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Monetary policy transmission and house prices, a VAR approach: a case study of South Africa (1994 to 2011)

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Monetary policy transmission and house prices, a VAR approach. A case study of South Africa (1994 to 2011).

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A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Management in Finance and Investment.

Johannesburg 2013

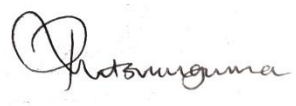
ABSTRACT

We analyse the role of financial and macro-economic variables in the conduct of monetary policy, particularly the role played by monetary policy in the house price boom of the early 2000s. The analysis is performed in the setup of a New Keynesian open economy. We estimate a five variable Recursive Vector Autoregressive model consisting of the short term interest rate, house prices, inflation, output and the exchange rate. Quarterly data from 1994 to 2011 was inputted in Eviews (6) to run the model. We find a significant causal relationship between the short term interest rate and house prices; the impulse response results show an instant response of house prices to a shock in monetary policy. We conclude that the house price boom of the early 2000s was partially attributed to an overreaction to a shock in monetary policy. We also find evidence of exchange rate pass- through to the consumer price index as in (Mishkin, 2008).We conclude that perhaps monetary policy should take cognisance of asset price fluctuations and exchange rate volatility in determining the policy instrument.

DECLARATION

I, Priscilla Mutsvunguma, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management in Finance and Investment at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Priscilla Mutsvunguma



Signed at Johannesburg
On the 21st day of May 2013

DEDICATION

This research is dedicated to my late mother, Mrs Benedicta Vudzayi Kondo, your inspiration lives on.

ACKNOWLEDGEMENTS

I would like to acknowledge the assistance and guidance of Professor Eric Schaling. Your insight and support is greatly appreciated. I also want to acknowledge the support of my family especially my father and my sister Patricia, friends and colleagues.

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Chapter One

Introduction

1.0 INTRODUCTION

The main objective of most central banks is to stabilize inflation around an inflation target and to bring in financial stability. Central banks implement policy changes by resetting their policy instrument, usually a short term interest rate. This instrument affects the economy through various mechanisms of transmission (Bernanke & Gertler 2001).

Decisions made by Central banks on the short term interest rate affect market interest rates (such as mortgage rates and bank deposit rates), to varying degrees. Policy actions and announcements not only affect expectations about the future development of the economy but also the confidence with which these expectations are held. This also affects inflation, output, asset prices and the exchange rate among other variables (Sims et al., 1982).

The main objective of this research is to investigate the transmission mechanism of monetary policy on house prices; we also disentangle and explore the channels through which monetary policy channels are propagated using the Vector Autoregressive Model (VAR). However, monetary transmission has been referred to as the 'black box' by (Bernanke & Blinder, 1995) because of the many channels through which monetary policy simultaneously operates.

The VAR approach recognizes explicitly the simultaneity between monetary policy and macroeconomic developments, that is, the dependence of monetary policy on other economic and financial variables (the policy reaction function), as well as the dependence of economic and financial variables on monetary policy (Mishra et al., 2010)**.** The analysis is performed in the setup of a New Keynesian small open economy and we estimate a five variable VAR consisting of a short term interest rate, house prices, inflation, exchange rate and output.

The paper is an extension to the work of (Ncube & Ndou, 2011) and that of (Gupta & Kabundi, 2009).Ncube and Ndou (2011) looked the relationship between housing, consumption and monetary policy. Gupta and Kabundi (2009) investigated the effect of monetary policy on real house prices using a Factor Augmented Vector Autoregressive Model (FAVAR). We extend their papers by opening up the economy through the inclusion of the exchange rate; we also add inflation and output in our model. Thus this paper is not only limited to investigating the relationship between monetary policy and house prices, but looks at the causal links between financial and macro-economic variables, in the context of the transmission mechanism of monetary policy.

1.1 PURPOSE FOR CARRYING OUT THE RESEARCH

The latest boom and bust cycle in housing prices in many economies has revitalized the discussion on the drivers of housing cycles and the role of the housing sector in amplifying economic volatility, as well as the appropriate response of the monetary authorities. This debate has led to some researchers like (McCallum, 2010) arguing that inflation targeting is an insufficient framework for monetary policy in the presence of financial exuberance. The purpose of the research is therefore is to find out the impact of monetary policy decisions in South Africa (with particular attention to the short term rate) on financial variables like house prices and the exchange rate and macroeconomic variables (inflation and output); we also investigate the causal relationship between these variables.

1.2 STATEMENT OF THE PROBLEM

A major challenge with which policymakers, and mainly central banks, has been provoked recently is the apparent increase in financial instability. A significant dimension of financial instability is the amplified instability of asset prices and the resulting increase in asset price bubbles. The emergence of several major boom-bust cycles in the prices of equity and real estate has been documented widely in the literature. The bursting of several of these asset price cycles was followed not only by instability in financial systems of countries, but also by significant reductions in real economic activity. Asset price volatility also becomes an independent source

of economic instability when booms and busts in asset markets have important effects on the real economy.

When asset price swings occur for non-fundamental reasons and these swings have the potential to destabilize the real economy, it has implications for monetary policy. Although monetary policy is not by itself a sufficient tool to contain the possibly damaging effects of booms and busts in asset prices, asset price crashes have traditionally done continuous damage to the economy only in cases where monetary policy remained impassive or actively reinforced deflationary pressures (Bernanke & Gertler 1999).

Like other asset prices, house prices are influenced by interest rates, and in some countries like the USA, the housing market is a key channel of monetary policy transmission. Certainly, house prices seem to be associated with business-cycle movements and inflation in a number of real variables, such as consumption and investment Bean (2003). The fact that house prices, monetary variables and macroeconomic aggregates also move in response to other shocks hitting the economy makes it difficult to tell the direction or extent of causality between these variables. Swings in house prices tend to be pro-cyclical—output gaps and inflation also tend to peak around the median house price peak. Empirically it would be difficult to tell whether monetary policy was reacting to house prices as well as output gaps and inflation. The VAR model assists in performing a direct Granger causality tests to determine the direction of causality between the variables under study.

The latest development of boom-bust cycles in house prices has been an issue of distress for policy makers (Borio et al., 1994; Bernanke& Gertler, 1999), since the bust of the house price bubble is always followed by significant contractions in the real economy. Given this, it is crucial for central banks to analyze thoroughly the effects of monetary policy on asset prices in general, and real estate in particular, which, in turn, would lead to the understanding of the effects of policy on the economy at large.

1.3 SIGNIFICANCE OF THE STUDY

Appreciating the key features of the transmission mechanism of monetary policy is vital for the application and implementation of an effective monetary policy strategy. The inflation targeting regime has so far been effective in South Africa and a number of other countries as consumer price inflation has decreased substantially since the early 2000s. However, asset price fluctuations still appear to be substantial. Asset prices are affected by monetary policy shocks, and the volatility of asset prices may in turn have considerable effects on aggregate output and consumer price inflation. Hence, identifying the appropriate monetary policy and asset price interactions may be essential when analysing monetary policy (Hilde et al., 2010).

The research primarily focuses on the role played by the SARB on the volatility of house prices and investigates the behavior of macroeconomic variables under various monetary policy decisions on the instrument. The research also looks at whether and how central banks should take cognizance of asset prices in determining monetary and regulatory policy. It discusses the key channels of monetary policy transmission and how this transmission mechanism is propagated to the variables under study and the economy as a whole.

1.4 OBJECTIVES OF THE RESEARCH

Primary objective

To analyse the role of financial variables (house prices and the exchange rate) and macroeconomic variables (Inflation and output) in the conduct of monetary policy.

Secondary objectives

1) To investigate the role played by the SARB on the house price boom of the early 2000s
2) To investigate the key channel links in the monetary policy transmission mechanism.
3) To determine how crucial macroeconomic variables such as inflation and output behave on average under various alternative policy rules.
4) To investigate the effect of monetary policy on the exchange rate; we test Dornbusch's 1976 famous exchange rate overshooting hypothesis[1]
5) To examine the relationship between financial variables and macroeconomic under study.

[1] See discussion of Dornbusch's hypothesis in chapter 2.

1.5 RESEARCH QUESTIONS

1) What role do house prices play in the conduct of monetary policy?
2) What are the channels through which interest rates affect house prices?
3) What are the key channel links in the monetary policy transmission mechanism?
4) Is inflation targeting enough to stabilise the economy?
5) What is the relationship between financial variables and economic variables under study?

1.6 RESEARCH HYPOTHESIS

This study tests the following hypotheses:

H_0: Monetary policy decisions on the short term interest rate do not have an effect on the financial and macroeconomic variables under study.

H_1: Monetary policy decisions on the short term interest rate have an effect on the financial and macroeconomic variables under study.

1.7 SUPPOSITIONS

We use nominal GDP growth as a proxy for the actual output gap and therefore of future inflationary pressures as in (Goodhart & Hofmann 2000).

1.8 CONCLUSION

The chapter has highlighted the factors that stimulated this research, what the research tries to achieve and the value and significance of the research. Against this background, the next chapter looks at available literature relating to monetary policy transmission mechanism on the variables under study and summarises the empirical evidence.

Chapter Two

Literature Review

2.0 MONETARY POLICY TRANSMISSION MECHANISM

Introduction

The transmission mechanism of monetary policy is apprehensive of the relationships between variations in the supply of money, inflation and the level of real income (output). Pétursson (2001) defines the transmission mechanism of monetary policy as a process that describes how a change in monetary policy propagates to other parts of the economy. Most economists have agreed that monetary policy has short run implications on the real economy. Bernanke and Gertler (1995) confirmed the early findings of (Friedman & Schwartz, 1963) that monetary policy decisions on the instrument are followed by movements in real output that may last for two or more years.

The paramount importance of understanding the transmission mechanism of monetary policy has led to more effort being put in understanding this fact Petursson (2001). In the words of (Bernanke& Gertler 1995) "The same research that has established that changes in monetary policy are eventually followed by changes in output is largely silent about what happens in the interim. To a great extent, empirical analysis of the effects of monetary policy has treated the monetary transmission mechanism itself as a 'black box' (p. 27). It is because of this fact that the research has been motivated and especially localised to South Africa.

There are several channels through which changes in money supply affects output since monetary policy is simultaneous in its operation. Nevertheless, a few prominent channels are the

interest rate channel, credit channel, exchange rate channel, and asset price channel Asif Idrees et. al (2009)[2].

Bernanke and Gertler (1995) summarize their view on how the credit channel fits into the 'black box' of monetary policy transmission. They came up with the balance sheet channel that explains the impact of monetary policy effect on the borrowers' balance sheet and income statements including the borrower's net worth, liquid assets and cash flow. They also cited the bank lending channel that is, the effect of monetary policy actions on the supply of loans by financial intermediaries. Bernanke and Gertler (1995) made a conclusion that deregulation and innovation has diminished the importance of the traditional bank lending channel.

2.1 MONETARY POLICY TRANSMISSION CHANNELS

2.1.1 The interest rate Channel

The Monetary Policy Committee (MPC) sets the short-term interest rate at which the SARB deals with the money markets.The SARB increases the repo rate, then banks follow this move and increase their prime lending rates. This in turn slows down aggregate demand.

According to the Keynesian theory, the interest rate is the key channel of monetary policy transmission. The Keynesian view of how a contractionary monetary policy can affect the economy is best illustrated by the equation below as postulated by Mishkin (1995). **M↓ = i↑= I↓= Y↓**

Where a contractionary monetary policy (M↓) leads to an increase in the real interest rate**(i↑)**this will in turn lead to a decrease in investment**(I↓)** as cost of capital is high; this will ultimately lead to a decline in aggregate demand and or output **Y↓)**.

2.1.2 Exchange rate channel

Monetary policy decisions on the interest rate affect the exchange rate. The exact impact of a change in the interest rate on the exchange rate is not clear as this depends on expectations about future domestic and foreign interest rate and inflation. However, holding other things constant, a

[2]Channels to be discussed further in the paper.

contractionary monetary policy (which increases the short term real interest rate) will lead to an appreciation of the domestic currency Taylor (1995). This is because the high domestic interest rate relative to foreign interest rate will attract more international investments. The appreciation in the domestic exchange rate makes domestic goods more expensive relative to foreign goods, this leads to a reduction in exports and output Mishkin (1995).

2.1.3 Credit Channel

Bernanke and Gertler (2000) have shared the view that asymmetries and moral hazard in the credit market create agency problems in the financial markets. Two major channels of monetary policy transmission arise from the agency problem that is, the bank lending channel and the balance sheet channel. The bank lending channel explains the fact that banks and other financial intermediaries deal directly with depositors and borrowers. Amidst these depositors and borrowers are small firms which are not able to enjoy the benefits of operating at a larger scale[3]and this fact thus pronounces the problem of asymmetric information. Thus a contractionary monetary policy that decreases deposits will also impact on borrowers through a higher cost of credit and will ultimately lead to a reduction in investment and output. However, the effect of monetary policy on the bank lending channel has been questioned by (Bernanke& Gertler, 2000) as they argue that financial markets have since changed through deregulation and innovation.

The balance sheet channel operates via the effect of monetary policy decisions on the net worth of firms. A contractionary monetary policy which increases the interest rate will reduce equity prices and consequently the net worth of a firm leading to a lower investment and a lower output[4].A contractionary monetary policy will also affect the firm's balance sheet through a reduction in the cash flow[5]Mishkin (1995).

[3] Larger firms can directly access credit through stock and bond markets without having to go directly through a bank Mishkin (1995).

[4]A lower net worth implies lower collateral thus losses form adverse selection are higher, an increase in adverse selection problems will lead to a decrease in lending and investment.

[5] Higher interest rates will lead to an increase in the interest obligation thereby reducing the cash flow

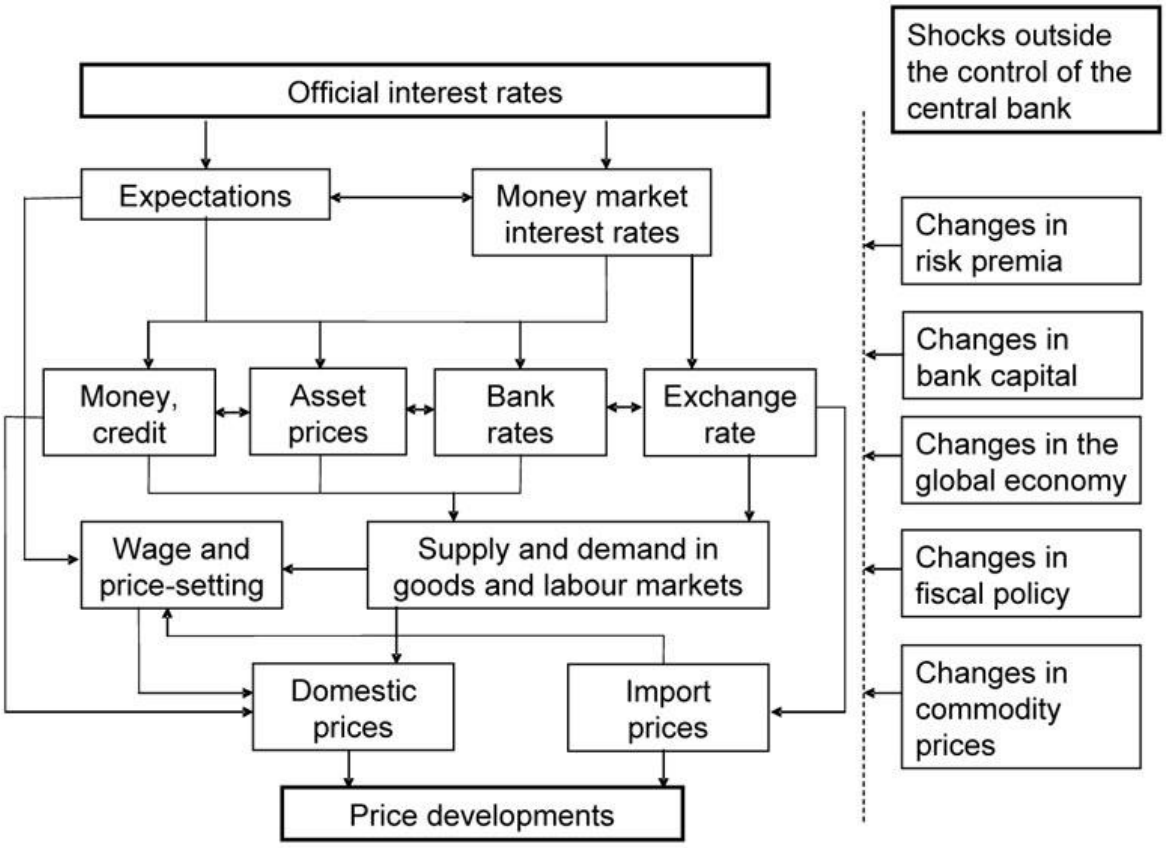
2.1.4 Asset price channel

Meltzer (1995) emphasizes the fact that asset prices are a key channel of monetary policy transmission through the Tobin's q theory of investment and wealth effects. The Tobin's q theory explains the fact that monetary policy decisions on the instrument affect the economy through the change in the value of equity. According to Tobin (1978) 'One way to look at q is that it represents the comparison between, on the one hand, the marginal efficiency of capital, the internal rate of return on investment at its cost in the commodity markets, and on the other, the financial cost of capital, the rate at which investors discount the future returns from such investment' (p. 423). In other words, q is the market value of firms divided by the cost of replacing capital.

A high q value would entail that the market value of the firm is higher than the cost of purchasing new plant and machinery; in such a scenario, firms will then issue equity for a higher price relative to cost of acquiring more plant and machinery. Thus investment spending will increase. A contractionary monetary policy will result in bonds being more attractive than equity thus reducing the price of equity and of q leading to a lower investment and output.

The wealth channel has been advocated by Franco Modigliani (1971) as cited by Mishkin (1995). He came up with the Modigliani's life cycle model where he explains that consumption is determined by the resources held by consumers and these are human capital, real capital and financial wealth. Stocks are a component of financial wealth and thus an increase or decrease in stock prices will affect financial wealth and consumption. A contractionary monetary policy will thus lead to reduction in stock prices, followed by a reduction in wealth and consumption and ultimately a reduction in output.

Figure 2.1.1: The Transmission mechanism of monetary policy.



Source: Bank of England, www.bankofengland.co.uk

Ehrmann (2000) investigated the implication of monetary policy transmission in 13 European countries using a Structural Vector Autoregressive framework. He found that the magnitude of the responses is different among countries. Cecchetti (2009) also found that the euro regions respond differently to interest rate changes. He provides evidence that shows that differences in the financial structure are the main cause of country specific monetary policy transmission. He concludes that the harmonisation of legal structures across Europe is likely to eliminate the diverse financial structures and monetary policy transmission mechanisms.

Cecchetti (2009) examines the financial structure of the countries under study with regard to differences in size, concentration and health of national banking systems and also availability of non-bank credit. He found that countries with smaller, less concentrated and weaker financial systems exhibited a greater deal of sensitivity to policy changes than those that have stronger and deeper financial systems.

The paper therefore primarily focuses on the response mechanism of financial and macro-economic variables to different monetary policy decisions. According to our knowledge, there has been no study thus far that includes all of the chosen variables in this research that is the repo rate, house prices, inflation, output and the exchange rate.

2.2 MONETARY POLICY AND HOUSE PRICES

Introduction

The housing market is a major channel of monetary policy transmission; it is also associated with other real variables such as business cycles movements through interactions with investment and consumption (Doyle et al., 2005). The global boom in house prices in the mid-2000s has provoked interest in the investigation of the relationship between house prices and interest rates; particularly the contribution of monetary policy in this regard. According to Kuttner (2012), two views arose from this experience. The first one is that monetary policy should respond to asset prices, more importantly booms in property prices. According to this view, by "leaning against the wind" central banks can prevent or attenuate asset price bubbles, and thus promote financial stability Kuttner (2012)[6].

The second view was articulated by Taylor (2007, 2009) and states that an overly expansionary monetary policy causes asset price bubbles and ascertains that the central bank should thus be held responsible for asset price bubbles. It then entails that the central bank should be cautious in its decisions on exercising an expansionary monetary policy as it can lead to a financial crisis

[6]This view however contradicts with that of Bernanke-Gertler (1999) which postulates that monetary policy should respond only to the macroeconomic consequences of asset price fluctuations, rather than to asset prices themselves.

(after a boom) if carelessly implemented. Both of these views are based on the hypothesis that interest rates have an economically significant effect on real estate prices. There is vast literature that supports this hypothesis for example(Iacoviello, 2005; lacoviello & Neri, 2008; Vargas-Silva, 2008).According to Stock and Watson (2003) house prices are leading indicators of real activity and can serve as an indicator to where the economy is heading.

The VAR will show us whether or not the SARB has contributed to the boom in house prices through its decisions on the policy instrument and whether it has directly responded to this boom by maybe 'leaning against the wind" as postulated by Kuttner (2012).

2.3 HOW INTEREST RATES AFFECT HOUSE PRICES

2.3.1 The credit channel

Households face a constraint in the amount of money they can borrow in order to buy a house. The extent to which an expansionary monetary policy relaxes credit constraints determines the amplification of the effects of monetary policy on house prices Kuttner (2012).An expansionary monetary policy has two effects in this regard, the first one is that it lowers the mortgage rate and secondly, it eases the availability of credit; the extent of the decline in mortgage rates will depend on the sensitivity of the financial system to changes in the policy instrument Cecchetti (2009).

2.3.2 The Risk Taking Channel

According to (Rajan, 2005; Borioand Zhu, 2011), lower interest rates entice banks to take on additional risk in a bid to increase their rate of return. Dell'Ariccia et al (2010) came up with a partial equilibrium model in which low interest rates can encourage risk-shifting, (that is banks are willing to take on additional risk where the central bank decreases the short term interest rate). An environment of low interest rates increases the demand for risky assets by banks thereby boosting the price of risky assets by more than they would otherwise have risen. A low interest rate environment would increase the risk appetite of financial intermediaries thereby

increasing credit supply. The increase in credit supply will diminish credit constraints on households, increase home purchases and increase house prices Kuttner (2012).

2.4 CONSUMPTION, HOUSING PRICES AND INTEREST RATES

The level of household consumption is dependent upon house wealth which varies with house prices and real interest rates that is, the higher the real interest rate, the lower the wealth and the lower the consumption. The instrument of monetary policy which is the short term interest rate affects the property market and the whole economy both directly and indirectly through a number of channels.

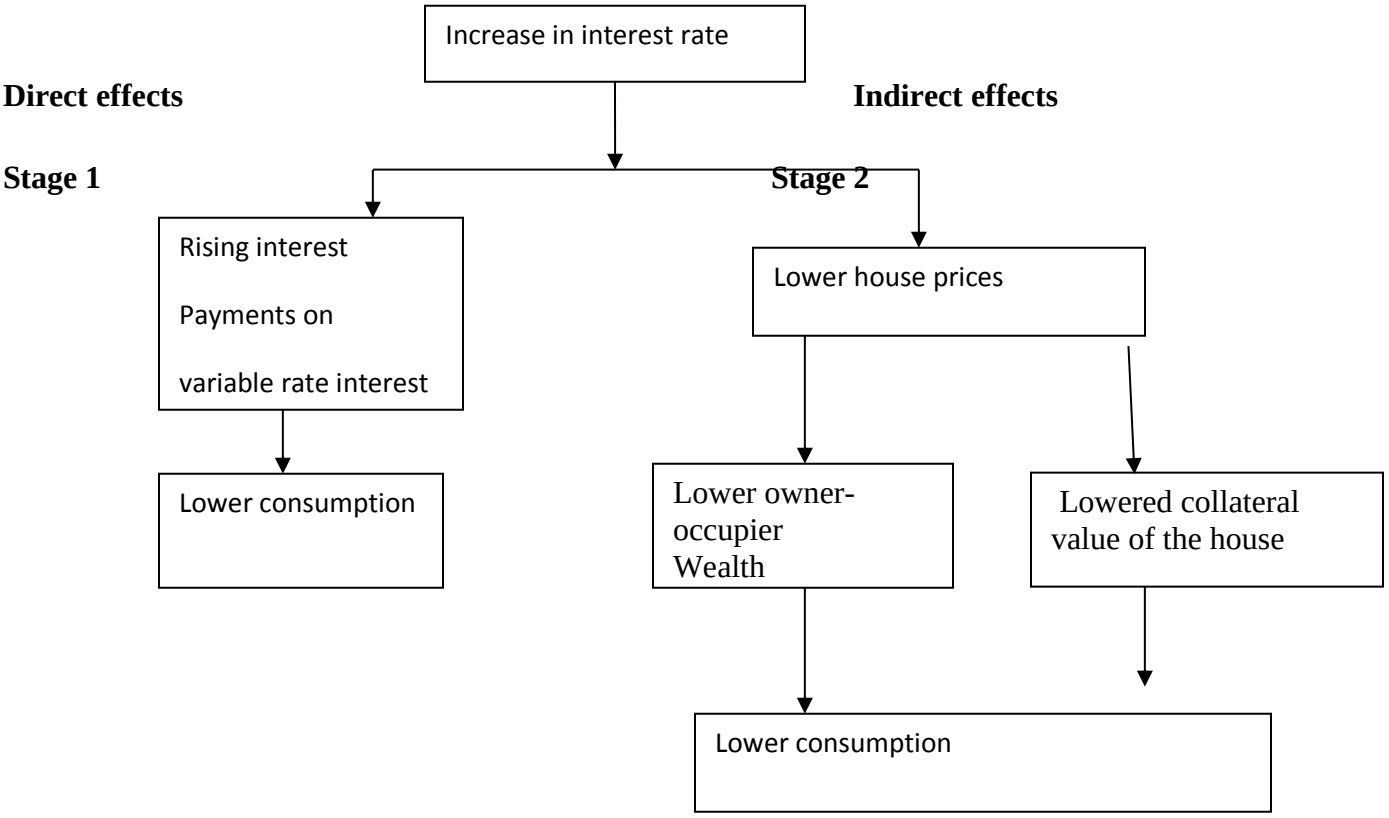
The direct effects of interest rates work through the income or cash flow effect in which a higher interest rate increases the burden of any outstanding variable interest debt and Ndou (2011).The increase in debt interest payments leads to a reduction in the cash flow, a decrease in disposable income (after housing costs) leading to a decline in households' expenditure in the shorter term[7]. The cash flow effects are amplified by the extent to which the households wipe out their budget and the extent of the constraint on household's access to credit. The direct effects also work through expectations of house price movements Elbourne(2008).

The indirect effects of an interest rate increase manifests itself in two stages, firstly asset- pricing theory suggests an inverse relationship between interest rate and house prices. Secondly increasing interest rates lead to a reduction in the owner occupier wealth and cash flow thereby lowering the collateral value of the house. This will then limit the households' access to credit; the resultant credit constraint will lead to a reduction in consumption. Lacoviello and Minetti (2007) as cited by Ndou (2011)argue that house prices play an important role in the transmission mechanism of monetary policy through credit-supply shifts and through determination of the lender's net worth, which constrain the amount of credit made[8].Figure 2.4.1 shows the direct and indirect effects of interest rates on housing and consumption.

[7] This also depends on the initial level of the interest rate.
[8] Lender's net worth = collateral

Figure 2.4.1: The Relationship between interest rate, housing and consumption

Source: Elbourne(2008)



2.5 Empirical evidence

There is lot of literature that is documented that explains the cyclical nature of house prices. Claessens et al (2011) brought out the fact that house prices are pro-cyclical with inflation and the output gap in most countries whilst (Ahearne et al., 2005) found that low interest rates tend to precede housing price peaks with a lead of about three years[9]. While the hypothesis that interest rates have an effect on house prices has proven to be statistically and economically significant, coming up with the impact of interest rates on house prices is complicated as other macro-economic factors that affect the demand for housing vary along with the interest rate. In addition, using descriptive analysis to determine the magnitude of the effect of interest rates on house

[9]This is consistent with the lag structure of the VAR.

prices will yield inconclusive results[10]. The VAR model takes into account major macro-economic variables namely inflation and output, so as to determine the causal relationship with house prices and how they also vary over time under different monetary policy decisions.

Another point of reference is Lacoviello and Minnetti (2007) who tested the credit channel of monetary policy in the property market using the VAR methodology using quarterly data. They came up with error correction models and VARs for the four countries under their study, namely Finland, Germany, Norway and UK. They found that house prices fell by 0.7 to 1% after an interbank interest rate shock of 70 basis points. Kabundi and Gupta (2009) worked on a paper that assessed the impact of a positive shock in monetary policy on house prices for the aggregate US economy using quarterly data (1976Q1 to 2005Q2) and 126 variables. They found a negative relationship between a positive monetary policy shock and house prices. They also found that the reaction of house price inflation differed across regions, indicating that different economic conditions result in different results.

Pariès and Notarpietro (2008) undertook an investigation to determine the importance of housing markets and household credit frictions on monetary policy setting within an open-economy framework; the study was based in the US and Euro area and used a two-country Dynamic Stochastic General Equilibrium model. They found that allowing for a direct response to house prices through the monetary policy enhances the empirical fit of their model. Silva (2008) wrote a paper on the impact of monetary policy shocks on house prices in the US using sign restrictions on the response variables except house prices, 'the response of the housing variable is left agnostically open by the identification procedure' (p.10). The results showed that a contractionary monetary policy has a negative impact on house prices and residential investments and the impact was stronger in the mid-west.

Bjørnlanda and Jacobsen (2010) analysed the role of house prices in the monetary policy transmission mechanism in Norway, Sweden and the UK, using structural VARs. They used

[10]Descriptive statistics cannot explain causal relationships between variables that is why the VAR is more appropriate given the research question under study.

short run and long run neutrality to eliminate the indogeineity problem of identifying shocks to interest rates and house prices. They found that house prices react immediately and more strongly to shocks, moreover, they confirmed the existence of co-movement between house prices, inflation and the output gap found in conventional literature[11]. The strength and timing of response varied across the countries under study showing that the role played by housing on monetary policy transmission varies across countries and economies.

Kasai and Gupta (2010) examined the effectiveness of monetary policy on house prices in South Africa pre and post liberalisation. Their findings where that the period of financial liberalisation was characterised by relatively stronger effects of interest rate shocks on house prices irrespective of house sizes. The empirical studies discussed above focused on the direct impact on house prices resulting from an interest rate shock. This research however goes beyond decomposing the relationship between house prices and interest rates and seeks to investigate the causal relationship between financial and macroeconomic variables and the behaviour of these variables under different monetary policy decisions.

2.6 LOCAL PROPERTY MARKET DEVELOPMENTS

The South African property market has shown a great deal of variability over the past 25 years. Growth patterns have fluctuated widely in direct response to exogenous events (Clark & Daniel 2006).For instance, the boom in the 1980s was caused by an environment of low interest rates, rising gold prices and a strong domestic currency. The boom was short lived as the economy crashed in 1984; the crash has been attributed to a high degree of political uncertainty and a falling exchange rate.

The prime lending rate increased from 11% during the fourth quarter of 1980, to an average of 21.5% during the second quarter of 1985 Clark et al (2007).The depreciation in the exchange rate caused the interest rate hike[12] which also affected the property market negatively through higher debt obligations. After the market crash followed a three year period of economic decline. The 1990s period was characterised by stable house prices which were depressed by the high real

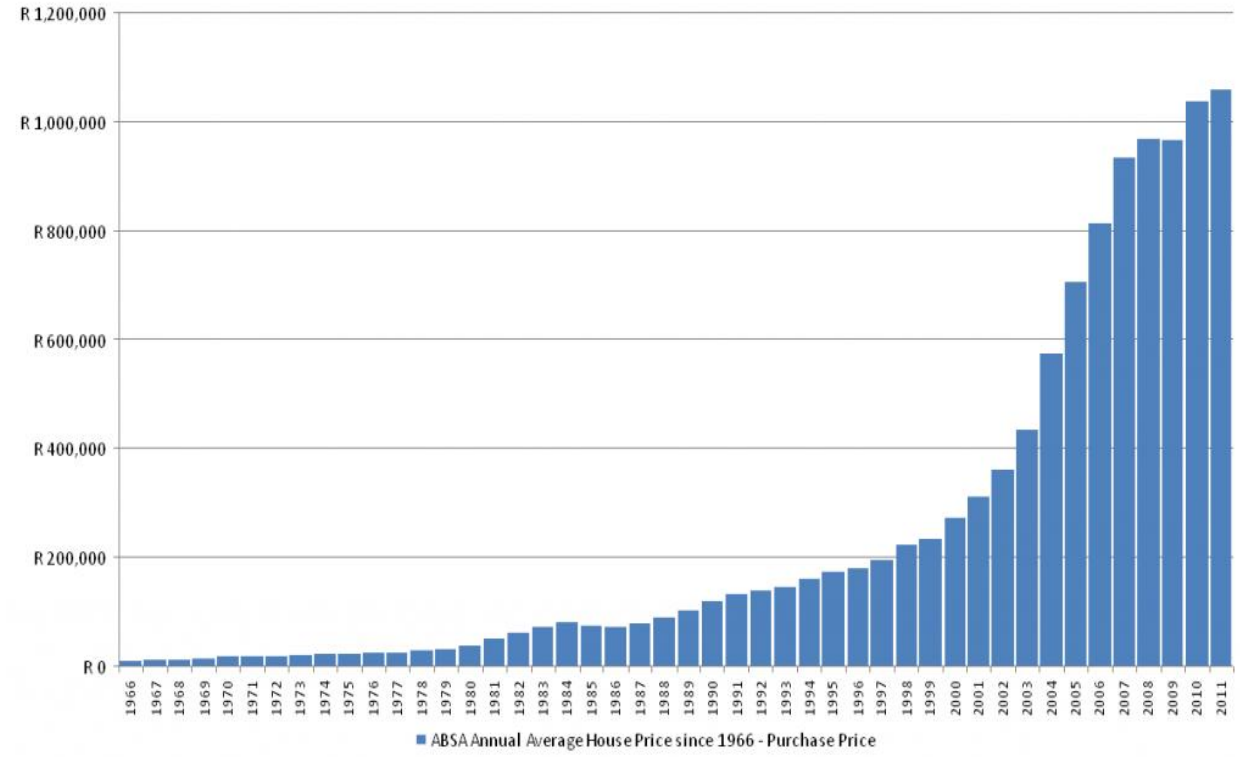
[11]This is what we expect for South Africa.

[12]The SARB increased the interest rate in order to improve the exchange rate.

interest rates. The start of the millennium saw house prices escalating; the boom in the property market has been attributed to the low interest rate environment that prevailed at the time, a growing middle income sector and a higher exchange rate Clark et al (2006).

In February 2012, The Absa national house price index showed no growth, with prices at the same level as last year. Jacques du Toit (2012) predicts a slower growth in 2012 compared to 2011. He observes that despite the low interest rate environment, for more than a year now, mortgage providers are not taking this into consideration despite the implications of lower borrowing costs. According to Jacques du Toit (2012), the major constraint facing banks is the high debt to disposable income ratio which has not gone down since the peak of the boom in the early millennium period. Another factor that is contributing to this constraint is the excessive growths in unsecured loans. These factors discourage banks on granting mortgage loans.

Figure 2.6.1 Annual average house price.



2.7 HOUSE PRICES AND THE CONSUMER PRICE INDEX

There has been a consensus among main stream economists[13] that the central bank should take into account for adjustment of policy, the fluctuations of asset prices in so far as the asset prices have long run implications for future inflation (Goodhart & Horfmann 2000).The inflation-targeting methodology calls for central banks to regulate monetary policy aggressively and proactively to offset emerging inflationary or deflationary pressure. According to Bernanke and Gertler (2000) to policy should react to asset price fluctuations as long as they reflect changes in expected inflation.

Bernanke and Gertler (2000) postulate the fact that attempting to stabilize asset prices exclusively is not sustainable and is tricky because it is hard to decompose whether asset price fluctuations are being driven by fundamental or non-fundamental factors or both. The central

[13]Monetarists and Keynesians

bank would rather focus on the inflationary and deflationary effects generated by asset price movements, in that way, it will be responding to booms and busts in asset prices. By doing this, the central bank would avoid creating a panic which follows after 'pricking' the bubble.

Inflation targeting aids in providing a steady macroeconomic environment and since interest rates will be likely to increase in an inflationary environment and asset price booms and fall during deflationary asset price busts, the approach prescribed by (Bernanke & Gertler, 2000) may thus aid in reducing potential financial panic. The research therefore seeks to define the significance of the long run effect of inflation on house prices and vice versa and to examine also the long run effect of monetary policy on house prices.

2.7.1 THEORETICAL CONSIDERATIONS

Prices /wages are usually sticky and do not respond instantaneously to monetary policy shocks, on the other hand, asset prices are volatile and their adjustment to monetary policy shocks is pro rata[14].Given the difference in response between asset prices and wages/consumer prices, it is most likely that asset prices will tend to overreact to monetary policy shocks; it is then hard to tell in practice whether or not the overreaction was caused by fundamental or non-fundamental factors. According to Iacoviello (2005), the primary effects of monetary policy shocks are likely to be through asset prices and successive transmission mechanism will occur as a result of the increase/ decrease in asset prices which will then affect investment through the Tobin's q effect, consumption through the wealth effect thus stimulating expenditures and activity(Goodhart & Horfmann 2000).

Bernanke and Gertler (2000) argue that the effect of monetary policy depends on the confidence status, balance sheet positions, expectations of future inflation and the credibility of the Central bank. The scholars bring out the point that structural innovations and deregulation diminished the predictability of the growth of money, thus the growth rate of money is not a suitable way to measure the effect of monetary policy and expected changes in inflation. The scholars also

[14]We expect to find this for South Africa.

postulate that borrowers are less concerned about the real interest rate and goods price inflation, but are more concerned about future asset price inflation.

Meltzer (2000) observed that there are periods and occasions when the rate of monetary growth can have a positive impact on activity for example in a Quasi- liquidity trap that existed in Japan in 1998 but the nominal rate of interest on short-term riskless assets is held at a quasi-fixed low nominal level. Because of the unobservable and time varying nature of these factors, the link between monetary policy and asset prices which feeds into inflation and activity is hard to break down with certainty. The causal path is thus time varying.

There is a causal relationship administered from asset prices to other real macro-economic variables. Higher asset prices may lead to expectations about higher profits and activity thereby stimulating bank lending. Higher asset prices may also lead to expectations of high future asset prices and capital gains; this will lower the real interest to the borrowers who intend to buy such assets[15].Asset prices may be an indication on expected movements in inflation and output. An increase in house price will lead to an increase in wealth and an increase in expenditure which might eventually feed into consumer prices (Bernanke & Gertler 2000).

The Tobin's q theory of investment breaks down the link between investment demand and equity prices. Bernanke and Gertler (2000) define the Tobin's q as 'the market value of capital relative to the replacement cost of capital' (p.126). This implies that firms can acquire more capital for the equity they issue; this will in turn increase investment demand which may then increase goods and services prices[16].House prices may also affect consumer prices through wages. An increase in house price will lead to an increase in the cost of living for workers who may then demand higher wages; to meet the demand for higher wages, firms may react by increasing their prices.

[15]The real interest rate will be lower since investors expect the real rate of return to be exceptionally high thus the opportunity cost of taking up credit to buy stocks becomes worthwhile.

[16]The Tobin's q theory has been discussed at length in the first section, the asset price channel of monetary policy transmission mechanism, see page 9

An additional relationship connecting asset prices and economic activity emerges from asymmetries in the credit market. This view suggests that an increase in house price will increase the collateral value and therefore diminish the credit constraints on households and firms. The additional credit could be used in the purchase of goods and services thereby increasing consumer price inflation. This process can be further amplified where the extra credit is used to purchase assets thereby pushing asset prices even more (Kiyotaki & Moore 1997).The interaction between the credit market and asset prices transmits shocks to the economy and result in the fluctuations of the business cycle; an incident called the 'financial accelerator' (Bernanke & Gertler 2000p.23). Property prices are prone to feed into consumer prices than equity prices, this is because from a credit standpoint, property is more suitable to serve as collateral than equity (Bernanke & Gertler 2000)[17].

2.7.2 EMPERICAL EVIDENCE

Studies have been done that investigated the correlations between rates of return on real estate and inflation rates over time. Marquardt and Price (1977) investigated the relationship between rates of return on US property prices and common stock for the period of 1918-1974. They found that nominal returns attributed to real estate where more than the rate of change in the CPI. Spellman (1982) also found that changes in housing prices grew more rapidly that both CPI and rents over the period of 1963-1978 (Anari & Kolari 2002).

Inglesi-Lotz and Gupta (2011) followed the thought process of (Anari & Kolari, 2002) with regard to investigating the relationship between house prices and inflation. The scholars use the Autoregressive Distributed Lag Model (ARDL) methodology in investigating the existence of a long run relationship and elasticity between house prices and prices of non-housing goods and services in South Africa. They found that house prices and the CPI are co-integrated in the long run and a Fisher coefficient of greater than one for the luxury segment, less than one for the small middle segment and less than one for the large and medium middle segments. They concluded that although quantitatively minor, house prices are a stable indicator of inflation in the long run.

[17]The volatility of equity prices make it unsuitable for equity to serve as collateral.

Goodhart and Hofmann (2000) examined whether adding asset price variables for instance, the changes in house and equity prices improve the predictive power of a reduced form equation for inflation. The study was a cross country (panel) time series exercise. They found that house prices provide significant information on future inflation, whereas equity prices and yield spread where insignificant.

The paper not only investigates the long-run impact of inflation on homeowner equity in South Africa but also included in the model, is lagged output and lagged short term interest rate. The research investigates further, the long run impact of inflation, output, exchange rate and monetary policy on house prices; it is thus comprehensive and all-encompassing as far as the analysis of the transmission mechanism of monetary policy on an open economy is concerned.

2.8 MONETARY POLICY AND INFLATION

Inflation targeting was first introduced in New Zealand in 1990 and now a lot of other countries have adopted it. Svensson(2002) defines inflation targeting as having three characteristics

1. There is a numerical inflation target which could be in form of a point target or a target range.
2. Is a framework for policy decisions
3. There is a high degree of transparency and accountability

Svensson (2002) also notes that many countries have adopted inflation targeting but are not "serious" about effective implementation of policy. He postulates that there is need for institutional commitment in order for the inflation targeting to be effective. Such institutional commitment would involve

1. A clear mandate for low inflation directed policy
2. Central bank independence in setting the policy instrument and in the formulation of an interpretation of the low inflation target.
3. Central Bank should be accountable for achieving the target

According to Rochon (2006), central banks always try to achieve some degree of price stability regardless of whether the central banks are governed by monetarists or new Keynesians[18]. Rochon argues that although central banks give the impression that they are also concerned about output and financial stability, it is apparent that mainstream economists are more concerned about price stability. Bernanke et al (1999) also postulates the same idea. According to Rochon (2006), and many other economists, monetary policy has a neutral effect on output in the long run, thus the pursuit of price stability becomes a short run goal via inflation targeting.

Bernanke (1997) shares the same view as that of (Svennson, 2002) and argues that Inflation targeting is not "an iron clad policy rule" (p. 2) as assumed by others scholars, it is instead a policy framework whose primary advantage is increased transparency and credibility if implementation is effective.

2.8.1 SUFFICENCY AND PREDICTABILITY OF INFLATION FOR EFFECTIVE CONTROL

Deregulation and innovation in the past two decades has a seen a massive change in the state of financial markets. The increased competition in the financial sector through the expansion of mutual funds and the commercial paper market has led to a decline in the size of the banking sector. Secondly, the wealth held in the form of private equity has increased significantly Palley (2002).

The significance of deregulation and innovation from a policy perspective is that it changes the choice combinations available for participants; this fact has changed the behaviour of financial markets and led to the introduction of new sources of disturbances which then complicate the transmission mechanism of monetary policy. As a result, Palley (2002) argues that a monetary policy that focuses solely on real economic variables is insufficient in the stabilisation of the economy. Palley(2002) advocates for a monetary policy framework that calls for both inflation

[18]Price stability depends on the preference of the central bank that is different countries target different inflation ranges or points.

targeting and financial intermediary balance sheet regulation as part of the transmission mechanism[19].

According to Goodhart and Horfmann (2000), many economists have argued that monetary authorities should take into account the effects of asset price fluctuation in as far as they affect future inflation. By using the VAR approach, Goodhart and Horfmann (2000) create a benchmark forecasting equation that takes into account lagged inflation, lagged house prices and lagged output gap inorder to assess the long run impact of inflation on house prices and the output gap.

2.8.2 MONEY SUPPLY VERSUS INTEREST RATE TARGETS: LESSONS FROM AN EARLIER DEBATE

There has been a debate on whether Central Banks should focus on controlling interest rates or controlling the money supply. The 1960s was characterised by the great debate between the Monetarists and the Keynesians where the latter advocated for a focus on interest rates and the former advocated a money supply focus. The monetarists debated that the output gap was primarily determined by instabilities in money supply caused by central banks, and central banks must then target to control the money supply in a sound predictable manner Bernanke (1997).

The work of Taylor (1993) seems to have silenced the debate as there was a wide agreement that the appropriate monetary policy instrument ought to be the short term nominal interest rate. Palley (2002) cited Goodhart's law that breaks down the empirical relationship between monetary aggregates and economic activity. Deregulation and innovation of the financial markets has led to less dependency on the quantity of money supply as it has brought about creation of new liabilities and portfolio possibilities; thus a shift from the monetarist view is necessary given this change in the financial system.

[19]Palley argues that there is need for balance sheet regulation since financial deregulation and innovation has led to an increase in the elasticity of private money production.

2.8.3 Inflation, output gaps and financial variables

Volatility in the money demand function has resulted in the growth of monetary aggregates being a defective measure of the standpoint of monetary policy and of future inflationary pressures in many countries. To react to this, most Central Banks have resorted to inflation targeting as opposed to monetary targeting. According to Svensson (1997), the model for inflation targeting consists of an aggregate supply curve (Phillips curve) which relates inflation to past inflation and an aggregate demand or IS curve relating the output gap to past output gaps and lagged interest rate (Goodhart & Hofmann 2000).Models like these are used to come up with the monetary policy reaction functions for inflation targeting.

The implication is that by setting a short term nominal interest rate, the Central Bank would have set the real short term interest rate when prices are sticky. The short term real interest rate thus summarizes the monetary transmission sufficiently. Mets (1997) postulates that financial variables have an impact on aggregate demand and therefore should be taken into account in the conduct of monetary policy. Equity prices, however, are more volatile than property prices making it more uncertain to accurately measure the gains and losses in equity wealth. Thus property prices are more appropriate in assessing the wealth effect as compared to equity prices (Goodhart & Hofmann 2000).

2.8.4 MONETARY POLICY AND THE EXCHANGE RATE

Dornbusch's (1976) came up with exchange rate overshooting hypothesis where he suggests that following a contractionary monetary policy, the nominal exchange appreciates instantaneously and then depreciates in line with the PPP (Purchasing Power Parity). The influence of this hypothesis has played a pivotal role in the New Open Economy Macro economics (NOEM) literature. In an open economy, the exchange rate plays an important role in the transmission mechanism of monetary policy. This is because the exchange rate presents other channels of monetary policy transmission in the form of:

- The exchange rate affects the aggregate demand channel through relative prices between domestic and foreign goods

- The exchange rate affects the prices of domestic goods explicitly through the cost of imports
- The exchange rate affects the domestic currency price of imports which in turn affects the pricing decisions of firms.

Dornbusch's theory shows that the exchange rate first overreacts to a shock in monetary policy relative to Purchasing Power Parity (PPP). However, Faust and Rogers (2003) highlight that many empirical studies do not necessarily confirm this theory.

2.8.5 MONETARY POLICY AND THE OUTPUT GAP

Introduction

The output gap measures the discrepancy between the potential and actual level of output. The output gap is an important indicator of the state of the economy and is thus useful for monetary policy planning. It presents a gauge of when an economy might be overheating or underperforming (Lubik, 2010). In an overheating economy, the implication is that the actual level of output has risen beyond the average level of output; this period is usually characterized by high inflation. A recession on the other hand implies that the actual level of output drops below the potential or 'desired' level of output and deflationary pressures can be observed in a recession. Monetary policy would typically react to a recession by lowering the short term interest rate, and increasing the short term interest rate when the economy is overheating in order to cool it off.

Measuring the output gap is not an easy task, this is because the potential level of output is not observable, an economy's potential output is a counterfactual that must be constructed either from *priori* theoretic reasoning or generated from analysing observable data Lubik et al (2010). The implication for policy is thus that a faulty gauge of the output gap provides a bias point of decision making and implementation. The output gap has been considered to be "a noisy signal of economic activity" (Billi, 2012 p.22) given the possibility of error in measurement.

2.8.6 The Construction and Use of the output gap

There are two methodologies of constructing the output gap. The first method calculates the gap from deviations of output from a long run trend. This methodology is based on the argument that there is an average growth rate of output that is a linear trend that varies little over time, and thus business cycles present objectionable deviations that policy makers should strive to eliminate Lubik (2010). The other method of estimating the trend allows for variability in long run growth trend and recognizes that the desired output level is affected by shocks in the progression of business cycles and thus varies over time.

Another way of calculating the output gap is the through the use of statistical and econometric models Lubik et al (2010).Such a model is usually based on the fact that the output gap can be a good predictor of inflation. The model usually works by estimating inflation by means of expectations about the amount of time it takes to detect price changes in the economy (the lag) and other prognostic variables. The output gap is thus extracted from the model as the part that best predicts inflation Lubik (2010).

The different ways of coming up with the output gap poses a huge challenge to policy makers as there is a possibility of getting it wrong, this has negative factors on the policy decision making process. According to Athanasios Orphanides (economist at the Federal Reserve Board of Governors and now governor of the central bank of Cyprus) “the Fed believed the output gap to be much more negative than it actually was which led policymakers to take action that overheated the economy and contributed to an inflationary surge”. According to Walsh (2002) there has been a consensus among modern macro-economic theorists that the potential level of output is also affected by the same shocks that affect actual output. The difference between actual and potential output may thus be more or less the same.

2.8.7 Different measures of the output gap.

According to Lubik (2010), the maximum level of output exists where product and factor markets are perfectly competitive implying that there is no existence of monopolies that can minimise output to low levels. Natural output on the other hand implies imperfectly competitive markets; here prices tend to be rigid. The natural output concept is more realistic as it does not

assume that monetary authority attempts to change the degree of competition in the economy. It instead assumes that the central bank merely tries to diminish the biases from price stickiness that is the speed at which prices change thereby affecting output. Thus, a more realistic output gap can be defined as the percentage difference between actual and natural output Lubik (2010)

2.8.9 The trade-off between inflation and output variability

McCaw et al (2004) explored the consequences implied by various approaches to the conduct of monetary policy with regard to the short run trade-off between stabilising inflation and stabilising the output gap in the Norwegian economy. They observed that different ways in the conduct of monetary policy leads to different levels of efficiency. They also came up with the following results which are all standard in literature:

- Both mild and aggressive monetary policy can be inefficient. Although monetary policy's major role is to offset shocks, it can also destabilise the economy
- Interest rate smoothing is not efficient[20]
- Monetary policy affects the economy through a lag and thus is not optimal to respond only to current inflation. The Central bank should thus take future inflation into consideration. Long response horizons increase the risk that inflation expectations may become entrenched away from the inflation target, complicating the role of policy.

Cover and Pecorino (2002) cited (Friedman & Schwartz, 1980) as the first scholars to note the negative correlation between prices and output in the post-war period and a positive correlation pre- war. Some scholars attributed the negative correlation post war to aggregate demand driven models. Friedman and Schwartz (1980) argued that the negative correlation could have been caused by statistical errors and differences in response of prices and output to a demand shock.

[20]Ellis and Lowe 2003pg 1 define interest rate smoothing as 'the tendency of central banks to move official interest rates in a sequence of relatively small steps'. McCaw et al found that interest rate smoothing increases the variability of output and inflation as the response of the central bank to these macro-economic developments maybe too small, too large or not timeous.

Billi (2012) uses the small Keynesian model and takes into account the Zero Lower Bound (ZLB) to address this limitation in previous research which took into account the inability to reduce interest rates below zero. He argues that this inability can impair the effectiveness of monetary policy to stabilize output and inflation. He found that policy makers should pay more attention to output gaps; according to his results, taking into account the ZLB leads to optimal policy being associated with a stronger response to the output gap. This response suggests greater monetary stimulus and aids in stabilising the economy when ZBT threatens it.

Table 2.8.0 Summary of the Empirical Evidence

SCHOLAR/S	**INVESTIGATION**	**RESULTS**
Ehrmann(2000)	investigated the implication of monetary policy transmission in 13 European countries using the Structural Vector Autoregressive framework	The scholar found that the magnitude of the responses is different among countries.
Cecchetti(2009)	Investigated the implication of monetary policy transmission in the Euro Zone.	Found that the euro regions respond differently to interest rate changes. He provides evidence that shows that differences in the financial structure are the main cause in the asymmetries in monetary policy transmission. He found that countries with smaller, less concentrated and weaker financial exhibited a greater deal of sensitivity to policy changes than those that have stronger and deeper financial systems.

Lacoviello and Minnetti (2007)	tested the credit channel of monetary policy in the property market using the VAR methodology using quarterly data	They found that house prices fell by 0.7 to 1 percent after an interbank interest rate shock of 70 basis points.
Kabundi and Gupta (2009)	Assessed the impact of a positive shock in monetary policy on house prices for the aggregate US economy using quarterly data (1976Q1 to 2005Q2) and 126 variables.	They found a negative relationship between a positive monetary policy shock and house prices. They also found that the reaction of house price inflation differed across regions, indicating that different economic conditions result in different results.
Pariès and Notarpietro (2008)	undertook an investigation to determine the importance of housing markets and household credit frictions on monetary policy setting within an open-economy framework in the US and Euro area using a two-country Dynamic Stochastic General Equilibrium model	They found out that allowing for a direct response to house prices through the monetary policy enhances the empirical fit of their model
Bjørnlanda,and Jacobsen (2010)	analysed the role of house prices in the monetary policy transmission mechanism in	They found that house prices react immediately and more strongly to shocks, moreover,

	Norway, Swedenand the UK, using structural VARs	they confirmed the existence of co-movement between house prices, inflation and the output gap found in conventional literature.
Kasai and Gupta (2010)	Examined the effectiveness of monetary policy on house prices in South Africa pre and post liberalisation.	Their findings where that the period of financial liberalisation was characterised by relatively stronger effects of interest rate shocks on house prices irrespective of house sizes.
Reilly, Marquardt and Price (1977)	investigated the relationship between rates of return on US property prices and common stock for the period of 1918-1974	They found that nominal returns attributed to real estate where more than the rate of change in the CPI.
Inglesi-Lotzand Gupta (2011)	Followed the thought process of Anari and Kolari(2002) with regard to investigating the relationship between house prices and inflation using the Autoregressive Distributed Lag Model (ARDL	They found that house prices and the CPI are co-integrated in the long run ; thus house prices are a stable indicator of inflation in the longrun
Goodhart and Hofmann (2000)	Examined whether adding asset price variables for instance, the changes in house and equity prices improve the predictive power of a reduced form equation for inflation.	They found that house prices provide significant information on future inflation, whereas equity prices and yield spread where insignificant.

Bjornland 2009	Tests the Dornbusch's overshooting exchange rate hypothesis by imposing a long run neutrality restriction on the real exchange rate.	The results are consistent with Dornbusch's hypothesis as the exchange rates for the four open economies appreciate instantly following a monetary policy shock then depreciates in line the PPP and UIP

2.9 CONCLUSION

The chapter reviewed related literature in connection with the transmission mechanism of monetary policy on the financial and macro-economic variables under study, discussed the relationship between the financial and macro-economic variables and made a summary of empirical evidence. The following chapter discusses the VAR methodology at length and describes the tests employed in order to enhance the fit of our model.

Chapter Three

Research Methodology

Introduction

Stock and Watson (2001) define a VAR as an *x* equation consisting of *x* variables and where each variable is explained by its own lags, and the lags of other variables. The VAR methodology represents a reduced form of a dynamic economic model which consists of a vector $\boldsymbol{z}_t$ of specific variables. There are three types of VARs

1) Reduced form VAR- each variable is expressed as a linear function of its past values, the past values of other variables and a serially uncorrelated error term.
2) Recursive VAR- seeks to identify a structure where the error term in a regression is uncorrelated to the error term in the preceding equation.
3) Structural VAR- This involves coming up with assumptions that will define the parameters of the VAR in order to spell out the causal links within the model or between specific variables.

This paper employs the Reduced form VAR model. The VAR methodology is relatively easy to use and appropriate for the analysis of multivariate time series. VARs can provide an accurate response of macroeconomic and financial variables to monetary policy shocks and the response of monetary policy to a shock in any of these variables.

3.1.1 Research Design

Malhotra (2005) states that research design can be generalised as exploratory or conclusive. Where exploratory research provides one with a deeper understanding of the research problem and provides ground for further research. Conclusive research tests specific hypotheses and also investigates the relationships of variables under study. According to Malhotra (2005), conclusive research seeks to investigate the cause and effect. This paper employs a conclusive research design through VAR methodology to determine the relationships between the variables under study, that is, to establish causes and effects.

3.1.2 Identification of the model

The choice of the variables under study is influenced by a theoretical set up of the new Keynesian small economy which is similar to the one described in Svensson (2000). The VAR will include the real house price index, the repo rate, inflation, nominal GDP and the nominal exchange rate. The repo rate is set to capture the effect of monetary policy shocks on the variables under study. The repo rate, inflation, exchange rate, and output can be seen as reasonable characterisation of the demand –supply dynamics underlying house price determination (Vansteenkiste & Hiebert 2011).

We first define $\boldsymbol{z_t}$ as the 5×1 vector of financial and macroeconomic variables under study where y_t is the nominal GDP in levels, i_t is the repo rate in percentage form, $h_t$is the real house price index in levels, e_t is the quarterly nominal exchange rate in levels and π_t is the quarterly change of the log of the domestic consumer price index that is, inflation.

$$\boldsymbol{z}_t = \left[e_{t\ldots}e_{t-p} \quad y_{t\ldots.}y_{t-p\ldots.} \quad i_{t\ldots.}i_{t-p} \quad h_{t\ldots.}h_{t-p} \quad \pi_{t\ldots.}\pi_{t-p}\right] \tag{1}$$

$$\boldsymbol{z}_{t=}B(L)v_{t,} \tag{2}$$

Where v_t is a 5×1 vector of reduced form residuals to be identically and independently distributed with positive definite covariance matrix. $B(L)$is the 5×5 matrix polynomial in the lag operator(L)such that$B(L) = \sum_{j=0}^{\infty} B_j L^j$

The VAR can be written in matrix form

$$\begin{bmatrix} \boldsymbol{e_t} \\ \boldsymbol{y_t} \\ \boldsymbol{i_t} \\ \boldsymbol{h_t} \\ \boldsymbol{\pi_t} \end{bmatrix} = \begin{bmatrix} \boldsymbol{\alpha_{11}}(L) & \boldsymbol{\alpha_{12}}(L) & \boldsymbol{\alpha_{13}}(L) & \boldsymbol{\alpha_{14}}(L) & \boldsymbol{\alpha_{15}}(L) \\ \boldsymbol{\alpha_{21}}(L) & \boldsymbol{\alpha_{22}}(L) & \boldsymbol{\alpha_{23}}(L) & \boldsymbol{\alpha_{24}}(L) & \boldsymbol{\alpha_{25}}(L) \\ \boldsymbol{\alpha_{31}}(L) & \boldsymbol{\alpha_{32}}(L) & \boldsymbol{\alpha_{33}}(L) & \boldsymbol{\alpha_{34}}(L) & \boldsymbol{\alpha_{35}}(L) \\ \boldsymbol{\alpha_{41}}(L) & \boldsymbol{\alpha_{42}}(L) & \boldsymbol{\alpha_{43}}(L) & \boldsymbol{\alpha_{44}}(L) & \boldsymbol{\alpha_{45}}(L) \\ \boldsymbol{\alpha_{51}}(L) & \boldsymbol{\alpha_{52}}(L) & \boldsymbol{\alpha_{53}}(L) & \boldsymbol{\alpha_{54}}(L) & \boldsymbol{\alpha_{55}}(L) \end{bmatrix} \begin{bmatrix} \boldsymbol{e_{t-1}} \\ \boldsymbol{y_{t-1}} \\ \boldsymbol{i_{t-1}} \\ \boldsymbol{h_{t-1}} \\ \boldsymbol{\pi_{t-1}} \end{bmatrix} + \begin{bmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \\ \mu_{4t} \\ \mu_{5t} \end{bmatrix} \tag{3}$$

Where,

$h_t = \left[h_t \ldots h_{t-p}\right]$ $\qquad$ $\pi_t = \left[\pi_t \ldots \pi_{t-p}\right]$

$i_t = \left[i_t \ldots i_{t-p}\right]$ $\qquad$ $e_t = \left[e_{t\ldots} e_{t-p}\right]$

$$y_t = [y_t \ \ldots . y_{t-p}]$$

3.1.3 Data /Sample

We make use of quarterly data from 1994Q1 to 2011Q4 (72 observations) in estimating the VAR. Data on GDP,CPI, Repo rate and the exchange rate(Rands/USD) is obtained from the South African Reserve Bank. The house price index is a weighted average of the of the price index of the middle segment in South Africa and is obtained from the ABSA house price Index[21]

3.1.4 ModeI Testing

We make use of the software Eviews (6) in estimating the VAR.

3.1.5 Unit root testing

We use the Augmented Dickey Fuller test in order to check for the unit root/stationary properties of the variables. Where variables are found to be non-stationary or having a unit root, the first or second difference is used to eliminate this problem. This is done before setting up the VAR.

3.1.6 Optimal lag Selection

We make use of information criteria such as the Akaike Information Criterion (AIC), Schwarz Criterion (SC) and Hannan- Quinn Criteion (HQC) for choosing the optimal length for our VAR model.We choose a lag order of 3 for all equations based on this information Criterion.

3.1.7 Serial Correlation

In a good model, residuals should not be serially correlated, serial correlation is common with time series data. We test for serial correlation using the Breusch-Godfrey Serial Correlation LM Test.

3.1.8 Heteroskedesticity

We test for heteroskedesticity using the Breusch-Pagan-Godfrey Test. In a good model, the variance of the residuals should be constant, that is, residuals should be homoskedestick.

[21] The house prices are based on the purchase price of all houses for which loan applications where approved by ABSA.

3.2 Impulse Response

An impulse response measures the response of one variable as a result of an impulse in the other variable that is it measures the response of each variable to a one unit increase (one standard deviation increase) in the other variable. It assumes that errors are equal to zero and that errors are uncorrelated across equations Stock ad Watson (2001).

3.2.1 Granger Causality

Granger (1969) came up with a time series based model in order to determine causality. In the Granger sense, *x* causes *y* if it has predictive power on *y*. We test for Ganger Causality in the context of VAR methodology where the multivariate model is included to test for causality simultaneously for all the included variables.

3.2.2 Conclusion

This chapter briefly discusses the VAR methodology, its advantages and suitability for the research question, it also covers the research design, sample size and the composition of the sample and also looks at the tests employed to test and enhance the fit of the model. The next chapter discusses and presents the results against the background of the discussed methodology.

Chapter four

Presentation and Discussion of Results

4.0 Introduction

The chapter presents the findings and discusses the implications of these findings. We first test the fit of the model by testing for unit roots, heteroskedasticity, normality and serial correlation. After eliminating the unit roots, serial correlation, heteroskedasticity and ensuring normality of residuals we test for correlation and perform graphical presentations of the results. We then estimate the VAR using OLS and perform a Granger causality test and an impulse response using the Cholesky decomposition.

Table 4.1.1 Augmented Dickey Fuller Test in levels.

Variable	Coefficient	Std. Error	t-Statistic	Prob.	1%	5%	10%
INF(-1)	-0.218529	0.056908	-3.84007	0.0003	-3.52705	-2.90357	-2.58923
EXC(-1)	-0.079174	0.041817	-1.89336	0.0625	-3.52562	-2.90295	-2.5889
NGDP(-1)	0.026337	0.001627	16.18987	0	-2.59794	-1.94546	-1.6138
HP(-1)	-0.051485	0.049514	-1.03982	0.3025	-2.59993	-1.94575	-1.61363
INT(-1)	-0.008034	0.008684	-0.92513	0.3583	-2.59891	-1.9456	-1.61372

We first start by testing for unit roots using the Augmented Dickey Fuller test. The order of integration I*(d)*shows how many times a variable has been differenced such that *I(0)* represents a variable in level form, differencing is used as a tool to eliminate non stationarity. Inflation which is in this case is represented by *I (0)* as it is the log of the CPI appears to be stationary. The rest of the variables would have to be differenced to eliminate the unit roots.

Table 4.1.2 First Difference Augmented Dickey Fuller Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.	1%	5%	10%
D(LEXC(-1))	-2.10758	0.181035	-11.6419	0	-2.59941	-1.94567	-1.61368
D(LNGDP(-1))	-2.508437	0.299082	-8.38712	0	-2.59993	-1.94575	-1.61363
D(LHP(-1))	-7.309321	1.101271	-6.63717	0	-2.60342	-1.94625	-1.61335
D(LINT(-1))	-1.32972	0.166066	-8.00719	0	-2.59941	-1.94567	-1.61368

After using the first difference for the previously non stationary variables, we successfully eliminate the unit roots on these variables as shown above. Thus we reject the unit root hypothesis at 99% confidence level for all the variables

Table 4.1.3 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.159330	Prob. F(2,5)	0.8350
Obs*R-squared	0.672713	Prob. Chi-Square(2)	**0.4364**

Null hypothesis: Residuals are not serially auto correlated
Alternative hypothesis: Residuals are serially correlated

Table 4.1.4 Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.018806	Prob. F(13,6)	0.5243
Obs*R-squared	13.76445	Prob. Chi-Square(13)	**0.3906**
Scaled explained SS	1.963870		

Null Hypothesis: Residuals are homoskedastic

Alternative Hypothesis: Residuals are heteroskedastic

Table 4.1.3 and table 4.1.4 show the results for serial correlation and heteroskedestcity. The highlighted p values for both the tables are more than 0.05 thus we accept the null hypothesis in both scenarios. Therefore residuals are not serially correlated and are homoskedastic.

Table 4.1.7 Normality Test

Test	**Statistic**	**p-value**
JARQUE-BERA (joint)	12.34563	0.08936
KURTOSIS (joint)	6.23560	0.11233
SKEWNESS (joint)	7.42563	0.15623

Descriptive Statistics help us see the normality of the data among other things. From the table 4.1.5 above, we notice that our data is not normal but becomes normal when we use the first difference, the Jarque-Bera test presented in table 4.1.7 also tests for normality, since the p value is above 0.05, we accept the null hypothesis and conclude that residuals are normally distributed.

Table 4.1.8 Correlation Matrix

	LINT	LHP	INF	LNGDP	LEXC
LINT	1	-0.18464	0.305494	0.168673	0.019679
LHP	-0.1846368	1	-0.05057	-0.14501	-0.16017
INF	0.30549407	-0.05057	1	-0.11565	-0.10615
LNGDP	0.16867337	-0.14501	-0.11565	1	0.131995
LEXC	0.0196786	-0.16017	-0.10615	0.131995	1

The correlation matrix shows the relationships between the variables under study; it is important to notice the inverse relationship between house prices and interest rates (the coefficient -0.1846368 though weak confirms this). This is what is confirmed by conventional literature and it is what we expected to find for South Africa. The small correlation coefficients between variables eliminate the issue of multicollinearity which can give us inconclusive OLS estimates.

The positive correlation between the short term interest rate and GDP implies that an increase in GDP leads to an increase in the short term interest rate, this entails that monetary policy responds to GDP by using the policy instrument, this also applies for the positive correlation between inflation and the short term interest rate. There is also a positive relationship between the short term interest rate and the exchange rate showing that a contractionary monetary policy leads to an appreciation in the exchange rate. However although the correlation matrix shows us the relationship between variables, it does not show us the significance and causal relationship between variables, thus the OLS estimates and a granger causality becomes vital in this regard.

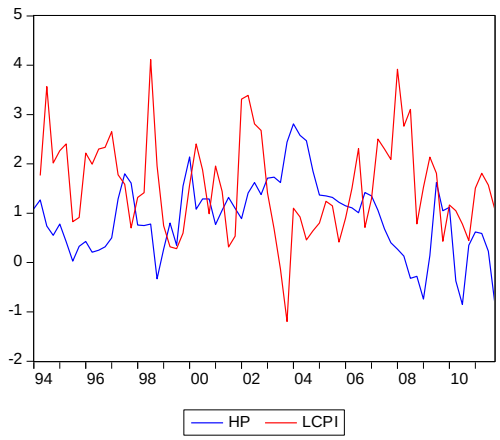


Fig 4.1.1

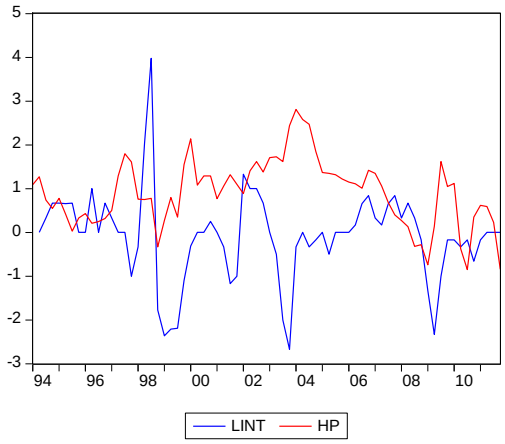


Fig 4.1.2

The inverse relationship between inflation and house prices as shown if Fig 4.1.1 and as reflected by a negative correlation coefficient of -0.05 is perplexing; we expected a co movement between these variables as in (Goodhart &Hofmann 2000). They found that house prices in the US have predictive power on inflation.

The negative correlation between house prices and inflation in South Africa is explained by the fact that the house price index was increasing exponentially relative to the CPI index, the major house price growth since the 2000s was certainly not driven by inflation but by other factors including a low interest rate environment, the rise of the middle class and the empowerment of the blacks etc. This may mean that the SARB followed an accommodative monetary policy, easy money, this depressed interest rates and increased the availability of credit and that then pushed up house prices. Moreover the ABSA house price index is based on the purchase price of all houses for which applications where approved by ABSA, thus over time, as prices rise the mortgage value does not change and become comparatively less and easier to payoff; hence the negative relationship between house prices and CPI.

Fig 4.1.2 clearly shows that the house price boom of 2002 to 2005 was characterised by a period of low interest rates and thus shows that monetary policy contributed to the house price boom in the early 2000s.

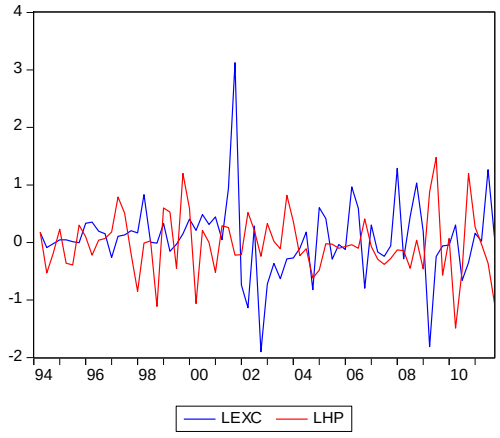


Fig 4.1.3

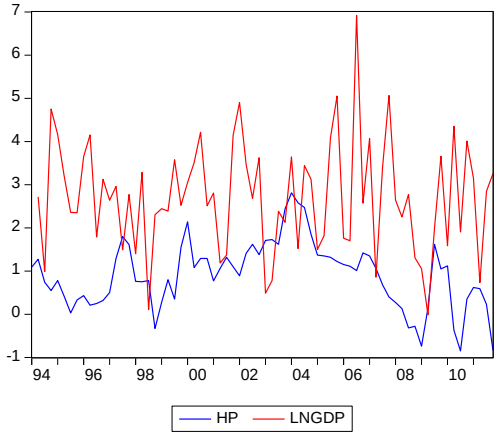


Fig 4.1.4

Fig 4.1.3 shows the inverse relationship between house prices and the exchange rate. This makes sense in the context of the transmission mechanism of monetary policy since a low interest rate

environment boosts house prices but leads to depreciation in the local currency. Fig4.1.4 shows the co movement between house prices and GDP, this shows that booms and busts in house prices move together with business cycles.

Table 4.1.9: OLS results for Unrestricted Vector Autoregressive Model.

Vector Autoregression Estimates
Date: 11/28/12 Time: 12:41
Sample (adjusted): 1995Q1 2011Q4
Included observations: 68 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LINT	LHP	INF	LNGDP	LEXC
LINT(-1)	0.573549	-0.179720	0.278369	-0.077845	-0.032514
	(0.15831)	(0.08949)	(0.23360)	(0.25458)	(0.13800)
	[3.62291]	**[-2.00827]**	[1.19166]	[-0.30578]	[-0.23560]
LINT(-2)	-0.320251	0.051608	0.198345	0.024475	0.053904
	(0.16858)	(0.09530)	(0.24876)	(0.27110)	(0.14696)
	[-1.89965]	[0.54155]	[0.79735]	[0.09028]	**[-1.79563]**
LINT(-3)	0.039282	0.008031	0.042377	-0.025520	-0.074867
	(0.15430)	(0.08722)	(0.22768)	(0.24813)	(0.13451)
	[0.25458]	[0.09208]	[0.18613]	[-0.10285]	[-0.55660]
LHP(-1)	-0.017002	-0.052699	0.428752	0.523411	0.019180
	(0.25824)	(0.14598)	(0.38104)	(0.41526)	(0.22511)
	[-0.06584]	[-0.36101]	[1.12521]	[1.26043]	[0.08520]
LHP(-2)	-0.219159	-0.230195	-0.085079	-0.184191	0.011261
	(0.23444)	(0.13253)	(0.34593)	(0.37700)	(0.20437)
	[-0.93481]	[-1.73698]	[-0.24594]	[-0.48856]	[0.05510]
LHP(-3)	0.333953	0.052358	0.349756	0.089876	0.036103
	(0.21683)	(0.12257)	(0.31995)	(0.34868)	(0.18902)
	[1.54015]	[0.42717]	[1.09317]	[0.25776]	[0.19100]
INF(-1)	0.021228	-0.033490	1.087464	-0.004338	-0.011451
	(0.11130)	(0.06292)	(0.16423)	(0.17898)	(0.09703)
	[0.19072]	[-0.53228]	[6.62144]	[-0.02424]	[-0.11802]
INF(-2)	-0.100355	-0.005498	-0.402963	-0.005833	0.021727
	(0.15467)	(0.08743)	(0.22823)	(0.24873)	(0.13483)
	[-0.64881]	[-0.06289]	[-1.76559]	[-0.02345]	[0.16114]
INF(-3)	0.068108	0.070113	0.064123	-0.146778	-0.039869
	(0.09852)	(0.05569)	(0.14537)	(0.15842)	(0.08588)
	[0.69133]	[1.25899]	[0.44111]	[-0.92649]	[-0.46424]
LNGDP(-1)	0.237613	0.086289	0.213147	-0.063192	-0.125307
	(0.08638)	(0.04883)	(0.12745)	(0.13890)	(0.07530)

	[2.75091]	**[1.76726]**	**[1.67236]**	[-0.45495]	**[-1.66419]**
LNGDP(-2)	0.064100	0.013678	0.003909	-0.123021	0.040558
	(0.08875)	(0.05017)	(0.13096)	(0.14272)	(0.07737)
	[0.72222]	[0.27262]	[0.02985]	[-0.86194]	[0.52421]
LNGDP(-3)	0.146277	-0.009393	0.172956	-0.038716	-0.043734
	(0.08878)	(0.05019)	(0.13100)	(0.14277)	(0.07739)
	[1.64764]	[-0.18716]	[1.32028]	[-0.27119]	[-0.56510]
LEXC(-1)	0.260931	-0.245423	0.472638	0.310748	0.170859
	(0.15673)	(0.08860)	(0.23126)	(0.25203)	(0.13663)
	[1.66485]	**[-2.77015]**	**[2.04372]**	[1.23296]	[1.25057]
LEXC(-2)	-0.196207	0.088861	0.072199	0.266231	-0.103080
	(0.17812)	(0.10069)	(0.26282)	(0.28643)	(0.15527)
	[-1.10155]	[0.88255]	[0.27471]	[0.92948]	[-0.66387]
LEXC(-3)	0.188829	0.106562	0.387125	0.023794	0.224614
	(0.17730)	(0.10023)	(0.26162)	(0.28512)	(0.15456)
	[1.06501]	[1.06322]	[1.47972]	[0.08345]	[1.45325]
C	-1.247584	-0.479515	0.502955	4.290747	0.588167
	(0.63393)	(0.35835)	(0.93541)	(1.01942)	(0.55262)
	[-1.96800]	[-1.33812]	[0.53769]	[4.20902]	[1.06433]
R-squared	0.522734	0.414945	0.864034	0.180763	0.147104
Adj. R-squared	0.385061	0.246179	0.824813	-0.055555	-0.098924
Sum sq. resids	35.07908	11.20913	76.37650	90.71171	26.65688
S.E. equation	0.821339	0.464285	1.211932	1.320779	0.715983
F-statistic	3.796921	2.458699	22.02985	0.764915	0.597914
Log likelihood	-73.98313	-35.19332	-100.4375	-106.2859	-64.64816
Akaike AIC	2.646563	1.505686	3.424633	3.596644	2.372005
Schwarz SC	3.168800	2.027923	3.946870	4.118881	2.894242
Mean dependent	-0.110294	-0.020441	6.321618	2.705071	0.067638
S.D. dependent	1.047385	0.534749	2.895522	1.285552	0.682997

Determinant resid covariance (dof adj.)	0.120172
Determinant resid covariance	0.031425
Log likelihood	-364.7940
Akaike information criterion	13.08218
Schwarz criterion	15.69336

Note: We did not highlight any significance of any univariate properties.

The highlighted coefficients are significant in the VAR model. The first equation in our VAR puts the short term interest rate as the dependent variable which is explained by its own lags, lags of house prices, inflation, GDP and the exchange rate. The results of the VAR show that the short –term interest rate is explained only by GDP and its own lags. This is shown by a

significant positive coefficient on LNGDP lag 1**[2.75091]** and lag 3**[1.64764]**[22].The positive relationship can make sense in the context of the so called Taylor rule Taylor (1993).

This implies that monetary policy in South Africa responds to GDP or most precisely the output gap, and does not respond to house prices, inflation and the exchange rate. These results are sensible in that SARB looks at the output gap and inflation for inflation targeting. However the fact that inflation is insignificant in explaining the policy instrument is puzzling. This result might be explained by the fact that there have been three distinct regimes in South Africa since the 1980s as far as inflation targeting is concerned. The first period (1980 to 1989) saw the SARB failing to stabilise inflation. The second period (1990 to 2000) showed some improvement in the SARB's pursuit of low inflation; however the SARB was implicitly and not explicitly targeting inflation. The third period (2000) to present is characterised by an explicit inflation targeting objective Burger and Marinkov (2011).Our model uses quarterly data from 1994Q1 to 2011Q and included in this period is the implicit inflation targeting period, this amongst other factors might be the reason why our OLS coefficients are insignificant in this regard. Nonetheless we expect the impulse response results to be more informative.[23]

The second equation in our VAR identifies house prices as the dependent variable. In this case, the coefficient on lag one of the short term interest rate **[-2.00827]**, lag one of GDP **[1.76726]** and lag one of the exchange rate **[-2.77015]** is significant. This means that house prices are explained by monetary policy, GDP and the exchange rate. This implies that an expansionary monetary policy leads to an increase in house price and a contractionary monetary policy leads to a decrease in house prices; there is also evidence of co- movement between house prices and GDP and a negative correlation between house prices and the exchange rate. The positive relationship between house prices and GDP makes sense in the context of a boom and bust cycle.

The third equation puts inflation as the dependent variable and the significant explanatory variables are GDP lag one with a coefficient **[1.67236]** and exchange rate lag one with a coefficient**[2.04372]**. This implies that there is co- movement between inflation and GDP (this is

[22] Critical values for t- statistics: At 90% confidence level- 1.64 , At 95% confidence level- 1.96, At 99% confidence level- 2.33

[23] Where we observe the response of inflation to a shock in the interest rate and also the response of the short term interest rate to a shock in inflation.

consistent with the existence of a Phillips Curve), and also inflation and the exchange rate as in Bjørnlanda and Jacobsen (2010). The positive relationship between the exchange rate and inflation implies that an increase/ depreciation in the domestic currency will lead to an increase in inflation. This view has been fully supported by (Miskin, 2008) where he observes that exchange rate pass through to the consumer price index is more prominent in emerging economies where a currency depreciation feeds into import prices and ultimately the consumer price index. The fourth equation which identifies GDP as the dependent variable has no significant explanatory variables, suggesting that the variables in our VAR model have no explanatory power for GDP.

The fifth equation in the model where the exchange rate is the dependant variable shows that GDP lag one **[-1.66419]** and lag two of the short term interest rate**[-1.79563]** are significant. This is reasonable and consistent with reviewed literature in the context of the transmission mechanism of monetary policy. This is because a contractionary monetary policy decreases output whilst leading to the appreciation in the exchange rate, and an expansionary monetary policy increases output whilst leading to depreciation in domestic currency.

Table 4.2 Granger Causality tests

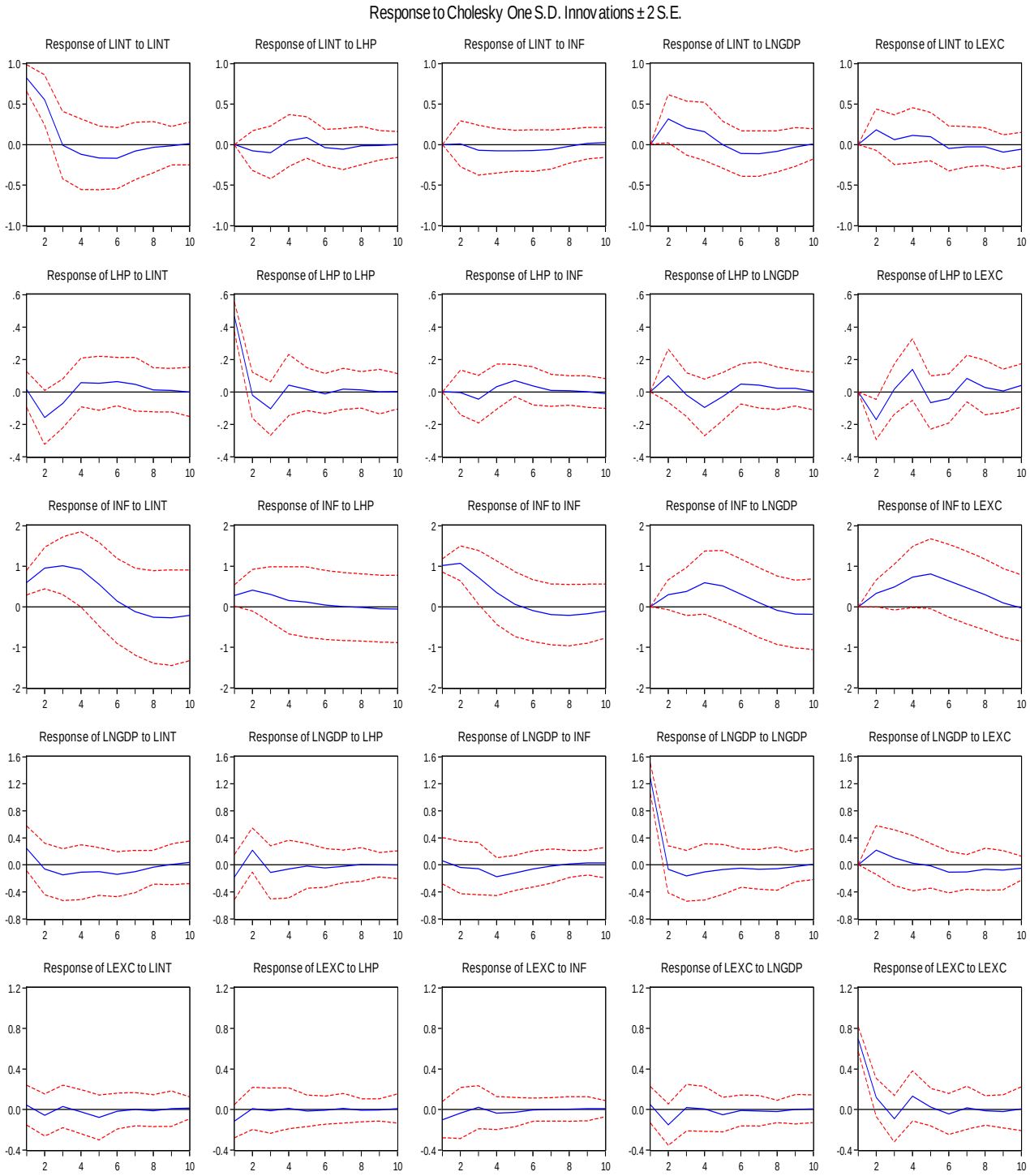
Pairwise Granger Causality Tests
Date: 11/28/12 Time: 12:54
Sample: 1994Q1 2011Q4
Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
LHP does not Granger Cause LINT	68	0.69016	0.5616
LINT does not Granger Cause LHP		**3.48920**	**0.0209**
INF does not Granger Cause LINT	68	0.72148	0.5430
LINT does not Granger Cause INF		1.42574	0.2439
LNGDP does not Granger Cause LINT	**68**	**4.05936**	**0.0107**
LINT does not Granger Cause LNGDP		0.34545	0.7925
LEXC does not Granger Cause LINT	68	2.15473	0.1026
LINT does not Granger Cause LEXC		0.39913	**0.0323**
INF does not Granger Cause LHP	**68**	**2.80802**	**0.0470**
LHP does not Granger Cause INF		0.21537	0.8854
LNGDP does not Granger Cause LHP	68	0.98317	0.4067

LHP does not Granger Cause LNGDP		0.38588	0.7635
LEXC does not Granger Cause LHP	**68**	**2.55129**	**0.0538**
LHP does not Granger Cause LEXC		0.17047	0.9159
LNGDP does not Granger Cause INF	68	2.26068	0.0903
INF does not Granger Cause LNGDP		2.50776	0.0672
LEXC does not Granger Cause INF	**68**	**3.08182**	**0.0339**
INF does not Granger Cause LEXC		0.28719	0.8345
LEXC does not Granger Cause LNGDP	68	0.84444	0.4749
LNGDP does not Granger Cause LEXC		1.25688	0.2971

The results from the Granger Causality test summarises the results of the VAR by explicitly showing us the direction of causality between variables in the model. The significant causal relationships are highlighted above as their p values are less than 0.05. We are mostly interested in the first significant observation that states that the short term interest rate granger causes house prices. This answers our primary research question of whether monetary policy contributed to the house price boom in South Africa. Monetary Policy indeed played a role in the house price boom although we acknowledge the fact that other factors that the model may have omitted also contributed to this phenomenon.

Table 4.3 Impulse Response; Cholesky Decomposition



The results of the impulse response show us the response of a variable to a one standard deviation shock[24] to the residuals of another variable. We use the Cholesky decomposition following Kasai and Gupta (2010).Column one presents the response of house prices, inflation, GDP and the exchange rate to a shock in the short term interest rate. The responses are consistent with economic theory and reviewed literature and shows that house prices GDP and inflation all fall following a monetary policy shock and the exchange rate appreciates.

House prices fall immediately following a monetary policy shock, by the end of the second quarter, the total decrease in house prices is approximately -1.98%, they start increasing and by the end of the fourth quarter they reach a threshold increase of 0.5% and stabilise. Inflation on the other hand only starts decreasing between the fourth and sixth quarter following a monetary policy shock. The exchange rate displays a hump shaped response with a deep effect of -0.1% in the first two quarters that is, it appreciates instantly after a monetary policy shock; it remains around this level for about six quarters before returning to the baseline; this response contradicts Dornbusch's exchange rate overshooting hypothesis which concludes that after a positive monetary policy shock, the exchange rate first appreciates then depreciates in line with UIP and PPP.

Column two shows us the response of monetary policy, inflation, GDP and the exchange rate to shock in house prices. Monetary policy only responds to a shock in house prices after the third quarter and the response is insignificant showing that the SARB does not respond explicitly to house prices. The co- movement between GDP and house prices is clearly shown by the response of GDP to a house price shock. The peak response of GDP is 0.02% after two quarters. This entails that higher house prices increase wealth which in turn increase GDP via extra consumption.

Colum three shows the response of interest rates, house prices, GDP and the exchange rate to a shock in inflation. The results confirm the co movement between GDP and inflation (although the response of GDP appears to be sticky as it only starts increasing after the fourth quarter) and also the co movement between inflation and the exchange rate. Column four shows the response

[24] A unit shock is applied to the residuals of each variable to see its effect on the other variable.

to a shock in GDP, the interest rate increases by about 0.25% in the first two quarters following an increase in output. There is also evidence of co movement between GDP and house prices, and also between GDP and inflation. In this case, both house prices and inflation respond instantaneously to an increase in GDP.

Column five shows the response on interest rates, house prices, inflation and GDP to a shock in the exchange rate. We observe that inflation increases following a shock in the exchange rate. This is because the exchange rate directly affects the prices of imports in terms of the domestic currency, and this will also affect the domestic consumer price index Mishkin (2008). An increase in the exchange rate (depreciation) leads to an increase in inflation by more than 0.5% in the first five quarters.

The impulse response results confirm the theory of price stickiness as inflation does not adjust pro rata to a monetary policy shock whereas house prices and the exchange rate respond instantaneously to such a shock. Undeniably, the combination of flexible asset prices and sticky goods prices in theory may lead to overshooting of asset prices (Goodhart & Hofmann 2000).It is thus evident that the housing boom of the early 2000s was partially an overreaction of house prices to an expansionary monetary policy.

4.2 Conclusion

The chapter has presented and discussed the results of the VAR, we confirm that monetary policy has significant explanatory power for house prices. We also conclude that asset prices (in this case house prices and the exchange rate) respond instantaneously to a monetary policy shock whilst inflation(represents goods prices)appears to be sticky. The next chapter concludes the research findings and presents policy implications and recommendations.

Chapter Five

Research Findings, Conclusions and Recommendations

5.1 Introduction

This chapter concludes the research by discussing the findings. We discuss the implication for monetary policy given these results. We look at international experiences and thereafter conclude the paper.

5.1.2 DISCUSSION OF FINDINGS AND CONCLUSIONS

The primary objective of the research is to analyse the role of financial and macro-economic variables in the conduct of monetary policy. We also seek to answer the primary research question of whether monetary policy contributed to the house price boom of the early 2000s. From our findings, (VAR estimation) we find a significant causal relationship between house prices and monetary policy. To be precise, the granger causality results confirm that the short term interest rate granger cause house prices. In addition, we find that monetary policy responds to output and inflation but not to house prices.We also find evidence of exchange rate pass through into the CPI, that is the positive correlation between the exchange rate and inflation as in Mishkin (2009).

The study tests the following hypotheses:

> **H_0**: Monetary policy decisions on the short term interest rate do not have an effect on the financial and macroeconomic variables under study.
>
> **H_1**: Monetary policy decisions on the short term interest rate have an effect on the financial and macroeconomic variables under study.

The results of the VAR and granger causality test have yielded some significant causal relationships and thus it is justifiable to reject the null hypothesis. We conclude that monetary policy decisions on the short term interest rate have an effect on the financial and macroeconomic variables under study. We also conclude from the impulse response results that house prices are non-sticky compared to the consumer price index and thus respond instantly to a shock in monetary policy.

5.2 IMPLICATIONS FOR MONETARY POLICY

There has been a debate on whether monetary policy should respond to asset price fluctuations or not. Goodhart (2000) argues that the central bank should include asset prices particularly house prices in the conduct of monetary policy. He also suggests that the reserve bank should broaden the CPI by including housing and stock prices. He argues that such a measure would stabilise the macroeconomic environment in so far as asset prices have predictive power on inflation. Gupta (2012) presented a paper on whether or not the SARB should respond to exchange rate fluctuations. He concludes that perhaps the SARB should respond to fluctuations in the exchange rate but should take cognisance of the fact that this may lead to increased volatility in output.

5.2.1 International Experiences

Japan: The period of the late 1980s was characterised by a stable economy with solid economic growth, tight labour markets and high investment spending. This scenario was supported by an environment of low interest rates and flexible credit markets. However, housing and stock prices where on a rampant. Inflation was stabilized by the high investment spending which held down unit labour costs; in 1989 economic performance began to sour, inflation was high leading to a tightening of monetary policy. The contractionary monetary policy led to a decrease in inflation, housing and stock prices and ultimately a contraction in economic growth. Since then, a contractionary monetary policy in response to high inflation or asset prices bubbles has been associated with a recession.

UK: The UK experience is almost the same as that of Japan in a number of ways. During the late 1980s, the UK economy was expanding owing to the high capacity utilisation and an increase in consumption. The period 1985 to 1987 was characterised by exorbitant housing and stock prices. By 1988 house price inflation had reached about 35%. However inflation was stable and low regardless of the asset price bubble. Inflation started to increase following this bubble and by the end of 1991, inflation had reached 9% from 4% in 1985.

Alchian and Klein (2009) argue that asset prices have predictive power on inflation. They postulate that expectations of higher future inflation from consumers lead to an immediate increase in asset prices. In this regard, asset prices can reflect expected inflation that has not been conventionally reflected. It follows that if Central banks were to follow the thought process of Goodhart, and include asset prices as a measure of future inflation, an increase in asset price would motivate a

tightening of monetary policy even when inflation is low and stable. This is because higher asset prices signal higher future inflation and by tightening monetary policy, Central Banks can harness these expectations.

The implication for policy in Goodhart depends strongly on the assumption that asset price fluctuations have predictive power for future inflation. However Filardo (2009) discovered that the relationship between asset prices and inflation is sometimes imprecise, the scholar highlighted two reasons for this. The first one is that stock and housing prices are not a correct proxy for asset prices, the aggregate index for asset prices would be more effective since consumers hold other forms of wealth like durables, collectibles, human capital etc. The second reason is that asset price fluctuations may occur for non-fundamental reasons and are not related to expectations of future inflation.

5.3 Conclusion

The house price boom of the early 2000s was certainly not driven by inflation but the growth was debt driven, consumption- led and exasperated by an expansionary monetary policy. Moreover the empowerment of the blacks, rise of the middle class worsened the situation. Nonetheless the SARB contributed to the boom and thus should take consideration of this fact in future. The SARB should also take into consideration, the exchange rate pass through into the consumer price index. We recommend, for further study, the inclusion of the bank credit channel in our model in order to test for the sensitivity of the credit market to a monetary policy shock.

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