPI and INT that initially decline before increasing. Credit and interest rates reach their maximum at ten quarters, real GDP at eight quarters and share prices at six quarters. The most pronounced influence of a house price shock is on share prices, interest rates and inflation. The results differ from the study of Assenmacher-Wesche and Gerlach (2008) in the following aspects. South African inflation and interest rates initially decline as opposed to the increase in the panel of 17 countries.

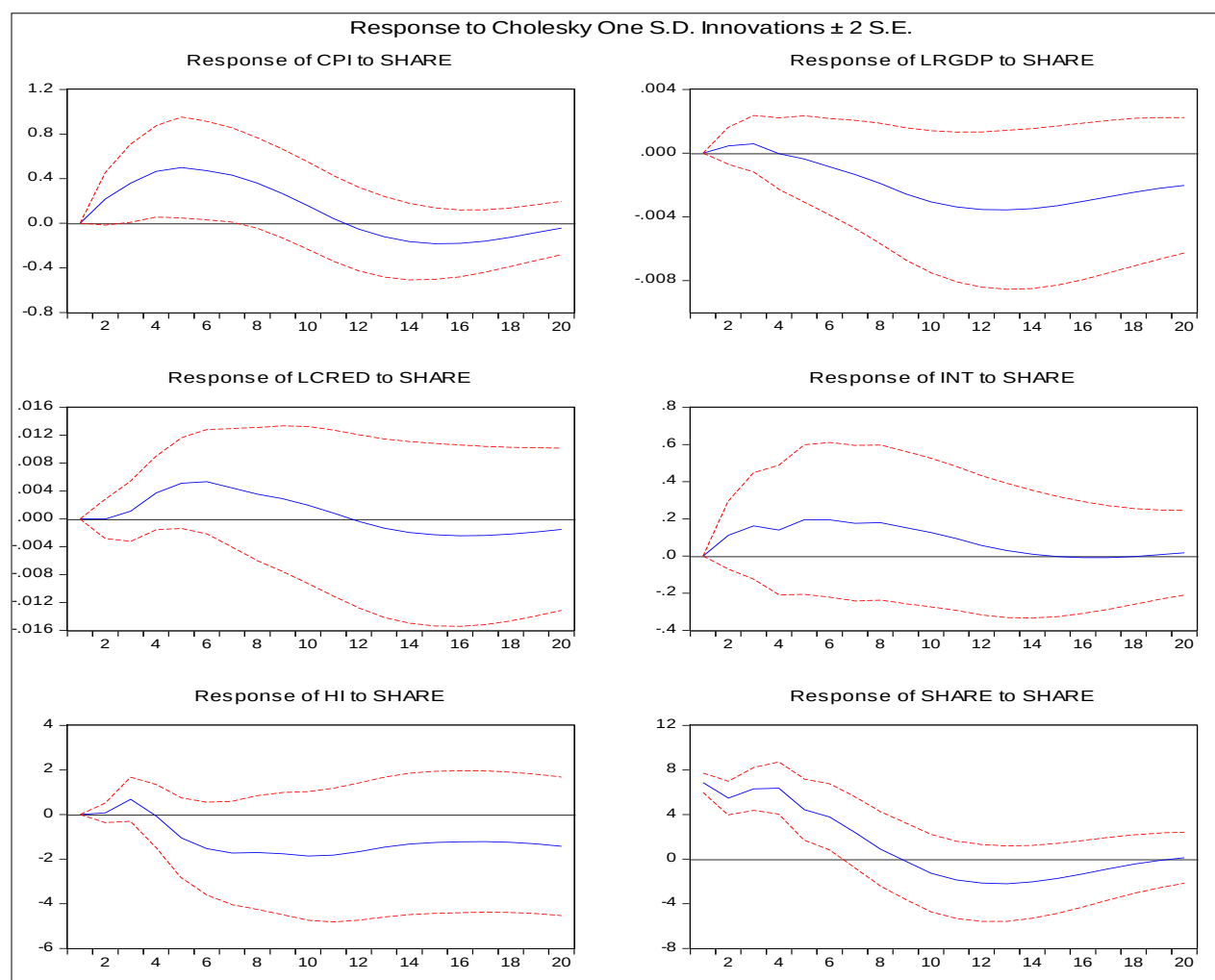


Figure 4.7: Impulse response to a share price shock

Source: Compiled by author

Lastly, Figure 4.7 will indicate the impulse responses to a shock in share prices. As could have been expected, the influence on interest rates and house prices was relatively small and insignificant. On the other hand, real GDP and credit increased for three and six quarters, respectively. Although it is very small, it may indicate that an improvement in share prices contains future information on the real GDP. The next section will discuss the variance decomposition model in order to determine the extent of volatility transmission between variables. The following points of difference were found in comparison to Assenmacher-Wesche and Gerlach (2008). Inflation reacts more intensely to a share price shock and increases as opposed to the decrease in the panel; real GDP decreases where the panel found a sharp increase and house prices decreased more in South Africa as opposed to the panel.

4.6.2 Variance decomposition

The variance decomposition model is a modified VAR model and divides the variations in one variable into component shocks. It will probably provide useful information about the percentage of movements in the real economic variables that are the outcome of asset price and credit shocks as opposed to those due to 'own' shocks. The normal VAR follows the influence of one endogenous variable shock to the other variables, where the variance decomposition model divides the endogenous variable's variation into component shocks (QMS, 2009:470). Therefore, the variance decomposition model determines the extent of the influence that one variable exerts onto the other variables (Brooks, 2008). In addition, the variance decomposition model has the ability to provide an explanation of every variable's forecast error variance. For example, the model determines the ratio of the movements in the credit market due to 'own' innovations, as opposed to those spillovers from different credit markets (Eun & Shim, 1989:241). Brooks (2008) indicated that 'own' innovation explained the majority of a VAR equation's forecast error variance.

Additionally, when X_t and Y_t are random variables with the same probability space, the variance decomposition model of variable X_t can be given as follows (Weiss, 2005:385):

$$var(X_t) = E\left(\frac{varX_t}{Y_t}\right) + varE\left(\frac{X_t}{Y_t}\right) \quad (4.28)$$

Where:

- $var(X_t)$ is the variance X_t ;
- $E\left(\frac{varX_t}{Y_t}\right)$ is the unexplained component of the variance of X_t ; and
- $varE\left(\frac{X_t}{Y_t}\right)$ is the explained component of the variance of X_t .

When using the chosen variables for the variance decomposition model, the output of the model shows a variance decomposition model for every endogenous variable. The output table's second column is marked 'S.E.' and presents the forecast error of the corresponding variables and time. The origin of this forecast error develops with the variation between the current and future values of the innovations to every endogenous variable included in the VAR. Differently stated, when the value is large, the contribution in the variation is mostly the result of 'own' shocks. The first column of the output table presents the different time horizons. Therefore, the results below will indicate how each variable deviates from its mean value due to an 'own' shock as well as from shocks to the other variables.

Table 4.7: Variance decomposition table

Variance Decomposition of CPI:							
Period	S.E.	CPI	LRGDP	LCRED	INT	HI	SHARE
1	1.036059	100	0	0	0	0	0
2	1.719856	96.60005	0.543241	0.192709	0.000895	0.127657	2.535449
3	2.268968	91.31972	0.362363	0.778294	0.261286	0.788511	6.489829
4	2.769364	87.6995	0.367542	1.50807	0.497268	1.48313	8.444492
5	3.034204	80.35124	1.137412	3.129855	1.705069	1.699541	11.97688
6	3.217443	73.87138	1.82424	4.354625	3.234565	1.512467	15.20272
7	3.392456	68.56537	3.014599	5.19821	3.931024	1.795601	17.4952
8	3.589627	62.71485	4.295578	6.026362	4.277781	2.783627	19.9018
9	3.800514	59.51933	4.763084	6.468864	4.209471	3.911213	21.12804
10	4.024852	58.27389	4.953001	6.862736	4.030025	4.753466	21.12689

Variance Decomposition of LRGDP:

Period	S.E.	CPI	LRGDP	LCRED	INT	HI	SHARE
1	0.006648	6.834719	93.16528	0	0	0	0
2	0.0116	7.165893	91.08701	0.887899	0.004181	0.213117	0.641903
3	0.016533	8.175469	87.6723	2.186372	0.098452	0.494518	1.372884
4	0.021081	10.35416	83.0614	3.628521	0.466299	1.128163	1.361453
5	0.025163	12.67001	78.65709	3.454273	1.593099	2.382883	1.242647
6	0.028811	14.43094	74.24612	2.901435	3.044044	4.216434	1.161022
7	0.032079	15.43171	70.64322	2.408695	4.367616	6.053814	1.094943
8	0.034809	15.60661	68.36933	2.061499	5.413797	7.516213	1.032543
9	0.037061	15.40168	66.9116	1.818712	6.348795	8.589823	0.92939
10	0.039002	15.0956	65.7269	1.646554	7.250168	9.441002	0.839772

Variance Decomposition of LCRED:

Period	S.E.	CPI	LRGDP	LCRED	INT	HI	SHARE
1	0.014982	2.111247	1.933652	95.9551	0	0	0
2	0.025314	2.186803	4.797342	90.99013	1.328651	0.305727	0.391352
3	0.033982	1.772532	6.497949	87.37278	1.987897	1.771143	0.597693
4	0.042901	1.781678	7.286488	83.75816	2.179379	4.597889	0.396407
5	0.053403	1.91612	8.372894	79.69009	2.296334	6.89872	0.825843
6	0.064193	2.405413	9.566069	76.9194	2.098079	8.099855	0.911183
7	0.074615	3.236819	10.11394	74.78935	1.855614	9.20726	0.797015
8	0.084762	3.987042	10.21641	72.63859	1.676233	10.85214	0.629591
9	0.094814	4.465294	10.10777	70.533	1.516	12.87435	0.503585
10	0.104306	4.678722	9.813371	68.9337	1.379946	14.77082	0.42344

Variance Decomposition of INT:

Period	S.E.	CPI	LRGDP	LCRED	INT	HI	SHARE
1	1.01778	0.047767	0.086861	0.241585	99.62379	0	0
2	1.727275	0.016662	3.98476	4.020256	91.35187	0.12099	0.505467
3	2.324567	0.171992	6.371594	8.909481	83.5587	0.205778	0.782454
4	2.861637	2.209154	9.528426	11.6846	75.79516	0.182163	0.600499
5	3.387526	5.364996	12.73133	13.52106	67.7671	0.130527	0.484986
6	3.903246	8.345045	15.84188	14.27191	60.93244	0.154548	0.454178
7	4.38922	10.37898	18.04517	14.81597	56.07325	0.267903	0.418726

8	4.812662	11.00429	19.43406	15.20978	53.50806	0.45991	0.3839
9	5.177239	10.92871	20.27	15.57535	52.1822	0.692108	0.35163
10	5.487993	10.69308	20.68353	15.96373	51.4361	0.904286	0.319271
Variance Decomposition of HI:							
Period	S.E.	CPI	LRGDP	LCRED	INT	HI	SHARE
1	2.459346	2.271656	0.315711	2.307841	0.885945	94.21885	0
2	5.716817	2.505017	0.643426	3.148423	2.392415	91.19801	0.112709
3	8.785718	2.989172	0.951934	2.759938	4.001765	87.82323	1.473957
4	11.12219	4.560136	1.026548	2.726192	5.874713	84.66319	1.149218
5	13.16499	6.72589	1.018106	2.804663	7.227283	81.29249	0.931572
6	15.34072	8.420754	1.006058	2.639896	7.848187	78.89256	1.192548
7	17.69492	9.069373	1.014744	2.324667	8.239606	77.91995	1.431661
8	19.9436	9.058235	1.051888	2.040488	8.659697	77.8688	1.320896
9	21.90579	9.023735	1.135724	1.842887	9.262511	77.56454	1.170599
10	23.64326	9.193013	1.259293	1.702385	9.992193	76.77717	1.075944
Variance Decomposition of SHARE:							
Period	S.E.	CPI	LRGDP	LCRED	INT	HI	SHARE
1	7.722095	1.021344	4.432477	0.193793	1.000015	8.492137	84.86023
2	11.36137	0.475117	5.448427	1.186964	4.664244	15.27506	72.95019
3	15.37233	0.270761	4.978327	1.900978	5.267451	20.23099	67.3515
4	19.12404	0.196372	4.572342	1.950483	5.039295	25.02541	63.2161
5	22.13405	0.246432	4.220644	2.37906	5.601563	31.23055	56.32175
6	25.18933	0.239807	3.587198	2.659245	5.736854	37.57647	50.20043
7	27.95445	0.26248	3.060446	2.872219	6.100627	43.31309	44.39114
8	30.37285	0.290599	2.609653	3.107786	6.663401	47.87103	39.45753
9	32.47927	0.315174	2.285303	3.245354	7.16415	51.39249	35.59753
10	34.31627	0.353487	2.080114	3.374166	7.679702	54.17832	32.33421
Cholesky Ordering: CPI LRGDP LCRED INT HI SHARE							

Source: Compiled by author

The first part of Table 4.7 is the variance decomposition model of an 'own' shock to CPI. The results indicate that all the variations of CPI in period one are as a result of its own shock, with a value of 100. Share prices influence inflation the most with an average

variance of 21.126 per cent over the estimated time period. The other variables have a small influence with credit at 6.862 at time period ten.

The second part presents an 'own' shock to real GDP indicating 93.165 of its variation is due to its 'own' shock with CPI contributing the second most with 6.834 per cent of its average variance in period one and 15.095 per cent over the estimated time period.

The third part suggests that 95.955 per cent of the variance is due to an 'own' shock to credit with the house index influencing credit significantly, with an average variance of 14.77 per cent over the estimated period.

The fourth part suggests that 99.623 of interest rates' variance is explained by its 'own' shock in period one, with credit, real GDP and consumer prices becoming more influential, contributing to an average variance of 15.963 per cent, 20.683 per cent and 10.693 per cent, respectively.

The fifth part indicates that 94.218 per cent of the house index's variance is explained by its 'own' shock and consumer prices and interest rates become more influential, each contributing roughly nine per cent in the tenth period.

Lastly, 84.860 per cent of share prices' deviation from its mean value is due to an own shock with house index contributing a huge 54.178 per cent average variance in the tenth period.

The Cholesky ordering is based on the study of Assenmacher-Wesche and Gerlach (2008), which was discussed in section 4.5.1. It can be concluded that house prices have a large influence on share prices, but share prices have no significant influence on house prices. Inflation and interest rates have a relatively large influence on house prices, and this suggests that monetary policy can influence the housing market through inflation and interest rates. Share prices significantly affect inflation. House prices play a large role in influencing credit, which supports the theory that when credit and house

prices vary from their long-term trend, it can signal potential financial instability. Lastly, real GDP, credit and inflation influence interest rates.

4.7 FINANCIAL STABILITY, ASSET PRICES AND CREDIT

The rationale behind this section is exclusively to determine the influence that asset prices and credit growth have on financial stability, as well as the relationship between these variables. A similar approach was followed as above in order to determine the influence of asset prices and credit growth on financial stability. Monthly data from January 2002 to June 2011 was used for each of the variables. The banking stability index (bsip) and credit extended to the private sector (cred) were obtained from the SARB. The house price index (hi) was gathered from the ABSA house price index and the share index was obtained from the IFS database. All the variables are in log format, except for the banking stability index. In addition, all the variables are I(1) (see Table 4.2).

The reason why credit and house index were not included in the same model, is because of a very high correlation between the two variables, with a correlation coefficient of 95.65. A correlation analysis revealed that there is a strong positive linear relationship between credit extended to the private sector and the house price index. To ensure no multicollinearity between independent variables, the two variables are not included together, i.e. $y_t = [\text{bsip}, \text{lcred}, \text{lshare}]$ and $x_t = [\text{bsip}, \text{lshare}, \text{hi}]$. Two VAR models are estimated. Both VAR models that were estimated satisfied the stability condition of no root outside the unit circle in order to proceed with further estimations. The results are displayed in Figure 4.8 below.

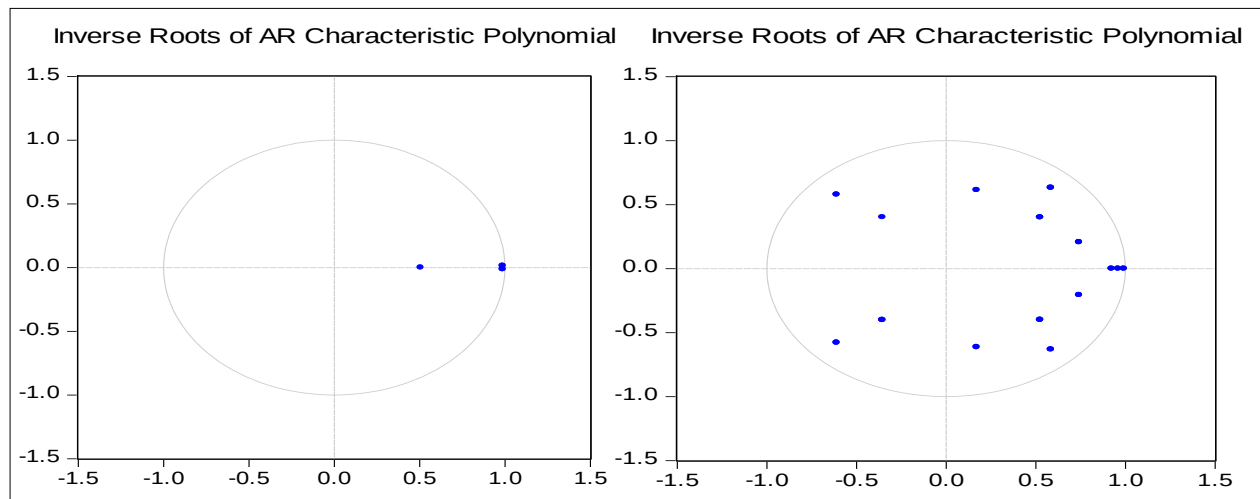


Figure 4.8: AR roots graphs

Source: Compiled by author

The next step is to determine the suitable lag lengths for both the models and to determine whether cointegration/co-movement among the variables exists. Twelve lags were included as the benchmark because of the monthly nature of the data. The results for both models are displayed in Tables 4.8 and 4.9 below.

Table 4.8: Lag length criteria (model 1)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	66.36366	NA	6.15e-05	-1.183601	-1.029191	-1.121075
1	462.7352	753.8831	3.09e-08	-8.779122	-8.393096*	-8.622807*
2	469.1965	11.90912	3.25e-08	-8.729344	-8.111703	-8.479240
3	480.7430	20.60247	3.10e-08	-8.779274	-7.930018	-8.435381
4	484.8555	7.096133	3.42e-08	-8.683441	-7.602570	-8.245760
5	502.1716	28.86013*	2.92e-08*	-8.846502*	-7.534015	-8.315031
6	506.8651	7.546393	3.19e-08	-8.762060	-7.217959	-8.136801
7	515.7991	13.83898	3.22e-08	-8.760767	-6.985050	-8.041718
8	518.5385	4.082306	3.68e-08	-8.638010	-6.630678	-7.825173
9	523.1487	6.598836	4.07e-08	-8.551935	-6.312988	-7.645309
10	531.6516	11.67068	4.18e-08	-8.542188	-6.071626	-7.541773
11	540.9650	12.23520	4.25e-08	-8.548333	-5.846155	-7.454129
12	551.1229	12.74720	4.26e-08	-8.571037	-5.637244	-7.383044

* indicates lag order selected by the criterion
 LR: sequential modified LR test statistic (each test at 5% level)
 FPE: Final prediction error
 AIC: Akaike information criterion
 SC: Schwarz information criterion
 HQ: Hannan-Quinn information criterion

Source: Compiled by author

The LR, FPE and AIC information criteria suggested that five lags should be included, where the SC and HQ information criteria suggested one lag. The VAR was estimated with both five lags and one lag. The model with only one lag was the better model, because the model with five lags had too many cointegrating relationships. This indicated that the SC and HQ information criteria were sufficient in determining the lag length of this model.

Table 4.9: Lag length criteria (model 2)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-50.95010	NA	0.000578	1.057845	1.135050	1.089108
1	530.4843	1117.266	7.72e-09	-10.16636	-9.857538	-10.04131
2	634.1812	193.1610	1.21e-09	-12.02316	-11.48273	-11.80432
3	708.5610	134.1753	3.35e-10	-13.30512	-12.53307	-12.99249
4	767.6897	103.1854	1.26e-10	-14.28803	-13.28437	-13.88162
5	793.5666	43.63554	9.06e-11	-14.61895	-13.38367*	-14.11875
6	804.4506	17.71306	8.78e-11	-14.65589	-13.18900	-14.06190
7	821.7391	27.11931*	7.52e-11*	-14.81841*	-13.11990	-14.13063*
8	825.1571	5.160473	8.47e-11	-14.70896	-12.77884	-13.92739
9	834.2906	13.25251	8.56e-11	-14.71158	-12.54984	-13.83622
10	841.9617	10.67937	8.92e-11	-14.68552	-12.29217	-13.71637
11	852.4381	13.96854	8.84e-11	-14.71447	-12.08950	-13.65153
12	862.7486	13.14081	8.83e-11	-14.74017	-11.88358	-13.58344

* indicates lag order selected by the criterion
 LR: sequential modified LR test statistic (each test at 5% level)
 FPE: Final prediction error
 AIC: Akaike information criterion
 SC: Schwarz information criterion
 HQ: Hannan-Quinn information criterion

Source: Compiled by author

The LR, FPE, AIC and HQ information criteria suggested that seven lags should be included, whereas the SC information criteria suggested five lags. The VAR was estimated with both seven lags and five lags. The model with five lags was the better model based on the number of cointegrating relationships, which indicated that the SC information criteria were sufficient in determining the lag length of this model. Table 4.10 and Table 4.11 present the results of the Johansen cointegration test for both models.

Table 4.10: Johansen cointegration test (model 1)

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	1	2	1	2	2
Max-Eig	1	2	1	2	2
*Critical values based on MacKinnon-Haug-Michelis (1999)					

Source: Compiled by author

From Table 4.10 it is evident that, for model 1 [$X_t=(bsip, lcred, lshare,)$], considering both the Trace and Max-Eig statistics, the null hypothesis of no cointegrating vector can be rejected using the first and third test assumptions. However, H_1 cannot be rejected, which suggests that the VAR contains at least one cointegrating relationship.

Table 4.11: Johansen cointegration test (model 2)

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	1	1	1	1	0
Max-Eig	1	1	1	1	0
*Critical values based on MacKinnon-Haug-Michelis (1999)					

Source: Compiled by author

Table 4.11 indicates that, according to both the Trace and Max-Eig statistics, the null hypothesis of no cointegrating vector can be rejected using the first four test assumptions for model 2 [$X_t=(bsip, lshare, lhi)$]. Only with the fifth test assumption the null hypothesis of no cointegrating relationship cannot be rejected. However, H_1 cannot be rejected, which suggests that the VAR contains at least one cointegrating relationship according to the first four test assumptions.

Subsequently, a VECM was estimated for both vectors. This first model was estimated with one lag and both the first and third test assumption; however, only the third assumption of an intercept and no trend delivered significant results. The second model was estimated with five lags and the first four test assumptions were used, with the first assumption of no intercept and no trend showing the most significant results. Therefore,

the first VECM was estimated with BSIP, LCRED and LSHARE and the second VECM with BSIP, LSHARE and LHI. The results will be presented in Table 4.12 and Table 4.13 below.

Table 4.12: VECM output (model 1)

Cointegrating Eq:	CointEq1		
BSIP(-1)	1.000000		
LCRED(-1)	-2.754154 (0.19601) [-14.0514]		
LSHARE(-1)	2.063720 (0.20967) [9.84257]		
C	29.19319		
Error Correction:	D(BSIP)	D(LCRED)	D(LSHARE)
CointEq1	-0.186202 (0.06708) [-2.77585]	0.015313 (0.00359) [4.26780]	-0.013285 (0.02006) [-0.66243]
D(BSIP(-1))	-0.329331 (0.08879) [-3.70916]	-0.010113 (0.00475) [-2.12936]	-0.014108 (0.02655) [-0.53145]
D(LCRED(-1))	1.157080 (1.72790) [0.66965]	0.008504 (0.09242) [0.09201]	0.162150 (0.51661) [0.31388]
D(LSHARE(-1))	0.106442 (0.33758) [0.31531]	-0.005942 (0.01806) [-0.32905]	0.159100 (0.10093) [1.57634]
C	0.018202 (0.02784) [0.65387]	0.010406 (0.00149) [6.98836]	0.001176 (0.00832) [0.14132]
Determinant resid covariance (dof adj.)			
3.21E-08			
Determinant resid covariance			
2.79E-08			
Log likelihood			
497.2406			
Akaike information criterion			
-8.557868			
Schwarz criterion			
-8.120966			

Source: Compiled by author

The first part of the VECM presents the long-run relationship of the equation. Both credit and the share index have t-statistics larger than the 1.96 critical value, which indicates that credit extended to the private sector and the share prices have a significant long-run relationship with the banking stability index. Credit has a negative influence on banking stability, which is used as a measure for financial stability and share prices have a positive influence. A one-unit increase in credit will lead to a decline of 2.75 index points in the BSI, while a one-unit increase in share prices will lead to a 2.064 index point increase in the BSI. When the value of BSI is above zero, it presents above-normal stability in the banking sector and *vice versa*. The error correction term is presented by the CointEq1, which presents the adjustment coefficient. The adjustment coefficient is significant ($2.77 > 1.96$) and suggests that when there is a shock to the system, there will be an 18.62 per cent adjustment per month. Therefore, it will take 5.37 months for the system to be in equilibrium again. The dynamic relationships are presented below the cointegrating equation.

Table 4.13: VECM output (model 2)

Cointegrating Eq:	CointEq1		
BSIP(-1)	1.000000		
LSHARE(-1)	1.808697 (0.15549) [11.6320]		
LHI(-1)	-1.612321 (0.12987) [-12.4153]		
Error Correction:	D(BSIP)	D(LSHARE)	D(LHI)
CointEq1	-0.202372 (0.09227) [-2.19324]	0.016363 (0.02925) [0.55950]	-0.001291 (0.00027) [-4.76031]
D(BSIP(-1))	-0.467645 (0.12279) [-3.80862]	-0.047560 (0.03892) [-1.22205]	0.001367 (0.00036) [3.78792]
D(BSIP(-2))	-0.370127 (0.11911) [-3.10738]	-0.048754 (0.03775) [-1.29139]	0.000783 (0.00035) [2.23714]
D(BSIP(-3))	-0.057436 (0.12053)	-0.118944 (0.03820)	0.000960 (0.00035)

	[-0.47652]	[-3.11341]	[2.70828]
D(BSIP(-4))	-0.193724 (0.11320) [-1.71139]	-0.112192 (0.03588) [-3.12699]	0.000725 (0.00033) [2.17896]
D(BSIP(-5))	0.012710 (0.09937) [0.12790]	-0.062325 (0.03150) [-1.97874]	0.000569 (0.00029) [1.94878]
D(LSHARE(-1))	-0.346595 (0.36242) [-0.95634]	0.012447 (0.11487) [0.10836]	0.002513 (0.00107) [2.35826]
D(LSHARE(-2))	0.189737 (0.34798) [0.54526]	-0.037427 (0.11029) [-0.33934]	0.000799 (0.00102) [0.78094]
D(LSHARE(-3))	0.315897 (0.32890) [0.96047]	0.012420 (0.10425) [0.11914]	0.002851 (0.00097) [2.94826]
D(LSHARE(-4))	-0.091521 (0.34635) [-0.26424]	-0.194790 (0.10978) [-1.77440]	0.003600 (0.00102) [3.53541]
D(LSHARE(-5))	-0.157582 (0.34851) [-0.45215]	0.077925 (0.11046) [0.70543]	6.23E-05 (0.00102) [0.06081]
D(LHI(-1))	-68.18377 (33.7996) [-2.01729]	8.554354 (10.7131) [0.79850]	2.578361 (0.09937) [25.9477]
D(LHI(-2))	176.3465 (96.5368) [1.82673]	-20.80384 (30.5981) [-0.67991]	-2.622139 (0.28381) [-9.23912]
D(LHI(-3))	-213.1983 (128.456) [-1.65970]	32.43228 (40.7151) [0.79657]	0.932129 (0.37765) [2.46825]
D(LHI(-4))	135.7859 (93.3446) [1.45467]	-27.74949 (29.5863) [-0.93792]	0.296964 (0.27442) [1.08214]
D(LHI(-5))	-40.63134 (31.5739) [-1.28687]	9.905940 (10.0076) [0.98984]	-0.274495 (0.09282) [-2.95715]
Determinant resid covariance (dof adj.)		6.00E-11	
Determinant resid covariance		3.71E-11	
Log likelihood		837.2124	
Akaike information criterion		-14.55949	
Schwarz criterion		-13.29293	

Source: Compiled by author

Table 4.13 presents the results for model 2, i.e. $[X_t=(bsip, lshare, lhi)]$. The first part of the VECM, which presents the long-run relationship, indicates that the house index and the share index have t-statistics larger than the 1.96 critical value. This implies that house and share prices have a significant long-run relationship with the banking stability index. House prices have a negative influence on banking stability and share prices have a positive influence. A one-unit increase in share prices will lead to a 1.81 index point increase in the BSI, while a one-unit increase in house prices will lead to a decline of 1.61 index points in the BSI. The error correction term is presented by the CointEq1, which presents the adjustment coefficient. The adjustment coefficient is significant ($2.19 > 1.96$) and suggests that when there is a shock to the system, there will be a 20.24 per cent adjustment per month. Therefore, it will take approximately 4.94 months for the system to be in equilibrium again. The dynamic short-run relationships for each lag period are presented below the cointegrating equation.

The following two tables will present the Granger causality/block exogeneity tests of the two distinct models in order to shed light on the endogeneity of the variables included in both vectors. Firstly, between financial stability, credit and share prices, and secondly, between financial stability, house prices and share prices.

Table 4.14: Granger causality test (model 1)

Dependent variable: BSIP			
Excluded	Chi-sq	df	Prob.
LCRED	29.99491	1	0.0000
LSHARE	22.39270	1	0.0000
All	30.11058	2	0.0000
Dependent variable: LCRED			
Excluded	Chi-sq	df	Prob.
BSIP	1.420364	1	0.2333
LSHARE	12.10068	1	0.0005
All	20.41291	2	0.0000

Dependent variable: LSHARE			
Excluded	Chi-sq	df	Prob.
BSIP	0.221376	1	0.6380
LCRED	0.043715	1	0.8344
All	0.584234	2	0.7467

Source: Compiled by author

Table 4.14 indicates the results for Model 1. The joint probability value of BSIP is 0.0000; therefore, the null hypothesis of weak exogeneity can be rejected, which indicates that the banking stability index is endogenous with causality likely running from LCRED and LSHARE to BSIP. The null hypothesis that LCRED and LSHARE do not granger cause BSIP can be rejected, and therefore BSIP can be predicted with greater certainty by using past values of LCRED and LSHARE. Likewise, it can be concluded that LCRED is endogenous, with causality running from LSHARE to LCRED. The null hypothesis that BSIP does not granger cause LCRED cannot be rejected, but the null hypothesis of LSHARE not granger causing LCRED can be rejected. As a result, LCRED can be predicted with greater certainty using past values of share prices. In addition, the null hypothesis of share prices being weakly exogenous cannot be rejected and BSIP and LCRED do not granger cause LSHARE.

Table 4.15: Granger causality test (model 2)

Dependent variable: BSIP			
Excluded	Chi-sq	df	Prob.
LSHARE	5.792785	5	0.3269
LHI	5.495083	5	0.3585
All	11.87969	10	0.2932
Dependent variable: LSHARE			
Excluded	Chi-sq	df	Prob.
BSIP	7.098691	5	0.2134
LHI	14.01974	5	0.0155

All	22.77183	10	0.0116
Dependent variable: LHI			
Excluded	Chi-sq	df	Prob.
BSIP	8.821309	5	0.1164
LSHARE	19.31507	5	0.0017
All	21.83335	10	0.0160

Source: Compiled by author

In terms of the second model, Table 4.15 indicates that BSI is weakly exogenous, since the null hypothesis of exogeneity cannot be rejected. On the other hand, it can be concluded that LSHARE is endogenous because the null hypothesis of weak exogeneity can be rejected, with causality likely running from LHI to LSHARE. The null hypothesis that BSIP does not granger cause LSHARE cannot be rejected. As a result, LSHARE can be predicted with greater certainty by using past values of house prices. Similarly, the null hypothesis of house prices being weakly exogenous can be rejected, with causality likely running from LSHARE to LHI. The null hypothesis that BSIP does not granger cause LHI can be rejected, but LSHARE does granger cause LHI. As a result, LHI can be predicted with greater certainty by using past values of share prices. It can also be concluded that there is a bi-directional causality between house and share prices.

4.7.1 Impulse response analysis

An impulse response analysis was again completed to indicate how dependant variables react to shocks in every other variable in the VAR framework (Brooks, 2008:299). Within the context of this study, impulse response analysis sheds light on the response of financial stability to a one-standard error unit shock in credit and asset prices. The next two figures will present the impulse response analysis of the two models by applying a one-standard deviation shock to each variable. Firstly, the impulse responses of Model 1 will be presented, followed by those of Model 2.

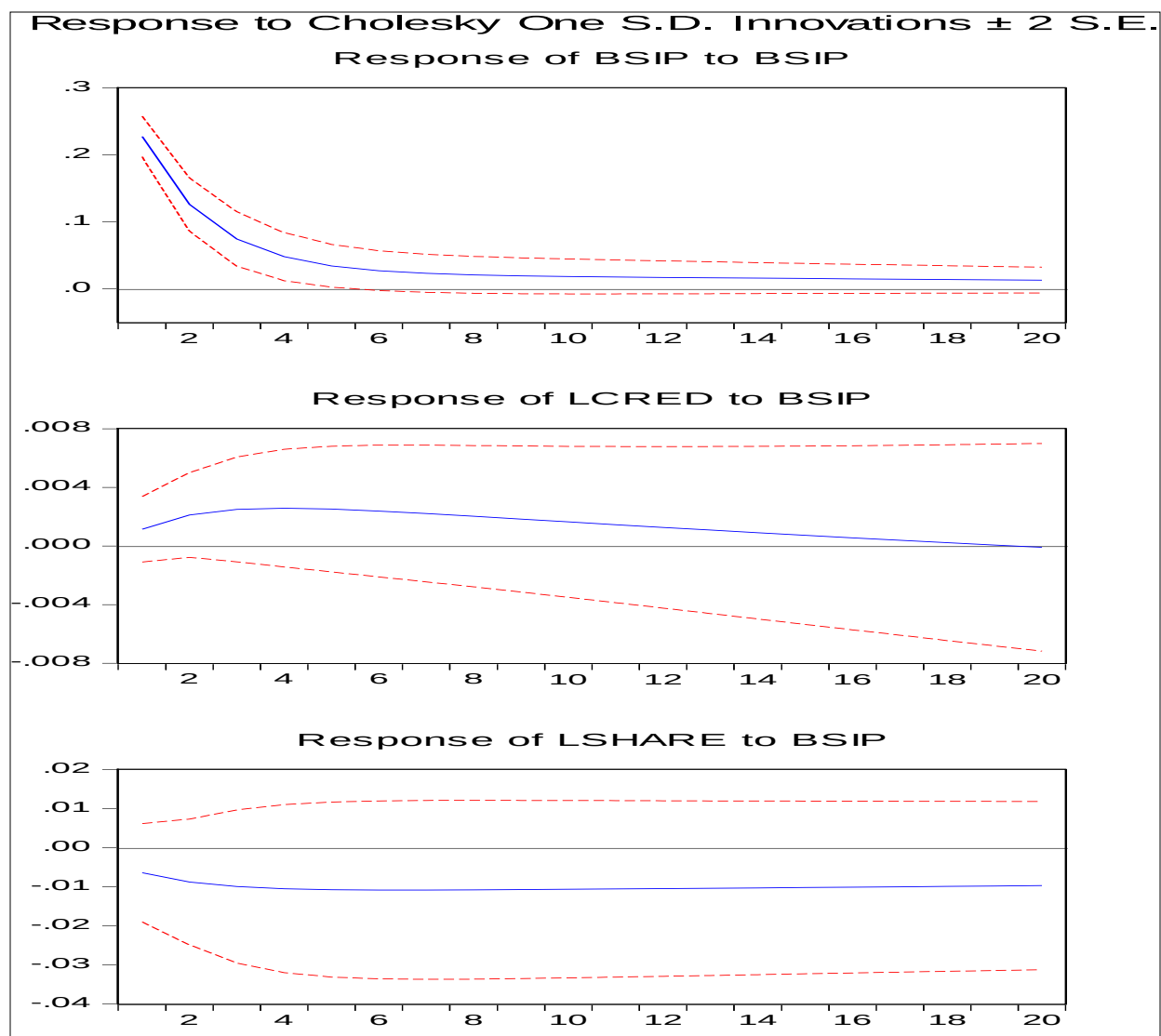


Figure 4.9: Impulse response to financial sector shock (Model 1)

Source: Compiled by author

Figure 4.9 illustrates that when there is a shock to the financial sector or system, for example a financial system when financial stability decreases, credit will initially increase for four months, before declining to its initial level after approximately 18 months. On the other hand, share prices initially decline, but only marginally, before starting to slowly increasing, reaching its original value in 20 months. It is, however, still 0.004 below its original value.

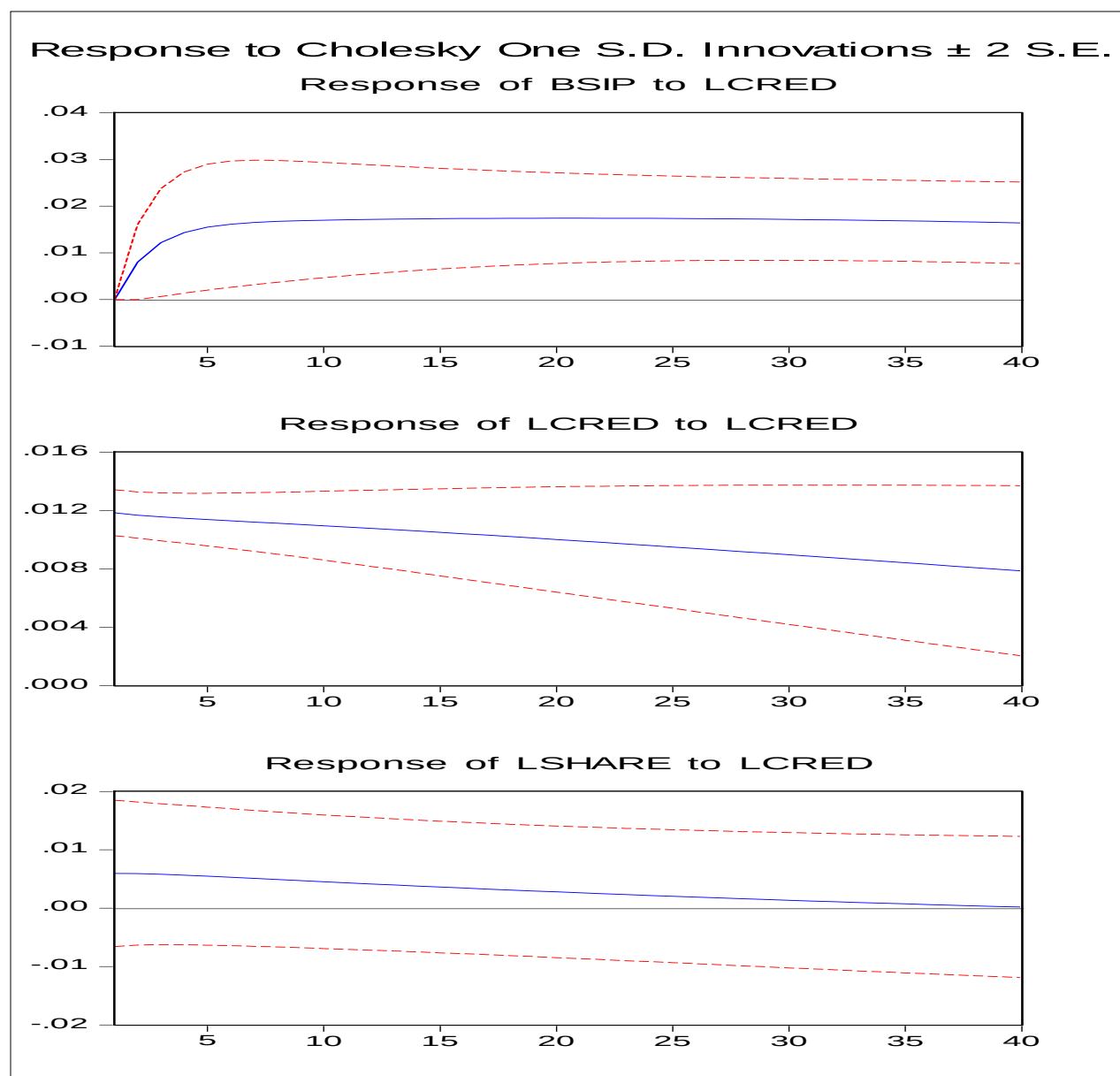


Figure 4.10: Impulse response to credit shock (Model 1)

Source: compiled by author

When credit is shocked, there is an increase in banking stability (increase above zero, which is above-normal banking stability) and reaches its maximum after approximately six months, before stabilising. However, it does not return to its original value after a period of 40 months. Share prices decline for 37 months before stabilising. This is shown in Figure 4.10.

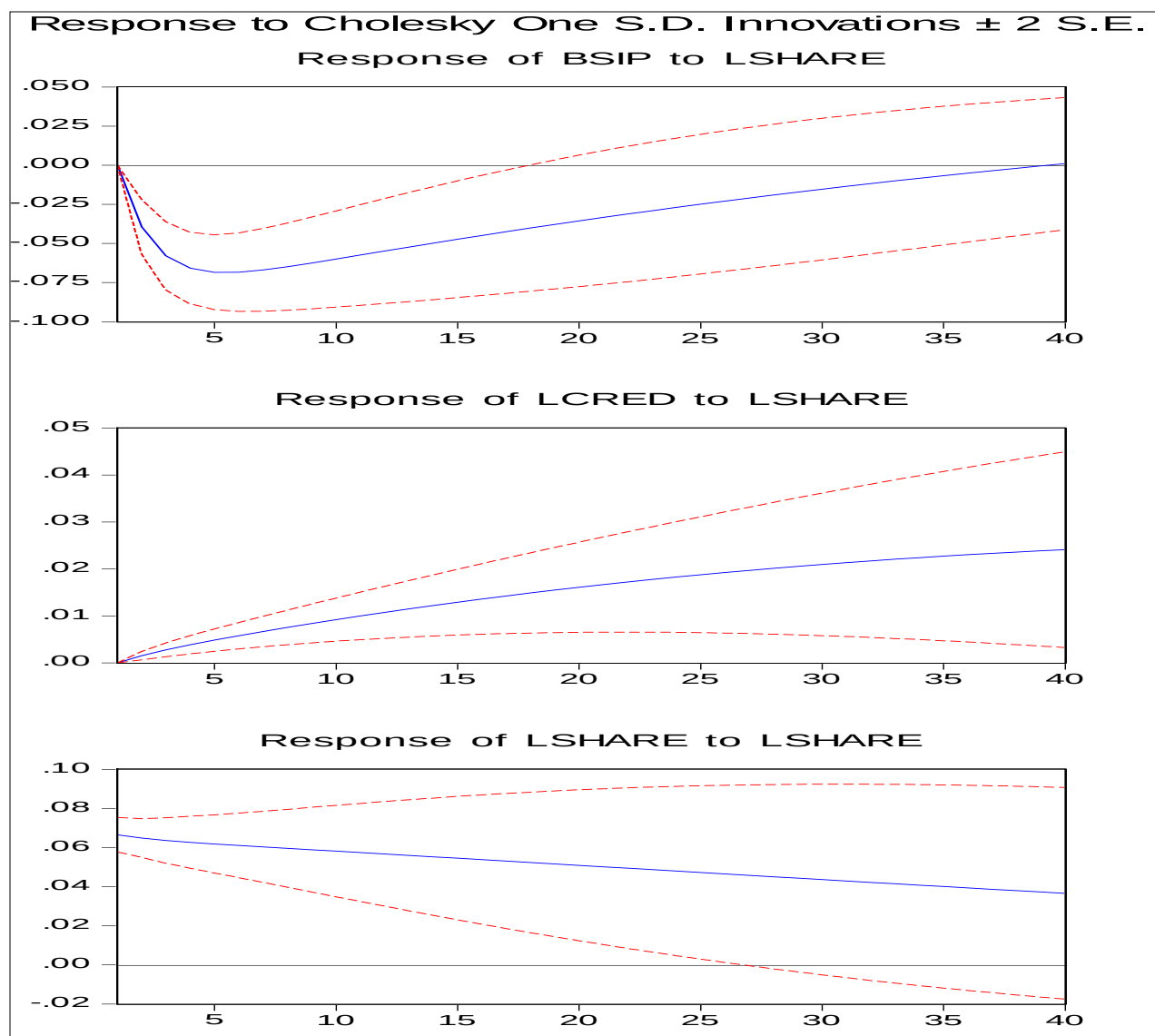


Figure 4.11: Impulse response to a share price shock (Model 1)

Source: Compiled by author

Figure 4.11 shows that the banking stability index responds negatively (decrease below-normal banking stability) to a share price shock and reaches its lowest point after five months, before starting to increase to its original value after 38 months. Credit responds positively to a share price shock and continues to increase until month 40. Next, the impulse responses of Model 2 will be presented with discussions.

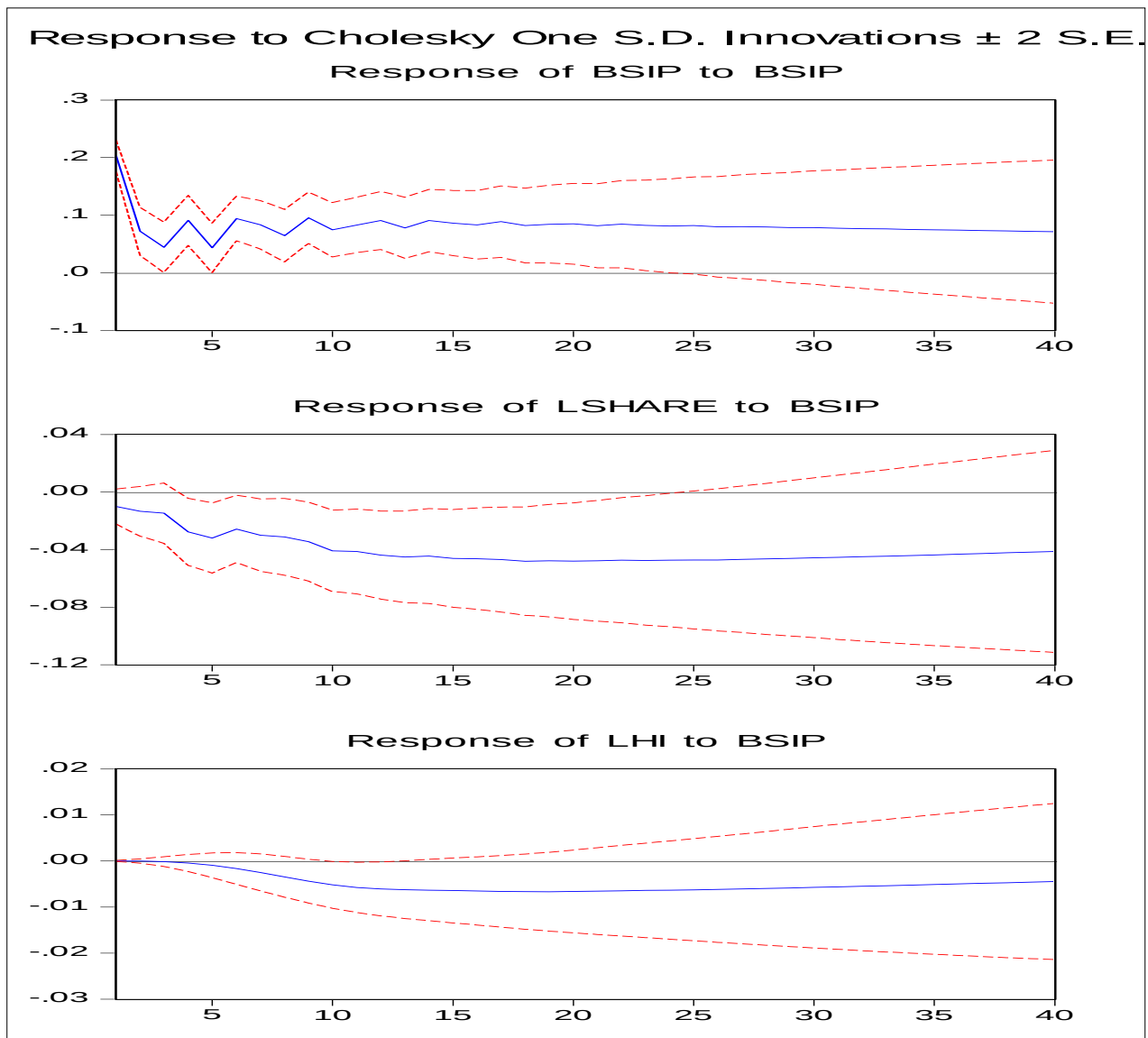


Figure 4.12: Impulse response to financial sector shock (Model 2)

Source: Compiled by author

Figure 4.12 shows that share prices respond negatively to a shock in the financial system and decline for 22 months before starting to increase at a very slow rate. House prices also respond negatively to a financial sector shock and decline for 21 months before slowly starting to increase in month 22. However, none of these prices reach their original value again, indicating a long influence of shocks to financial stability.

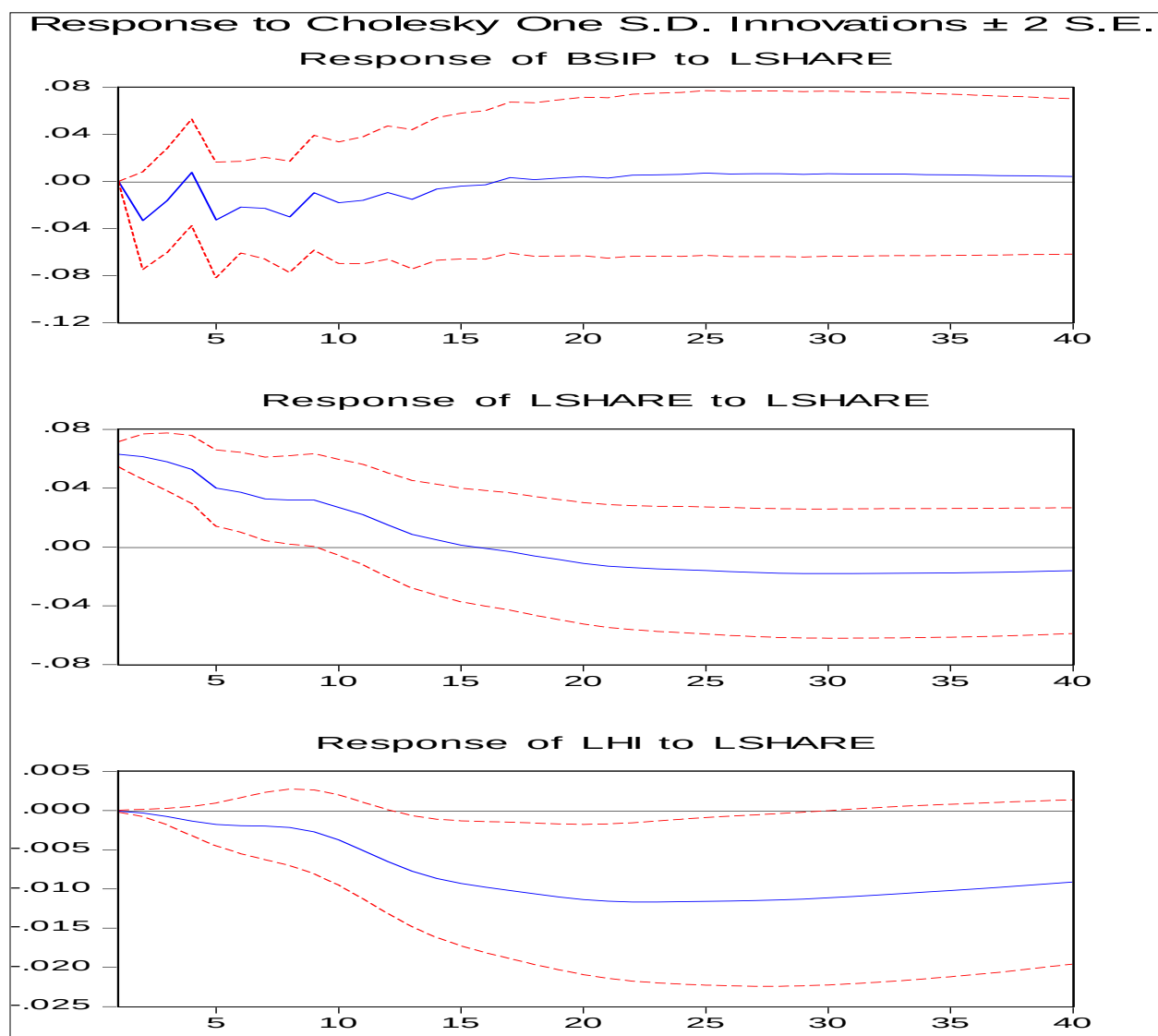


Figure 4.13: Impulse response to a share price shock (Model 2)

Source: Compiled by author

Financial stability substantially fluctuates in response to a share price shock; initially, it decreases, and then increases, then it decreases and continues fluctuating until it stabilises after approximately 18 months. However, it stays below the normal banking stability level for approximately 17 months. This is shown in Figure 4.13. House prices respond negatively to a share price shock and continue decreasing until month 23 before starting a slow recovery from month 24 onwards.

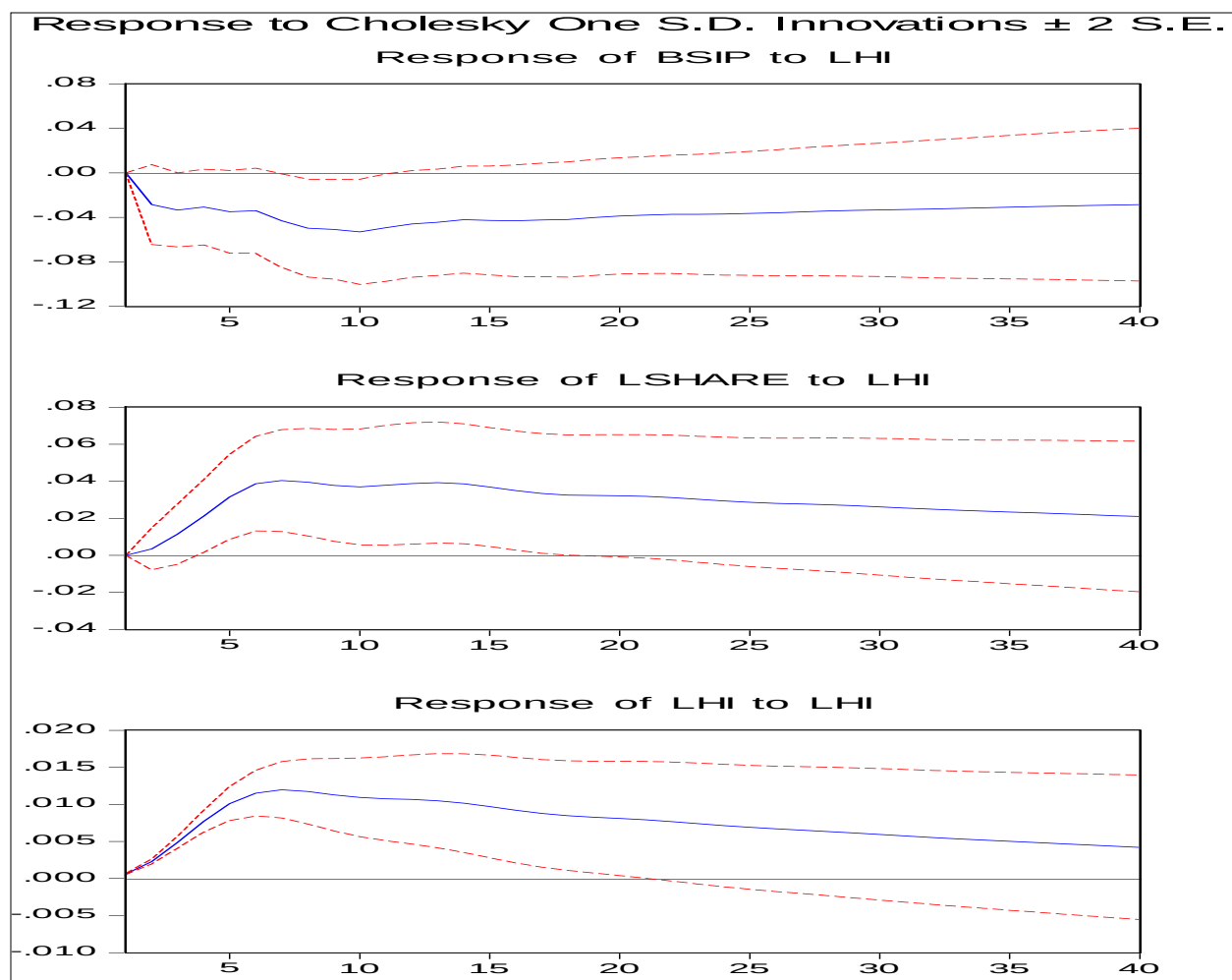


Figure 4.14: Impulse response to a house price shock (Model 2)

Source: Compiled by author

Figure 4.14 shows that banking stability responds negatively to a house price shock and declines for ten months before starting a slow recovery process until month 40. Share prices initially respond positively to a house price shock, reaching its maximum after seven months before slowly starting to decrease to its original level. Finally, the variance decomposition models are discussed below.

In conclusion, the first model revealed that a shock to financial stability influenced credit the most with an initial increase before the decline; in other words, credit will experience a squeeze with financial instability; financial stability improved with a credit shock and share prices decreased; and finally, a share price shock decreased financial stability

and increased credit extended to the private sector. The results of the second model suggest that house prices and share prices will decline due to a shock on financial stability. Financial stability fluctuated and house prices decreased as a result of a share price shock, and lastly, financial stability decreased and share prices increased when house prices were shocked.

4.7.2 Variance decomposition model

The variance decomposition model divides the variations in one variable into component shocks. It will most likely supply useful information about the percentage of movements in the financial stability, which is the outcome of asset price and credit shocks as opposed to those due to 'own' shocks. The Cholesky ordering was chosen as follows for the first vector estimated: banking stability was placed first, because it was the dependant variable; then credit, as literature suggested that credit bubbles are easier to detect than asset price bubbles.

Table 4.16: Variance decomposition model (Model 1)

Variance Decomposition of BSIP:				
Period	S.E.	BSIP	LCRED	LSHARE
1	0.227535	100	0	0
2	0.26326	97.66667	0.093525	2.239807
3	0.279924	93.46756	0.27253	6.259906
4	0.291899	88.66331	0.492489	10.8442
5	0.302173	84.02793	0.722868	15.2492
6	0.311412	79.87431	0.949193	19.17649
7	0.319796	76.26725	1.166504	22.56624
8	0.327408	73.17081	1.374176	25.45502
9	0.334317	70.51895	1.573219	27.90784
10	0.340585	68.24385	1.765094	29.99106
Variance Decomposition of LCRED:				
Period	S.E.	BSIP	LCRED	LSHARE
1	0.011897	0.913783	99.08622	0
2	0.016872	2.017644	97.17681	0.805544
3	0.020787	2.766881	94.94848	2.284636
4	0.024184	3.180923	92.6106	4.208481
5	0.027276	3.351852	90.19476	6.453386
6	0.030175	3.361749	87.69909	8.939164

7	0.032948	3.270197	85.12543	11.60438
8	0.035642	3.117828	82.48512	14.39705
9	0.038287	2.931776	79.79662	17.2716
10	0.040904	2.730033	77.082	20.18796

Variance Decomposition of LSHARE:				
Period	S.E.	BSIP	LCRED	LSHARE
1	0.067087	0.911879	0.7866	98.30152
2	0.093876	1.340937	0.80039	97.85867
3	0.113975	1.671722	0.803132	97.52515
4	0.130602	1.919796	0.799081	97.28112
5	0.144995	2.106541	0.790838	97.10262
6	0.157783	2.249553	0.780005	96.97044
7	0.16934	2.361584	0.767582	96.87083
8	0.179907	2.451487	0.754206	96.79431
9	0.189654	2.525342	0.740289	96.73437
10	0.198704	2.587344	0.726104	96.68655

Cholesky Ordering: BSIP LCRED LSHARE

Source: Compiled by author

The first part of the variance decomposition model in Table 4.16 indicates how much variation in financial stability (BSIP) is as a result of an 'own' shock and how much is as a result of shocks to credit and share prices. The results indicate that 100 per cent of the deviation in the mean value of financial stability is due to an 'own' shock in period one, but share prices become increasingly influential, contributing to 29.99 per cent of the variance in financial stability. The second part of the table indicates that 91.37 per cent of the variance in credit is due to an 'own' shock, with share prices becoming more influential contributing 20.19 per cent in month ten. Lastly, the deviation from the mean value of share prices is mainly as a result of an 'own' shock, contributing to 96.69 per cent in month ten, with financial stability only contributing 2.59 per cent of the variance in period ten. In this model, share prices therefore contribute more to explaining deviations in credit extended to the private sector and financial stability.

Table 4.17: Variance decomposition model (Model 2)

Variance Decomposition of BSIP:				
Period	S.E.	BSIP	LSHARE	LHI
1	0.202991	100	0	0
2	0.219793	96.02085	2.301019	1.678127
3	0.227239	93.60742	2.665186	3.727389
4	0.246769	92.92974	2.358802	4.711459
5	0.255057	89.85743	3.853319	6.289248
6	0.274846	89.10295	3.948896	6.948149
7	0.291264	87.50301	4.131015	8.365974
8	0.303892	84.85464	4.776747	10.36862
9	0.322667	84.00012	4.325431	11.67445
10	0.335879	82.4515	4.280441	13.26806
Variance Decomposition of LSHARE:				
Period	S.E.	BSIP	LSHARE	LHI
1	0.063879	2.491145	97.50885	0
2	0.089652	3.489882	96.36336	0.146756
3	0.10833	4.224188	94.56653	1.209283
4	0.125416	8.037084	88.20935	3.753569
5	0.139096	11.81394	79.99668	8.189377
6	0.151285	12.87751	73.65308	13.46941
7	0.162734	14.52056	67.6884	17.79105
8	0.173311	16.04633	63.07558	20.87809
9	0.183483	17.84954	59.29306	22.8574
10	0.193457	20.53284	55.26442	24.20274
Variance Decomposition of LHI:				
Period	S.E.	BSIP	LSHARE	LHI
1	0.000627	0.008946	2.078975	97.91208
2	0.0024	0.001646	1.918849	98.0795
3	0.005489	0.06323	2.357737	97.57903
4	0.009581	0.226551	2.746383	97.02707
5	0.014064	0.542491	2.854147	96.60336
6	0.018359	1.112265	2.792379	96.09536
7	0.022146	2.034342	2.718145	95.24751
8	0.025398	3.392818	2.789049	93.81813
9	0.028276	5.149744	3.181929	91.66833
10	0.030988	7.080971	4.117678	88.80135
Cholesky Ordering: BSIP LSHARE LHI				

Source: Compiled by author

Table 4.17 shows the variance decomposition model for Model 2, i.e. $[X_t = (\text{bsip}, \text{lshare}, \text{lhs})]$. Cholesky ordering was chosen on the same criteria as above, except credit was replaced by the house index due to the high correlation between the variables. After ten months, 82.45 per cent of the variance is due to an 'own' shock to financial stability with house prices contributing to 13.27 per cent of the deviation in the mean value of financial stability. When an 'own' shock is applied to share prices, only 55.26 per cent of the variance is explained by the 'own' shock in ten months, with financial stability and house prices being very influential, contributing 20.53 per cent and 24.20 per cent, respectively. The variations in the mean value of house prices are mainly as a result of an 'own' shock, contributing to 97.91 per cent of the variance in month one. Financial stability and share prices are more influential in month ten, with financial stability explaining 7.08 per cent and share prices 4.12 per cent of the variance in house prices. When house prices are used, the asset prices group has the largest influence on credit, with a combined variance explanation of 44.7 per cent, but when house prices are not used, the influence is larger on financial stability with credit and share prices in the model. The next section will conclude the findings of the chapter.

4.8 DISCUSSION OF RESULTS

The objective of this chapter was firstly to determine the influence of credit growth and asset prices on the real economy and secondly to establish the influence that credit growth and asset prices have on financial stability. Firstly, a significant long-run relationship was found between consumer prices, real GDP, credit extended to the private sector, house prices and share prices. Real GDP and share prices were found to have a negative effect on the inflation rate (consumer price index), where the other variables had a positive contribution.

Granger causality tests further established that the real GDP, inflation, and credit extended to the private sector granger caused interest rates and as a result past values of these variables can be used to predict interest rates. A bi-directional relationship between house and share prices exists therefore they can help predict one another.

Share prices granger cause credit; therefore, past share price values can help to determine future credit values. The impulse response analysis revealed that only inflation responds positively to a monetary policy shock, with real GDP, credit, house and share prices responding negatively. When there is a shock in the credit market, all the variables initially respond positively before starting to decline. House and share prices respond with the same speed to a credit shock, with share prices responding with higher values.

Variance decomposition models revealed that share prices have the largest impact on inflation over a period of ten quarters; inflation had the greatest influence on real GDP after ten quarters, with house prices second and share prices third. House prices and the real GDP proved to influence credit extended to the private sector the most. Real GDP, credit and inflation had the most influential impact on interest rates after ten quarters. House prices were mostly affected by inflation and interest rates and finally house prices had a larger influence on share prices in quarter ten than share prices itself after an 'own' shock. When interest rates are low, it can create a stimulating environment for house prices to increase, which may result in the development of bubbles. It is also interesting to note that GDP, inflation and interest rates are included in the Taylor rule, but credit, which is one of the most important transmission channels, is excluded.

To further determine the influence of asset prices and credit extension on financial stability, two additional vectors were estimated as indicated in section 4.7. Lastly, a significant long-run relationship was found between financial stability, credit and share prices, with credit having a negative influence on financial stability. Additionally, a long-run relationship was also found between financial stability, share and house prices with house prices negatively affecting financial stability. Granger causality indicates that credit and share prices can be used to predict financial stability and share prices can help predict future credit extended to the private sector. Furthermore, house prices can help estimate future share prices and *vice versa*. Impulse response analysis suggests that credit will initially increase after a shock to financial stability before starting to

decrease; financial stability increases after a credit shock and share prices decrease. Financial instability increases when there is a shock to share prices and credit will increase. Furthermore, house prices respond negatively to a share price shock and there is an increase in financial instability when house prices are shocked. Share prices respond positively to a house price shock. In addition, the two variance decomposition models found that share prices are greatly influential in the variation of financial stability from its mean value after ten months and share prices play a large role in the variation of credit. Lastly, in comparison with share prices, house prices were more influential on the variation of financial stability after ten months, and both house prices and financial stability greatly affected share prices, and financial stability had the largest role in house price variations.

The results are in line with theory that suggests that despite the influence of share prices on financial stability, house prices are more influential than credit is. In addition, the results revealed that house prices will influence share prices and when there is instability in the financial sector, house prices will be affected the most when compared to share prices. In addition, share prices can signal potential changes in credit and share prices in combination with credit can signal potential financial instability.

4.9 CHAPTER SUMMARY

This chapter had two main objectives, which were obtained by means of two different analyses. The first objective was to determine the influence of asset prices and credit growth on the real economy, as well as the relationship between these variables. The second objective was to determine the influence that asset prices and credit growth have on financial stability and the link between these variables. Vector error correction models were used to shed light on the long-run relationship between the variables, as well as the dynamic short-run relationships. It also indicated how long it will take for the system to be in equilibrium again after a shock to the system. Furthermore, Granger causality tests were performed in order to determine the endogeneity of the variables in the VAR. Lastly, impulse response analysis and variance decomposition models were

estimated. Impulse response analysis shed light on the response of financial stability and the real economic variables to a one-standard error unit shock in credit and asset prices. Variance decomposition models supplied useful information about the percentage of movements in the financial stability and the real economy, which is the outcome of asset price and credit shocks as opposed to those due to 'own' shocks.

CHAPTER 5: CONCLUSION

5.1 INTRODUCTION

The recent financial crisis highlighted the influence of financial stability on the real economy and opened the debate on whether and how monetary policy should react to pending financial crises. In the light of the events, this study addressed the following research question: To determine the relationship between credit growth, asset prices and financial stability and real economy in SA. The primary objective was therefore to analyse the influence that rapidly growing credit and asset prices have on financial stability in the country as well as on the macroeconomy as defined by real GDP and inflation. In order to reach this objective, this study identified five secondary objectives. Firstly, to theoretically establish the prerequisites for financial stability and to determine what can cause financial instability; secondly, to present theoretical information on the relationship between credit growth, asset prices and financial stability; thirdly, to describe the current South African monetary policy framework and to determine how monetary policy can influence financial stability; fourthly, to assess the current policy and evaluate current debates on when and how monetary policy should react to various asset price and credit bubbles; and lastly, to empirically analyse the effect of asset prices and credit growth on financial stability and the real economy in South Africa and to make recommendations on what this implies for monetary policy in the country.

This chapter will provide conclusions with regard to each of these objectives. Firstly, by providing conclusions with regard to the first three objectives that are literature related and secondly, a conclusion of the empirical results will be presented. Limitations of the study will also be identified and the chapter will conclude with some recommendations for future studies and policy recommendations for the South African monetary policy.

5.2 CONCLUSIONS

The world economic downturn and recession in the second half of 2008 was mainly the result of the crises that influenced the world's financial markets and of the sub-prime

mortgage market losses in the United States. After the financial crisis, the extended period of rapid credit growth that was driven by asset price increases, especially property prices, came to an end. This led to the research question of this study, namely how credit growth and asset prices influence financial instability and the macroeconomy in SA. Firstly, is the fact, that the recent crisis showed that problems in the financial sector have a possible stabilising effect on the economy, to such a degree that it affects the real economy. Secondly, the recent crisis also revealed that the current macroeconomic framework failed to detect and manage instability in the financial sector, which opened the debate on whether monetary policy should react to asset and credit bubbles. Before determining how asset prices and credit growth can influence financial stability, it is crucial to understand what financial instability entails.

5.2.1 Conclusions with regard to financial stability

From the literature it is evident that there is no general agreement on a specific definition for financial stability. Some literature suggested that financial stability is an indicator of the financial system's ability to provide systematic credit intermediation and payment services that are needed for the economy to proceed on the same economic growth path. Other authors (see section 2.2.1) defined financial stability by rather defining financial instability. This literature suggested that financial instability has three distinct characteristics: (i) when a specific asset price group varies from its basic values, it results in a (ii) substantial credit accessibility and market efficiency distortion, within a country and internationally, which finally results in (iii) a mismatch between aggregate spending and the economy's production capacity. Finally, the South African Reserve Bank (SARB) suggested that the broad definition of financial stability is when there is stability in the fundamental financial institutions, and financial markets are well functioning. Financial stability is an important concept, as the recent crisis highlighted the fact that shocks to the financial system have an influence on economic growth and the distribution of the shocks affects the real economy as a result of unstable financial sectors. In addition, international financial markets became more integrated as a result

of liberalisation and deregulation. Therefore, when there is instability in another country's financial market, it is likely to influence the domestic country as well.

There are exogenous and endogenous sources of risk to financial stability, although this study mainly focused on the endogenous sources. Endogenous risk factors can be separated into three groups; firstly, financial institutions, because they may be vulnerable to credit, market or liquidity risks; secondly, endogenous risk may originate in financial markets, because it creates an additional source of finance for the non-financial sector – financial markets additionally create a link between several financial institutions and between savers and investors; and lastly, financial infrastructure may be a source of risk because it creates a link between the different participants in the market.

An additional important point of view is the fact that the welfare costs of financial instability are often related to monetary instabilities. Therefore, it is crucial to have clarity about the link between financial stability and monetary stability. Monetary stability is otherwise known as price stability, which is recognised by conditions of stable price levels or low inflation levels. There are two different views on this relationship between monetary stability and financial stability. Firstly, the conventional view that summoned this relationship by suggesting that a monetary policy that ensures stability of aggregate prices will resultantly encourage stability of the financial system. The empirical study of Hardy and Pazarbasioglu (1999) supported this view by concluding that a fast drop in inflation after a period of high inflation increases the likelihood of a financial crisis. On the other hand, the new consensus argued that price stability may spark financial instability and therefore the central bank should have extensive information on the stance of the economic systems' daily financial situation. In this case, asset prices have a fundamental influence in monetary policy-making. In the new consensus, two main arguments were discussed, i.e. price stability brings forth financial stability (section 2.3.2.1); price stability may spark financial instability (section 2.3.2.2).

5.2.2 Conclusions with regard to the relationship between financial stability, asset prices and credit growth

Chapter 2 commenced by establishing that, if there is an upset in intermediation (i.e. in the banking sector), it may have a substantial negative influence on the macroeconomy. It was found that when an economy recovers from a financial crisis where intermediation was influenced negatively, the recovery period is longer and financial intermediation may be more mismatched than a crisis that did not affect intermediation. Rosengen (2011) concluded that the failure of individuals or financial institution groups does not influence financial stability when intermediation is not affected. As the main source of credit for individuals and firms in South Africa, it can be expected that instability in banks and financial intermediaries will therefore also have a greater influence on financial stability in SA.

The relationship between financial stability, credit creation and asset prices was further explored. This subject has been studied from the early 1900s when Veblen (1904) found a positive relationship between collateral borrowing and asset prices. More recently, several observers suggested that the 'boom and bust' of the last decade in the US house prices is due to mortgage credit standards that are not sustainable. There is, however, a limited number of empirical studies that incorporated credit standards in their house price models due to measurement problems. Modern researchers used loan-to-value ratios for credit standards, but there was no clear evidence found that it explained the recent house price boom. On the other hand, between 2003 and 2008, evidence revealed that credit-driven asset price booms can provoke a financial crisis and the crash of the financial system. Grauwe and Gros (2009) suggested that central banks have the ability to monitor the risk of a financial crisis by focusing on specific indicators, for example stock price indices, bank credit and house prices.

In the discussion of financial stability and asset prices, the important role that credit plays in combination with asset prices came to light. Asset price can be separated into

two different groups: house prices and share prices. Literature revealed different views on the relationship between house prices and credit growth. Some suggested that when 'boom and bust' cycles of the housing and credit market are more intense, it increases the likelihood of a fragile financial system in the future. Therefore, when there is a variation in the long-run trend of house and credit prices, it may be a good indication of potential banking sector distress. On the other hand, Mian and Sufi (2009) proposed that mortgage credit expansion is a driver of house price growth instead of a reaction to house price growth. Duca *et al.* (2012) supported the view and concluded that in the majority of cases, asset price bubbles are driven by unsustainable increases in the availability of credit or by utilising poor financial practices. Literature suggested that the connection between share prices and credit is similar to the connection between house prices and credit, but the link is not as strong.

5.2.3 Conclusions with regard to the current South African monetary policy

This study commenced in Chapter 3 with a brief overview of the history of the South African monetary policy where the time between the Second World War and 1984 were divided into five stages by the De Kock Commission. In addition, Mollentze added two additional stages between 1984 and 1997. These seven stages explained the development and changes in the South African monetary policy over time and provides the background to the rationale of the current monetary policy stance.

South Africa implemented an explicit inflation targeting policy with a flexible exchange rate regime on the 23rd of February 2000 and the government set the inflation target between three and six per cent, while the country's exchange rate is determined by supply and demand of the country for an international currency. Despite the fact that monetary policy should act strict to achieve their objective of price stability, monetary authorities have to have freedom to act or judge on their own. For example, the SARB monitors changes in the economy to detect possible development of insurgent shocks that can affect their goal of price stability. In certain situations the SARB is allowed to deviate from original set targets with the precondition that they specify how these

targets will be reached in the future. This is made possible by an escape clause that is built into the inflation targeting framework. The fact that the ultimate objective of monetary policy in South Africa is price stability does not imply that the SARB has no interest in sustainable high economic growth and development. A stable price environment is rather viewed as a pre-condition that provides the foundation for economic development.

Numerous benefits of formal inflation targeting were revealed in section 3.3.2 and despite these benefits it is still uncertain whether inflation targeting is most suitable for the South African economy given the slow growth and persistent unemployment experienced by the country. The objective behind inflation targeting is that inflation provides the foundation for sustainable economic growth and the SARB suggests there is no long run trade-off between unemployment and inflation. Mminele (2012) concluded that despite the weaknesses of inflation targeting, in comparison to other monetary policies, it is probably the most appropriate for South Africa with the present knowledge.

5.2.4 Conclusions with regard to the link between price and financial stability

In section 3.4, the ultimate objective of price stability in South Africa as well as the importance of low inflation became evident. The South African Reserve Bank sets the repo rate with the aim to influence bank lending and other interest rates in the economy to reach the objective of stable inflation. The objective is not excessively high interest rates, but to influence interest rates in order to obtain the inflation target of between three and six per cent. Furthermore, it was shown that the SARB uses interest rates as a tool to manage the behaviour of the economy. This calls for an additional explanation as to how the SARB uses interest rate rules to make monetary policy decisions.

Central banks react to output and inflation gaps when they differ from the targeted levels. Taylor rules are considered fundamental or essential in monetary policy decision-making. The basic Taylor rule states that a central bank's policy rate is a linear

function of the actual or expected inflation and the actual or expected output gap. The output gap is considered as the degree of output deviation from capacity of trend output.

Monetary policy influences the economy's financing terms, the expected inflation rate and economic activity. In addition, monetary policy can affect the prices of goods, assets, exchange rate, investment and consumption. The process of how this occurs is explained by the monetary transmission mechanism. Of particular interest in this study is the asset price channel in the transmission mechanism. Section 3.6.3 showed that asset prices and credit markets are fundamental in the monetary transmission mechanism and the conclusion was reached that when credit markets tend to reach extremes, it is closely correlated with asset prices. In addition, financial disruptions affect the monetary transmission mechanism and the channels respond in unfamiliar ways. Excessive leverage and maturity information promote rapid asset price increases and credit extension. When these relationship terms are conversed or transposed, deleveraging and shocks to liquidity are the main drivers of financial instability and crises, while the influence of interest rates during such times become obsolete.

Chapter 3 further investigated whether price stability is sufficient as a monetary policy objective and explores the link between monetary policy and financial stability. Marcus (2010) concluded by stating that there is no mutual agreement on what exactly a central bank's function should be in financial stability or what exactly the true meaning of financial stability is. It was, however, suggested that central banks should not only focus on price stability, but should also play a part in financial stability.

5.2.5 Conclusions with regard to monetary policy's role in financial stability

A discussion of the monetary policy instrument problem that the South African economy experienced in 2010 led to two contrasting main arguments regarding the inclusion of financial stability variables in the current monetary policy of inflation targeting. Firstly, it was argued that asset prices should be part of monetary policy rules, because Alchian and Klein (1973) proposed that asset prices include information of future consumption.

On the other hand, it was suggested that asset prices should be excluded from monetary policy, but should be included if it improves inflation and output growth forecasting. Authors, for example Schwarz (1988), suggested that it should be excluded because it does not strengthen inflation forecasting.

Whether central banks should burst asset price bubbles or whether central banks should rather be concerned about the fragility of the financial system are also two contrasting views that were found. Proponents of the first argument suggested that the asset price misalignments will adjust automatically due to market forces, whereas proponents of the second argument agreed that an economy is sensitive to asset prices, but they suggested that financial imbalances are more important.

The literature concludes with an argument known as the lean versus clean debate of asset price and credit bubbles. The one argument suggests that monetary policy should clean up after the burst of an asset price bubble rather than to lean against asset price bubbles. On the other hand, an argument proposed that once an asset price bubble has burst, it can have far-reaching effects on the economy as the recent crisis and Japanese experience showed. Therefore, the large costs that accompany an asset price bubble burst suggested that central banks should rather focus on the debate of reacting to possible asset price bubbles.

The link between house price bubbles and the credit market resulted in the classification of two distinct types of asset price bubbles. The first type of asset price bubble is known as a 'credit driven bubble' and the second is known as an 'irrational exuberance bubble'. It was concluded that the 'credit driven bubble' is more damaging as the 'irrational exuberance bubble'. Literature showed that when credit-driven asset price bubbles burst, it is very costly and damaging to the economy, while also being very hard to clean up afterwards. As a result, the direction of the current debate indicates that leaning against these bubbles is a better option than to clean up afterwards.

Having said this, the major obstacle identified is the difficulty in detecting asset price bubbles. Therefore, the argument develops that credit bubbles are easier to detect than asset price bubbles and monetary policy should rather lean against credit bubbles than asset price bubbles. There are two suggested policies to deal with these credit bubbles. Firstly, macroprudential policies could be used to limit the connection between asset price bubbles and credit supply. Secondly, monetary policy could react to credit bubbles. In this regard, Mishkin (2011) suggested that monetary policy may not be adequate in dealing with credit bubbles, because a tight monetary policy might be ineffective in constraining certain types of asset bubbles, as market participants mostly anticipate high rates of return on purchased bubble-driven assets. Using monetary policy to lean against credit bubbles, therefore, has to be done only if policy-makers are fully aware of the influence it may have on the economy, as it may result in a weakened economy at times, or inflation can decrease below its targeted level. This suggests that there is a monetary policy trade-off between financial stability and inflation targeting. This can develop confusion on the central bank's dedication towards the targeted inflation rate with possible adverse effects on economic outcomes. Mishkin (2011) concluded that it is important that central banks should monitor conditions in the credit market to detect possible credit bubbles and the methods that will be used should be carefully considered.

5.2.6 Conclusions with regard to the link between asset prices, credit and the real economy

The objective of the empirical study was firstly to determine the influence of credit growth and asset prices on the real economy and secondly to establish the influence that credit growth and asset prices have on financial stability. The first model provided information on the relationship between credit growth, asset prices and the real economy in SA. The study followed the work by Assenmacher-Wesche and Gerlach (2008) and Goodhart and Hofmann (2008) in establishing the link in the South African economy. A vector error correction model was estimated and the following conclusions can be derived:

Firstly, a significant long-run relationship was found between consumer prices, real GDP, credit extended to the private sector, house prices and share prices. Real GDP and share prices are found to have a negative effect on the inflation rate (consumer price index), whereas the other variables had a positive contribution, i.e. indicating an increase in inflation. When a shock is applied to this system, adjustment to equilibrium is slow.

Granger causality tests revealed that the real GDP, inflation, and credit extended to the private sector granger caused interest rates and as a result past values of these variables can be used to predict interest rates. This can suggest that monetary policy can consider incorporating credit in their monetary policy rule, because all the variables are already in the Taylor rule, except for credit. The credit channel is also seen as one of the most important channels of the monetary transmission mechanism. A bi-directional relationship between house and share prices exists, which indicates an interdependence of asset prices in SA. A shock in one is therefore likely to spill over to the other asset class as well. Furthermore, share prices granger causes credit, therefore past share price values can help to determine future credit values.

In addition, impulse response analysis was conducted in order to determine how each of the variables responds when a shock is applied in a specific market. When there is a shock in the credit market, all the variables initially respond positively before being influenced negatively. House and share prices respond with the same speed to a credit shock, with share prices reacting more intensively.

Lastly, three variance decomposition models revealed how a shock to one endogenous variable will influence the other variables. The shocks are interpreted as 'own shocks' that explain how much of the deviation in the mean value of the variable that is shock is as a result of the own shock and how much is contributed by the other variables' shocks. Firstly, it was determined that share prices have the largest impact on inflation, inflation had the greatest influence on real GDP, with house prices second and share prices third. House prices and the real GDP proved to influence credit extended to the

private sector the most, which is not surprising. Real GDP, credit and inflation had the most influential impact on interest rates. This is interesting because the transmission channels assume that interest rates influence credit, but it seems that credit has a large influence on interest rates as well. House prices was mostly affected by inflation and interest rates, which suggests that interest rate rules may be used to react to excessive house price growth and finally house prices had a larger influence on share prices than share prices itself after an 'own shock'.

5.2.7 Conclusions with regard to the link between asset prices, credit and financial stability

The second part of the empirical analysis estimated two additional models in order to obtain information on the relationship between asset prices, credit growth and financial stability. Financial stability was measured by using the SARB's banking stability index (see section 4.3). Firstly, two vector error correction models were estimated and the following conclusion can be made:

A significant long-run relationship was found between financial stability, credit and share prices with credit having a negative influence on financial stability. Furthermore, when a shock is applied to the system, it will take more or less 5.3 months for the system to be in equilibrium again. Lastly, a long-run relationship was also found between financial stability, share and house prices, with house prices negatively affecting financial stability. It will take 4.9 months to adjust to equilibrium after a shock to this system. Granger causality tests showed that credit and share prices can be used to predict financial stability and share prices can help predict future credit extended to the private sector.

Impulse response analysis with respect to the two financial stability models concluded that credit will initially increase as a result of a financial stability shock before declining. Therefore, a squeeze in the credit market will follow after a decrease in financial stability, as was experienced with the recent crisis. There is improved financial stability

after a shock to the credit market and share prices will decline due to the credit shock. Financial instability will increase when there is a share price shock and the amount of credit extended to the private sector will increase. Furthermore, house prices respond negatively to a share price shock and there is an increase in financial instability when house prices are shocked. Share prices respond positively to a house price shock.

In addition, it was determined that share prices have a great influence on financial stability and share prices also have a significant influence on credit. Lastly, in comparison with share prices, house prices are more influential on financial stability. However, house prices and financial stability greatly affected share prices and financial stability had the largest role in house price variations. It can therefore be concluded that a definite relationship exists between asset prices, credit growth and financial stability and that share prices can predict future credit and financial stability. Financial stability responds positively to a credit shock, which provides even more incentive for the central bank to monitor conditions in the credit market and react to potential credit bubbles, as proposed by Mishkin (2011). A financial crisis will adversely affect house prices.

5.3 LIMITATIONS AND RECOMMENDATIONS

This section will conclude the study, by providing some policy recommendations for the South African monetary policy. Lastly, the limitations of the study will be revealed with recommendations for future studies.

5.3.1 Policy recommendations

The literature and empirical results suggest that monetary policy should consider credit extended when setting monetary policy, and conditions in the credit market should be monitored carefully. The problem, however, arises as a result of the endogeneity of credit. The literature and the monetary transmission channels assume that interest rates are used to influence credit, but the evidence also suggests that credit influences interest rates. In addition, it was found that there exists an interdependent relationship between house and share prices; therefore, a shock in one asset market will most likely

spill over to the other. Furthermore, financial stability will decrease when there is a shock to house and share prices and credit will also increase due to the house and share price shock. The evidence therefore supports the literature that when credit and asset prices deviate from the long-run trend, it can signal potential financial instability. From the empirical results and findings, it can therefore be suggested that monetary policy uses its interest rate rules to influence house prices, which will most likely spill over to share prices to prevent a bubble and possible financial sector instability. On the other hand, literature suggested that asset price bubbles are difficult to identify, and therefore monetary policy should rather consider credit in their monetary policy rules. The empirical evidence supports the argument that monetary policy should rather lean against potential credit bubbles and additionally use prudential regulation to protect the economy from potential financial crises. The challenge would ultimately be to use the appropriate methods in order to obtain the desired results. Monetary policy normally uses interest rates to influence credit, but evidence also suggests that credit can influence interest rates.

5.3.2 Limitations

Limitations of the study are firstly the influence of the new credit act that was not considered as a result of the limited data available after the act was instated. Secondly, the study only used a banking stability index and not a whole financial stability index as a result of the various opinions on the definition of financial stability. The banking stability index is, however, the proxy used by the SARB for financial stability. However, the results may be skewed towards banking stability, although it is argued that a financial shock that influences intermediation is far reaching, and therefore the results are still valid.

In addition to the results obtained in this study, the following recommendations can be made for future studies. The literature suggested that there are many downfalls to linear Taylor rules. Therefore, future studies can focus on the alternatives to the linear Taylor rules and investigate how these functions can be adapted to incorporate asset prices

and/or credit growth. Additionally, more research can be done in order to adapt the current monetary policy rule of the South African Reserve Bank to include asset prices and credit growth and to test whether it yields significant results. Another point of interest can be to test the spillover effects from, for example, the United States, where the financial crisis began, to the South African economy. In other words, how long it will take from the start of a financial disruption in another country to the time it takes to influence the other country. Lastly, future studies can spend more time on investigating a more comprehensive financial stability index and establish whether it yields the same results as this study.

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