IDENTIFYING THE INTERDEPENDENCE BETWEEN SOUTH AFRICA'S MONETARY POLICY AND THE STOCK MARKET

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DECLARATION

Except where explicitly stated references and sources, this thesis is wholly my own effort and has not been submitted to any other University, Technikon or College for degree purposes.

ABSTRACT

This study estimates the interdependence between South Africa's monetary policy and stock market performance, utilising structural vector autoregression (SVAR) methodology. The study finds that a stock price shock which decrease stock prices by 100 basis points leads to 5 basis points decrease in interbank rate. A monetary policy shock that increases the interbank rate by l percent leads to decrease in real stock prices by 1 percent. This result for South Africa is similar to the result by Bjornland and Leteimo (2009) which earlier concluded that there was a high interdependence between interest rate setting and stock prices. However the magnitude of the relationship is relatively lower for South Africa compared to that of the United States of America (USA). The result of the current study is also very much consistent with the argument that the South African stock market is resource-based and so is influenced by external shocks, meaning monetary policy shock does not have as much impact on stock market in South Africa as in the USA. However the SARB may have to consider watching movements in stock prices so that booms in stock markets do not defeat central bank monetary policy thrusts. The stock price market is an essential source of information for monetary policy in South Africa.

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DEDICATION

This work is dedicated to the Almighty God for the grace and His insight for my life. For everything there is a purpose and l thank God for the experience I had throughout the two years of my work, I met wonderful people. I hope I touched those peoples' hearts as much as they touched mine. Secondly I dedicate this work to my parents, brothers and sisters you are a blessing that I was given from above. To my brothers and sisters this work is an inspiration to you that it can be done if you just dare to dream and dream big.

Brian Muroyiwa

Opinions expressed and conclusions derived are those of the author and are not necessarily to be attributed to Rhodes University

Table of Contents

APPENDICES

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1
INTRODUCTION

1.1 CONTEXT OF RESEARCH

The interdependence between stock market and monetary policy is an intriguing topic. A good number of theoretical postulations have been used to illustrate how the two ends of the financial market are linked to one another. Financial theory, for instance, supports a relationship between stock prices and monetary policy. Stock valuation methods like the Net Present Value model by Smith (1925) and the Gordon Growth Model (1962) postulate the existence of a relationship between stocks and the interest rate (rate of return). Purfield (2007:8) asserts that asset prices are leading indicators of future changes in economic activity because asset prices reflect the discounted value of expected future dividends (and thus expected future growth). Thorbecke (1997) qualifies the previous statement when he states that evidence that positive monetary shocks increase stock returns indicates that expansionary monetary policy exerts real effects by increasing future cash flows or by decreasing the discount factors at which those cash flows are capitalized. Similarly, Bernanke and Kuttner (2004) state that, a tightening of monetary policy leads investors to view stocks as riskier investments and thus to demand a higher return to hold stocks. It is evident then even to the casual observer that central bank decisions affect asset prices, including equity prices.

A broad sum of literature has attempted to discuss the linkages, attracting contributions from the monetary and financial schools of economic thought. Studies on this topic have focused on announcements effects of monetary policy on stock returns (Bredin *et al.*, 2004; Engle *et al.*, 2006), empirical tests on the use of stocks to hedge against inflation (Sellin, 2001), stock market volatility and effects of monetary policy on macroeconomic variables (Saryal, 2007; Bernanke and Gertler, 2001; Zervou, 2008; and Erdem *et al.*, 2005; Thaker *et al.*, 2009). Specifically, early papers on financial and monetary economics attempted to ascertain whether past money supply data could be used to predict future stock returns. Empirical studies by Sprinkel (1964), Homa and Jaffie (1971), Hamburger and Kochin (1971) reveal that indeed past money supply data can indeed predict future returns. The findings which purported that there is a predictive relationship between money supply and stock returns were however disputed by subsequent research. Work done by Cooper (1974), Pesando (1974),

Rozeff (1974) and Rogalski and Vinso (1977) show there is no predictive content in past changes in money but there could be reverse causality in the Granger sense from stock returns to changes in money supply.

Empirical efforts aimed at establishing some definite relationship focus on both the impact of monetary policy on stock markets and the magnitude and duration of the impact. More recent studies like that of Naceur, Boughrara and Ghazouni (2009) for the Middle East and North African (MENA) countries produces mixed results for the countries included in the sample. Stock prices in Oman and Saudi Arabia react significantly to real activity and inflation. Tightening of monetary policy in Saudi Arabia and Oman tended to decrease stock prices. Stock price shocks do not result in a significant impact on inflation in the case of Egypt and Jordan. However, Jordanian monetary policy is effective in impacting stock prices. Morocco and Tunisia's monetary policy are shown to be effective in impacting stock prices but their monetary authorities are not interested in stock market dynamics. In contrast the Turkish central bank is interested in following stock prices as they believe that stock prices are leading indicators of inflation. Similarly also, studies conducted in the US show very significant correlation between stock returns and monetary policy direction (Bjornland and Leteimo, 2009; Conover *et al.*, 1999).

The above review shows that studies conducted in developed countries yielded varying results from the few conducted in developing and emerging market economies. A possible reason for this divergence could likely be due to differences in methodology. The most common model that has been utilized by previous researchers to investigate the interaction between the stock market and monetary policy is the ordinary vector autoregression (VAR) model. Earlier studies that utilized this model found an insignificant degree of interdependence between the money market and the stock market ends of the financial system (Lee, 1992; Thorbecke, 1997; and Millard and Wells, 2003). The results from these works are arguably biased due to the fact that the researchers did not allow for simultaneous interdependence. They also failed to take into consideration the presence of structural shocks in utilising recursive, short-run restrictions on the interaction linking monetary policy and equity prices (Bjornland and Leteimo, 2009). This explains the growing support for the use of Structural VAR, as can be evidenced in recent studies.

Considering that in the case of South Africa evidence on money market and stock market interdependence is still scarce, this study will add to the current body of evidence by building on existing knowledge and the scant literature available for South Africa. Primarily, it seeks to find out if this is really the case that there exist an interdependence between monetary policy and stock market, and if it is, establish the reasons why this is the case. The study's objective is also to seek to harmonize the contrasting findings of the few studies that we have reviewed for South Africa. A good justification for the choice of South Africa as a case study here is that her only stock exchange, the Johannesburg Stock Exchange is by far the largest stock market in Africa which makes it the most lucrative and attractive African investment destination. At the end of January 2010 market capitalisation of the JSE stood at around US$666 billion (World Federation of Exchanges, 2010).

1.2. GOALS OF THE RESEARCH

The main research goals of this study are:

1. To identify the relationship between the stock prices and money market rates in South Africa.

2. To investigate the extent to which SARB can use stock-price information as indicators of the monetary-policy stance as well as its effectiveness.

3. To determine the extent and effectiveness of the stock market channel of monetary policy transmission in South Africa as suggested by Chami, Cosimano and Fullerkamp (1999).

1.3. METHODS, PROCEDURES AND TECHNIQUES OF THE STUDY

Available literature offers a number of methods and techniques that can be used to establish and analyse the level of relationship between monetary policy and the stock market. The study will review the financial and macroeconomic theory to gather all the variables that will explain the interdependence of the stock market and monetary policy. A survey of empirical studies conducted elsewhere and in South Africa will be undertaken as background to the research.

To address the methodological gap between emerging market and developed country studies, this study will use Structural VAR model with the following variables included: monetary variables [M3 measure of money supply, the interbank rate, the annual changes in the consumer price index (CPI)]; the only stock market variable; the Johannesburg All Share Index and the industrial production index which is included as a real activity measure as well as measure interest rate change sensitivity of companies. Some of the variables included in the model would be logged for sensitivity; easier analysis and interpretation of the data. The strength of the SVAR over ordinary VAR lies on its capacity to resolve problems associated with simultaneity bias (Rigobon and Sack, 2003; Bernanke and Kuttner, 2004; Allington and McCombie, 2005).The imposition of a combination of short run and long run restrictions on the parameters has been proposed as a solution to the simultaneity problem in work done by Bjornland and Leteimo (2008). The data sources for this study are the Thompson DataStream and SARB Website and Statistics South Africa (StatsSA).

1.4. ORGANISATION OF THE STUDY

This study is organised in the following form. Chapter 2 discusses the theoretical framework of the study as well as empirical studies and evidence. Chapter 3 discusses the overview of the South African monetary policy and stock market; it assesses the performance and trends to date. Chapter 4 provides the formal description of the data and methodologies to be utilised to achieve the goals of this study. Chapter five discusses the findings of this study. Chapter six concludes and gives recommendations as well as possible areas for future studies.

CHAPTER TWO

THEORATICAL ISSUES AND LITERATURE REVIEW

2.1 INTRODUCTION

This chapter explores the theoretical and empirical literature on the link between monetary policy and the stock market. It starts with a discussion of the importance, objectives and transmission mechanism of monetary policy (Section 2.1). This is followed by Section 2.2 which discusses roles, functions and importance of the stock market. The following heading (Section 2.3) then considers the theoretical links between monetary policy and the stock market. The links can either be direct link (Section 2.4) or indirect link (Section 2.5).The discussion of the direct link centres on interest rates and stock valuation methods, the present value models by (Smith, 1925 and Gordon, 1962). The objective is to demonstrate the impact that interest rates have on the valuation of stocks by investors from a theoretical viewpoint. The direct link operates through the interest (discount) channel while the indirect link operates through the wealth effect on consumption and its effect on investment represented by the Tobin's Q theory.

2.2 MONETARY POLICY CONCEPT

Monetary policy comprises the formulation and execution of policies by the central bank to achieve the desired objective or set of objectives; the policies and decisions are aimed at guiding bank lending rates to levels where credit demand and money growth are at a level consistent with aggregate supply elasticity (Faure, 2007; Loayza and Schmidt, 2002). The objectives and goals that the central bank seeks to achieve generally are low inflation (usually targeted), protection of value of currency, full employment and sustainable economic output (economic growth). The South African Reserve Bank (SARB) regards its main objective in the South African economy as the achievement of and maintenance of price stability (SARB, 2010). These goals are pursued through some conventional instruments which reflect the goals this study is pursuing. The conventional instruments at the disposal of the Central Bank are interest rates, open market operations, reserve requirements, moral suasion, lending, direct credit control and prudential guidelines.

The government has a number of tools to influence the economy in the desired direction. The two most significant ones are fiscal and monetary policy. However the focus of this study is on monetary policy. Bernanke and Kuttner (2004) note that the influence of monetary policy instruments on the macroeconomic variables (employment, inflation and output), which it is meant to regulate is largely indirect. They further assert that the most direct and immediate effects of monetary policy actions, such as changes in the federal funds rate, are on the financial markets. Policymakers' actions affect asset prices and returns, as they thrive to modify economic behaviour in ways that will help to achieve their ultimate objectives. Understanding the links between monetary policy and asset prices is thus crucially important for understanding the policy transmission mechanism. Crowder (2004, 1) states that the effectiveness of monetary policy depends on its ability to change economic behaviour of economic agents. He also alludes to the fact that the tools available to central banks have direct effects on interest rates and quantities of money and can only influence the ultimate objectives in as much as changes in the interest rates and money supply adjust economic behaviour.

Interest rates are one of the most important variables in this study and are measurable in regard to been an input in econometric tests it is interesting to know what prompts changes in official interest rates. The impact that some of the measures adapted by the Central Bank to influence the economy like prudential guidelines and moral suasion is not easily visible and measurable. The change in official rates is transmitted to all other interest rates in the economy. Change in interest rates is mainly for a reason most probably stabilising the macroeconomy in the midst of shocks. Sinclair (2005, 6) identifies and discusses four factors that necessitate a change in the official interest rates by the central bank. The four main influences are current levels, or forecasts of inflation; current levels or forecasts of the output gap, the markets' expectations of future policy rates and official interest rate changes abroad.

If inflation is expected to be high in future interest rates are increased to compensate for the rise in inflation. The increase in interest rates is meant to dampen aggregate demand and therefore reduce the price level; however the reaction of economic agents is not always predictable and certain. If output gap is above potential the monetary authorities seek to stabilise it both for its own sake and because a positive output gap is inflationary. When markets foresee a policy rate rise in future a decision to leave them unchanged contrary to

these expectations may have numerous effects some undesirable and some deliberately sought (Sinclair, 2005:8). The effects may have a sudden negative pressure on exchange rate, prices of other assets like equities and long term bonds may soar. Changes in interest rates abroad are mainly watched by central banks that target the exchange rate. Aside countries that adopt inflation and monetary targeting can still infer about international trading conditions affecting many of its domestic firms. Sinclair advises a rate cut abroad could signal a downward revision in expected world trade growth. In order to stabilise domestic output and inflation it calls for a domestic official rate reduction in such circumstances.

The other major motivation for discussing interest rate changes in this study is that South Africa's monetary policy influences the economy through official interest rate changes within the inflation targeting framework adapted since April 2000 (Mboweni, 2003: 2). Monetary policy is the starting point of the transmission mechanism. The process through which monetary policy is transmitted and ultimately affects inflation, employment and aggregate output is called the monetary policy transmission mechanism (MPTM). The decision to vary the level of interest rates is one among the few policy tools that central banks can use in order to influence the economy. A decision to rise or decrease repo rate depends on the economic environment and also the direction that the Central Bank want to drift the economy. Stunted growth of the economy necessitates an expansionary monetary policy to increase level of output. The decision involves a cut in the repo rate. The central bank ensures the repo rate is effective by creating a permanent money market shortage (Faure, 2007: 4).The repo rate is only effective if banks are forced to borrow from the central bank at all times.

Repurchase rate is essentially a short term rate and it is always above the market call rates making it solely last resort facility (Coetzee, 2002 and Faure, 2007). The repo rate influences all other interest rates in the economy with an immediate impact on the interbank rate. Actually the interbank rate is the first interest rate directly affected by changes in the repo rate. It is a statutory requirement by the central bank (SARB) for banks to maintain an amount of funds with the Reserve Bank based on the size of their deposits (Coetzee, 2002). The clearing banks end up with net cash position (deficit or surplus) on their current account with the central bank after interbank clearing. Surpluses are allowed but do not make good business sense since they do not earn interest. Banks in deficit have to borrow from those banks with surpluses, so there is competition for funds among participating banks after

interbank clearing. The objective is to avoid borrowing at highly negligible rates offered by the Central bank (Coetzee, 2002 and Faure, 2007).

The interbank rate and the repo rate directly influence call money rate which is the shortest rate in the market (Faure, 2007). Participants in the call money market are insurance companies, pensioners and banks that try to find huge sums of money on short notice. This rate is a wholesale rate that is charged on overnight money. Banks play an active role in the call money market as well as securities markets as broker dealers and holders of securities. Borrowing and lending are two sides of the same coin, when borrowing rates increase it also means lending rates have soared. Securities are borrowing (debt) instruments when rates on them increase it means lending rates have gone up. Adjustments in call money rates results in adjustment of commercial bank's borrowing and lending rates in the same direction. Banks would also need to change the prime rate which necessitates changes in all other bank rates in the same direction.

Faure (2007:5) notes that the essence of monetary policy lies therein that the repo rate has major influence on the bank's deposit rates. Banks always want to keep a certain margin between cost of deposit and their lending rates since this is their profit margin. Faure goes further to argue that the central bank indirectly influences the banks' lending rates; the most important been the prime rate, which is the rate at which banks borrow to big borrowers with good credit ratings. This rate however is also the benchmark for the rates that will be charged to other bank customers. The prime rate is based on the repo rate. By making repo effective, the Central Bank actively sets the lending rates in the economy thereby determining the growth rate of demand for credit (Faure, 2007:5). Demand for credit is the driver of economic activity. If money markets are more liquid than capital markets investors will borrow from the money markets to buy capital market instruments. We would largely expect monetary policy to influence stock prices in this instance. However an illiquid money market may imply a weak link between monetary policy and stock market.

2.3 THE STOCK MARKET

Godspeed (2008:11) defines the stock market as the institutional framework through which public companies issue new share capital in the primary market and the ownership of the shares changes hands in the secondary market. It is also referred to as the equity market,

nonetheless this definition is not conclusive as one may want to know what a stock or equity is. Mishkin (2007) defines a stock as a security that is claimed on the earnings and assets of corporations. Stocks are sold in a formal market called the stock exchange. Economic agents buy shares because they value the dividends that their investments will pay in future. Equity stock not only pays a dividend but also capital gains if the owner transfers ownership in the secondary market. The stock market plays a pivotal role in the growth of the industry and commerce of a country that eventually promotes economic growth. In the primary market new share issues are made whilst change of ownership of shares already issued occurs in the secondary market. The stock market existence is on the premise of providing funding to enable investment and productivity and as a result spur economic growth.

Stock prices are among the most closely watched assets in the economy (Bernanke, 2003) this is because in the past stock markets have been used to predict the business cycle. Fischer and Merton (1984) acknowledge that economic theory states that in a well-functioning and rational stock market changes in stock prices reflect both revised expectations about future corporate earnings and changes in the discount rate at which earnings are capitalized. The interest rate today is used to discount future cash flows in order determine whether a future investment project is profitable. Even so today the predictive power of the stock market of economic conditions cannot be disputed. It is expected that present high stock prices have a dampening effect on future prices of stocks. Expectations are stock prices will be low in future which results in reduction of the pace of economic growth.

Dufour and Tessier (2006) argue that asset prices tend to incorporate a forward-looking component and may provide leading indicators of economic activity or inflation. This observation is quite relevant in the context of an inflation-targeting regime, where the monetary policy stance is set according to inflation forecasts. The stock market is a conduit for meaningful investment for individuals who want to borrow their funds on the money market. Individual can borrow in the money market buy stocks and later sell the stocks for capital gain. The stock market existence is highly relevant in developing and emerging market economies where it has yet been adequately exploited; there is a huge dependence on bank lending channel. There is still more room for development of equity markets in emerging and developing countries' economies.

Although central bank officials need to watch closely stock market activity, it is considered highly risky for monetary authorities' decisions to be solely dependent on signals from stock market participants in developing policy (Dufour and Tessier, 2006).The stock market has some highly emotional tendencies which moves prices in all sorts of directions. This is the 'irrational exuberance' referred to by Alan Greenspan former Chairman of the Federal Reserve in one of his speeches. This statement is emphasised by (Bordo and Wheelock, 2009:91) who assert that financial markets are inherently volatile and that market prices often stray from fundamentals. The tragedy will be the response of monetary policy authorities to non-fundamental movements in the stock market which may easily become a recipe for further instability in the financial markets.

It is a fact that the stock market has the ability to stabilise liquidity shocks of firms as it allows investors facing liquidity crisis immediate access to their funds through the secondary market. Firms do not have to withdraw funds invested in long term investment projects as such withdrawals could hamper economic growth. Borrowers have a long term supply of capital via the secondary market. These activities result in the diversification of risk that individual face at the aggregate level. The existence of the stock market enables individual investors to transfer the control of their savings to the market place with confidence. Individual investors exchange their savings for shares of companies that are listed on the stock exchange. The share gives the individuals the right to vote and appoint directors of the company who have the responsibility for steering the performance of the company. If the company is doing well the shareholders are entitled to a return on their investment in form of a dividend on each share held. Management has to perform adequately and satisfactorily or they will have to be replaced by competent managers. Shareholders therefore keep a firm grip on management so that they at least try to guarantee a return on their investment, (Pilbeam, 1998:1980).

The stock market impacts economic activities through the creation of liquidity. Most capital intensive and profitable investments require long term commitment of capital but most lenders are reluctant to relinquish control of their savings for long periods. Liquidity is of paramount importance in the stock market as it makes investments less risky and more attractive. Savers are able to acquire stocks sell immediately and cheaply if they need access to their savings or want to change portfolios. Liquid stock market results in efficient

allocation of capital and resources as investors are free at any time to switch their investments from less viable to better performing companies. Funds flow from surplus economic units to deficit economic units through the facilitation process of the stock market. The stock market provides the necessary environment to siphon free funds into viable investments. Much of the savings of ultimate lenders will not have been of any consequence if it were not for a sound stock market which links ultimate lenders and ultimate borrowers.

The stock market is instrumental in overcoming the issue of information asymmetry .It would take investors an enormous amount of time and might be impossible for an investor to have timely information about all firms listed. The stock market has the ability to provide informational support at rapid intervals to market participants. This information enables reallocation and diversion of surplus funds which would ultimately lead to economic growth.

2.4 MONETARY POLICY AND STOCK MARKET INTERRELATIONSHIPS

2.4.1 Money supply and stock prices

There is no clear-cut explanation of the effects of money supply on stock prices. A positive causal relationship which is hypothesized in financial theory literature by (Sprinkel :1964,Homa and Jaffe:1971,Hamburger and Kochin:1972,Pearce and Roley :1985,Husain and Mahmood :1999). This based on the assumed inverse relation from money supply to interest rates, and a negative causal relation from interest rates to stock prices (Alatiqi and Fazel, 2008:1). However, some studies dispute the positive causal relationship arguing for non-existence of a stable and structural relationship (Pesando: 1974, Kraft and Kraft: 1977, Gupta: 1974). The foundation of the inverse causal relation from money supply to interest rates is the short term liquidity effect (Alatiqi and Fazel, 2008:1).The liquidity effect postulates that an increase in the supply of money creates an excess supply of money at existing income, interest rate, and price levels.

Money supply growth is expected to lead to a decrease in interest rates which will lead to a decrease in the discounting factor on future receipts. This is expected to lead to an increased demand for shares as the share prices and returns soar. However the increase in money supply will at the same time lead to an increase in money demand therefore the shift in the money demand function to the right would result in the simultaneous shift of the money

supply function to the right as well. This may result in new equilibrium interest rate above the old equilibrium interest rate. Therefore the assumption that is made is that the effects of factors that lead to a decline in interest rates outweigh those that may result in ultimately a higher equilibrium interest rate (Alatiqi and Fazel, 2008: 1). Hashemzadeh and Taylor (1988) have found bi-directional causality present in regression models between money supply and stock returns using stock indexes to estimate market returns. Financial theory postulates that an increase in money supply increases the demand for stocks which rallies the price of shares. The next subsection will discuss the relationship between interest rates and stock prices.

2.4.2 Interest rates and stock prices

A portion of data which arrives frequently to the equity markets are interest rates and stock price fluctuations. Theoretically the interest rates and the stock prices have an inverse relationship. This is because a rise in the interest rate reduces the present value of future dividends income which should depress stock prices (Hamrita, Abdallah and Ammou, 2009). Conversely, low interest rates result in a lower opportunity cost of borrowing. Lower interest rates stimulate investments and economic activities which would cause prices to rise. The direction of causality seems to be mostly running from interest rates to stock price but not the other way. Apergis and Eleftheriou (2000:232) argue that the link between stock prices and nominal interest rates mirrors ability of an investor to adjust the structure of her portfolio between stocks and bonds. The implication is therefore that an interest rate increase (decrease) prompts our representative investor to change the composition of her portfolio in favour of (against) bonds. Consequently, stock prices are expected to decrease (increase), since a decline in interest rates leads to an increase in the present value of future dividends (Hashemzabdeh and Taylor, 1988). Malkiel (1982) and Modigliani and Cohn (1979) argue that the interest rates seem to the most important determinants of stock prices. There is no consensus in literature over the actual relationship that exists between stock prices and interest rates. Certain empirical attempts provide evidence in favour of a positive, rather than a negative relationship in other empirical studies (see Asprem, 1989, Shiller and Beltratti, 1992 and Barsky, 1989). This study therefore endeavours to link up and explain the nature that exists between stock prices and interest rates in South Africa.

2.4.3 Stock Prices and Inflation

Sourial (2002) observes that inflation is positively related to interest rates and negatively related to stock prices. This he refers to as inflation expectation hypothesis. Modigliani and Cohn(1979) argue that stock markets react inappropriately to inflation due to investors' ignorance that interest rate rise is to compensate for the rise in inflation. When interest rates increase investors view this as an increase in the cost of production since cost of capital has increased and they increase prices of their goods and services. The price level rises yet the objective of monetary authorities was to contain inflation which is interpreted wrongly by the market. However stock prices of firms go down, since stocks are now less attractive, on top of that companies' profitability is affected by the rising inflation as households reduce their consumption in expectation of tougher times ahead. Households may sense a recession in the near future might have prompted the interest rate rise.

Most of the arguments which explain the relationship between inflation and stock prices distinguish between expected and unexpected inflation (Sellin, 2001:510). Sellin finds that except for UK and Sweden the effect of inflation on short-horizon stock returns appears to be negative (or nonexistent) regardless of whether actual, expected, or unexpected inflation is considered among the countries included in his sample of analysis of previous studies. He however also finds that inflation seems to be positively related (or unrelated) to long horizon returns. Historically, U.S. stock market returns have been negatively correlated with inflation (Fama and Schwert, 1977). That relationship is explained by (Fama, 1981) as an irregularity resulting from the contemporaneous impacts of real economic activity on inflation and stock returns. Goodfriend (2003) argues that prior to the 1980s; monetary policy was an important source of both macroeconomic and financial market instability, which could explain the negative relationship between stock returns and inflation. An increase in inflation would tend to depress stock returns because long-term interest rates would rise in response to higher expected inflation and tighter monetary policy and because tighter policy would also slow economic activity and thereby reduce current and future corporate earnings.

2.5 THEORETICAL LINK BETWEEN STOCK MARKET AND MONETARY POLICY.

Our interest in this study is to find out the linkages that exist between monetary policy and the stock market. In some circles they argue the link runs from monetary policy to the stock market. Whilst in some circles the argument is the link runs from the stock market to monetary policy. Monetary policy authorities have to keep abreast with stock market activities as they would influence their policy. Stock market participants also need to be aware of policy direction of the central bank as it is expected to have an impact on their decisions and activities. Theory says the market reacts to unexpected changes; these are surprise announcements by the central bank. The market will not react to expected changes as the market agents will already have incorporated them in their decisions. Therefore unexpected monetary policy and stock price shocks are the interest of this study.

Before indulging in the foregoing discussion it is important to highlight that the study is not implying superiority of the interest rate channel over other alternative channels of monetary policy. It is well appreciated that monetary policy is transmitted through a number of channels (Chami, Cosimano and Fullerkamp, 1999). Alternative monetary policy transmission mechanisms are stated as follows; exchange rate channel, credit channel, other asset price effects and credit channel (Miskin, 1995). This study attempts to expose the relevance and importance the interest rate channel to South Africa's monetary policy regulators in their execution of monetary policy but does not seek to undermine other transmission mechanisms. In order to discuss these links this study has separated the link between monetary policy and stock market into either direct or an indirect link. The direct link of monetary policy to the stock market is through the interest rate channel of the monetary policy transmission mechanism. The study discusses what happens immediately in the stock market and economy when there is an adjustment of interest rates. Asset price channel is the indirect link and it affects wealth and companies valuation. Miskin (1995, 1) divides the asset price channel into wealth effects and Tobin's q theory of investment. We will first discuss the expected direct link between monetary policy and the stock market.

2.5.1 Direct link

Interest rate channel is the traditional transmission mechanism one which is thoroughly explained in economics textbooks under Keynesian model often regarded as the main channel (Loayza et al, 2002). It can be easily regarded as the main channel since it has an indirect impact on other monetary transmission mechanism channels. Adjustment and variations in interest rates have an impact on asset prices by altering the discount rate which is a crucial input in asset pricing (Faure, 2003:250). An interest rate adjustment has an effect on the exchange rate through its impact on capital flows. The exchange rate in small open economies is considered essential as most central bank's target exchange rate (Neri, 2004: 15). Neri further states that the exchange rate is also considered a major component of monetary policy transmission is small open economies. It is important to note that the relevance of the exchange rate channel of monetary policy has grown over the years due to the globalisation of world economies. The exchange rate effect is influenced by the interest rate effects. An increase in real interest rates in South Africa, domestic rand deposits become more attractive relative to deposits denominated in foreign currencies, this consequentially leads to a rise in the value of rand deposits to other currency which is interpreted as an appreciation of the rand. The appreciation of the rand will result in decline in net exports as locally produced goods become relatively expensive to foreign produced goods. Imports become cheaper and local consumers will have a huge appetite for foreign produced goods, all these events leading to a fall in aggregate output (Mishkin, 1995: 5).

A central bank can pursue an expansionary monetary policy by adjusting its policy instrument, either decreasing its policy interest rate or increasing a monetary aggregate under its control. A contractionary monetary policy involves increasing the policy interest rate or decreasing the monetary aggregate under the Central Bank control. If there is a tightening of monetary policy (M↓), in most cases this results in the decline of money supply, this policy move is associated with higher interest rates (i ↑). Cost of capital increases when interest rates have been increased consequently leading to a reduction in demand for credit which leads to decline in investment (I↓). Aggregate demand and output decline for there no longer is meaningful investment. Schematically this is shown below:

$$M\downarrow \rightarrow i\uparrow \rightarrow I\downarrow \rightarrow Y\downarrow \quad \text{.....2.1}$$

If there is an expansionary monetary policy then money supply is expected to increase, this policy move favours lower interest rates. This results in the decrease in the cost of capital and consequently a rise in demand for credit which leads to an increase in investment. This relationship is shown below:

$$M\uparrow \rightarrow i \downarrow \rightarrow I\uparrow \rightarrow Y\uparrow \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.2$$

Although there are arguments that the interest rate is market determined in actual sense it is influenced by Central Bank through the Monetary Policy Committee (MPC).There are meetings at given intervals where the MPC meet to decide the fate of interest rates and this is a decision is on the repo rate. However this rate affects all other prices in the economy. The interest rate is an important variable in the economy for it is useful in determining future paths of returns of investments. There are various ways of valuing equity but our interest will be on two methods, Smith (1925) and Gordon Growth Model (1962), net present value models. The interest rate channel just discussed is a component of these valuation methods indirectly through the rate of return. Therefore we review these stock valuation methods in the next subsection.

2.5.1.1 Stock market valuation and interest rates

In financial theory issues relating to valuation of shares in the stock market are based on the present value model. Literature has two versions of the present value model: Smith's (1925) and Gordon's (1962) version (Moolman, 2004:51). The purpose of stock valuation methods is to attempt to estimate the intrinsic value of a share. The current interest rate is used to discount future dividend flows. An investor decides if an investment which is to result in future cash flows is worthwhile by discounting future dividends at the current interest rate. Lucas (1978) postulated that the price of a stock is given by the discounted sum of future dividend payments. The issue for the investor is whether an investment decision made today will continue to be worthwhile in the future. The objective of this subsection is the need to explore and understand how investors value shares as part of attempting to understand the relationship between stocks and monetary policy. A change in the supply of money will lead investors to revalue the stock market (Sellin, 2001: 492). Equities are bound to become more attractive with an increase in money supply as a result of an expansionary monetary policy. This study will give a brief discussion of the stock valuation methods stated above.

The standard theory of the present value model of share valuation according to Smith (1925) postulates that the equilibrium price of a share at a point in time is equal to the discounted present value of the expected future (cash dividend) flows from that share. The model advocates that any factor that affects or alters the expected future profits of firms will affect their dividend payment, and consequently affect the share valuation (Jefferis and Okeahalam, 2000). Smith (1925) presented the present value model as follows:

$$P_{e=} \sum \frac{D}{(1+R)^t} + \frac{E(P_{en})}{(1+R)^n} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots . .2.3$$

Where E (P_e) is the expected price of the share in year n. This equation says that the value of equity is the discounted value of all the dividend payments due plus the discounted expected value of the share in year n.

2.5.1.2 Gordon Growth Model

This model was developed to correct the major problem of the present value model as presented by Smith (1925), represented by equation 2.3. The major weakness of the present value model is the assumption that dividend payments D are fixed especially in the long run. It is more rational to assume that dividend payments are prone to change. This assumption is carried; following a model put forward by Gordon (1962), which is a variant of the present value model as presented by Smith (1925). The Gordon constant growth model argues that, over time dividends will grow at a certain consistent growth rate of g percent per annum. Value of share according to the Gordon growth (1962) is computed as follows:

$$V = \frac{D_1}{r-g} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots ..2.4$$

Where

V = value of share i

D_1 =expected dividends per share in one year's time

r = shareholders required rate of return

g = constant dividend growth rate

At all times r should be greater than g for the formula to make sense and avoid the possibility of a negative or infinite share price. Interest rate represented by r in the formula is the variable affected by monetary policy directly. Whenever interest rates increase rate of return has to increase as well but the increase in the denominator reduces the value of share. Then investors find that alternative investments like Treasury bills, negotiable certificates of deposit (NCD's) become more desirable than equity. Investors sell stocks and stampede on the money market. A decrease in r reduces the discount rate on future dividends. The denominator in the formula is smaller which increases the value of shares. An expansionary monetary policy makes the stock market more attractive than money market investments.

The discussion on equity valuation models was explored since monetary policy particularly surprise policy moves is likely to have an impact on stock prices directly through the discount (interest) rate channel. Monetary policy is most likely to affect output, employment and inflation and this will affect company profitability indirectly through these variables. This will affect dividends companies pay eventually, which will lead to decrease in stock prices if a contractionary monetary policy is implemented. Monetary policy influences stock prices indirectly through its influence on the determinants of dividends and the stock return premium by influencing the degree of uncertainty faced by the agents.

2.5.2 Indirect link

There is an indirect relationship between monetary policy and stock market which is quite pronounced. The importance of credit extension in the economy is largely under emphasised. When economic agents borrow it is largely because they want to finance acquisition of an asset. Borrowing may be to finance purchase of house, car, combine harvester, an industrial machine, plant and equipment. The essence of this argument is that borrowing finances productive activities. Growth in credit extension is linked to growth in demand for goods and services. The growth of credit extension is also the growth in M3 that is money supply. Growth in money supply is not inflationary as long as the growth in money is attached to growth of national output. The increased demand leads to multiplication in productive activities to satisfy the demand. When aggregate demand increases firms do well and profits of companies soar. Investors are always on the lookout for companies that are performing well. Performance is measured according to profitability of the company. If a company is doing well in the market then investors would jostle for its shares. Investors stampede for

shares of blue chip companies; this just as well increases the price of the share due to demand and supply dynamics. Investors may buy a share simply because others are buying the share. If negative sentiments are passed in the market about a certain stock the majority of investors may shy away from taking an active interest in that particular stock.

The indirect link between the stock market and monetary policy is based on total expenditure in the economy and credit extension. Total expenditure is the Gross Domestic Expenditure (GDE) which is consumption(C) plus investment (I) equation [(2.5(i)]. The total product (output) produced in the economy is the Gross Domestic Product (GDP) which is GDE plus exports minus imports(X-M) shown in equation 2.5 (ii).

GDE=C +I.....2.5(i)

GDP= C + I =GDE+ (X-M).....2.5 (ii)

Equations 2.5(i) and 2.5(ii) show the relationship between total expenditure and total product in the economy. The following sub-sections discuss the effect of interest rates on the variables in the equations above.

2.5.2.1 Effect of interest rates on consumption

Bain and Howells (2003:173) state consumption expenditure derives from current income but consumption decisions depend also on expected future income, the level of wealth and on the ability to borrow against existing wealth. Therefore consumption expenditure is affected by a list of factors. A decrease in interest rates would make savings from current income less attractive as well as decrease payments on existing floating rate debt and thus increase disposable income; the result is also an appreciation of prices of financial assets and hence influences the price of private sector wealth. Monetary policy easing decreases cost of borrowing and thus increases the cost of goods and services obtained on credit; it increases house prices and this influences estimates of household's wealth and increases the value of collateral against which households wish to borrow. Therefore households can borrow more since there is now more money in the economy and productivity increases leading to economic growth.

Interest rate hike make savings from current income attractive; however it increases repayments on existing floating rate debt and thus lowers disposable income. The interest rate hike increases the cost of borrowing to the ultimate borrower and thus increases the cost of goods and services bought on credit. Since the cost of borrowing has increased it becomes unattractive to seek loans for investment and consumption. GDE is forced downwards as consumption and investments decline. A monetary policy tightening lowers the price of financial assets and hence influences estimates of private sector wealth. Above that it lowers house prices or at least slows the rate at which they are increasing and this too influences estimates of household wealth and lowers the value of collateral against which households seek to borrow (Bain and Howells, 2003:174).Therefore the effect of an increase in interest rates is a wealth effect which makes households feel poorer since they have to pay more for their mortgages and other current debt whilst the value of their assets has declined. Stock prices may influence consumption indirectly through a wealth channel on consumption.

The life cycle model of consumption developed by Ando and Modigliani (1963) in which households' wealth is a key determinant of consumption spending is the foundation of wealth effect on consumption. The link to monetary policy stems from the connection between interest rates and asset prices; a policy induced interest rate increase reduces the value of long-lived assets (stocks, bonds and real estate), shrinking households' resources and leading to a fall in consumption. Smal and De Jager (2001) note that many households hold portfolios consisting of equities and property. A decision to implement a contractionary monetary policy leads to decrease in equity and property prices and an increase in interest rates. This corresponds to a decline in consumer's wealth and as a result there will be a decrease in consumer spending. This transmission mechanism is represented schematically by the following equation adapted from Mishkin (1995:6).

$$M \downarrow \rightarrow P \downarrow \rightarrow \text{Wealth} \downarrow \rightarrow \text{Consumption} \downarrow \rightarrow Y \downarrow \quad \text{.....2.6.1}$$

2.5.2.2 Effect of interest rates on investment

Bain and Howells (2003:175) discuss the effects of an increase in interest rates on firms as raising external borrowing costs for firms that raise funds through bank or from bills or bond markets. Borrowing becomes exorbitantly high and these firms have to cut expenditure on investment. The adjustment of the interest rate increases the rate at which firms discount

back expected future returns from investment, making investment projects less attractive; investment projects are either shelved or abandoned. Monetary policy tightening increases the return from the savings of firms, retained from past profits, raising the opportunity cost of financing investment internally. This makes firms reluctant to plough back profits for future investment as the alternative return is higher. Contractionary monetary policy increases the difficulty and cost of raising investment funds through the issue of new capital on the stock market as well increases the costs of holding inventories of goods, which are often financed by bank loans. However it lowers asset prices, reducing the net worth of firms and making it more difficult for them to borrow. Asset prices may influence investments indirectly through the Tobin's q theory.

Tobin (1969) defines q as firm's market value divided by the replacement cost of capital. Monetary policy can affect economy through its effect on the valuation of equities (Smal and de Jager, 2001:8) this is the basis of Tobin's q theory. The lower the interest rates the higher equities will be valued. Lower interest rate which is an expansionary monetary policy makes it possible for households to have excess balances. Households realise that they have more money to spend. Smal and de Jager went further to state that one possible place to spend excess money balances is the stock market. There is an increased demand for equities which will raise the price of equities. Henceforth, the increased value of equities and the lower interest rate will result in a high q.

A q value greater than 1 implies that the firm's market price exceeds the cost of replacement capital. The firm can issue expensive equity as buyers may feel they are purchasing cheap plant and equipment, since plant and equipment is cheap relative to the market value of the firm. Firms can issue equity at a price that is relatively higher than the cost of capital. Investment spending will rise as firms need only issue small amounts of script to accumulate large quantities of capital goods. However if q is low, firms will not purchase new investment goods as the market value of firms will be low relative to the cost of capital (Mishkin,1995:6). The following illustration articulates this channel:

$M \downarrow \rightarrow P \downarrow \rightarrow q \downarrow \rightarrow I \downarrow \rightarrow Y \downarrow$…….2.6.2

2.5.2.3 Effect of interest rates on Net Foreign receipts from abroad (X-M)

For the purposes of this study net foreign receipts represents the balance in the current account and the capital account combined.Net foreign receipts from abroad will increase if there is an increase in interest rates as there will be huge capital inflows from abroad. This result is inconclusive since rises in interest rates affect capital and current account in different directions. The domestic interest rates will be more attractive than the foreign interest rates and foreign investors will tend to invest in the domestic market. This is supposed to be true for South Africa since it is relatively an open economy. Bain and Howells (2003:176) state that other things been equal an increase in domestic interest rates should increase the attractiveness of the currency in foreign exchange markets, raising the value of the currency. The rise in the value of the currency makes imports cheaper and exports relatively expensive.

Domestic firms which export are adversely affected since they have to reduce profit margins, accept a loss in the share of the export market or both. In the short run there is no scope for reducing costs of production or lowering the domestic currency prices. This change in interest rates is likely to influence aggregate expenditure in different ways as the prices of domestic and foreign goods have changed. Households may substitute domestic products for foreign products and domestic firms may struggle to compete. Aggregate demand the counterpart of aggregate expenditure declines as a result of these developments in the economy. Warehouses accumulate huge quantities of goods which are not been demanded which would result in companies' making losses. Companies would lay off workers as they cannot sustain a huge wage bill spread on a tiny revenue base. Share prices will go down since the economy has slowed down and economic agents have a pessimistic view of the near future. Investors will be reluctant to spend as they save for an uncertain harsh economic environment ahead of them.

2.5.2.4 M3 and Gross Domestic expenditure

Growth in M3 is influenced by the growth in credit extension. Demand for goods and services are at the centre of the demand for credit. If there is an increase in the aggregate demand in the economy the demand can only be satisfied if there is more money in the economy .Therefore money has to be created out of thin air by simple balance sheet entries (Faure,2007). Firms have to produce more so that they are able to satisfy the high level of demand. The level of M3 is important in both a monetary targeting and an inflation targeting

framework. The Central Bank has to know the level of growth of money supply so that the growth of M3 does not become inflationary. It is important also to note that if there was no growth in money supply over time there will be no economic growth. Gross Domestic expenditure is financed by money. The recent effects of the global financial crisis are clear evidence that if the financial system is insolvent there is mayhem in the economy. The banks in America where practically insolvent due to toxic assets which were on their balances sheet as a result of sub- prime mortgage debacle (Turner Review, 2009). The US financial system was on the brink of collapse if it were not for stimulus packages by government to induce liquidity and stimulate demand in the economy. Banks were no longer willing to lend to each other due to high level of risk due to illiquidity in the market (Larosisere, 2009). The US economy is the engine of growth of the world economy so the crisis spread far and wide which resulted in the world economy shaking. Economic activity is financed by cash and credit therefore money has a big role to play in the economy.

2.6 EMPERICAL REVIEW

2.6.1 Introduction

The world economy over decades has grown into a global village with highly intertwined financial markets. World economies depend on each other more than ever before with the results of the global financial crisis been clear testimony of the linkages and interdependence of the world economies. Global financial crisis crippled the world economy and left more questions than answers. The stock market grew between 1996 and 2001 remarkably due to the remarkable performance of information technology companies (dot com bubble) and even more remarkably after recovering from the effects of the dot com bubble and September 11 terror attacks of 2001 (Naude, 2009:2). When the dotcom bubble burst there was an aggressive drive to stimulate the US economy (Naude, 2009:2).

There was also the American Dream in the US; everyone should own a house which led to sub-prime lending which culminated in the crisis now referred as the sub-prime mortgage crisis. Interest rates were kept low between 1999-2004 banks offering adjustable-rate mortgage (Marshall, 2009: 7) which appeared attractive to potential buyers. Sub- prime loans where loans given to borrowers with high chance of defaulting, offered at unrealistically low interest rates at initial repayment but the interest rates increased during the duration of

repayments resulting in the borrowers not been able to pay back the loans and they opted for foreclosures and banks were left with white elephant balance sheets. By 2006 a number of factors had conspired to burst the boom in the property market (Marshall, 2009: 7). When prices started to decline borrowers realised they could not pay back the loans and they decided to walk away.

These dramatic events in asset markets are what make them an interesting area of research as developments in these markets have far reaching consequences on the economy. The unpredictability of asset markets makes them an interesting empirical subject. Central banks will be keen on been well advised on how they should react if there are disturbances caused by pricing of assets in financial markets. An example of such disturbances is the financial crisis of 2007/2008. Central banks all over the world responded to the financial crisis with cut in interest rates in an effort to induce liquidity (Marshall, 2009). Fiscal stimulus packages was the other policy remedy, government expenditure was increased, the increase was meant to stimulate aggregate demand.

Numerous studies have been done in the developed world on effects of monetary policy on macroeconomic variables (Bjornland and Leteimo, 2009), whilst very few attempts have been on the interaction between stock market and monetary policy. Although there are a number of studies that have been done in the developed countries on this topic there are still very few studies in emerging and developing countries. This presents a research gap in this area of expertise, therefore this study is meant to contribute to this area of study as future developments point to more active stock markets in developing and emerging market economies. A study which seeks to articulate directly the impact of monetary policy on stock market has been long time coming.

2.6.2 Review of Empirical methods

Literature offers a number of empirical approaches which can be used to assess the linkages that exist between stock markets and monetary policy. Naceur, Boughara and Ghazouni (2009) identify empirical approaches which have been followed in literature to assess the linkages that exist between stock markets and monetary policy. They expose four classes the first class covers studies having recourse to monetary policy rules such as Taylor's rule or forward-looking rules (Hayford and Malliaris, 2002:2004). Hayford and Malliaris (2002)

investigated if the Federal Reserve under its then Chairman Allan Greenspan incorporated the stock market over valuation in its FOMC decisions. They set out to know whether the Greenspan Fed had been stock market neutral or not. They compared the period between 1987 and 2000, the changes in the federal funds rate with the behaviour of stock market valuation, unemployment, GDP gaps and inflation. The regression results of the augmented Taylor rule hint that the Greenspan FOMC used the federal funds rate policy to offset increases in the value of the equity market above estimates of fundamentals, federal funds policy has perhaps unintentionally, on average accommodated the apparent stock market overvaluation. They also concluded that the FOMC transcript evidence is consistent with Taylor's rule suggesting the federal funds rate target has largely been set in response to inflation and measures of excess demand. Therefore federal funds rate has not been increased solely to offset a potential stock market overvaluation.

Studies that utilise autoregressive models methodology is the second class of models identified and it includes (Thorbecke, 1997; Lastrapes, 1998; Sourial, 2002; Neri, 2004; Ehrmann *et al.*, 2005; Bjornland and Leteimo, 2009). The major strength of such methodology is that it enables the researcher not only to assess the impact of monetary policy decisions on price movements of equity markets but also to inform policymakers about the reaction of the monetary authorities to changes in the stock market (Naceur, Boughara and Ghazouni, 2009). This methodology has also been useful in studies which attempt to establish whether stock market channel is operative (Cassola and Morana, 2004). The drawback of this approach is that if it is a question of evaluating the relationship between monetary instruments and different asset prices it becomes less attractive. Furthermore, high frequency data is a necessity as well as inclusion all required variables when utilising this methodology since this enhances the performance of the model (Naceur, Boughara and Ghazouni, 2009). Otherwise the inferences that will be made from the model will be fragile.

The third class of models is popularly used to measure the reaction of stock prices to money supply (Lynge, 1981; Cornell, 1983; Pearce and Roley, 1983; Jensen and Johnson, 1999).They focus on single-equation conditional models popularised by (Ehrmann and Fratzscher,2004) favouring the impact of monetary policy changes on stock market disregarding the effect of other variables, including news about the economic outlook which could have an impact on both short-run interest rate and asset prices. The major setback of

this approach is the assumption of one-directional causality; therefore it does not recognise reverse causality. The usefulness of these models is however defeated by the endogeneity problem especially when using short term interest rate as a proxy for monetary policy stance. Short term interest rates are contemporaneously influenced by stock prices if they are used as the monetary policy stance measure.

The final class of models attempt to overcome the weaknesses of the single equation condition models. They use simultaneous equation so that there is contemporaneous determination of the relationship between monetary policy and stock market (Rigobon and Sack, 2003, 2004; Bohl *et al.*, 2007). All the methods discussed except for the simultaneous equation model fail to provide for and correct the endogeneity problem. Bjornland and Leteimo (2008) who utilises SVAR attempt to defeat the endogeneity problem by imposing a combination of long run and short run restrictions. The following paragraphs discuss a summary of studies that have been referred to in detail and other notable studies that have been done.

2.6.3 Review of empirical studies for Developed economies.

There is an extensive body of literature on stock market and monetary policy as a result of extensive research in the past four decades. Contributions include Brunner (1961), Friedman (1961) and Friedman and Schwartz (1963), they viewed money as an asset among other assets in an investors' portfolio. Investors will substitute between money and other assets in an effort to re-establish their desired money holdings if there are money supply shocks. The response of investors may not be immediate, it may take a while which makes it possible for money to predict stock returns. The hypotheses that past money supply data can be used to predict future stock returns was supported by empirical studies (Sprinkel, 1964; Keran 1971 and Hamburger and Kochin, 1972). Inside the decade these findings were published there were studies which disputed these results, the findings by (Cooper, 1974; Rozeff, 1974) showed there is no predictive content in past money supply changes but stock returns may actually cause money supply changes. The expectation is that changes in interest rates will influence or at best cause changes in money supply in the economy. Rogalski and Vinso (1977) set out to find out the relationship between money supply and stock returns as well as establish the direction of causality in a study to consolidate the work of Rozeff (1974). At the time literature was diluted as far as the relationship between stock returns and monetary

policy, some researchers had found a strong linkage as noted above whilst Cooper (1974) and Rozeff (1974) had queried these findings.

In South Africa the use of inflation targeting mean that central bank influences changes in money supply with interest rates. Interest rates influence money supply indirectly through their influence on investments. If a confirmation of a strong linkage between money supply and stock prices is made then it is possible for one to predict future stock prices and returns from money supply forecasts. Rogalski and Vinso (1977:1018) assert that the later statement contradicts with the efficient market hypotheses (EMS). The results of the study by (Rogalski and Vinso,1977:1027) are consistent with the proposition that information concerning the actual growth of the money supply is incorporated into stock returns as purported by various monetary portfolio theorists. It also supports the notion that the stock market is efficient with respect to monetary information as the efficient market theory would suggest. Based on their results therefore they propose a bi-directional theory of causality between money supply and stock returns with causality mainly appearing to run from stock prices to money supply and back again. The implication of their findings is that money supply changes will directly influence returns on shares. Rogalski and Vinso (1977) further assert that although monetary policy should not be guided by stock markets, authorities should observe carefully developments in this market as it influences economic activity.

The weakness of these earlier studies when they referred to money changes is that they did not distinguish between supply and demand shocks. It is difficult then to determine which money they referred to. Lastrape (1998) addresses this by identifying money supply shocks from the statistical model by imposing long run monetary neutrality on the system. The implication is that it would be assumed permanent changes to money supply have no effect on real variables at infinite horizons. He states that because money neutrality at infinite horizon is a characteristic of most macro models, this approach is more general in distinguishing money supply from money demand shocks than approaches taken by other studies looking at the effects of money on asset prices and particularly stock prices. This paper seeks to estimate the short run responses of interest rates and equity prices to money supply shocks over the post war period for G-7 countries (Canada, France, Germany, Italy, Japan, the UK and the US) and Holland. He finds that money supply shocks have real liquidity effects in both stock and bond markets.

Studies of 1980's feature contributions from Pearce and Roley (1983), Pearce and Roley (1985) among others. Pearce and Roley (1982) investigate the short run reaction of stock prices to weekly money announcements. They concluded that stock prices respond only to the unexpected change in the money stock as predicted by the efficient markets hypotheses. They also find that an unexpected change in money depresses stock prices. Their findings supported the view that stock market participants take into account the revisions in the money stock as well as unexpected changes. Pearce and Roley (1984) examined the daily response of stock prices to announcements of the narrowly defined money stock, the CPI, the PPI, the unemployment rate, industrial production, and the Federal Reserve's discount rate. They concluded that new information related to monetary policy affected stock prices. These findings clearly point to an interdependence of stock market to monetary policy.

Fama and French (1989) study is modelled on business conditions. They state that the default spread[1] is a business conditions variable, high when business is persistently poor and low in periods during which the economy is persistently strong. They further state that the dividend yield is correlated with the default spread and moves in a similar way with long –term business conditions. They also reported on the term spread[2] of which for most of 1927-1987 the term spread is related to short term measured business cycles. The study concluded that these three variables affected stock and bond returns however they did not articulate what causes changes in business conditions. The theoretical literature set out earlier in the chapter would predict monetary policy conditions have a lot to do with predicting business conditions. Expansionary monetary policy will proxy good business conditions whilst contractionary monetary policy proxies poor business conditions. It is concluded that expected stock returns vary with business conditions the reason might be when business conditions are poor, income is low and expected returns on bonds and stocks must be high to induce substitution from consumption to investment (Fama and French, 1989:26). They further assert that in good times income is high and the market clears at lower levels of expected returns.

[1] Default spread is the difference between the yield on a market portfolio of corporate bonds and the yield on Aaa bonds.
[2] Term spread is the difference between the Aaa yield and the one-month bill rate.

Interesting contributions to this body of knowledge in the 1990's are by Jensen and Johnson (1995, 1996); (Conover et al 1999a, 1999b) and Thorbecke (1997). Jensen and Johnson (1995) motivate their study on the premise that small open economies are more vulnerable to international capital movements than relatively closed developed economies. They use data for the US covering the period between 1962 and 1991 focusing on long-run monthly as well as quarterly performance and find that expected stock returns are significantly greater during expansive monetary periods than in restrictive periods. Thorbecke (1997) utilizes innovations in the monthly federal funds rate and non-borrowed reserves to capture the effects of monetary shocks on industry level returns over the period 1967 to 1990. He utilises a VAR that includes industrial production, inflation, stock returns, log of commodity price, the log of non-borrowed reserves and the log of total reserves. It is concluded that monetary policy exerts large effects on ex-ant and ex-post stock returns. This finding is consistent with the theoretical framework of this current study. Monetary policy indeed at least in the short run has real and quantitatively important effects on real variables. Small firms are affected more than large firms by monetary shocks that affect the firm's access to credit (Thorbecke, 1997).

Rigobon and Sack (2002) estimate a VAR model using daily and weekly data on stock returns and federal funds interest rates relying on heteroskedasticity to identify the equations to measure the effect of monetary policy shocks on equity returns, manipulating the conditional volatility in asset returns to identify the policy shocks. The authors use data in the period 1985M3-1999M12 which consists of federal funds rate, treasury bill rate, S§P 500 as well as macroeconomic shocks which include (core consumer price index, the National Association Of Purchasing power (NAPM), non-farm payrolls (NFPAY), the core producer price index (PPI) and retail sales (RETL). They find that the stock markets movements have a significant impact on short term interest rates. Short term interest rates move in the same direction as the variation in stock prices. According to their findings the estimations show that 5% increase in stock prices over a day causes the probability of a 25 basis point interest hike to increase by half. Anticipated policy actions are influenced more by a comparable-sized movement that occurs over a week (Rigobon and Sack, 2002).

A similar study is conducted by Bernanke and Kuttner (2004) who seek to measure in some detail the stock market response to monetary policy actions. Bernanke and Kuttner (2004)

state that market is unlikely to respond to anticipated policy action. This complicates the process of estimating the response of equity prices to monetary policy actions. It is essential to distinguish between expected and unexpected changes. They use two methods the event study approach to measure the level of surprise in the market and follow a method developed by Campbell (1991) and Campbell and Ammer (1993) which assesses how policy surprises affect expectations of future interest rates, dividends, and excess returns. The later method uses VAR to calculate revisions in expectations of these key variables (Bernanke and Kuttner, 2004). The study concluded that there is a strong and persistent response of the equity market to monetary policy actions. In their study they use federal funds futures data to measure policy expectations. They also found that the market response tend to be larger for policy changes regarded to be more permanent. The comparisons that were done across industries revealed that reactions to monetary policy surprises tend to differ across industry portfolios. Goukasian and Whitney (2006) also conduct a similar study and examine the reaction of the stock market to the monetary policy announcements by the FOMC. They use data from 1989M6-2006M1 in their analysis with CRSP weighted value index and broad market index as variables. Event study approach is utilized to measure level of surprises. Goukasian and Whitney (2006) conclude that there is statistically significant abnormal returns to the broad market index (CRSP VW index) on the day following the day during which FOMC decisions were announced regarding monetary policy and federal funds target rate (FFTR).Both studies that there is a significant relationship between monetary policy and stock market.

Neri (2004) analysed relationship between monetary policy and stock market indices in the G-7 countries and Spain using Structural VAR. He concluded that contractionary monetary policy shocks, measured by exogenous increases in the short term interest rate have on average small, negative and transitory effects on stock market indices. The findings by (Neri, 2004) are contrary to the findings by (Bernanke and Kuttner, 2004 and Goukasian and Whitney, 2006) who found significant relationship. Belke and Polleit (2005) used cointegration analysis for data in the period 1974- 2003 to establish whether central bank is able to influence stock returns. They conclude that the Bundesbank and later the ECB do have a significant short and long term influence on stock returns using dividend growth as the stock return measure. Bjornland and Leteimo (2009) explore the US economy with the objective of ascertaining interdependence of stock market(S§P 500) to monetary policy.

They employ structural VAR analysis in the study with data sample from 1983M1 - 2002M12. The variables that were utilised in the model include the consumer price index, log of industrial production ,the federal funds rate ,log of commodity price index and the S§P 500 stock index. They find that a monetary policy that increases the interest rate has an immediate and significant impact on stock prices. It is also noted that stock return is higher after the monetary policy shock and falls only gradually back to an average return. The study concludes that there is a substantial simultaneous interaction between interest rate setting and shocks to real stock prices in the US (Bjornland and Leteimo, 2005: 281).

Li, Iscan and Xu (2007) focused their analysis in determining whether openness and macroeconomic interdependence matter for the impact on and transmission to stock prices of monetary policy shocks. The theoretical foundation of the study is that small open economies tend to have less diversified economic structures than large and relatively closed economies therefore the transmission of monetary policy shocks to asset prices in small open economies works through smaller set of sectors and industries. This leads to different dynamic responses in asset prices. Secondly foreign trade contributes a large proportion of GDP in small open economies than in large relatively closed economies. The intuition is that the degree of trade openness may influence the impact and transmission of monetary policy shocks on domestic asset prices. Stock prices in small open economies are susceptible to international capital flows. An appreciation of the currency or hike in interest rates will make domestic securities more attractive than foreign securities. Investors will buy domestic securities as a result. The degree of openness will affect capital inflows. Li, Iscan and Xu (2007) in the study that they did for the US and Canada they found that small open economies like Canada respond more to monetary policy shocks as compared to large closed economies like the US. Utilising structural VAR models with short-run restrictions, they find that in Canada the immediate response of stock prices to a domestic contractionary monetary policy shock is small and that the dynamic response is brief. By contrast, in the U.S. the immediate response of stock prices to a domestic contractionary monetary policy shock is relatively large and the dynamic response is relatively prolonged. The results of the study suggest that incorporating wealth effects into empirical open economy monetary business cycle models is important in understanding the transmission of monetary policy shocks.

Gregoriou, Kontikas, McDonald and Montagnoli (2009) examine the impact of anticipated and unanticipated interest rate changes on aggregate and sectoral stock returns in the UK. The sample period under scrutiny is June 1999-March 2009 which provides 119 MPC meetings, which will be the time dimension in the panel analysis. The econometric analysis uses time series and panel regression models. The results show that both expected and unexpected components of monetary changes impact significantly on stock returns. Kurov (2009) set out to investigate the stock market response to monetary policy statement in different states of the economy. He used data from the period between 1994M1 and 2008M9 estimating using principal component analysis and factor estimation. His findings were, the reaction of stock market tends to be positive in recessions and negative in expansions. Tatom (2009) examines if there is an exploitable link between the Fed's main policy instrument the federal funds rate and stock prices as captured by the price earnings ratio. If there really is a link between federal funds rate and stock prices

2.6.4 Emerging market and developing economies

Published studies on this particular topic are limited for emerging and developing countries, literature offers only a few. There are two notable studies done in South Africa (Coetzee, 2002; Hewson and Bonga- Bonga, 2005). Other interesting studies done elsewhere include Sourial (2002) for Egypt and Naceur, Boughara and Ghazouni (2009) for MENA countries. These studies made varied attempts to explain the relationship that exist between equity markets and monetary policy. Related studied examine the impact of monetary policy on macroeconomic variables. The discussion below will explore studies that have been done for South Africa and then the discussion will expand to include other selected developing and emerging market economies.

Coetzee (2002) uses monetary conditions as an indicator which reflects the stance of monetary policy for example restrictive monetary policy (high interest rates) reflects tight monetary conditions. According Coetzee (2002), expansive (restrictive) monetary conditions serves as good (bad) news for stock returns, i.e. cuts in interest rates are followed by periods of excess stock returns, while increases in interest rates have a restrictive effect. The author utilizes cointegration analysis using weekly data from 5 January 1991 to 19 May 2001. Coetzee (2002) analyses the relationship between monetary conditions as proxy by a monetary conditions index (MCI) and stock returns. Interbank call rate is used as a proxy for

MCI. He reports that South Africa had 3 expansive and 2 restrictive periods within the period of analysis. The expansive periods were also longer than the restrictive periods. He stated in the report that monetary conditions expanded on average 9.9% per expansionary period compared to 4.7% per restrictive period. Stock returns were less in restrictive conditions than in expansive conditions. The absolute return in expansive periods was 52.94% compared to 11.11% in restrictive periods. The findings of this study are consistent with theoretical and empirical evidence in the developed world. There is an inverse relationship between monetary conditions and stock returns. The finding of the study is that there is long run equilibrium relationship between monetary conditions and stock returns.

Another notable study for South Africa is by Hewson and Bonga- Bonga (2005); they were looking at effects of monetary policy on stock returns. They sought to find out whether monetary policy indeed influences stock market as well as establish the extent to which monetary policy influences stock market changes over time. It was also of interest for them to find out if the ability of monetary policy to influence asset prices changes across sectors. The study assessed the following sectors Financials, Industrials, and Resources and the findings were consistent with those from some developed countries, monetary policy clearly affects different sectors by varying degrees as well as over different time periods. They also found that there was an apparent change in the effects that monetary policy has on the stock market within their sample period. They attributed this to the use of the repo rate as policy instrument in the inflation targeting era that began on 23 February 2000 as well as the volatility in the exchange rate. Therefore Hewson and Bonga- Bonga (2005) also confirmed that a relationship does exist between stock market returns and monetary policy for South Africa.

Far and wide on the African continent Naceur, Boughrara and Ghazouani (2009) did a study for seven Mena countries. The countries considered in this study are Jordan, Morocco, Oman, Saudi Arabia, Tunisia and Turkey. They acknowledge the fact that there is limited literature for developing and emerging market economies. The number of time observations they use range from 110 for Oman and 218 observations for Turkey. Since the study is for a number of countries the observations are at different periods mainly in the 1990s up until 2008. The econometric modelling is done employing Structural VAR. It was found that equity prices in Saudi Arabia and Oman react significantly to real activity and inflation.

Restrictive monetary policy tends to reduce stock prices in the later countries. Stock prices shocks in Egypt and Jordan do not result in significant adjustment of inflation but Jordan monetary policy is effective in impacting stock prices. It was also found that for Egypt and Jordan real shocks have no significant impact on stock prices. The empirical analysis also shows that the monetary policy for Morocco and Tunisia could be effective in impacting stock prices but monetary authorities do not care about stock market dynamics. A tight monetary policy reduces stock prices so monetary policy is effective in influencing stock prices. The Turkish central bank considers the stock market prices as a leading indicator for inflation, the empirical investigation shows that subsequent to any hike in stock prices the Turkish central bank does not delay its reaction. Therefore Turkish authorities monitor closely stock market activity.

Sourial (2002) study was to establish whether the stock market can be an alternate channel for transmitting monetary policy rather than the traditional money and credit channels for Egypt. He also wanted to investigate the level of predictability of stock returns from monetary policy variables. The empirical study was performed using Bayesian VAR models consisting of four endogenous variables with four lags and a constant. The data sample used consisted of 94 Hermes Financial Index returns starting July 1992 through April 2000 for stock market index. The monetary variables used are the credit to private sector (cps), discount rate (dr), inflation (inf) rate, money supply (M1) and broad money (M2).The author found strong evidence that the balance sheet and the bank lending channel are well established and effective in transmitting monetary policy in Egypt. The study concluded that the stock market channel in Egypt is in its early stages of development. The author observes that the variance decompositions in the study imply that monetary indicators could have forecasting power to stock market performance. He concludes that in an optimal environment the stock market channel could play a crucial role in the future for transmitting monetary policy.

Related but not so similar studies for developing and emerging market economies where done in India and Malaysia, Thaker et al (2009) examine the short run and long run causal relationship between Kuala Lumpur Composite Index(KLCI) and selected macroeconomic variables. It is interesting to know the findings of this study especially the impact of money supply and inflation on the KLCI. This is linked to the current study. Due to the limitation

of studies of impact of monetary policy on stock market in developing and emerging market the study review related studies. The econometric techniques used in this study include unit root test, cointegration test, error correction model (ECM), variance decomposition and impulse response function. The empirical analysis in this paper covers an 8 year period for the pre-crisis (January 1987-January 1995) as well as for the post crisis (January 1999-January 2007) using monthly time series data. The results indicate that the variables in the model share a long run relationship in both periods, indicating that deviations in the short run stock prices will be adjusted towards the long run value. They conclude that there is a positive relationship between stock prices and inflation which is not consistent with theory and empirical evidence elsewhere. This result however is consistent with previous studies in Malaysia (Ibraham and Yusoff, 2001; Ibrahim and Aziz, 2003 and Islam, 2003). They also report an inverse relationship between money supply (M3) and stock market which is in line with previous findings by (Ibrahim and Yusoff, 2001; Ibrahim and Aziz, 2003). The explanation for the relation between money supply and stock market is increase in inflation may lead to uncertainty that may lead to decrease in stock prices.

2.7 CONCLUSION

This chapter reviewed the theoretical issues relating effects of monetary policy on stock market. A brief discussion of monetary policy and stock market is provided. The discussion is expanded to monetary policy and stock market interrelationships, this heading is subdivided into three sections, a section on money supply and stock prices, interest rates and stock prices as well as stock prices and inflation. The discussion is then shifted to the possible links that exist between monetary policy and the stock markets. The debate on the various links is grouped into the direct and indirect link. Under the direct link sub-heading the net present value stock valuation methods are discussed. The discussion is then refocused on the indirect link; the sub-heading explores wealth effect on consumption and Tobin's Q theory of investment. The subheadings under the heading indirect link include the effects of interest rates on consumption, effects of interest rates on investment and effects of interest rates on net foreign receipts from abroad. The final part of that section centres on explaining relationship between M3 and gross domestic expenditure.

The review of the empirical literature begins with an appraisal of methodologies that have been used in previous studies. The review then moves to summaries' of empirical studies

that that have been done for developed, developing and emerging market economies. Even if there is no consensus on the stance that monetary policy should adapt there is indeed interdependence. The argument therefore is whether the Central Bank should be reactive or proactive. The different schools of thought advocate particular stance. Those that do not support reaction of Central bank like Tatom (2009) state that reaction can result in destabilization in financial markets. It is important to take note that most the studies have been done in developed countries. However the few that have also been conducted in emerging market economies support the interdependence. Studies such as this one will help inform policy makers in developing and emerging market economies on the most informed policy stance as far as dealing with equity market activity.

CHAPTER 3
OVERVIEW OF THE SOUTH AFRICAN ECONOMY

3.1 INTRODUCTION

This chapter provides an overview of the trends in the economic performance of the South African stock market and money market. The major thrust of the chapter is to link historically the various linkages and trends of the components of the two markets under discussion. The chapter has been divided into three sections as follows: Section 1 institutional frameworks of South African money market discussed within the monetary policy framework, the discussion links money market to monetary policy and analyses the money market and its various instruments. Section 2 extends the discussion to the institutional framework of the stock market. The discussion is centred on the history of the stock market, trading sequences and participants. The discussion then propagates to consider the trend and performance of the JSE Limited the discussion further strengthened by an analysis of various stock market performance indicators. In the last section of the chapter the relationship between consumption and share prices is considered.

3.2 MONETARY POLICY PRACTICE IN SOUTH AFRICA

Monetary policy practice is a product of continual evolution since monetary authorities shift focus and emphasis on different monetary instruments as they deem fit in order to achieve their constitutional mandate. South Africa's monetary policy has been conducted under three broad monetary regimes in the past five decades which are the liquid asset ratio- based system, cash reserves based system and flexible money supply targeting (Aron and Maellbauer, 2007). Monetary authorities utilised the liquid asset ratio- based system in the 1960's with quantitative controls on interest rates and credit. This policy was in use only until the early 1980's when a range of monetary policy reforms where enacted towards a cash reserves based system as a result of recommendations made by the de Cock Commission Reports of 1978. Cash reserve based system was adopted thereafter, (Gidlow,1995) claim that the cash reserve based system was in full operation by mid-1985 subsequent to technical changes on asset requirements and a redefinition of the role of the discount rate. In the middle of the 1980's the de Cock Commission (1985) made recommendations which led to the adaptation of yet another monetary regime. Pre- announced flexible money supply

targeting was adapted in South Africa in 1986 even though the US and UK authorities had abandoned this system due to some of its shortcomings.

Money supply targeting emphasised the role of the central bank discount rate in influencing market interest rates. The usefulness of monetary targeting was diminished by the extensive financial liberalisation beginning in the 1980's (Aron and Maellbauer, 2007). It became increasingly difficult to set and meet the monetary targets due to a more open capital account from 1995 (Aron and Maellbauer, 2007). Money supply targeting was replaced by money supply guidelines in 1990. In February of 2000 inflation targeting was formally introduced in South Africa. Money supply guidelines where quite similar to flexible money supply targeting except for the fact that the focus was now on keeping M3 within an agreed percentage threshold. There was an upper and lower limit for the percentage threshold. Until after the adoption of the inflation targeting the only revision on the focus of monetary policy was monetary targets were supplemented by eclectic set of indicators including exchange rates, asset prices, wage settlements and the balance of payments (Aron and Muellbauer, 2007). Monetary regulators formally adopted the inflation targeting policy on 6 April 2000. The advantages of inflation targeting are transparency, enhanced clarity about the objective of monetary policy, providing for improved accountability of the central bank and providing an anchor for inflation expectations and price as well as wage setting (Mboweni, 2003:2). Changes in the official rate (repo) are directly targeted at influencing the interbank rate which will also directly influence other money market rates and thereby ensure effective pricing in the money market.

Monetary authorities can only strengthen the implementation of monetary policy by improving the functioning of the interbank market (Angelis, Aziakpono and Faure, 2005). This is because the interbank market has a large bearing on money market activity. Its efficiency and effectiveness is been able to ensure that changes in the refinancing rates of the SARB will be speedily transmitted to other market rates and thereby guarantee effective pricing in the money market as a whole (Gidlow, 2001:2). He goes further to articulate that in the South African context the interbank market qualifies to be effective only if it is flexible and stable as well as liquid and competitive as well as quickly able to adjust to changes in banking liquidity. Monetary authorities are active in the money market on a daily basis utilising money market instruments like Treasury bill tenders to manage liquidity in the

banking sector. Monetary policy decisions directly impact money market activity which makes money market the medium through which monetary policy is transmitted in the economy. The discussion in the next subsection is on money market and how it relates to stock market and monetary policy.

3.2.1 The Money Market

The money market is defined as an environment in which economic entities from household, business and government sectors (who are in need of short term funds), meet those entities (from the same sectors) who have surplus funds and engage in various forms of lending and borrowing (Botha, 2008). He further explains that the money market is referred to as the environment in which short term financial claims and assets are traded and this does not refer to a physical market where money is traded. This clarification is important as it is easy to be misled into thinking that there is actual exchange of money. The money market is discussed in the context of its essential role as the conduit of fulfilling Central bank objectives and functions. Money market serves a number of functions and these roles where discussed by Botha (2008) under the following categories; government financing, cash management, monetary policy, price discovery, financing corporate and banking sectors. The interest of this study cuts across all the various roles of the money market but emphasising the monetary policy and price discovery roles of the money market. Interest rate behaviour reveals economic agents future economic expectations and views they hold on future prices. Price discovery in the money market is made possible through the interaction of economic agents to ultimately influence the level of interest rate. Central Banks utilise the money market instruments on a daily basis to manage liquidity (cash reserves) in the banking sector. The most prominent role in the money market is played by banks as the custodians of the public's money (Botha, 2008).Banks perform intermediary function between deficit and surplus units by taking deposits from excess units and lending out to borrowers in different ways. In the following subsection the study explicitly discuss various participants in the South African money markets, some of them however have been mentioned in passing previously.

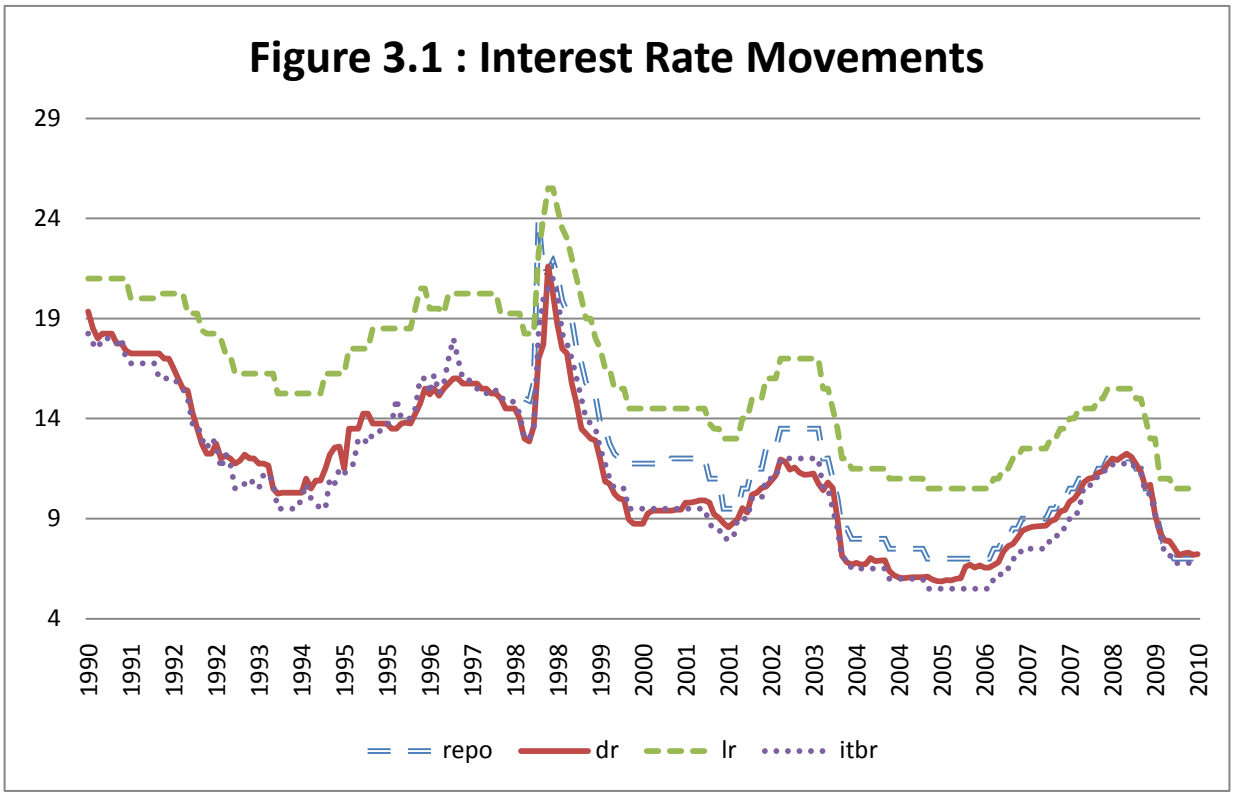
3.2.2 Participants in the Money market

Banks are the major participant in the money market. The Central Bank plays a dominant role in the money markets its role been supplemented by its subsidiary, Corporation for Public Deposits (CPD) which invests short surplus funds of various bodies in the public

sector (Botha,2008:8).Anyone can be a supplier of funds as long as they have excess funds. The other less important participants in South Africa's money market are Public Investment Corporation (PIC)-(100% government owned corporation responsible for managing pensions of government employees), long term insurers, provident funds and pension funds as well as parastatals (Botha, 2008:9).Botha also notes that even though foreign investors play a significant role in South Africa's capital markets their role in money market is insignificant. The reason maybe that foreign investors find the equity market more lucrative than the money market. Godspeed (2008, 47) mentions that there are the following instruments in the local money market: banker's acceptances, commercial paper, negotiable certificates of deposits (NCDs), treasury bills and repurchase agreements. The next subsection discusses the behaviour of interest rates in South Africa.

3.2.3 Interest rates behaviour in South Africa

Ultimately interest rates in the economy are determined by the interaction of economic agents in the money markets. In this study a number of selected interest rates are plotted against each other on the same graph in order to identify possibly the most suitable interest rate to use in this study. The graph plots the repo/discount rate, deposit rate, interbank rate and lending rate together. It is interesting to observe that the interest rates move in the same direction which can imply the possibility of using any of the interest rates. Figure 3.1 shows the trends in the selected interest rates within the period of this analysis and how the react to changes in the official interest rate (repo). It is commonly expected that when the official interest rates are adjusted then the market interest rates will adjust accordingly in the same direction. As discussed before the repo/discount rate influences all the other interest rates in the economy. The behaviour of the interest rates is similar meaning that any interest rate chosen would be appropriate for this study however the popular view in literature is chosen and this study uses the interbank rate.

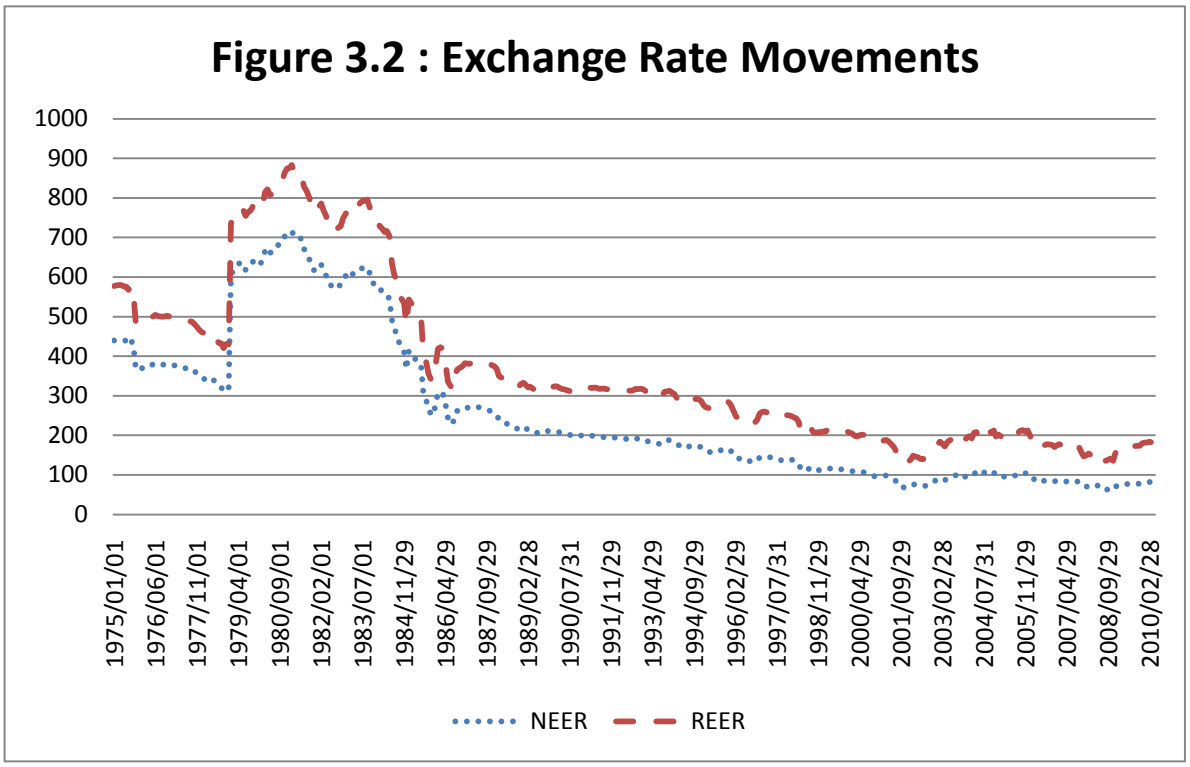


Source: Authors compilation based on data obtained from SARB via Thompson DataStream.

3.2.4 The Long term behaviour of the South Africa Exchange rate.

Figure 3.2 shows that the long term trend in the real and nominal effective exchange rate for South Africa between 1975 and 2010. South Africa operated a dual exchange rate regime between 1985 and 1995; this system was only abolished on 13 March 1995 (Beelders, 2002:3). There was a commercial rate which was used for trade flows and a financial rate for capital flows. The financial rate traded at a discount to the commercial rate and the discount rate was referred to as a political risk premium (Beelders, 2002: 3). South Africa moved to a freely floating exchange rate after the abolishment of the dual exchange rate. Exchange rate has been used in other similar studies to capture external shocks which may generate inflationary pressures (Neri, 2004). This study chooses the real effective exchange rate which is a weighted basket of South Africa's trading partner's exchange rates adjusted for inflation. A strong assumption is made that even though South Africa is not immune to external shocks as any other country it has a very independent monetary policy. It is difficult for one to pinpoint foreign monetary policy which directly influences the South African monetary policy. South African interest rate cannot be replaced by a foreign interest

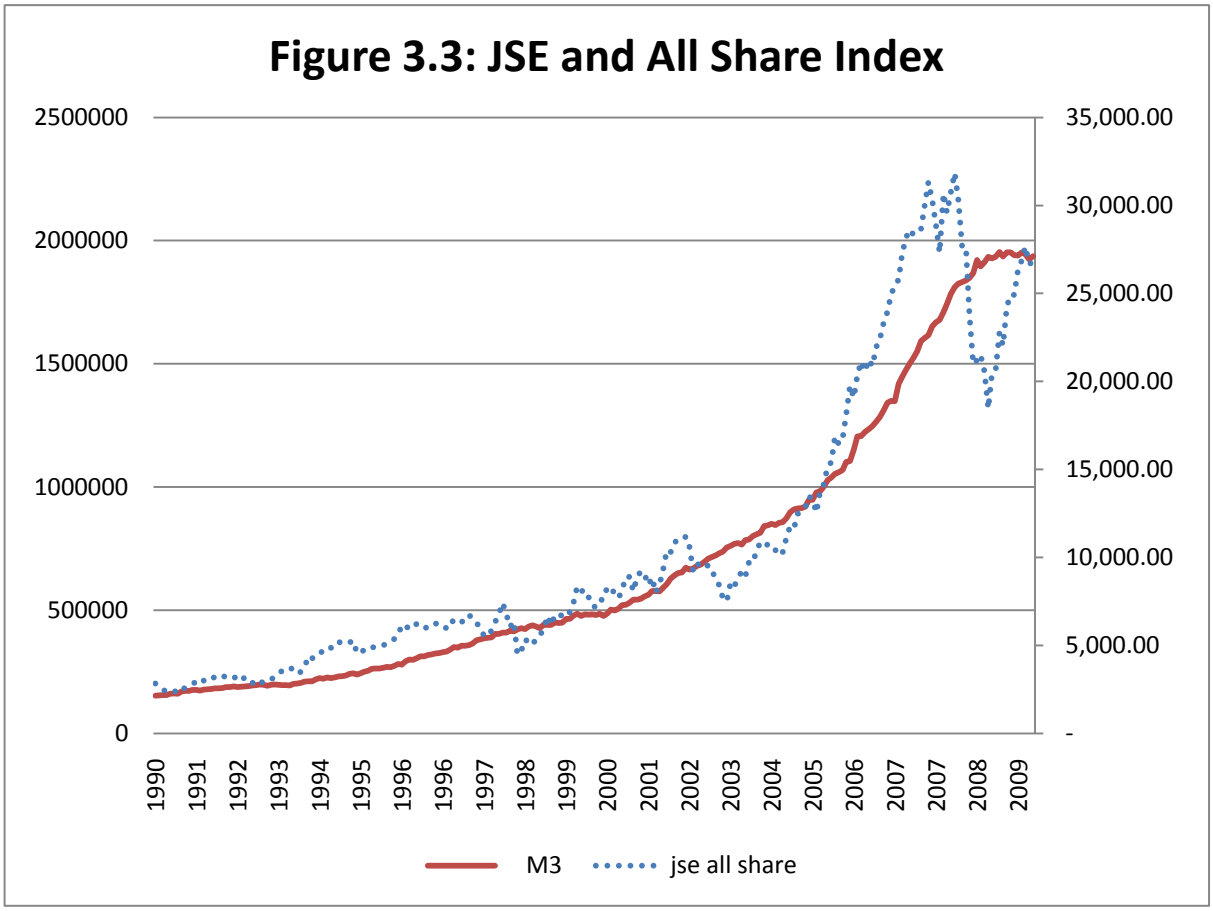
therefore under such a strong assumption South Africa is a closed economy. Therefore the inclusion of the exchange rate is to merely capture output and capital account shocks.



Source: Authors compilation based on data obtained from International Financial Statistics via Thompson DataStream.

The relationship between stock prices and exchange rate is varies from country to country, this is according to work by (Morley, 2007). Kim (2003) stated that the exchange rate affects stock prices through three channels. Appreciation of the exchange rate results in imported inputs becoming cheaper which results in decline in domestic prices. This channel however must be explored with caution as the appreciation of the domestic exchange rate may lead to decline in exports outweighing the benefits on importers. Exporters must also lower their prices so that they remain internationally competitive, the second channel. Profits are likely to increase as a result of the appreciation in the exchange rate because prices of inputs are lower. There is no general consensus as to the direction of the influence.

3.2.5 Money Supply Vs All Share Index



Source: Authors compilation based on data obtained from SARB and JSE Securities Exchange via Thompson DataStream.

Figure 3.3 above shows the link between JSE all Share index and M3 for South Africa between 1990 and 2010.The graph shows strong comovement in the two series showing that they could possibly be a predictive positive relationship between money supply and share prices as predicted by (Sprinkel, 1964; Homa and Jaffie, 1971; Hamburger and Kochin, 1971).However the M3 series is more smoother and stable compared to the JSE all share index. Contractionary monetary policy results in economic agents having more money to spend which increases liquidity in financial markets. This situation may be prompted by stern performance on the stock markets which increases money demand therefore prompting Central bank to increase money supply. Therefore causality may indeed be bidirectional. Money aggregate M3 in South Africa has been influenced and controlled through the various monetary regimes discussed in Section 3.2. It is also important to note that SARB is very

much in charge of its mandate in the South African economy if events of the global financial crisis are anything to go by.

3.3 THE SOUTH AFRICAN STOCK MARKET (JOHANNESBURG STOCK EXCHANGE)

The Johannesburg Stock Exchange (JSE) was established in November of 1887. Currently there are three major market sectors on the JSE that is the Resources, Financials and Industrials indices. Similar to other exchanges it facilitates the trading, clearing and settlement of equities and any other securities transactions of listed South African companies (Goodspeed, 2008; Equity Trading Manual, 2008). JSE is licensed in terms of the Securities Services Act (SSA) of 2005 which also allows the existence of more than one stock exchange, however there is still only one stock exchange in South Africa. It is commonly appreciated that too much regulation in financial markets may discourage prospective investors. However, investors are only confident with a stock exchange where a proper regulatory framework is in place and regulatory authorities rigorously enforce it as well as make sure that market participants adhere to it.

The South African stock market is regulated only to the extent of protecting members of the general public in buying and selling of shares without unduly infringing upon self-regulation. The legislation that governs the JSE is embodied in the Securities Services Act, Act 36 of 2004. Transactions in the primary market affect the size of the equity pool as opposed to transactions in the secondary market which do not affect the number of shares in issue (Equities Trading Manual, 2008). The secondary market is a market of the sale of previously owned securities, prices are determined by demand and supply in the market. The trading system for the secondary market in South Africa is through an electronic system called JSE Trade Elect (Equities Trading Manual, 2008).

The critical role that the secondary market plays is based on the major influence it has on the primary market. The primary market only functions successfully as a result of the liquidity that the secondary market provides. Investors want the guarantee that they can easily convert equity into cash at known prices; at any time since they don't want to be stuck with meaningless paper hence the invaluable role of the secondary market. Stock markets around the world operate under two trading systems the order driven system and the quote driven

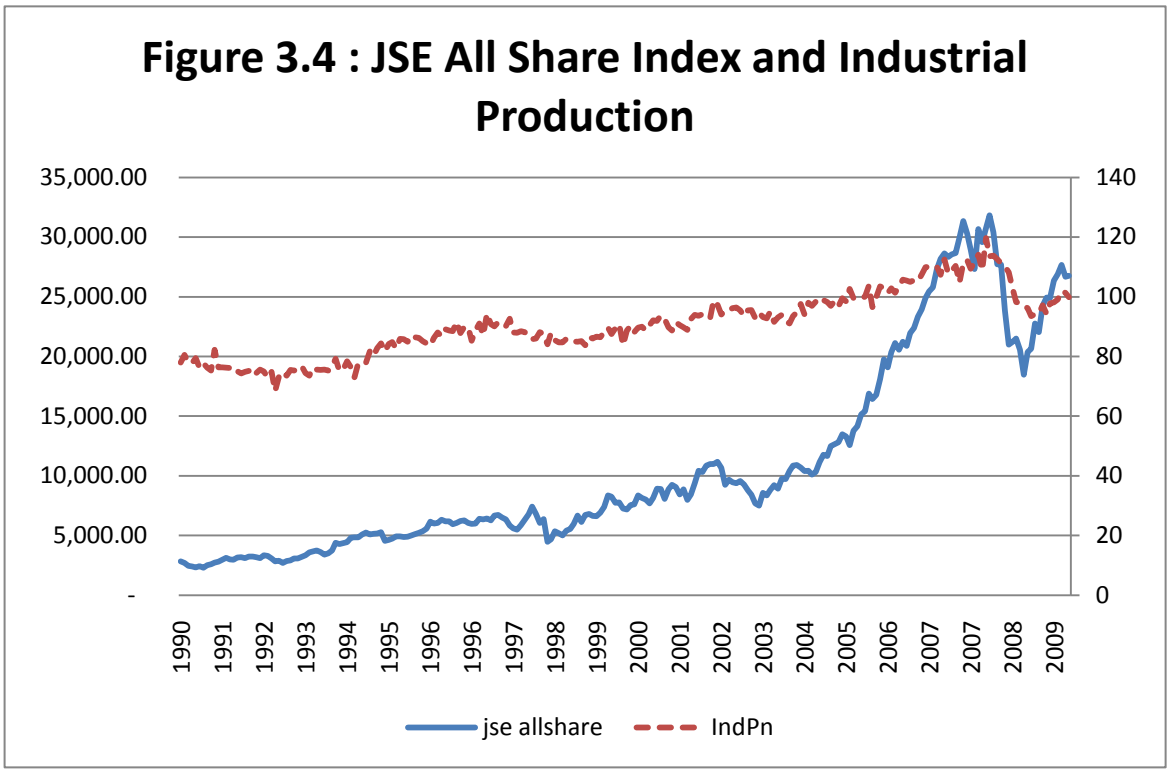
system. They may use both or either of these two trading systems. The JSE uses the order driven pricing system, buyers and sellers submit bid and ask prices of a particular share to a central location where the orders are matched by a broker while in the quote driven market individual dealers act as market makers by buying and selling shares for themselves (Godspeed, 2008; 11). The market price of equity can change throughout the day and selling prices are quoted continuously (Equities Trading Manual, 2008; 14). The section that follows discusses the behaviour and the local stock market.

3.3.1 Trends and performance of the Johannesburg Stock Exchange.

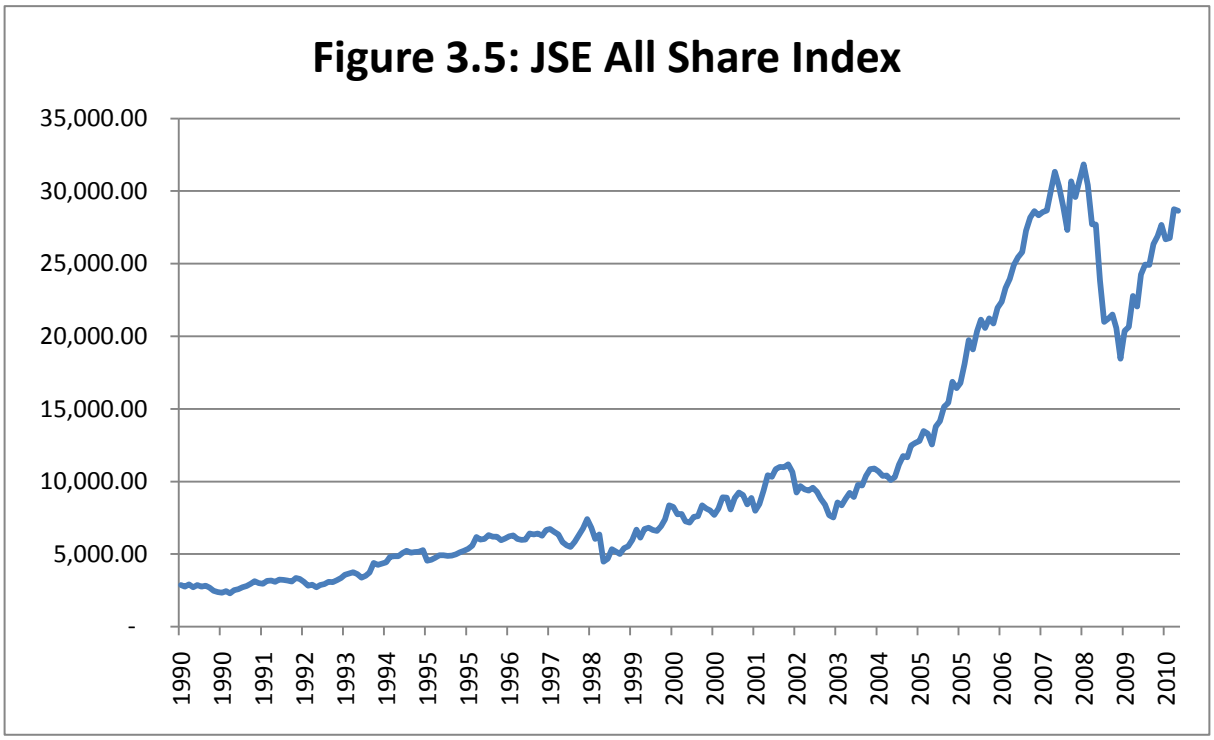
Stock markets around the world no longer exist in isolation as the world economy has become a global economic village. South Africa's financial markets used to be heavily regulated with controls which were meant to stifle severe capital flight as a result of huge political risk which was associated with investing in South Africa at the time (Beelders, 2002; 2). The political environment was made more favourable however with the release of Nelson Mandela in 1990 as well as the holding of democratic elections in 1994 (Beelders, 2002; 2). The opening of financial markets which followed political developments in the country, as well as the positive outlook the international community had for South African economy, improved share prices. The advent of democracy in South Africa marked the lifting of sanctions by international community, fiscal adjustment policies, moderate growth rates and an introduction of a fluctuating exchange rate (Bosker and Krugell, 2008). The unification of the dual exchange rate in March 1995 was the most important economic event in the 1990's (Beelders, 2002; 2). This brought to an end the dual exchange rate on residents and stringent exchange rate controls on non-residents. This went a long way in influencing activity on South Africa's one and only stock market.

The JSE Securities Exchange which is by far the largest stock exchange in Africa has three main indices listed as follows, the Resources Index, Financials Index and Industrial index (JSE, 2010). Movements in the volume and share traded are tracked as well as measured by the JSE all share index which in actual fact is a barometer of performance of listed companies. South Africa's stock market is largely resource based since the biggest listed companies are mining conglomerates. Consequently movements of the main index are driven by movements in the Resources index which are a result of movements in resource prices especially gold and platinum (Beelders, 2002:4-5). A look at figure 3.4 shows the

comovement of the industrial production and all share index. This clearly shows that movement of share prices is related to output produced in the economy.



Source: Authors compilation based on data obtained from Thompson DataStream StatsSA.



Source: Authors compilation based on data obtained from Thompson DataStream.

JSE All Share Index has generally been on an upward trend in the entire period of analysis with a few definitive acute and deep declines (see Figure 3.5). Figure 3.5 serves to show that the market index has registered phenomenal growth over the years. This discussion of the trend of the stock market will be focused on the period between 1990 -2010. JSE All share index performed remarkably well between 1991 and 1996. As pointed out earlier the relaxation of hostile controls and regulations made South Africa's stock market more accessible and favourable to international investors with non-residents taking a more active role in the bond and stock markets (SARB 1996;. SARB, 1997).The financial markets were also more accessible to residents so that the stock markets flourished.

This steady and stable performance of the share market in the 1990's was brought to an abrupt end by the South –East Asian economies financial crisis of 1997 (SARB, 1997).The JSE all share index declined sharply in October 1997 but it immediately recovered (SARB, 1997). The worst was not over as the economic events during the turmoil that had been caused by the Asian financial crisis resulted in further instability between second half of 1997 and 1998 in world economies (SARB, 1998).The problem was that capital flows were been redirected to advanced economies which resulted in external finance constraints for emerging market economies this deprived these countries of the much needed capital inflow. In 1999 South-East Asian economies were firmly on a recovery path, this brought back stability in financial markets, there were also positive sentiments with regard to a positive world economic outlook (SARB, 1999).

At the time the world economy recovered from the effects of the Asian financial crisis, stock markets around the world gathered moment yet again as a result of a boom in share prices of companies who produce communications, information and computing technology equipment (SARB, 2002). The dotcom bubble nevertheless burst in 2000 and this resulted in an acute decline in the JSE all share index due to linkages of world stock markets, nevertheless the index recovered immediately[3] (Naude, 2009;2). However the September 11 terror attacks of 2001 in the US which immediately followed afterwards affected economic activity in the US and beyond (SARB, 2002). The impact of the disturbances in the US economy as a result of

[3] see figure 3.5

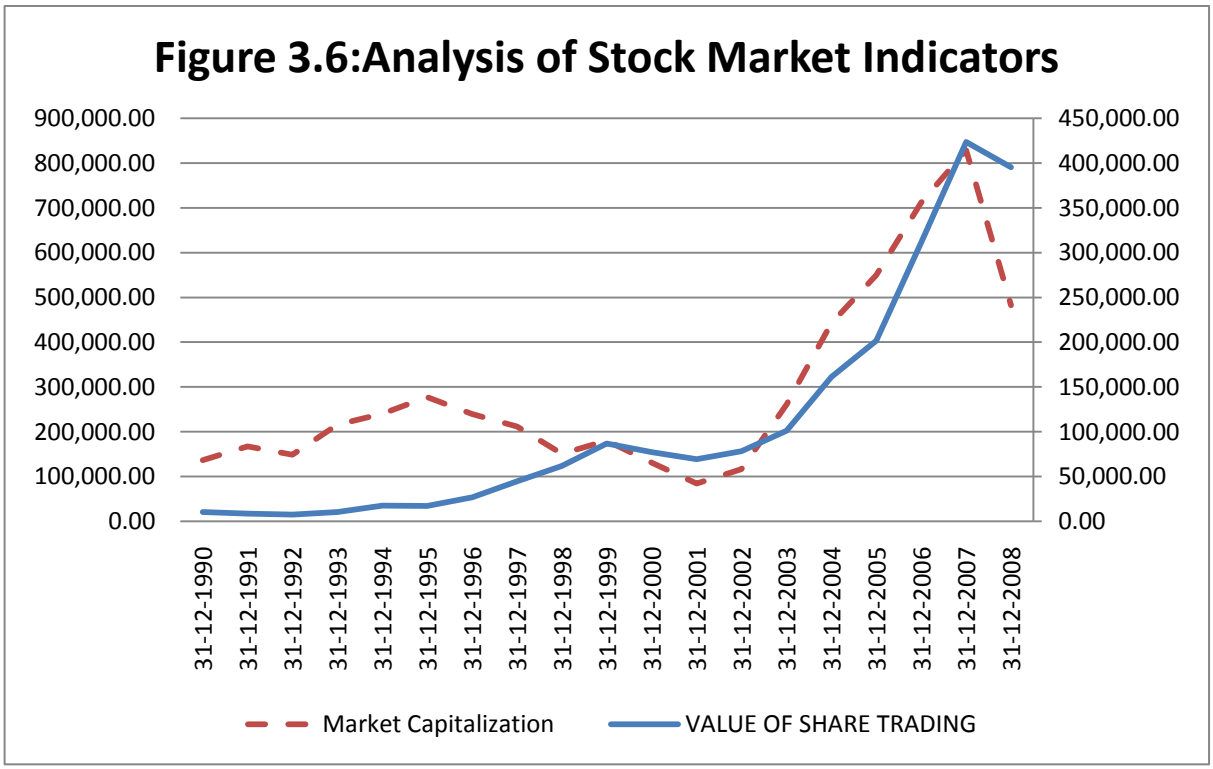
the attacks was more evident in the second quarter of 2002 in South African stock markets as the JSE all share index started to decline (SARB, 2002).

Global economic activity picked up in the second quarter of 2003 and remained solid between 2003 and 2006. However the world was to be hit by a major economic crisis in 2007 that could only be compared to the Great Depression of 1929. By the end of October 2008 US$ 25 trillion had been wiped off the value of world stock markets (Naude, 2009; 1). Between November 2007 and February of 2009 the all share index lost 41% of its value. Stocks markets all over the world tumbled due to the dire effects of the global financial crisis of 2007/08 (SARB,2007;SARB,2008).Figure 3.5 shows the biggest decline in the index in the whole period of analysis, the JSE lost almost half of its total value in the turmoil from the beginning of the crisis. Signs of recovery were visible in South Africa from mid-2009 onwards as the index picked up and at around the same time most major world economies which had been devastated by the financial crisis where also showing signs of recovery (SARB, 2009).

3.3.2 Analysis of selected stock market performance indicators

In consolidation of the discussion of trends and performance of the JSE limited all share indexes the discussion is shifted to two other traditional stock market size indicators, domestic market capitalization and value of share trading. World Federation of Exchanges (2010) defines domestic market capitalization of the stock exchange as the total number of issued shares of domestic companies, including their several classes, multiplied by their respective prices at a given time. Domestic market capitalization as shown by the graph below (Figure 3.3) has behaved similar to the JSE all share index. The peaks and troughs were also largely influenced by the factors discussed above in section 3.4. This stock market indicator is usually used for comparison purposes and to judge whether the value of listed companies in the local bourse is increasing. The importance of market capitalization is that it is easier for investors to trade in large capitalised company stocks, market capitalization also measures liquidity and investors can make comparisons of stocks to trade in. On the international level investors are most likely to trade in highly capitalised stock markets as they are more likely to have a high level of liquidity which makes it easy for investors to dispose of the shares anytime.

Trading volume also referred to as the value of share trading by the World Federation of Exchanges is the total number of shares traded multiplied by their respective matching prices (World Federation of Exchanges, 2010). Mubarik and Javid (2009) describe trading volume as a critical piece of information in the stock market because it either activates or deactivates the price movements. It shows liquidity of the stock market and can be used for comparisons of the performance of the stock markets. It can be argued that an increase in price induce investors to trade more, thereby increasing trading volume (Floros and Vougas, 2007). Conversely, it can be hypothesised that an increase in trading volume can lead to an increase in price. Trading volume and stock returns are related due to their joint dependence on the rate of information flow called the underlying common mixing variable (Nowbutsing and Naregadu, 2009). See figure 3.3 for the plot of the value of share trading between 1990 and 2008. In the subsection which follows an attempt is made to compare emerging market stock markets and developed countries stock markets using the indicators discussed.



Source: Authors compilation based on data obtained from World Federation of Exchanges

3.3.3 Comparison of developed and emerging market economies stock markets.

In order to do the comparison the study isolates three developed countries stock markets of the following countries, the United States of America (US), Japan and United Kingdom (UK) and three stock markets of emerging market economies as follows, South Africa, Egypt and Mauritius. The comparison is based on number of listed companies, market capitalisation and value of share trading. It is quite evident from the information provided in the tables below that US has the largest stock exchange represented by the NYSE (US1), the second largest exchange is the Tokyo Stock Exchange (Japan) and the third largest stock exchange is the London Stock Exchange (UK). The statistics confirm that South Africa's stock exchange is by far the biggest in Africa.

Table 3.1: 2009 Stock Market transactions for developed and emerging economies compared

Country	**Domestic Market capitalisation in US $ millions**	**Value of share Trading in US$ millions**	**Number of listed companies**
US1(NYSE)	9,208,934.10	33,638,937.00	3011
US2 (NASDAQ)	2,396,344.30	36,446,548.50	2952
JAPAN(TOKYO EXCHANGE)	3,115,803.70	5,607,321.90	2390
UK (LONDON STOCK EXCHANGE	1.868.153.0	6,271,521.60	3096
South Africa(JSE)	482.700.0	395,235.20	411
Egypt	85.247.2	93,475.70	373
Mauritius	4,662.00	396.6	68

Source: Authors compilation based on the data World Federation of Exchanges.

A comparison of these market indicators shows the huge disparity in size between the sample of emerging market economies stock markets and developed countries stock markets. Developed countries stock markets are by far larger than emerging market economies. It is expected that there would be more activity and trading on the stock markets of developed countries compared to emerging and developing countries stock markets. This is due to the argument raised before on the significance of volume traded as well as market capitalisation in section 3.3.2.

3.4 CONCLUSION

The chapter begins with a discussion on monetary policy in South Africa; the discussion revolves around the propagation of monetary policy in South Africa from as far as the 1960's to the present day. The various monetary policy regimes that South Africa has adapted in the past five decades are discussed. Strength and weaknesses of the various monetary policy regimes are also exposed and the reasons for shifting the various monetary policy regimes. The next session then discusses the money market including another short session that discusses the various participants in South Africa's money market. The discussion is then shifted to two short sessions on the behaviour of interest rates in South Africa and also the long term behaviour of the exchange rates. The various plots are meant to show the trend in the interest rates and exchange rates and ultimately motivate the variables to be used in chapter five for estimations. The final part of the monetary policy section discusses the relationship between money supply and the all share index. The subsection concludes that they might as well be a bi-directional relationship between money supply and shares prices.

The discussion then shifts to a discussion on the operational framework, trends and performance of the South African only stock exchange, the Johannesburg Securities Exchange Limited. In order to consolidate the discussion on the sub-section on trends and performance of the local stock market an analysis of various stock market performance indicators for selected countries (developed and emerging market economies) is done.

CHAPTER 4
METHODOLOGY AND DATA DESCRIPTION

4.1 INTRODUCTION

According to Stock and Watson (2001) there are three varieties of VARs that are discussed in econometric literature namely reduced form, recursive and structural. Reduced form VAR they say expresses each variable as a linear function of its past values and the past values of all other variables being considered and a serially uncorrelated error term. A recursive VAR constructs the error terms in each regression to be uncorrelated in the preceding equations. In pursuit of the objectives of this study as set out in Chapter one, the study follows the popular view in literature, that is the use of Structural Vector Autoregressive model in analysing the interaction between monetary policy and stock market. This chapter not only introduces SVAR model but also explores ordinary VAR analysis as from the SVAR point of view, a VAR equation is the reduced form of a SVAR equation. A SVAR is a result of fitting ordinary VAR into a restricted model. Short run restrictions or long run restrictions are often imposed on the model in order to construct a SVAR model. The chapter discusses weaknesses of ordinary VAR which consequently leads to the choice of Structural VAR analysis as a superior estimation method. The fact that most of the previous studies made use of ordinary VAR makes it imperative for some distinctive qualification of the SVAR (see, Lee, 1992; Thorbecke, 1997; Patelis, 1997 and Millard and Wells, 2003).

This study follows earlier empirical works such as (Sourial, 2002; Neri, 2004; Crowder, 2004; Hewson and Bonga-Bonga, 2005, Li et al, 2007, Naceur et al, 2009). However, the major one whose methodology is imitated is Bjornland and Leteimo (2009), which identify a VAR model that is comprised of monthly data on the annual change in five macroeconomic variables. Neri (2004) acknowledges that the few studies that have been done on analysis of the effects of monetary policy on stock market mostly utilised structural VAR methodology. He further asserts that this method has the advantage of imposing a minimal set of restrictions, usually from economic theory so that it is possible to simulate the dynamic responses of the variable of interest to policy shocks and to evaluate the relative importance of the different shocks. Bjornland and Leteimo (2008) acknowledged that the studies cited above are useful for quantifying the immediate (short-run) effect of a specific action, such as

a monetary policy surprise, while ignoring the issue of dynamic adjustments following the initial shock. Furthermore, they rarely provide for two-way causation, focusing either exclusively on the effects of monetary policy shocks, or stock price shocks. To take this into account one should therefore identify the shocks in a system like the Structural VAR.

4.2 ORDINARY VECTOR AUTOREGRESSIVE MODELS

Vector Autoregressive (VAR) models are models of vectors of variables of autoregressive processes where each variable depends linearly on its own lagged values and those of other variables in the vector. Ordinary VAR assumes a causal chain among the variables whereby the first variable in the VAR system is assumed to be contemporaneously exogenous to all remaining variables and the second variable is contemporaneously exogenous to all except the first variable and so on (Sims, 1980). The error terms in each equation are uncorrelated with the error in the preceding equations and this is done by judiciously including some contemporaneous values as regressors in the case of a recursive VAR (Stock and Watson: 2001, 103). An ordinary VAR model describes the dynamic movements of endogenous variables by their own past values. It is expressed as:

$$X_{t=}\, k + B_1 X_{t-1} + B_2 X_{t-2} + \cdots + B_q X_{t-q} + u_t; \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots u_t \sim i.i.d.(0, \Sigma_u) \quad [4.1a]$$

This can be represented using the lag operator (L) as follows

$$X_t = k + B(L)X_t + u_t. \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [4.1b]$$

Where X_t *is* a vector of endogenous variables, k is a vector of constants, B's are matrices of coefficients, u_t is a vector of disturbances, and L is the lag operator. This is a much generalised model, which imposes no restriction on the form of *B* (L), i.e. the dynamic relationship among variables. If X_t is to represent monetary policy shock for example the change in the interest rates in the above equation implies that the monetary policy shock depend on own lags.

$$x_{1t} = \alpha_{10} + \alpha_{11} x_{1t-1} + \omega_{11} x_{2t-1} + u_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [4.1c]$$

$$x_{2t} = \alpha_{20} + \alpha_{21} x_{2t-1} + \omega_{21} x_{1t-1} + u_{2t} \ldots\ldots\ldots\ldots\ldots. \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [4.1d]$$

The above equations ($4.1c\ and\ 4.1d$) include variables and lags of two variables and they convey a VAR in reduced form where each variable is expressed as a linear function of its own past values, the past values of all other variables being considered and a serially uncorrelated error term. Applying it in the context off this study monetary policy shock is expressed as a linear function of its past values, the past values of all the other variables and the error term. The equation is estimated by ordinary least squares regression. There are different methods used in order to determine the number of lagged values to be included in the equation. The commonly used methods are Akaike information Criterion (AIC), the final prediction error (FPE), the Schwarz information criterion (SC), the Hannan-Quinn information criterion (HQ) and Bayes Information Criterion (BIC).Stock and Watson(2001,102) assert that the error terms in these regressions are the surprise movements in the variables after taking their past values into account. In most cases the different variables are correlated with each other in macroeconomic applications for example consider the discussion in chapter two about the relationship between shares and interest rates; this therefore implies that the error terms in the reduced model will also be correlated across equations.

The VAR models of Sims (1980) are often described as atheoretical but they actually imply a particular economic structure that is difficult to reconcile with economic theory (Keating: 1992, 37). There is no distinction between endogenous and exogenous variables in the VAR model so that all variables depend on different combinations of the lagged values of all the variables in the system. The researcher does not have to specify which variables are endogenous or exogenous in the VAR model which makes it a very valuable tool. A VAR model also allows for a richer analysis and is able to capture more features of the relationship since it allows variables to depend on more than just its lagged values (Brooks, 2003: 330-340).It makes it possible to simply use OLS separately on each equation given that there are no contemporaneous terms on the RHS of the equations. VAR models are also particularly useful for forecasting purposes. The major output from a VAR analysis is a report on a number of standard tests. Standard practice in VAR analysis is to report results from Granger Causality tests, impulse responses and forecast error variance decompositions (Stock and Watson; 2001, 104).Granger –causality tests examine whether lagged values of one variable help to predict another variable. Impulse responses trace out the response of current and future values of each variable to a one unit increase in the current value of one of the errors,

assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero (Stock and Watson;2001,104). Forecast error variance decomposition is constructed to determine the proportion of the variability of errors in forecasting y_1 and y_2 at time t+s based on the information available at time t that is due to the variability in the structural shocks ε_1 and ε_2 between times t and t+s.

The basic problem with VARs is that they appear to yield a lot of useful evidence without putting a lot of structure in their models (Mishkin, 2002). Hamilton (1994) states that the weakness of a VAR is that the description does not make use of prior theoretical ideas about how these variables are expected to be related and therefore cannot be used to test theories or interpret the data in terms of economic principles. One drawback of such a VAR as a tool for economic analysis is, however, that each equation has no economic interpretation. It becomes a challenge for our purpose of analysing monetary policy effect, as we cannot tell what the monetary policy is in the VAR. For instance consider a VAR model with endogenous variables for example: industrial production ($y_{t,}$), inflation (Φ_t), interest rate (i_t), and money stock (m_t). One may attempt to analyse the effect of a contractionary monetary policy which raises interest rate by looking at the impulse responses to the innovations in the (i_t) equation (u_t^i). But the (i_t) equation may reflect not only monetary policy reaction to the economy but also money demand and other economic relations. Accordingly, its innovation u_t^i will contain not only the innovations in monetary policy but also the money demand and other kinds of shocks. Thus naively interpreting the impulse responses to u_t^i as the effect of monetary policy may be problematic. We need to 'identify' the underlying 'structure' of the economy reflected in the VAR, in particular that of monetary policy reaction and its innovation, to measure the true monetary policy effect. This is what the 'Structural VAR' approach intends to do. The next subsection will discuss the Structural VAR theoretical model.

4.3 STRUCTURAL VAR METHODOLOGY

McCoy (1997) argues that structural VARS are an extension of the traditional VAR analysis and he further states that they differ in that within SVAR an attempt is made to identify a set of independent disturbances by means of restrictions provided by economic theory rather than the so called experimental (atheoratic) restrictions used in traditional VARs. VAR systems can be informative, if used properly, on broad macroeconomic issues. The advantage of

VARS as well is that they can be used to analyse short run dynamics and speed towards equilibrium and indicate the sources of the shocks. Keating (1992, 37) acknowledge that the crucial difference between atheoretical and structural VARS is that the latter yield impulse responses and variance decompositions that can be given structural interpretations. A structural VAR utilises economic theory to arrange the contemporaneous links among the variables that are been modelled in any particular study, this is described researchers like, Bernanke (1986) ,Sims (1986) as well as Blanchard and Watson(1986) .These researchers go further to explain that SVAR require identifying assumptions that allow correlations to be interpreted casually. A variety of structural VAR models have been proposed, advocating short-run restrictions or long-run restrictions (Blanchard and Quah, 1989), or combinations of short-run and long-run restrictions(Gali,1992) on impulse responses that are derived from economic theory.

Short run restrictions impose restrictions on the contemporaneous short run effects of shocks upon certain variables included in the model (Bernanke, 1986 and Sims, 1986).Most studies favour this approach. Li et al(2007) champion the use of short run restrictions as there are a number of benefits to estimating the interaction between monetary policy and stock prices using short run restrictions as it allows the use of a unified empirical framework to impose (arguably) weak restrictions based on economic and structural considerations. The researcher can also utilise statistical model selection techniques in combination with macroeconomic theory, and identify structural shocks, including unanticipated changes in monetary policy (Li et al, 2007). Structural VARs with short run restrictions are also argued for by (Kim and Roubini, 2000; Christiano, Eichenbaum and Vigfusson, 2006). A SVAR with long run restrictions imposes the restriction that changes in the money supply have no long run effects on the real variables (Blanchard and Quah; 1989).Faust and Leeper (1997) emphasize that SVARs with long-run restrictions may perform poorly when estimated over the sample periods typically utilized. Also, as discussed by Cooley and Dwyer (1998) and Lippi and Reichlin (1993), a short-ordered VAR may provide a poor approximation of the dynamics of the variables in the VAR if the true data-generating process has a Vector Autoregressive moving average (VARMA) representation.

A structural VAR is expressed as:

$$Z_0 X_t = c + Z(L)X_t + \mathcal{E}_t; \qquad \varepsilon_t \sim i.i.d.(0, D) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [4.2]$$

The structure of simultaneous determination in the economy is now explicitly represented in the matrix Z_0. Each equation is assumed to represent a specific economic relation such as monetary policy reaction or money demand, and thus the innovation ε represents the exogenous shocks in it. Since we assume ε's exogenous shocks, they are orthogonal to each other; i.e. the variance matrix D is a diagonal matrix by assumption. Given a SVAR an ordinary VAR [4.1] can be regarded as the reduced form of [4.3b]. Multiplying both sides of [4.3] by Z_0^{-1}:

$$X_t = Z_0^{-1}c + Z_0^{-1}Z(L)X_t + Z_0^{-1}\mathcal{E}_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots [4.3a]$$

$$X_t = k + B(L)X_t + u_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots [4.3b]$$

Hence, the relationship between the structural and the reduced form parameters are:

$$c = Z_0 k,\ Z(L) = Z_0$$

$$Z_0 u_t = \mathcal{E}_t \leftrightarrow Z_0^{-1} D (Z_0^{-1}) = \Sigma_u \dots\dots\dots\dots\dots\dots\dots\dots [4.4]$$

The challenge of estimating the structural VAR [4.3] is that it is a system of simultaneous equations and thus the OLS estimator will be biased and inconsistent. A common procedure is to estimate the reduced form VAR [4.1] by OLS, and recover the structural parameters using the relationship[4.4].If Z_0 is estimated ,other structural parameters can be recovered by [4.1], Z_0 (together with D) is to be recovered using [4.2].But while Z_0 and D contain n^2 unknown parameters , Σ_u has only n(n+1)/2 information in it as it is a symmetric matrix. Therefore $l \geq n(n-1)/2$ additional restrictions are required from the identification of Z_0.Equation 4.1 can also be expressed as follows:

$$Z_0 X_t = Z_1 X_{t-1} + \cdots + Z_p X_{t-p} + \mathcal{E}_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots [4.5]$$

$$Z_0 X_t = \sum_{i=1}^{k} Z^*{}_i X_{t-i} + \mathcal{E}_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots [4.6]$$

Where $Z^*{}_i = Z_0 Z_i$, i=1,....,k .A usual way of identifying the instantaneous relationships is to assume a recursive causal structure. That is the first variable X_{1t} is only influenced by innovations in the first equation and lagged variables; the second variable is affected by

innovations in the first equation, by innovations in the second equation, and lagged variables and so on. This work will use the recursive causal structure for identification of the model.

The main objective of SVAR models is to find the dynamic responses of economic variables to disturbances by combining time series analysis and economic theory. Keating (1992) notes that the crucial difference between atheoretical and structural VARs is that the latter yield impulse responses and variance decompositions that can be given structural interpretations. There are three main criticisms that are labelled against VAR systems by Maclennan et al (2000) which he lists as follows: (a) VARs might be mispecified because of omission of crucial variables (b) the Lucas critique[4] applies even more to reduced form VAR than to Simultaneous Equation Models (SEM); (c) VARS trivialize macroeconomic policies and cannot be used to analyse alternative policies. Structural models are more relevant for one to do counterfactual analysis. In addition, VAR models may not entail the level of detail necessary to address implementation of policies.

4.3.1 Cholesky Decomposition

The standard procedure for conducting impulse responses is firstly to identify the model by imposing some structure on the system (McCoy, 1997:8). There are a number of methods that are proposed in literature in order to identify the model. Common practice in most VAR models is the use of Cholesky decomposition, where the identification restriction is based upon a recursive structure (McCoy, 1997: 8). Primary use of cholesky decomposition is to constrain the system such that the contemporaneous value, for example that of interest rate does not have a contemporaneous effect on money aggregate (Enders, 2005:307). On the basis of an arbitrary ordering of the variables cholesky decomposition separates the residuals into orthogonal shocks by the restrictions imposed (McCoy, 1997:8). Cholesky decomposition splits the residuals (e_t) into orthogonal (uncorrelated) shocks by restrictions imposed on the basis of a random ordering of the variables. The first variable responds only to its own exogenous shocks, the second variable responds to the first variable and to the second variable's exogenous shocks and so on(McCoy,1997:8). That is the implication that cholesky ordering has in the VAR model.

[4] The Lucas critique observed that SEM-style models that assume that private agents' expectations are fixed linear functions of lagged data are likely to be mistaken in projecting the effects of systematic changes in monetary policy

A revisit of equations 4.5 and 4.6 illustrates the identification of the model. The major assumption made is that the innovations in the different equations are uncorrelated (that $\sum_u$ is diagonal).In this case $Z_0=P^{-1}$, and $\sum_u = PP'$, where P is a triangular matrix calculated using Cholesky decomposition. Of course, the implications of the model do now depend on the ordering of the variables. It is impossible to shock one variable with the others fixed, a method to transform the variables is needed. Cholesky decomposition is the most popular method in this regard. This method factors $\sum$ into $P * P'$ where P is lower triangular calculated using X_t.When the restrictions have been imposed on the model then impulse response functions will be conducted.

The standard approach to deriving impulse responses functions is to start from moving average representations. Impulse response functions measure the impact of a shock to current and future values due to a percentage change in one of the VAR errors assuming this error returns to zero in subsequent periods and that all the errors are equal to zero (Brooks, 2008; McCoy, 1997; Stock and Watson, 2001). This implied thought experiment of changing one error while holding the others constant makes most sense when the errors are uncorrelated across equations, so impulse responses are typically calculated for recursive and structural VARs. Variance decompositions give the percentage of the forecast variance due to shocks to each of the variables. Variance decompositions depend on the way the shocks are identified and, hence, can change dramatically if another assumption is employed.

4.4 DATA ISSUE

The empirical study requires a decision on the measures of monetary policy stance and stock market returns. Literature suggests a number of measures of monetary policy; other empirical reviews have used the interbank rate as the interest rate in these kinds of analyses. The interbank rate is directly influenced by the repo rate and it is more volatile compared to the repo rate. It represents the changes in the cost of borrowing among the banks, those in surplus lend to those in deficit so that they meet central bank daily reserve requirement. In the US interbank rate is referred to as the federal funds rate. This study shall use the interbank rate as proxy for monetary policy stance. Figure 3.5 in chapter three shows that the interbank rate influences other market rates while it is directly influenced by the repo rate. The study will use M3 to proxy monetary aggregate.M3 represents level of money supply in the economy. The choice of M3 as the monetary aggregate is because South Africa monetary

authorities targeted M3 before 1990 as discussed in section 3.2 chapter three. Money targeting was replaced by a system of money supply guidelines which were also centred on percentage threshold growth of M3. Money supply in this study is represented by money supply growth rates[5]. Whereas some empirical studies use M1 and M2, in this study, experimentation with M2 in the model yielded the same results as M3. Monthly series for CPI, money supply (M3) and the interbank rate were from the International Monetary Fund, StatsSA and SARB and were sourced through Thompson DataStream. The stock market index (J) is also observed monthly and was accessed from Thompson DataStream, the proxy for stock prices is the Johannesburg All Share Index.

4.5 TESTING FOR THE MAJOR ASSUMPTIONS OF A VAR MODEL

Standard procedure when using time series data is to do stationarity tests. The standard ordinary least squares (OLS) require that all the series are integrated of order 0, I(0), that is the series are stationary at level. However, differencing to induce stationarity may result in loss of important information. Gujarati (2005:496) describes a stationary stochastic process as containing constant mean and variance overtime and a covariance that is not serially correlated. A process of this nature is normally referred to as a 'white noise'. Stationarity of series is important for two reasons. Firstly, if series are stationary then it is possible to make forecasts. Secondly, stationarity minimises the possibility of spurious OLS regressions. There are different ways to test for stationarity: visual plots, autocorrelation functions, unit root tests and stationarity tests (Brooks, 2008). This study uses two popular tests. The first is a unit root test Augmented Dicker Fuller test (ADF) and the second is a stationarity test**,** Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test. Since the two tests are very common and have been extensively used in empirical literature, they shall not be discussed (See (Enders, 2004: 211 and Brooks 2008:320) for a detailed description of stationarity and unit root tests. As in other studies which handle financial data, common tests that are also conducted on financial time series data will be done these include normality tests (Jarque-Bera statistic), kurtosis, and skewness tests.

[5] See Sourial (2003) for money growth rate computation formula.

4.6 THE IDENTIFIED VAR MODEL

Three strategic decisions have to be made in order to construct a SVAR model. The first step is to select the variables to be included in the system. In our model we have opted for a closed economy model, however, with the inclusion of the foreign exchange to capture external shocks to output and inflation. The motivation for this choice of model is based on the independence of South Africa's monetary policy. Further evidence is also from the way South African economy withstood the financial crisis which was clear testimony of a well regulated financial sector. South Africa's Reserve Bank is very much in charge of the South Africa's economy. In choosing these variables theoretical considerations have been made to ensure that the number of variables cannot become too high to allow some dynamics. Literature has enormous evidence pointing to non-stationarity of macroeconomic time series. The second decision deals with the treatment of non stationarity in the data. According to Jacobs et al (2003) the researcher has three options firstly he may render all series stationary by first differencing and set up the model in covariance-stationary form; secondly appealing to the conclusion of Sims *et al.*(1990) that 'the common practice of attempting to transform models to stationary form by difference or cointegration operators whenever it appears likely that the data are cointegrated is in many cases unnecessary, the researcher can formulate and estimate the model in levels; and thirdly he needs to specify the Vector Error Correction Model(VECM) if he chooses to apply cointegration techniques. However this study is not going to be extended to co-integration analysis. Bjornland and Leteimo (2005) model their SVAR all series at level (expect stock prices) and they argue that this is standard practice in many VAR models on monetary policy. SVAR does not consider the stationarity of the data set unless the researcher is also concerned with possibility of co-integrating relationships in the data set (Hamilton, 1994).

Commodity price index is excluded in the analysis unlike in some works done for developed countries. Although it is true that South Africa has an active commodities market it is not as big and active as those found in developed countries such as the US. M3 is instead included to capture the period where the monetary regime for South Africa was monetary targeting as motivated in section 4.3. Van de Merwe (1998) states that the intermediate objective of monetary policy in South Africa is money aggregate (M3). This was before the days of inflation targeting which is the current monetary policy regime. M3 is a comprehensive aggregate consisting of all bank notes and coins in circulation plus all deposits of the

domestic private sector with banking institutions. The inclusion of M3 in the study is further qualified with the assertion by van de Merwe that M3 was chosen as an intermediate objective by the SARB because it is the money supply measure that has the most stable relationship with domestic demand and is unaffected by deposits shifts between different maturities.

Distinct from Bjornland and Leteimo, a 6×1 vector of macroeconomic variables (W_t) on the monthly change in the log of consumer prices (Φ_t), the log of the industrial production (y_t), the interbank rate (i_t), the log of monetary aggregate represented by M3 (m_t), the real effective exchange rate (e_t) and the log of the JSE All Share price index (j_t)can be ordered as:

$$W_t = [y_{t,} \Phi_t, \Delta j_t, m_t , i_t]' \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots [4.7]$$

W_t can then be incorporated into a VAR that is assumed to be stable and can be inverted and stated in terms of moving average (MA) representation:

$$W_t = A(L)p_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots .. [4.8]$$

Where, according to Bjornland and Leteimo(2009), p_t is a 6×1 vector of reduced –form residuals assumed to be identically and independently distributed, p_t~iid (0, θ), with positive -definite covariance matrix θ. A(L) is the 6×6 convergent matrix polynomial in the lag operator L, $A(L) = \sum_{j=0}^{\infty} A_j L^j$.An assumption is made that the orthogonal structural disturbances u_t can be written as linear combinations of the innovations$(p_{t)})$, that is,$p_t = Ku_t$, where K is the 6×6 contemporaneous matrix ; (4.8) can then be written in terms of the structural shocks as

$$W_t = E(L)u_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . \ldots [4.9]$$

Where $A(L)$K= $E(L)$.In order to identify K, the u_t are first assumed to be normalized with unit variance. Normalisation of cov (u_t) implies that KK' = θ. There are a number of methods of identifying the coefficients of which all the various techniques need to impose

adequate restrictions to achieve this. The six variable system used in this study imposes 21 restrictions on the elements in K. Nevertheless orthogonalization of the different innovations is only achieved when 15 more restrictions are imposed since the K matrix contains 36 elements. Of these there will be 15 contemporaneous restrictions directly on the K matrix. This study orders the vector of the uncorrelated structural shocks as $u_{t=}[u_t^y, u_t^\theta, u_t^m, u_t^j, u_t^i]$. Monetary policy shock is represented by u_t^i while u_t^j represents the stock price shock and these shocks are the ultimate interest of this study. An effort is not made to interpret the individual equations from the other respective identified shocks.

This study will follow the standard closed economy literature (Christiano et al 1999, 2005) and identify monetary policy shocks by supposing that macroeconomic variables do not instantaneous react to policy variables, while an instantaneous reaction from the macroeconomic environment to policy is allowed for. This same methodology is followed by Bjornland and Leteimo (2009) and it is what this study adopts as well. The motivation for using the closed economy case has been given before and has been attributed to the independence of South Africa's monetary policy. The ordering of the variables in the model therefore matters and is taken care of by placing the four macroeconomic variables above the interest rate in the ordering and assuming three zero restrictions on the relevant coefficients in the fifth column in the K matrix ,as follows

$$\begin{bmatrix} y_t \\ \theta_t \\ \Delta m_t \\ e_t \\ \Delta j_t \\ i_t \end{bmatrix} = A(L) \begin{bmatrix} K_{11} & 0 & 0 & 0 & 0 & 0 \\ K_{21} & K_{22} & 0 & 0 & 0 & 0 \\ K_{31} & K_{32} & K_{33} & 0 & 0 & 0 \\ K_{41} & K_{42} & K_{43} & K_{44} & K_{45} & 0 \\ K_{51} & K_{52} & K_{53} & K_{54} & K_{55} & K_{56} \\ K_{61} & K_{62} & K_{63} & K_{64} & K_{65} & K_{66} \end{bmatrix} \begin{bmatrix} u_t^y \\ u_t^\theta \\ u_t^m \\ u_t^e \\ u_t^j \\ u_t^i \end{bmatrix} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 5.0$$

With regards to stock prices in monetary policy VARs common practice in previous empirical studies has been to assume that real stock prices respond with a lag to monetary policy shocks($K_{56} = 0$).The alternative practice is to assume that monetary policy responds with a lag to stock price shocks in effect then interest rate is ordered above the stock price. This alternative practice permits for an instantaneous reaction in real stock prices to a monetary policy shock. In the preceding paragraph the discussion on the identifications rules

such as these discount possible important conduit for the interaction between monetary policy and the stock price which if empirically relevant would bias the results. The study then follows Bjornland and Leteimo(2009) imposing the alternative identifying restriction that a monetary policy shock has no long run effects on the level of real stock prices. By setting the infinite number of relevant lag coefficients, $\sum_{j=0}^{\infty} A_{56,j} = 0$, in 4.9 the restriction can be applied.

$A(1)\text{K}= E(1)$ ... ... [5.1]

Where, A(1) =$\sum_0^{\infty} A_j$ and $E(1)$=$\sum_0^{\infty} E_j$ indicate the 6×6 long run matrix of A(L) and E(L) respectively the long run restriction that $K_{56}(1) = 0$ implies

$A_{51}(1)K_{16} + A_{52}(1)K_{26} + A_{53}(1)K_{36} + A_{54}(1)K_{46} + A_{55}(1)K_{56} + A_{56}(1)K_{66} = 0$ .... [5.2]

The above restrictions result in a just identified model where restrictions are placed in the lower diagonal for matrix A with the diagonal normalised, as for matrix B the restrictions are on the diagonal. The recursive Cholesky restriction identifies the nonzero parameters above the interest rate equation, whereas the remaining parameters are uniquely identified from the long run restriction $K_{56}(1)$ =0. Note that the responses to the monetary policy shock (or the stock price shock) will be invariant to the ordering of the three first variables.

4.7 CONCLUSION

The chapter discussed the theoretical framework of ordinary VAR its strength and weaknesses. A motivation is made for the use of SVAR other than VAR which has been used in other monetary policy studies. It is made very clear that the main paper been followed is by Bjornland and Leteimo (2009) nevertheless strong assumptions are made to fit the model to an emerging market economy like South Africa. A noble effort is made to explain Structural Vector Autoregressive models; the discussion presents the methodology and then states the pros and cons of the methodology. Empirical literature favours the use of SVAR methodology and within the chapter advantages of SVAR as opposed to VAR are discussed. The chapter then discusses model identification under cholesky decomposition. The focus of the discussion then shifts to data issues, data type and sources of the data.

Before the discussion of the actual identified model the study briefly discusses assumptions behind a VAR model. A motivation is made for the inclusion and exclusion of certain variables in the model. The final part of the chapter discusses the identified model and presents the actual model used in this study. Cholesky ordering is used to order the variables in the model. Short run and long run restrictions are imposed in the model in order to deal with simultaneity problem.

CHAPTER 5
EMPIRICAL RESULTS

5.1 INTRODUCTION

This chapter builds on the empirical framework and methodology that are articulated in the preceding chapter. Overall, the analysis is aimed at addressing the set research objectives, which include: (i) To identify the relationship between the stock prices and money market rates in South Africa, (ii) To investigate the extent to which SARB can use stock-price information as indicators of the monetary-policy stance as well as its effectiveness, (iii) To determine the degree of significance of the stock market channel for monetary policy in South Africa as suggested by Chami, Cosimano and Fullerkamp (1999).

5.2 PRE- ESTIMATION REPORTS

5.2.1 Descriptive Statistics

Table 5.1: Descriptive Statistics

	INIPI	INCPI	INM3	INEXR	INTB	INALLS
Mean	1.955	1.873	13.17	2.041	11.20	3.92
Median	1.955	1.889	13.09	2.005	10.75	3.88
Maximum	2.078	2.139	14.49	2.329	21.00	4.50
Minimum	1.835	1.519	11.94	1.751	5.50	3.36
Std. Dev.	0.051	0.162	0.78	0.167	3.79	0.31
Skewness	0.011	-0.316	0.18	0.216	0.35	0.26
Kurtosis	2.326	2.149	1.84	1.812	2.28	2.11
Jarque-Bera	4.474	11.046	14.49	15.702	10.10	10.58
Probability	0.107***	0.004*	0.00*	0.000*	0.01*	0.01*

*indicates significance at the 10% level; ** indicates significance at the 5% level;
*** indicates significance at the 1% level

N.B :INIPI -log of industrial production; INCPI -log of consumer price index; INM3-log of money supply; LNEXR-log of exchange rate; INTB-interbank rate; INALLS- log of all share index.

The general reflection from a standard look at table 5.1 is that all series show features of non-normality; this is common in financial time series data. The probability values measure the series at 1%, 5% and 10% levels of significance. The Jarque-Bera statistic tests the normality of the series and the null hypothesis is that series is normally distributed. The null hypothesis cannot be rejected at 1% for the INALLS, INTB, INEXR, INM3 and INCPI. However at 5% and 10% the null hypothesis is rejected for INALLS, INTB, INEXR, INM3 and INCPI. For the INIPI the null hypothesis of a normally distributed series may be rejected at 10%.

5.2.2 Unit root and stationarity tests

As was discussed in Chapter 4 there are a number of methods of testing for stationarity but in this study we will adopt the ADF and the KPSS tests. A look at the series shows that most of the series have an intercept and a trend except for interbank rate and exchange rate which are relatively unstable (see Appendix 1). In line with the approach adopted in previous studies, the series are all logged with the exception of interbank rate. M3 has also been lagged in order to compute the money supply growth rates as discussed in chapter four, therefore stationarity tests were on the logged and lagged series. The result of stationarity tests, as shown in table 5.2 below, is that the series are not stationary at levels. All the series have unit roots except for CPI which at 1% the null hypothesis of a unit root cannot be rejected. Naturally after doing stationarity tests on our dataset the estimations have to be at first difference if the tests confirm existence of unit roots. However, Bjornland and Leteimo (2009) argue that due to the low power of ADF tests, an existing unit root may be declined when it actually exists. They argue further that ADF tests fail to make a distinction between a persistent (trend) stationary process and unit root; this implies that variables can be equally represented in levels but with a trend.

Table 5.2: Unit root/stationarity test (with intercept and trend)

ADF (H: 0 ~ Unit Root) Critical Values: 1% (-3.464643), 5% (-2.876515), 10% (-2.574831)

KPSS (H: 0 ~ Stationarity) Critical Values: 1% (0.739), 5% (0.463), 10% (0.347)

	ADF		KPSS	
Series	**Level**	**1st Difference**	**Level**	**1st Difference**
INIPI	-1.126	-9.519***	1.804	0.077***
INCPI	-3.472*	-11.003***	2.031	0.727*
INM3	0.200	-6.964***	2.050	0.197***
INEXR	-2.519	-11.558***	0.936	0.048***
INTB	-1.914	-11.496***	1.139	0.062***
INALLS	-0.454	-15.106***	1.946	0.044***

*indicates significance at the 10% level; ** indicates significance at the 5% level;

*** indicates significance at the 1% level

5.2.3 VAR Lag Length Selection criteria

As discussed in chapter four there is various lag length selection criteria used to obtain optimal lag length. Table 5.3 below shows the various lag length chosen by the various lag length selection criterias but does not report the serial autocorrelation test for fifth and the sixth lag. The autocorrelation test for the fifth and sixth lag gives insignificant probability values of 32% and 9% respectively .The optimal lag length chosen has to be the smallest lag length among the ones that eliminate serial autocorrelation and the researcher can use discretion in this matter as well. The lag length does not have to be too large as this eliminates the long run properties of the data. An optimum lag length of 4 lags is chosen for this study.

Table 5.3: Var lag length and autocorrelation test.

Information criteria	**VAR Lag**	**Autocorrelation test***
LR	7	0.02
FPE	3	0.00
AIC	3	0.00
SC	1	0.53
HQ	2	0.59
Optimum lag	4	0.03

***The table reports the probability values autocorrelation LM test**.

5.3 ESTIMATION RESULTS AND IMPULSE RESPONSES

Table 5.4: **The short run Estimated A and Estimated B matrix**

Log likelihood	3541.052				
Estimated A matrix:					
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000
-0.002994	1.000000	0.000000	0.000000	0.000000	0.000000
-0.061308	0.892682	1.000000	0.000000	0.000000	0.000000
-0.171750	0.239482	-0.125531	1.000000	0.000000	0.000000
-3.586803	-8.261794	-3.858365	9.490121	1.000000	0.000000
-0.473213	1.048321	-0.150790	-0.069062	0.004225	1.000000
Estimated B matrix:					
0.009930	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.001859	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.012012	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.016431	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.541916	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.023904

Table 5.5: The long run Estimated A and Estimated B matrix

Log likelihood	1689.037				
LR test for over-identification:					
Chi-square(15)	3720.524		Probability	0.0000	
Estimated A matrix:					
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000
Estimated B matrix:					
0.042265	-0.050366	0.051449	0.001286	0.003680	-0.036754
0.003560	0.026819	-0.014215	0.008354	-0.000875	-0.009220
-0.068006	0.024767	0.065895	0.010143	0.003981	-0.005112
0.000318	0.073748	-0.116865	0.031993	0.005442	0.077832
-1.658940	-0.495678	4.143260	0.509765	0.390551	-1.769871
-0.042618	0.083465	-0.166404	-0.014873	0.023891	0.130781

Table 5.4 and Table 5.5 show the estimates of coefficients of the K matrix of the short run and the long run restriction models. Log likelihood is maximized with respect to the free coefficients of the K matrix. The short run restriction model is just identified. However the long run restriction model is over identified, nonetheless at 5% level of significance the study's restrictions are not rejected.

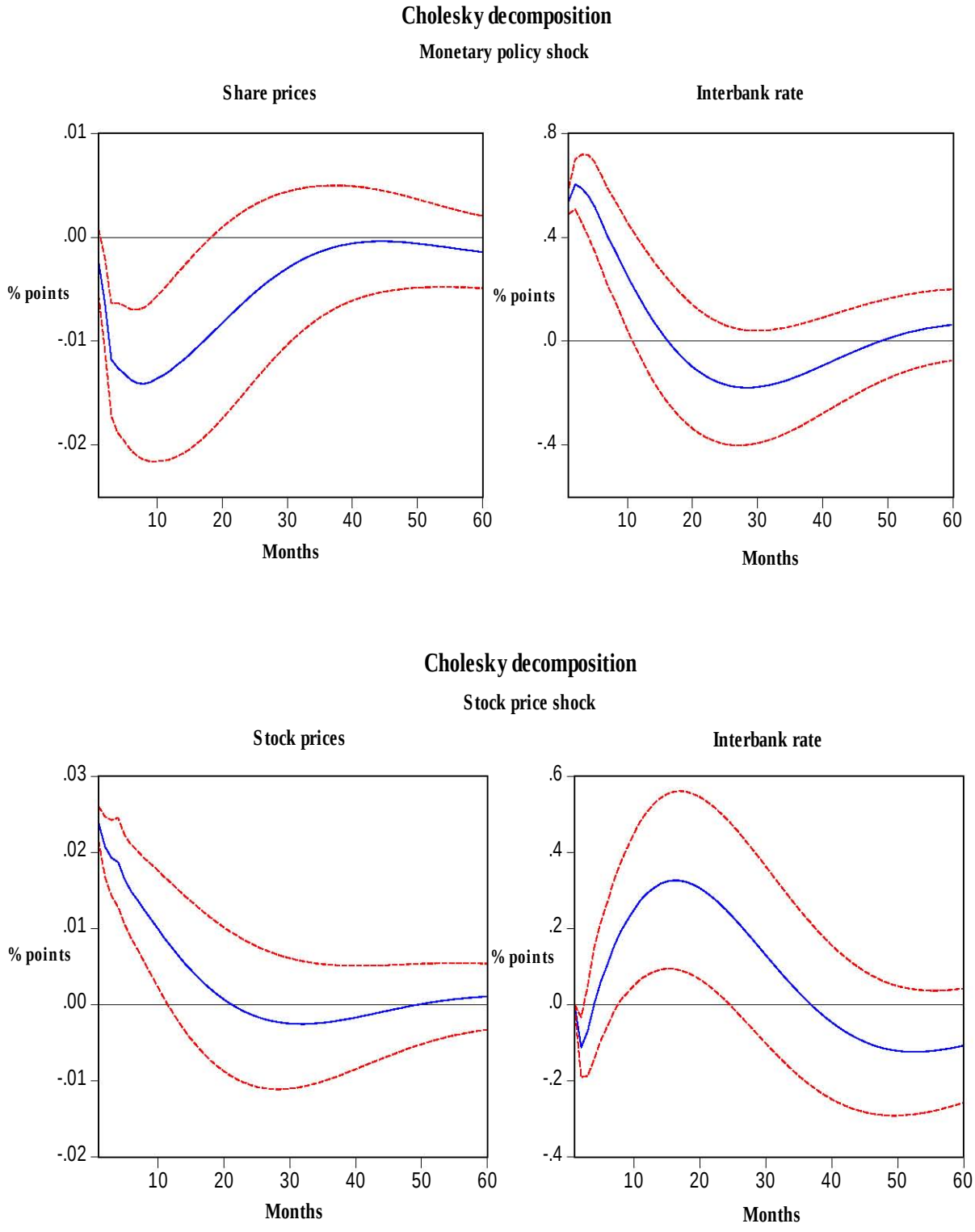
5.3.1 Impulse response functions

A period of 60 months has been chosen for this study for the analysis of impulse response functions. The choice is carefully made to reflect periods of parliamentary and presidential elections in South Africa, which normally usher in new administrative regimes. Stakeholders usually adapt a wait and see approach since they are not aware of the economic outlook after elections. In line with the objectives of this study, monetary and stock price shocks can be induced by factors such as political regime change and shift in public policy goals. Similar to Bjornland and Leteimo (2009) the study restricts one of the shocks not to have instant effect on one of the variables. It is not expected that cholesky decomposition of the effects of the shocks would pick up simultaneity.

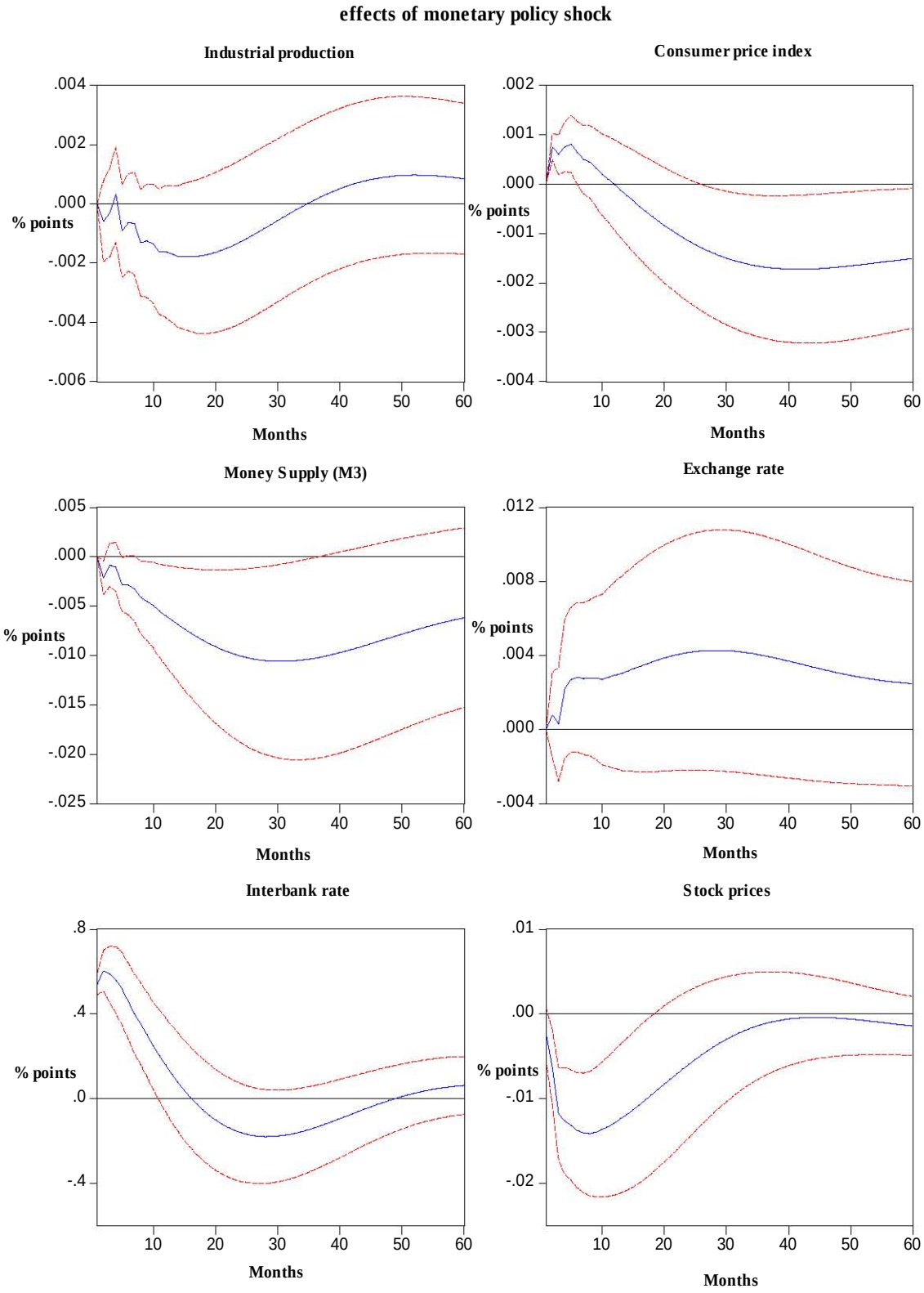
5.3.2 Cholesky Decomposition

In order to motivate the model identification criterion, the figure below reports the impulse responses of stock prices and interest rates to shocks in both stock price and monetary policy under standard cholesky decomposition. Impulse responses are shown for two different orderings of variables, interchanging the stock price and monetary policy shocks, as last and second from last in the variable ordering. The conclusion from figure 5.1 is that monetary policy has no instantaneous impact on stock prices and stock prices do not immediately impact interest rates. It is also safely concluded that monetary policy surprise and stock price surprise do not have instantaneous impact on other variables as well. The restriction imposed by either Cholesky ordering will distort the estimate of the two shocks in such a way that the level of interaction will seem negligible if both stock market and monetary policy react importantly to shocks in the other sector and the interaction is essential (Bjornland and Leteimo,2009)

Figure 5.1: Impulse responses with two Cholesky identification schemes



5.3.1 Impulse Responses to a monetary policy shock



A monetary policy shock that raises the interbank rate causes an immediate fall in stock prices. This is consistent with the earlier emphasis that the rate at which investors discount future dividends increases due to the rise in interest rates. Increase in interest rates is also associated with higher cost of credit which eventually leads to decrease in output and is most likely to dampen expectations of higher future dividends. As is displayed in figure 5.1 above, output behaviour is inconsistent in the short run. In the first quarter, industrial output is unstable – falling slightly before reaching a high in the fourth month and then subsequently maintaining a gradual decline. A monetary policy shock that increases interbank rate leads to a sharp increase in the consumer price index in the first quarter. This is accompanied by a decline in output, and is consistent with the postulation that higher interest rates discourage borrowing and leads to decline in firm output thereby reducing profitability. A closer look at the consumer price index graph reveals that inflation increases sharply in the first month. It then increases at a decreasing rate in the third month and thereafter prices gradually decline and then stabilise throughout the entire period. The effect on inflation of this monetary policy shock is not huge and significant. As found by Bjornland and Leteimo (2009), increase in inflation can be accounted for by the price puzzle explained in Eichenbaum (1992) and it is said to be precipitated through the cost channel of the interest rate. The cost channel is explored by Chowdhury et al (2006) who argue that the structure and sophistication of the financial system determines the existence and strength of such channel. The argument posed in their paper is that, of the countries in their sample, the ones with heavily regulated and uncompetitive financial intermediary system have a weak cost channel. South Africa has a highly regulated financial sector and the extent of its competitiveness is contestable for there are only four major players in the entire banking system. Lack of competition is associated with delayed pass-through from the monetary policy rate to working capital (Chowdhury et al, 2006).

An unexpected increase in interbank rate leads to money supply aggregate (M3) dropping sharply and persistently. The impact on the monetary aggregate M3 is consistent with hypothesised relationship postulated in financial theory (Sprinkel, 1964; Homa and Jaffe, 1971; Hamburger and Kochin, 1972). There is an inverse relationship between interest rates and monetary aggregate. As shown by the figure 5.1 above, the initial monetary policy shock which increases interbank rate reduces money supply. The short run impact of interest rate on money supply is also shown to be highly pronounced. However the figure shows that in the long run monetary policy authorities cannot influence money supply with interest rate innovations since interest rates have a long run

negligible influence on money supply. This conclusion is also similar to the one reached for the impact of monetary policy shock on exchange rate. Changes in interest rate have a short run effect on exchange rate, however in the long run interest innovations have no impact on exchange rate.

5.3.2 Impulse responses to a real stock price shock

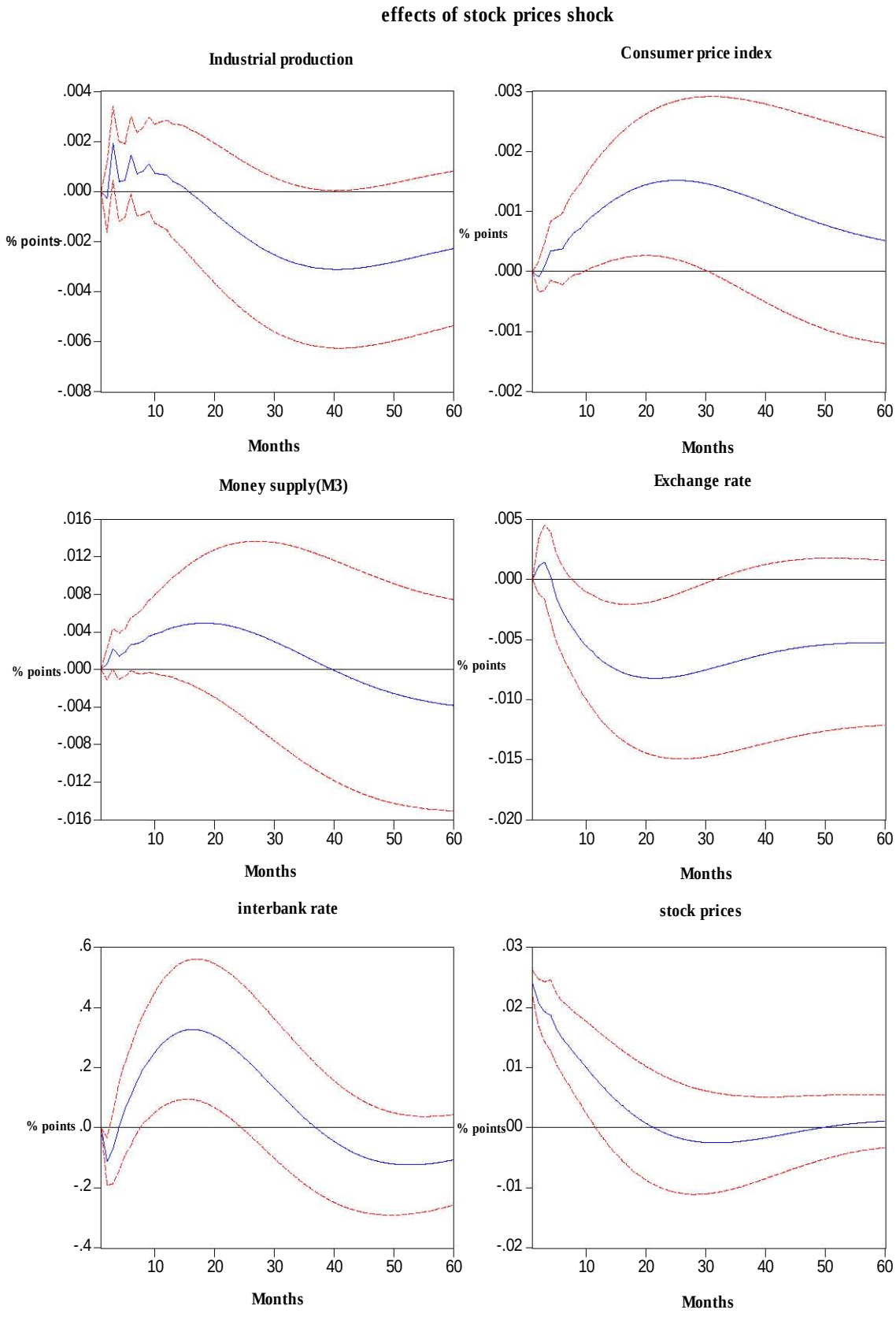
Results of the impulse response analysis, which is represented in figure 5.2 and appendix 2, reveal that in the short run, the stock price shock which immediately decreases stock prices leads to an instantaneous decrease in the interbank rate, consumer price index and output.[6] The impact of the shock lasts for 4 months before it is relieved and it remains steady for the entire period. This result is consistent with the postulation that a decrease in real stock prices reduces consumption through a wealth effect and investment through a Tobin Q effect, which affects gross domestic expenditure. Similar to the finding by Bjornland and Leteimo (2009), inflation does react immediately to the stock price shock, and due to nominal rigidities, prices react slowly and consumer price index rises in the intermediate run. The decline in interbank rate in response to a stock price shock is consistent with the theoretical framework of this study.

SARB is most likely to reduce interest rates when stock prices go down to stimulate economic activity, since the decline in stock prices may have been as a result of strenuous borrowing conditions. The action does not necessarily imply that the Reserve bank targets stock prices, but this action could be necessitated by the need to achieve its central banking goals. It is expected that the instability in the stock market will transmit to the other sectors therefore its impact has to be contained. An expansionary monetary policy increases the amount of money available in the credit market. Firms can borrow at low rates which will resultantly boast economic activity. Stock prices are therefore an important input in interest rate setting. A stock price shock which decreases stock prices by 100 basis points leads to 5 basis points decrease in interbank rate three months after the shock. This result is consistent with other studies which concentrate on short run responses (Rigobon and Sack, 2004 and Bjornland and Leteimo, 2009).

[6] A shorter time period is used in appendix 2 in order to clearly show the behaviour of the other series to a stock price shock.

A stock price shock that decreases stock prices leads to an immediate increase in stock prices which may be explained by speculative tendencies of investors. Some foreign investors may want to take advantage of the situation by buying low and selling high; therefore there will be an increase in demand for South African rand in the foreign exchange market which results in the appreciation of the rand. In the long run, however, investors could realise there are no gains to be made since a continuation of the downward spiral of stock prices might lead to their shunning the stock market. On money supply and stock prices, the increase in money supply may be due to decrease in interest rates shortly after the stock price shock, however in the long run money supply decreases. The relationship between money supply and stock prices which is postulated in literature is visible since decreasing stock prices present an opportunity for speculators and can only make prospective stock buyers richer when stock prices rise.

Figure 5.2: Impulse Response Results



5.4 VARIANCE DECOMPOSITIONS

The discussion will now be centred on the importance attached to the variance caused by the different shocks identified in this study. More importance however is attached to stock and monetary policy shocks as they are the primary interest of this study. Therefore table 5.4 displays the variance decomposition for stock prices and interbank rate. Stock price and monetary policy shocks in the short run explain the variation in stock prices and interbank rate leaving the other variables to explain the variability in the long run. The model in this study is composed of all the important variables for monetary policy decisions, therefore the systematic part of monetary policy explains a large part of interest rate movements in the short run. In the first month monetary policy shock explains 92% of the changes in interbank rate, while 7% is explained by the exchange rate. After one year the exchange rate continues to explain a significant portion of the initial monetary policy shock accounting for 19% of the variance whilst interbank rate explains 58% of the monetary policy shock. Whilst the industrial production and stock prices both account for 22% of the variation in the interbank rate proportionally.

In the first two quarters, after the initial monetary policy shock, interbank rate explains 70% of its own variation. This serves to show the independence of monetary policy in South Africa. After 5 years monetary policy still shows a great deal of resilience explaining 39% of its own variation whilst stock prices overtake the influence of the exchange rate in explaining the change in stock prices. The limited impact that monetary policy has on stock prices has been explained by Hewson and Bonga – Bonga (2005) as being because the introduction of the repo rate made monetary policy more transparent and predictable. Therefore, when a monetary policy announcement is made, any arising shifts in policy thrusts are already factored in investors' decisions, leading to a situation where such announcement only less impact on stock markets.

A stock price shock explains 93% of itself in the first month of the shock. After one quarter 15% of the stock prices shock is explained by the interbank rate, whilst 74% of the variance in stock prices explains themselves. Two years after the initial shock, stock price is proportionally explained by other macroeconomic variables, 67% in variability is explained by both monetary policy and stock prices, and the remaining component in the variability of stock prices is explained by other variables. The persistence of self-explaining variation of

stock prices in the short and medium term can be attributed to non-fundamental factors that explain the stock prices. This is because all fundamental variables that would affect stock prices have been included in the model. As is discussed in chapter three, South Africa's JSE All share index is largely resource based. The prices of resources therefore may actually be responsible for the deduction of such a conclusion. Five years after a stock price shock, stock prices and interbank rate still explain a greater part of the variability in stock prices compared to other variables in the model. However, exchange rate and money supply (M3) in the fifth year account for a more significant proportion of variability in stock prices, which is about 22%. Consumer price index has no significant link to the variation in both stock prices and interbank rate. M3 as well is responsible for a negligible part of the variation in interbank rate, however in the long run it explains stock prices relatively significant. Appendix three reports the other variance decompositions of the other shocks in detail, they are not discussed here since they are not the centre of focus of the study.

Table 5.6: Variance Decomposition

	Forecast horizon	Output shock(%)	Inflationary shock(%)	Money aggregate shock(%)	Exchange rate shock(%)	Monetary Policy shock(%)	Stock price shock(%)
Stock prices							
	1	4.65	0.45	0.39	0.58	0.91	93.02
	4	5.07	0.37	3.78	1.41	15.41	73.96
	8	4.83	1.63	6.01	3.31	26.12	58.10
	12	4.85	2.35	7.72	6.73	30.67	47.68
	24	4.85	2.95	10.22	14.49	31.38	36.10
	36	4.59	2.91	10.84	16.03	28.69	36.93
	48	4.64	2.86	11.21	15.77	27.59	37.92
	60	4.98	2.85	11.59	15.57	27.27	37.75
Interbank rate	1	0.17	0.11	0.29	7.57	91.85	0.00
	4	2.09	0.72	0.35	14.52	81.24	1.08
	8	6.59	1.25	0.58	17.99	70.01	3.59
	12	10.50	1.15	0.52	18.54	58.16	11.13
	24	15.29	0.80	0.44	13.72	40.58	29.17
	36	14.80	0.80	0.56	13.92	40.37	29.55
	48	14.40	0.79	0.56	15.08	40.01	29.16
	60	14.45	0.78	0.58	14.95	39.32	29.94

5.5 CONCLUSION

The major conclusion arising from this chapter is that monetary policy has a significant impact on stock prices through interest rate channel. The central bank can indeed influence stock prices to a large extent. In this chapter the objectives of the study have been met that is to establish the relationship and extent of the relationship that exists between stock prices and monetary policy in South Africa. The findings of this study are similar to other short run response studies; however the extent of the relationship is not as large as found in these studies. The findings of this study cannot be immediately equated to other VAR studies which found an insignificant relationship because of the differences in level of development and sophistication of stock markets and monetary systems. The result is regarded as significant. Therefore due to the interdependence, a monetary policy authority can rely on information from stock markets to set policy targets.

CHAPTER 6
SUMMARY, CONCLUSIONS, IMPLICATIONS OF RESULTS, AND AREAS FOR FURTHER STUDY

6.1 SUMMARY AND CONCLUSIONS

In this study, an attempt has been made to identify the degree of predictability of stock market returns from monetary variables. The study seeks to: identify whether there is a relationship between the stock prices and money market rates in South Africa; investigate the extent to which SARB can use stock-price information as indicators of the monetary-policy stance; determine the degree of significance and effectiveness of the stock market channel for monetary policy in South Africa as suggested by Chami, Cosimano and Fullerkamp (1999). The general consensus from the theoretical and empirical review is that there is indeed a relationship between monetary policy and stock market. Therefore the major contribution of this study is not only to address the issue of limited literature but also address the inconclusiveness of the current literature of the extent of the relationship that exists. There are few studies for emerging market economies which are directly linked to this current work. The role of stock markets in emerging market economies is also increasing by the day, hence pointing at the pressing need for central banks in these countries to understand the role and impact that the stock market has on their decisions, the economy and the ultimate goals they seek to achieve.

The first part of the study reviewed the theoretical literature on monetary policy and stock market. Central bank roles and objectives were discussed, followed by the definition as well as a discussion of the importance of the stock market. The following section was divided into a discussion on various interrelationships that exist between monetary policy and stock prices. The discussion is then shifted to possible theoretical link that exists between monetary policy and stock market which is classified into direct and indirect link. Stock prices are expected to react directly to changes in interest rates since interest rates affect directly the rate of return which is an ingredient in stock valuation methods formula, this is the direct link. Indirect link can be explained with relation to the role of credit extension in the economy. Decrease in interest rates reduces cost of borrowing which increases credit

extension, stimulating various sectors of the economy, thus increasing productivity thereby increasing company profits and consequently share prices.

The second part of the work reviews the South African economy with emphasis placed on monetary policy, money market and stock market. The trend and performance of the JSE is traced in the chapter. Substance is added to the discussion with the comparison of developed and emerging market economies using number of listed companies, market capitalisation and volume traded. The analysis of these stock market performance indicators demonstrates that developed countries stock markets are way bigger than emerging market stock markets. Even the South African stock market which is by far the largest in Africa is next to nothing compared to the stock markets of the developed countries. Therefore it is expected that the stock market channel of monetary policy will be less influential in emerging market economies compared to developed economies. The long term behaviour of exchange rate as well as private and government consumption is also discussed. The movement of long term consumption is highly correlated to the movement of the all share index. One of the most interesting conclusions reached in the chapter is that South Africa's stock exchange is resource price driven. This therefore limits the level of influence that the central bank has on the JSE, since it is largely affected by external shocks.

In order to address the objectives of the study, SVAR methodology is utilised. This methodology is constructed based on economic assumptions so that economic interpretations can be made and hence policy recommendations. There are two major outcomes from this study the first is that a monetary policy shock surely influences stock market activity in the short run. It is found that a stock price shock that decreases stock prices by 100 basis points leads to a 5 basis point decrease in the interbank rate. The magnitude of influence is a basis point higher for South Africa compared to the result by Bjornland and Leteimo for the USA. Therefore monetary authorities should be more accommodative to signals from the stock market in South Africa since the stock market has more influence. While paying more attention to the traditional credit and money channels, monetary authorities should not undermine the importance of the stock market as an alternative channel of monetary policy. The other major outcome of the study is that a monetary policy shock which decreases interest rate by 100 basis point leads to a decrease in real stock prices 1 percent. This result is similar to the findings by Bjornland and Leteimo (2009) for the US; however the magnitude

of influence is smaller for SA. This discrepancy can be explained by the difference in level of sophistication of emerging market economies and developed economies stock markets. The result is not surprising since it is expected that the more active the stock markets the more the influence. South Africa's stock market is also resource price-driven, meaning that monetary policy can only influence it to a certain extent. Nonetheless the level of influence is still quite significant.

6.2 POLICY IMPLICATIONS OF RESULTS

The results of this study have implications for monetary policy in that change in interest rate will results in a significant change in stock prices. Monetary policy authorities have a significant influence on stock market activity and can use the interest rate to contain stock market movements. The issue for monetary policy authorities is whether to take the position proposed by Bernanke and Gertler (1999), which recommends the reaction of the central bank to equity price movements. They go further to state that this should be permitted only by the extent to which they convey information regarding expected inflation .On the contrary Bullard and Schaling (2002) argue that the inclusion of stock price information to Taylor type monetary policy rule has dire consequences on economic performance. The conclusion by Bullard and Schaling (2002) is also in direct contravention with Cecchetti et al., 2000 who argue that explicit reaction to asset price movements can help the monetary authorities in stemming out asset volatility. However, South Africa is operating under the inflation targeting regime which Hewson and Bonga-Bonga (2005) have described as more transparent and it has brought more credibility to conduct of monetary policy. Inflation targeting does not directly target asset prices nonetheless investors' confidence has risen since its introduction to the point where they back their expectations on what future policy is likely to be. Judging from the results there is no need for SARB to change interest rates after the 38 months as stock prices are in steady state until 60 months, innovations in interest rates is likely to lead to instability other markets. SARB also has to work towards legislation that increases competitiveness of the country's financial sector which is currently very closed and regulated. This will increase interest rate pass through which will in turn make monetary policy decisions more effective.

6.3 AREAS FOR FURTHER STUDY AND LIMITATION

The primary objective of this study is to examine how monetary policy reacts to shocks in stock prices. The study concentrates on the period between 1990 and 2010 capturing two monetary policy regimes, money supply guidelines and the inflation targeting era. Future research could also expand the period of analysis and establish whether this change could

result in different findings and conclusion. Given that some studies elsewhere have used cointegration analysis in similar analysis, it would be interesting to combine SVAR and co-integration and carry out a Structural Vector Error Correction Model using similar data. Incorporating these refinements could pose for an interesting future research in the case of South Africa. A multi-country study can also be done between South Africa and other emerging markets economies for comparison purposes.

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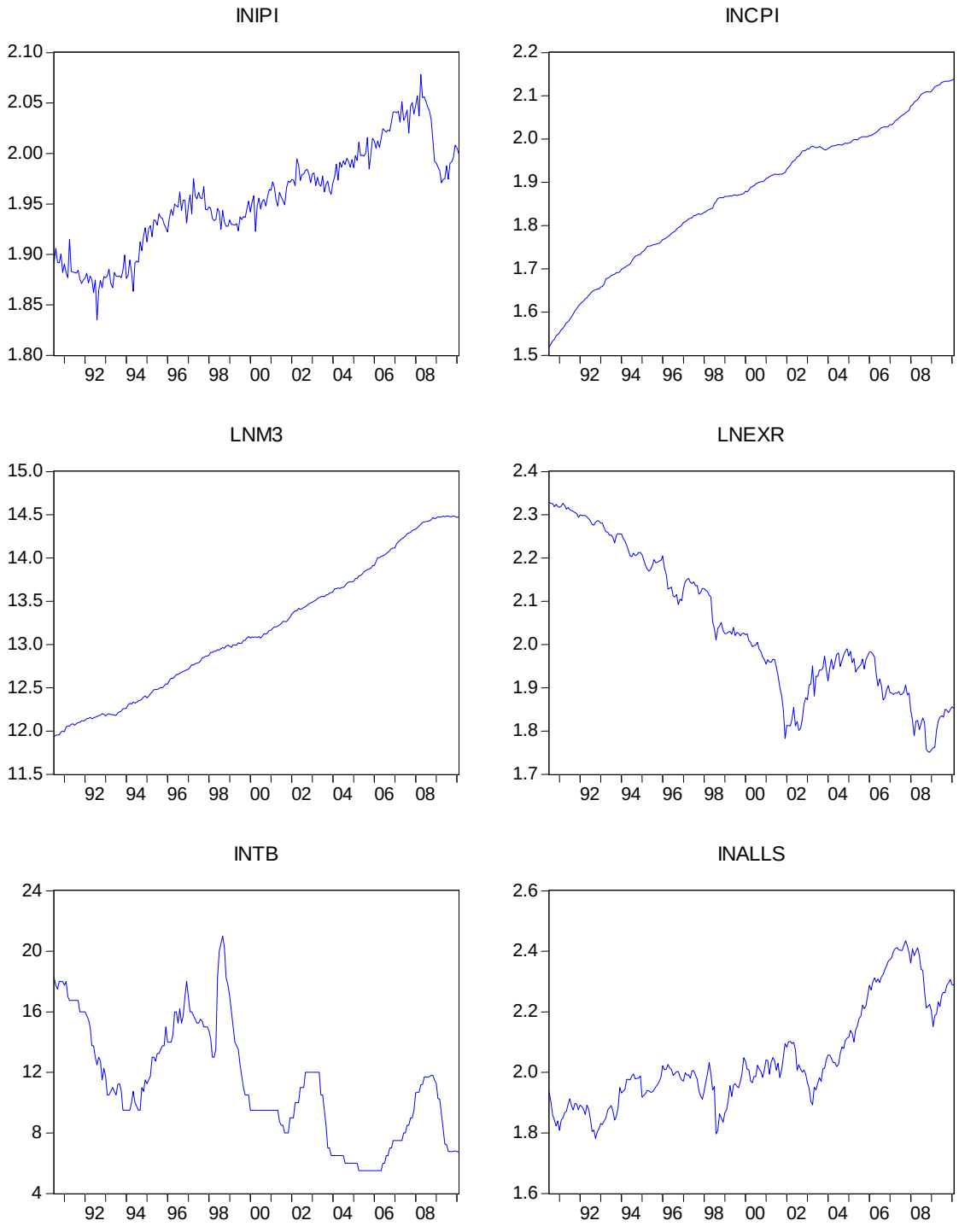
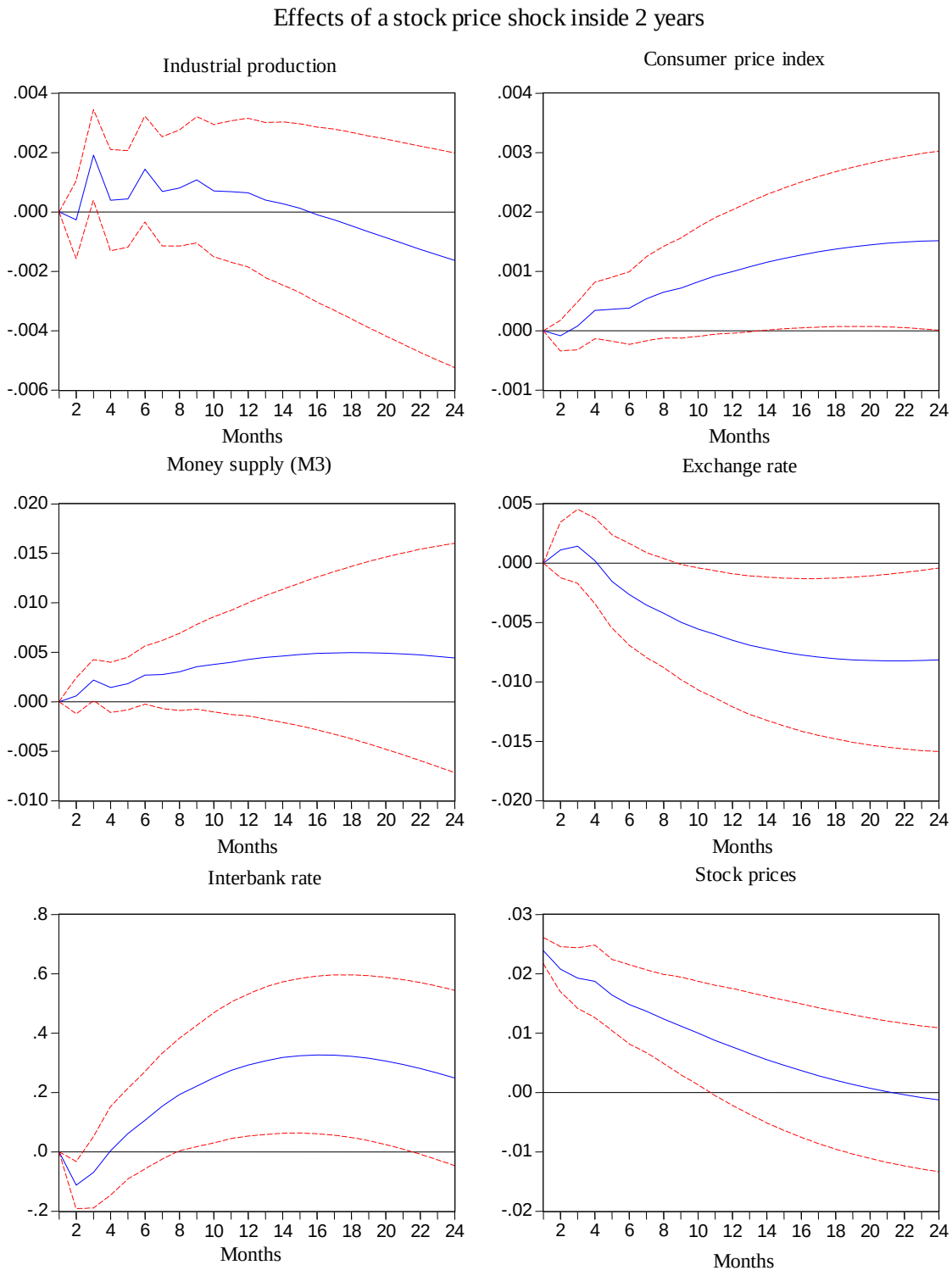
APPENDIX

APPENDIX 1: THE LONG TERM BEHAVIOR OF SERIES



APPENDIX 2: EFFECTS OF STOCK PRICE SHOCK INSIDE TWO YEARS



APPENDIX 3: VARIANCE DECOMPOSITIONS OF THE OTHER VARIABLES IN THE STUDY MODEL

	Forecast horizon	Output shock(%)	Inflationary shock(%)	Money aggregate shock(%)	Exchange rate shock(%)	Monetary Policy shock(%)	Stock price shock(%)
Consumer price	1	0.05	99.95	0.00	0.00	0.00	0.00
	4	0.16	82.30	0.82	6.38	8.85	1.49
	8	0.19	65.59	1.10	18.72	6.70	7.70
	12	0.18	51.38	0.71	26.33	4.44	16.96
	24	0.85	25.97	2.12	26.40	9.70	34.97
	36	2.83	16.59	5.62	19.56	17.93	37.47
	48	4.96	12.46	9.36	14.90	24.32	34.01
	60	6.68	10.29	12.67	12.31	28.28	29.76
Industrial production	1	100.00	0.00	0.00	0.00	0.00	0.00
	4	95.33	0.01	1.25	0.20	0.31	2.91
	8	89.11	0.02	1.72	0.19	2.78	6.18
	12	80.61	0.04	2.00	0.69	7.62	9.04
	24	63.86	0.08	2.44	4.24	20.19	9.19
	36	59.53	0.08	2.53	5.82	22.27	9.77
	48	58.55	0.12	2.53	5.79	21.87	11.13
	60	58.19	0.14	2.59	6.10	21.77	11.21
Money aggregate(M3	1	0.45	1.36	98.19	0.00	0.00	0.00
	4	4.42	1.47	90.46	1.13	1.35	1.18
	8	13.39	2.19	77.85	0.85	3.91	1.81
	12	21.04	2.36	66.93	0.50	6.58	2.59
	24	29.96	2.13	47.45	1.09	15.81	3.57
	36	29.20	1.89	40.46	2.87	22.89	2.69
	48	27.41	1.72	38.42	3.98	26.38	2.09
	60	26.34	1.59	38.15	4.18	27.79	1.96
Exchange rate	1	1.06	0.18	0.86	97.90	0.00	0.00
	4	0.31	0.31	1.15	97.28	0.57	0.38
	8	0.20	0.47	1.06	93.89	2.18	2.20
	12	0.18	0.39	1.00	88.97	2.90	6.57
	24	0.32	0.37	0.83	73.36	5.14	19.97
	36	0.36	0.41	0.75	65.80	7.75	24.93
	48	0.35	0.44	0.79	63.74	9.15	25.53
	60	0.35	0.45	0.89	63.25	9.59	25.47