MONETARY POLICY AND THE STOCK MARKET IN SOUTH AFRICA

How do South African equity prices respond to expected and unexpected changes in the repo rate?

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Abstract

This analyses the impact of unexpected changes in monetary policy on the South African equity market over the period 2005 -2018. In an attempt to understand this relationship, two main views have emerged. The wealth effect suggests that monetary policy changes have an indirect effect on the stock market, via changes in the value of private portfolios. On the other hand, it has been argued that the stock market is an independent source of macroeconomic volatility to which policy makers may wish to consider. This paper applies an event study approach to examine the stock market reaction to monetary policy. Furthermore, to understand the economic sources underpinning that reaction a Vector autoregressive model is estimated. The results suggest that on average, a surprise rate hike of 100 basis points causes short term JSE All Share index total returns to decline by 2.71%. We also find that the stock market reacts positively (negatively) to expansionary (contractionary) unexpected monetary policy actions due to revised market expectations about future dividends, excess premiums and the discount rate. The findings are crucial for central bank policy makers and JSE stock market investors.

Key Words: Monetary Policy, Stock Market, Equity Market, JSE All Share Index

1. Introduction

The primary objective of monetary policy in South Africa is to achieve and maintain price stability, and thus enable balanced and sustainable economic growth and development. These objectives are often measured in terms of macroeconomic outcomes like employment, growth and inflation levels. However, the manner in which monetary policy affects these variables is to some extent indirect. The transmission mechanism of monetary policy is known to have long, variable and uncertain time lags (SARB, 2019). As a result, the most direct effect of monetary policy action can be observed on the stock market, through its impact on cash flows, discount rates, stock prices and returns of listed companies (Iddrisu et al, 2017).

South Africa's stock market has a significant contribution not only to growth and development of the financial sector., but to the economy at large. The ratio of total market value to gross domestic product (GDP) was 332% in 2018; second highest in the world (Bloomberg, 2018). A high level of market value to GDP would suggest that variation in the total value of the stock market has significant implications for spending and consumption which affect domestic output (Hassan, 2013). Therefore, it is important to examine the link between monetary policy and the stock market in order to understand the transmission mechanism of monetary policy since changes in stock prices (which are linked to the real economy) play a crucial part as a transmission channel.

Theory suggests that the stock market continuously reflects available information about monetary policy and the macroeconomic environment. Although the market may not always have perfect information or foresight, it is generally forward looking with sufficient malleability to incorporate any new information. Consequently, a large volume of theoretical and empirical literature has focused on investigating the extent to which financial markets react to unexpected monetary policy actions.

Two divergent views have emerged on the transmission mechanism, the conventional view posits that, transmission through the stock market occurs via changes in the value of private portfolios, a concept known as the wealth effect, and changes in the cost of capital through the bank lending and balance sheet effects (Mishkin, 2001; Ioannidis and Konotonikas, 2006).

Another view is that the stock market is an independent source of macroeconomic volatility to which monetary policy committees may wish to consider and respond to (Ioannidis and Konotonikas, 2006). The degree of variation inherent in stock market prices is high and will often experience pronounced expansionary (boom) or contractionary (bust) cycles. The real concerns lie in the periods where the stock market has materially deviated from its intrinsic value, wherein once

corrected, may result in undesirable consequences for the broader economy. For these reasons, it may prove useful to obtain quantitative estimates of the relationship between monetary policy and the stock market (Ioannidis and Konotonikas, 2006).

The discounted cash flow (DCF) model posits that the value of a stock is equal to the present value of future expected cash flows. This implies that any monetary policy action will have an impact on (a) the future expected cash flows or (b) the discount rate. These two channels are inter-connected since higher interest rates imply a higher discount rate and lower future cash flows. Consequently, contractionary monetary policy should be synonymous with lower stock prices in light of the higher discount rate for the future expected cash flows and muted economic activity. The reverse can be assumed for an expansionary policy environment which often facilitates higher economic activity and earnings for listed companies. Investors in the stock market analyse company strategies in the context of the prevailing monetary policy environment which can be inferred from changes in interest rates. Moreover, financial media reports are often found attributing stock price movements to the interest rate environment (Ioannidis and Konotonikas, 2006; Bernanke and Kuttner 2005).

Past studies examining the relation between stock market and unexpected monetary policy interventions, have focused mainly on the US economy (for example Bernanke et al, 2004; Bordo & Wheelock, 2004; Rigbon & Sack, 2002 among others), with a few in other developed markets (for example Zeng, 2010; Heinlein and Lepori, 2018; Balfas et al 2018) and the Chinese market (for example Tang et al, 2013; Chen and Xie, 2016). From these studies, two broad categories of studies have emerged. The first body of studies employ single and or multivariate equations and only seek to establish whether there is a relationship between monetary policy and the stock market, without giving much attention on the economic dynamics that underpin that relationship. Most of these are single country studies, and they show that the stock market responds negatively to an unexpected rate increase (Rigobon and Sack (2002), Zeng (2010) and Tang et al, 2013). Particularly, Tang et al (2013) note that this negative reaction is more pronounced (with larger fluctuations) in a bear market for Chinese stocks. Zeng (2010) used an event study to also determine the speed of the stock market returns' reaction and found that the stock market in Australia stops reacting to monetary news after 90 – 120 minutes.

The second group of studies go a step further and investigate the economic dynamics that influence the relationship. Two inferences can be drawn from the second category of studies. The first is that, while there exists a relationship between unexpected monetary policy and stock prices,

the response of the stock market is only attributable to changes in expectations about future cash flows and excess returns (Bernanke and Kuttner, 2005; Fausch and Sigonius, 2017; Ioannidis and Konotonikas, 2006) [1] The second inference, which is highly contested, is that the reaction of the stock market is also attributable to changes in the discount rate used in the discounted cash flow model (Thornton, 1987: 3; Li and Hu, 1998). On the other hand, some studies suggest that the equity market reacts positively (negatively) to expansionary (contractionary) monetary policy surprises only during tough economic times , that is market cycles synonymous with negative economic growth (recession) or deteriorating financial conditions (Basitha and Kurov, 2008; Kurov, 2010; Bordo & Wheelock, 2004).

Empirical studies from African countries is limited and are not focused a single country (for example Coleman and Agyire-Tettey, 2008; Sunday, 2013; Mabitle (2013); Iddrisu et al 2017) and inadvertently imply an identical reaction across African countries. Specifically Iddrisu et al (2017)[2] employ a panel vector autoregressive (VAR) model, with various monetary and macroeconomic variables, to examine the relationship between monetary policy and the stock market. They found that the stock market reacted positively to monetary interventions particularly through the interest rate (discount rate) channel, in all 12 African countries in their study. Although, Naraidoo and Raputsoane (2013) employ a single country study, they however focus on the response of financial markets and monetary policy to uncertainty in South Africa, and do not provide much insight on the relationship between monetary policy and stock market.

This paper contributes to the growing corpus of international knowledge by extending this investigation to the stock market in South Africa and fills the scant in African literature. It differs from Iddrisu et al (2017) in that it focuses on a single country, thereby averting the challenge of different regulatory and monetary policy frameworks. In addition, Iddrisu et al (2017) and Mabitle (2013) do not distinguish between the expected and unexpected element of policy surprises. This paper uses a unique measure for repo rate surprise like Bernanke and Kuttner (2005). Furthermore, the use of a VAR technique helps to examine the bidirectional relationship between the stock market and monetary policy as with Mabitle (2013) however differs in a sense that the VAR is employed to explain the underlying factors driving the reaction of the stock market. The African studies above do not address this at a single country level, hence the need to fill this gap. It

[1] Ioannadis & Kontonikas 2006 focus on 13 OECD countries: Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Switzerland, United Kingdom, United States, Sweden. Spain and Finland

[2] The countries include: Botswana, Egypt, Ghana, Ivory Coast, Kenya, Mauritius, Morocco, Namibia, Nigeria, South Africa, Zambia and Zimbabwe

empirically examines the relationship between expected and unexpected monetary policy actions with the equity market.

The objectives of the paper seeks to contribute to existing literature in a number of ways. First, the paper analyses responses at an aggregate level and industry specific level, and examine industries in South Africa which are particularly sensitive to unanticipated monetary policy actions, which is also a unique addition of this paper relative to other African studies. This is important for investors who make investment decisions based on a balance of risks attached to a particular industry. Secondly, the sample period chosen (2005-2018) captures key macroeconomic events like the global financial crisis, local political unrest[3] and a recession, to name a few. These are key deteriorating factors which the monetary policy committee considers when making policy decisions. Moreover, the period captures a time when South Africa has firmly implemented Inflation Targeting as a monetary framework, ruling out any regulatory ambiguity that may arise when analysing different monetary frameworks. Further, with a stock market of R14bn as at January 2019 (Bloomberg, 2019), more than twice the value of GDP, the link between monetary policy and the stock market is important from a South African more so considering the fact that it is one of the leading stock markets in Africa.

The rest of the paper is structured as follows: Section 2 reviews the relevant literature and discusses the theory of monetary policy transmission and its impact on the stock market. Section 3 gives a brief overview of monetary policy in South Africa. Section 4 describes the data and methodology. Section 5 presents the results of the empirical study and Section 6 concludes.

2. Monetary policy and the stock market: theory and empirical evidence

Whilst the "ultimate objective" of monetary policy is expressed in terms of macroeconomic variables such as inflation, the influence of policy instruments may also have an indirect impact on the economy, through the stock market. Changes in stock prices affect the real economy by affecting firms' cost of capital and their capacity to raise new capital and invest, as well as through the wealth effect of stock prices on consumption and economic growth (Basistha & Kurov, 2008).

From a discounted cash flow (DCF) perspective, stock prices (P_t) are estimated as the present value of expected future cash flows from that asset, i.e. dividends (D_{t+j}), such that:

[3] Marikana Massacre (2012) and Nenegate (2016)

$$P_t = E_t\left[\sum_{j=1}^{K}\left(\frac{1}{1+R}\right)^{j} D_{t+j}\right] + E_t\left[\left(\frac{1}{1+R}\right)^{K} P_{t+k}\right] \quad (1)^4$$

Where: E_t is the conditional expectations operator based on information available to market participants at time *t*, *R* is the discount rate (assumed to be constant) and *t* is the investor's time horizon, and *K* is the holding period.

Under the standard transversality condition[5] as the investor's holding period, *K*, increases, the second term of equation (1) tends to zero as there are no rational stock price bubble therefore:

$$\lim_{K\to\infty} E_t\left[\left(\frac{1}{1+R}\right)^{K} P_{t+K}\right] = 0 \quad (2)$$

Leading to the familiar equity valuation model:

$$P_t = E_t\left[\sum_{j=1}^{K}\left(\frac{1}{1+R}\right)^{j} D_{t+j}\right] \quad (3)$$

Viewed in this way, monetary policy affects equity returns in two ways: either by altering the discount rate used by economic agents, or by influencing expectations of future economic activities, which consequently affect future cash flows (Ioannidis and Kontonikas, 2008).

A more restrictive monetary policy implies higher discount rates and lower future cash flows; therefore, increasing the repo rate should be associated with lower stock prices and vice versa (Thorbecke, 1997; Ioannidis & Kontonikas, 2008). Bernanke and Kuttner (2005) provide three broad reasons why an unexpected increase in the repo rate may lead to a decline in stock prices:

1. The policy shock may result in an increase in the future expected real interest rate used to discount dividends.
2. The policy shock may be associated with a decrease in expected future dividends.
3. The policy shock may increase the expected excess returns (equity premiums) associated with holding stocks.

Bernanke and Kuttner (2005) find through log linear approximation testing that the second and third explanations are the most relevant – somewhat surprisingly, the effect of the real interest rate is insignificant compared to the other factors, perhaps because of its relative stability or because it does not affect the cost of equity directly. This supports earlier findings by Jensen and Johnson (1995), who suggest that stock performance patterns (and therefore price) cannot be explained by

[4] See Ioannidis and Kontonikas (2008) for detailed explanation on the derivation

[5] Transversality conditions are optimality conditions often used along Euler equations to characterise the optimal paths of dynamic economic models (Kamihigashi, 2006)

interest rate movements. This is in contrast to Li and Hu (1998) who postulate that a more restrictive monetary policy emanating from a surprise increase in money supply leads to a decline in stock prices. This, they argue, is due to the policy anticipation effect (also known as the liquidity effect) which asserts that when the SARB unexpectedly increase money supply, they are in effect signalling a tighter monetary policy trajectory in the future as a way to offset the increase in money supply. Market participants thus expect higher interest rates and discount rates in the future.

In theory, an increase in the repo rate will result in an immediate increase in market interest rates which leads to a decrease in stock prices of firms listed on the exchange market (Kuttner, 2001). As Thornton (1986: 3) explains, the relationship between the repo rate and market interest rates is governed by the loanable funds theory which states that interest rates are "determined by the intersection of the demand for and supply of credit"(Thornton, 1986:3). Therefore, changes in the repo rate will affect market interest rates only to the extent that they alter the demand for and supply of credit by listed firms. However, some evidence from past studies does not support this theoretical postulation. As an example, Cook and Hahn (1989) as well as Roley and Sellon (1995) argue that the Federal funds rate[6] has little impact on market interest rates (see also Radecki and Reinhart, 1994; Edelberg and Marshall, 1996). This would suggest that monetary policy changes have no impact on market interest rates as suggested theoretically by Thornton (1986:3) and therefore cannot influence discount rates.

The study by Igelias (2011) support the theoretical assertions of Thornton (1986: 3) and also argues that the key avenue through which monetary policy may transfer to equity prices is through interest rates. Interest rates have a direct effect on the demand for loans. Higher interest rates imply a higher cost of borrowing which may dis-incentivise firms from borrowing to invest. If firms invest less, the present value of their future cash flows may decline which will cause a negative impact on equity prices and returns. On the other hand, Maio (2013) applied a vector autoregressive model on data from the US, over the period 1963 to 2008 and established rather, that the negative effect of federal funds rate shocks on stock returns is attributable to the corresponding negative effect on future expected cash flows, more than it is to changes in the discount rate.

Still on the interest debate, literature from African economies is scant. That said, Mabitle (2013) finds that there exists no long run relationship between the stock market and monetary policy South Africa, only a contemporaneous and dynamic short run relationship. This, they argue, emanates from innovations in the equity market which affects monetary policy decisions and vice

[6] In the United States, the federal funds rate is the rate at which banks and credit unions actively trade balances held at the Federal Reserve with each other on an uncollateralized basis (Bloomberg, 2015).

versa. Iddrisu et al (2017) employ a cross country approach and study how 12 African countries respond to monetary and macroeconomic news. Their findings show that stock markets in all 12 countries reacted positively to expansive monetary interventions. They emphasise that the influence on stock prices in all 12 countries occurred via the interest rate channel.

The debate surrounding which channel of influence monetary policy affects the most is a recurring theme found in this scope of literature. However, studies which conclude that there is no apparent link that exists do not distinguish between anticipated and unanticipated monetary policy interventions. Distinguishing between anticipated and unanticipated policy actions is therefore essential for discerning the effect of policy interventions on market interest rates. Estimating the response of equity prices to changes in monetary policy is complicated by the fact that the market is unlikely to respond to anticipated policy interventions. This implies that some effort needs to be applied to isolate the unanticipated policy action which can be reasonably expected to induce a market response. This also means that the market response is not limited to central bank surprise actions and will also respond to any changes in expectations regarding future policy. The unexpected policy action acts a proxy for convenient exogenous events which allows researchers to clearly ascertain the stock market's reaction to monetary intervention (Bernanke and Kuttner, 2005).

Kuttner (2001) was among the first to investigate the impact of expected and unexpected components of monetary policy on market interest rates. Using Federal funds futures data, over the period 1989 to 2000, the study found a strong relationship between surprise policy actions and market interest rates, whereas the response to anticipated interventions was small, if not non-existent. In a widely cited contribution, Bernanke and Kuttner (2005) adapt the work of Kuttner (2001) and investigate the observed market response to policy surprises, across both broad stock indices and industry portfolios. Using log-linear approximation, they decompose excess equity returns into components that can be attributed to news about changes in the real interest rate, dividends and future excess returns in the United States. They employ the Vector Autoregressive (VAR) methodology to attain proxies for the relevant expectations about the path that monetary policy will take. Their results show that the largest effects came from revisions to expectations of future excess returns and to expectations for future dividends. However, real interest rate, although significant in the model, had a negligible impact.

Thorbeke (1997) also studied how the federal monetary policy shocks affect equity prices in the United States using multiple methodologies. The author also employed the VAR methodology with impulse response and variance decomposition to analyse the causality between the federal

funds rate, monthly equity returns and growth in output. He finds that expansionary monetary policy (lowering interest rates) leads to a positive reaction from the stock market. Further, he established that monetary policy surprises, measured by orthogonalized innovations in the federal funds rate have a bigger impact on smaller capitalisation stocks. This affirms the hypothesis that monetary policy has an effect on the ability of firms to access credit.

The credit and interest rate channels of the monetary policy channel imply that listed firms that are highly encumbered financially are likely to be the hardest hit in a tighter monetary environment. This is because these firms are likely to be characterised by constrained financial ratios (example, low interest cover capacity, bad credit ratings, and low cash holdings) which will likely deteriorate further if monetary policy officials unexpectedly raise interest rates. While Balafas et al (2018) acknowledge the role of the aforementioned, they found no significant evidence proving that more financially constrained firms on the London Stock Exchange (LSE) were more responsive to monetary policy shocks in comparison to those firms who were relatively less encumbered and constrained.

They attribute this finding to the possibility that investors on the LSE do not consider the relationship between financial constraints and monetary policy interventions as a risk when making short run investment decisions. Moreover, the majority of the firms that were more encumbered were smaller cap firms, which have limited trading liquidity suggesting that their prices are slower to incorporate interest rate shocks. Furthermore, while theory suggests an inverse relationship between tighter monetary policy and stock prices, they found that the relationship became positive during the global financial crisis and when the interest rate environment was more restrictive. This corroborates findings by Fausch and Sigonius (2017).

However, in contrast to Igelias (2011) and Bernanke and Kuttner (2005), Thorbeke's results show that monetary policy shocks only account for a small proportion of equity price changes because equity prices respond with significant delay. Furthermore, Mann, Atra and Dowwen (2004) analysed the short term sensitivity of six international stock indices namely the S&P 500, Morgan Stanley Capital international (MSCI) European stock index, MSCI pacific stock index and three MSCI country stock (UK, Japan and Germany) indices to changes in the US discount rate and the federal funds rate from 1970 to 2001. Their findings echo Thorbeke (1997) and emphasise that not all monetary policy changes in all monetary operating periods induce changes in equity prices. This highlights the importance of acknowledging the diversity of economic environments suggesting that the magnitudes of the effect of shocks to monetary policy may be substantially different across economies (Iglesias, 2011).

Further to this, there is evidence that other dynamics may influence the extent to which the stock market reacts to unanticipated policy interventions, even in ways that contradict theoretical underpinnings. For example Marinescu et al (2017) suggest domestic equity market reactions in the US are determined by whether policy decisions at the time were rule based or discretionary. Rule based decisions emulated the Taylor formula from Taylor (1993)[7], which is a numerical equation and rule of thumb that connects the Federal Reserve Open Market Committee's (FOMC) target of the federal funds rate with the economy. Their results show that policy decisions that followed the Taylor Rule led to rational reactions by the S&P 500. On the other hand, discretionary decisions, which emerged in the year 2000 and is characterised by deviations from the Taylor rule, led to microeconomic inefficiencies, persistent inflation and was correlated with high investments in housing which ultimately enabled the 2008 global financial crisis.

However recent studies seem to strengthen the findings by Bernanke and Kuttner (2005). For example, Fausch and Sigonius (2017) find that the overall movement of excess returns from the Morgan Stanley Capital International (MSCI) German stock index is associated with revised expectations from economic agents regarding future dividends. Fausch and Sigonius (2017), also suggest that the prevailing interest rate regime in Europe influenced how German stock behaved towards policy action. They found that during periods of negative interest rates, unanticipated monetary tightening led to a decline in excess returns of the MSCI Germany. Kurov and Stan (2017) highlight an intertemporal rational expectations equilibrium model which shows that prevailing policy uncertainty within the market causes equity investors to overemphasise the severity of bad news during periods when they believe the economy is in a good condition. In contrast, during periods when economic agents believe that the economy is facing unfavourable circumstances, they tend to underemphasise the value of good news. This investor sentiment regarding uncertainty impacts the discount rate used to value stock prices. Their thesis asserts that the higher the presence of monetary policy uncertainty in the investment community, the higher the discount rate, and the more likely it becomes for stock prices to decline.

Broadly speaking, most researchers in this field of study utilise an event study methodology on daily data to their studies (see for example Bernanke and Kuttner, 2005; Zeng, 2010; Haitsma et al, 2015). There are two possible issues that arise from employing this method as highlighted by Zeng (2010). The first pertains to endogeneity, which is that monetary policy officials maybe making surprise policy interventions in response to stock market movements. The second pertains to the possibility of a joint response to news by both monetary officials and the stock

[7] See Bernanke (2015) for a more detailed explanation of the Taylor Formula.

market. Moreover, using an event study does not allow researchers to observe and compare changes in the stock market on event and non-event days and relied on survey and consensus expectations (from Bloomberg and Reuters) to measure the surprise element of policy rate changes (Rigobon and Sack, 2003). However, the method has evolved over time and significant effort has been exerted to improve the method including the way the surprise element is measured (Gurkanynak, 2002; Zettlemeyer, 2004; Kearns and Manners; 2006).

The endogeneity and joint response issue has somewhat been averted through the use of daily intraday data and shorter event study windows (Bernanke and Kuttner, 2005). Furthermore, Rigobon and Sack (2002) employ a heteroskedasticity based estimator of the surprise policy action to circumvent the endogeneity problem and yield a more consistent estimates of the stock market's reaction. As a result, an event study methodology is now still widely accepted in literature (Zeng, 2010). The VAR methodology is also widely employed by researchers (see for example Rigobon and Sack 2004; Mabitle, 2013; Fausch, 2018). The method is also susceptible to the issue of endogeneity, and not accounting for this in the model may result in biased empirical estimations (Rigobon and Sack, 2004).

Literature shows that there are a myriad of considerations when analysing the relationship between monetary policy and the stock market. These pertain to the reigning economic climate of a specific country and global economic dynamics which affect the direction and size of the stock market response, sometimes even in a way that disproves theory. The results from the developed world are plenty and diverse, making the corpus of research a reliable framework for a South African study. The next section describes the data and methodology employed by this paper.

3. Overview of how monetary policy has evolved in South Africa

Emerging market economies are increasingly gaining prominence in both international trade and finance. Financial and foreign exchange markets in these countries are becoming more sophisticated and international interest in their assets is evidenced by rising levels of volatility and exposure to external shocks. South Africa is testament to the aforementioned and is host to the Johannesburg Stock Exchange (JSE), which is the largest stock exchange on the African continent, and the 19th largest out of 79 stock exchanges in the world (JSE, 2018). The rand is a free floating currency which is commonly traded and as such, is sensitive to economic and political shocks. The country provides a rich context for analysing the impact of events on asset prices. With its historical landscape of close to five decades of racial segregation and the transition into a multi-racial

democracy, the country still faces a plethora of economic problems. Since this transition, there has been a number of monetary and political developments.

Table 1: Major Political Events in South Africa

Event Date (Month)	Event Name/Description
December 2002	ANC elective conference in Stellenbosch
April 2004	National elections
December 2007	ANC elective conference in Polokwane
September 2008	Recall of President Thabo Mbeki
April 2009	National elections
August 2012	Marikana Massacre
October 2012	Anglo American Platinum 12000 striking workers
December 2012	ANC elective conference Mangaung
May 2014	National elections
December 2015	Jacob Zuma axes Finance Minister Nhlanhla Nene
March 2017	Jacob Zuma axes Finance Minister Pravin Gordhan
December 2017	ANC Elective Conference Johannesburg - Cyril Ramaphosa becomes ANC President
February 2018	Jacob Zuma resigns as President, Cyril Ramaphosa becomes President of South Africa

Source: Bloomberg, Mpofu and Peters (2017)

Between 1960 and 1998, The South African Reserve Bank followed a wide range of monetary policy and complementary exchange rate frameworks. These varied from exchange rate targeting, discretionary monetary policy, monetary aggregate targeting and an eclectic approach (May et al, 2017). In February 2000, the South African Reserve Bank (SARB) adopted an inflation targeting (IT) monetary framework with the objective of achieving price stability in the interest of sustainable and balanced economic growth and development, in a credible and transparent manner. The SARB's inflation target has been 3 – 6 percent, which is a relatively more flexible than a point target framework. The SARB seeks to ensure that inflation is within the target band and will achieve this by adjusting the repurchase rate (repo rate). Inflation targeting allows the Monetary Policy Committee (MPC) to decide on an opposite monetary policy stance which the Governor of the SARB will communicate to the public on predetermined announcement dates. A Monetary Policy Committee was constituted before the formal adoption of the IT Framework, in line with global standards such that rate decisions are made objectively by a diverse and qualified constituency. Subsequent to every MPC meeting, the SARB will issue a statement with reasons for

their monetary policy stance, generally pertaining to why the SARB has decided to increase, decrease or make no change to the repo rate.

Table 2: Details of the SARB Monetary Policy Committee (MPC) Meetings

Years	Scheduled Meetings (per year)	Unscheduled Meetings (per year)
2004 - 2008	2 -3	0
2009	9	0
2010 - 2012	6	0
2013 - 2018	6	0

Source: Bloomberg, SARB, Mpofu and Peters (2017)

Table 2 above shows that the SARB decided on a varying number of meetings per year and finally agreed to keep the frequency of meeting to 6 per year. The total number of unscheduled meetings was 4 in a period of 16 years, and each unscheduled meeting was prompted by unexpected political events and extreme rand depreciation which posed significant risk to inflation expectations. Since our period of study is between 2005 and 2018, there are no unscheduled meetings in our data and thus reduces the risk of ambiguity and distortion in the results.

The SARB is responsible for managing overall liquidity in the market and building foreign denominated reserves and as such will participate in the foreign exchange market even though it does not explicitly target the exchange rate. Announcements of changes in the Repo rate have direct implications on the market (prime lending) rate which is linked to the stock market and have an impact on the exchange rate. Therefore, it is likely that monetary policy actions will have some bearing on the short term behaviour of the equity and foreign exchange markets (Mpofu and Peters, 2017).

The repo rate was established under the repurchase tender system of the SARB and was introduced in 1998, before the adoption of the IT Framework. The repo rate is the rate at which the central bank borrows money to commercial banks to meet daily liquidity shortages. Liquidity refers to credit balances that commercial banks have with the SARB that are available to settle interbank transactions in excess of the required statutory minimum reserves that they are required by law to hold. The SARB makes the repo rate effective and forces commercial banks to borrow large sums of money by draining excess liquidity and creating a shortage in liquidity through open market transactions using various instruments at their disposal like issuing its own debentures where market participants tender for the amounts and interest rates on SARB debentures, which are then

allocated in ascending order of the interest rates bid, until the amount on tender is fully subscribed (SARB, 2018). The bank will then refinance the liquidity shortage it created with repurchase agreement auctions where it purchases selected government bonds and other money market instruments from commercial banks in exchange for cash. The commercial banks pay the central bank borrowing rate for the cash they receive and at maturity return the cash to the bank in exchange for the instruments they previously sold to the bank at the auction which reverses the initial transaction. In the early stages, daily liquidity for this transaction was enabled by a variable repo rate which was determined in the market. In doing so, the market would signal what the underlying liquidity conditions were to the bank. Any changes to the repo rate signalled changes in market liquidity (May et al, 2017).

Since 1970, monetary policy in South Africa has developed gradually from a non-market based system with stringent direct controls to a fully market integrated system. Since the adoption of inflation targeting, inflation levels have been managed in a way that promotes business and does not hamper investment (Mabitle, 2013).

4. Data and Methodology

An event study approach is employed to measure the response of stock market returns, as with Bernanke and Kuttner (2005). The surprise element of monetary policy action is defined using monthly data spanning the years October 2005 – October 2018. Historical repo rate data is found on the official SARB website. All other data is collected from Bloomberg. Monthly data allows one to measure the surprise element at regular time intervals and is better suited for the VAR methodology that is also utilised in this paper (section 5.3) to assess the causes of the equity market's response.

Due to data availability, certain adjustments have been made that allow for an extension of their approach to the case of South Africa. Specifically, their analysis makes use of federal funds futures data in order to construct a measure of unexpected policy interventions. However, futures on the Repurchase rate (commonly known as the repo rate), which serve as the South African equivalent to the federal funds rate, are not traded on the Johannesburg Stock Exchange or any other regulated platform.

Despite this, 1 month futures on the Johannesburg Interbank Agreed Rate (JIBAR)[8] do exist and serve as a very good proxy for repo futures. As seen in Figure 1 below, the repo rate and the JIBAR

[8] JIBAR is a term that refers to the Johannesburg Interbank Agreed Rate. This is the rate that banks use in interbank credit agreements. JIBAR is quoted independently through the futures market on a daily basis and is a true market-

are closely aligned and any change in the repo is almost immediately adjusted for in the JIBAR. Ioannidis and Konotonikas (2006); Wang and Mayes (2012) also utilise futures as a proxy for the official policy rate.

The FTSE /JSE Africa All Share Index is used as a measure for stock market returns. The index is a free-float market-weighted index. Companies included in the index make up the top 99% of the market capitalization of all listed companies on the Johannesburg Stock Exchange (Bloomberg, 2019). This paper uses the JSE All Share Total Return index which assumes all dividends have been reinvested and are accounted for. Financials, Industrials and Resources[9] are equally weighted stocks of largest 25 companies listed in each industry respectively (JSE, 2019; Bloomberg, 2019). This paper adopts the method of Bernanke and Kuttner (2005) to examine the impact of monetary policy interventions (both expected and unexpected) on equity prices. A number of researchers adopt a similar approach (for example Wiranto, 2008; Fausch, 2018). Bernanke and Kuttner (2005) use both monthly and daily data in their study, however this paper only employs monthly data. The unanticipated change in monetary (Δi^u) in any given month can be formulated as below:

$$\Delta i^u = \frac{1}{M}\sum_{m=1}^{M} i_{t,m} - f^1_{t-1,M} \tag{5}$$

where $i_{t,m}$ is the repo rate on day *m* of the month *t*, $f^1_{t-1,M}$ represents the one month JIBAR futures contract rate on the last day (*M*) of the previous month (*t – 1)*. Bloomberg calculates the settlement price of a JIBAR futures contract as the average over a calendar month, with weekends and public holidays carrying over the last business day's rate. The above definition of the surprise element may cause the size of the policy surprise to be underestimated. This arises because equation 5 uses monthly data and may cause a time aggregation issue (See Bernanke and Kuttner, 2005). Consequently, for equation 5 to hold for the analysis, this paper has had to make some assumptions[10] about the days in which rate changes occurred. As a result, some discretion is required when interpreting the size of the surprise element.

determined rate. The 1 month JIBAR is often seen as an approximation by the market of what the Repo rate should average over the next month (West, 2008).

[9] Bloomberg reference: JFINX Index for Financials, JRESO Index for Resources and JASIN for Industrials

[10] The assumptions are as follows: (a) there are 30 days in a month. (b) no other macroeconomic news occurred on the same day that policy rates were announced

From the above, the expected component of the repo rate change can therefore be defined as the difference between the futures rate on the last day *(M)* of the previous month *(t-1)* and the repo rate on the last day *(M)* of the previous month *(t-1)*. This can be formally expressed as follows:

$$\Delta i^{e} = f^{1}_{t-1,M} - i_{t-1,M} \tag{6}$$

Since 2000, when the Reserve Bank announced that Monetary Policy in South Africa had adopted inflation targeting, changes in the Repo rate became increasingly transparent (Arora, 2007:11). The Monetary Policy Committee (MPC), which sets and reviews the Repo, began announcing its meeting timetable before the beginning of each year, allowing the public to be aware of the meeting dates well in advance (SARB, 2019). After 2000, an MPC statement was issued after every meeting through a press conference by the Governor of the Reserve Bank which was broadcast on national television (SARB, 2019). Due to the repo change being announced before the close of the futures market, it is likely that the closing futures price incorporates all the day's news regarding monetary policy.

Prior to 2000, however, changes in the Repo were not as easily observed by the general public, and were often only made available the day after the policy action. As our sample focuses on the period from 2005 to 2018, all timing ambiguity associated with rate changes is eliminated. The total number of observations in the sample is 154.

More formally, the regression is expressed as:

$$\Delta J_t = \alpha + \beta \Delta i_t + \varepsilon_t \tag{7}$$

Where ΔJ_t represents the change in the

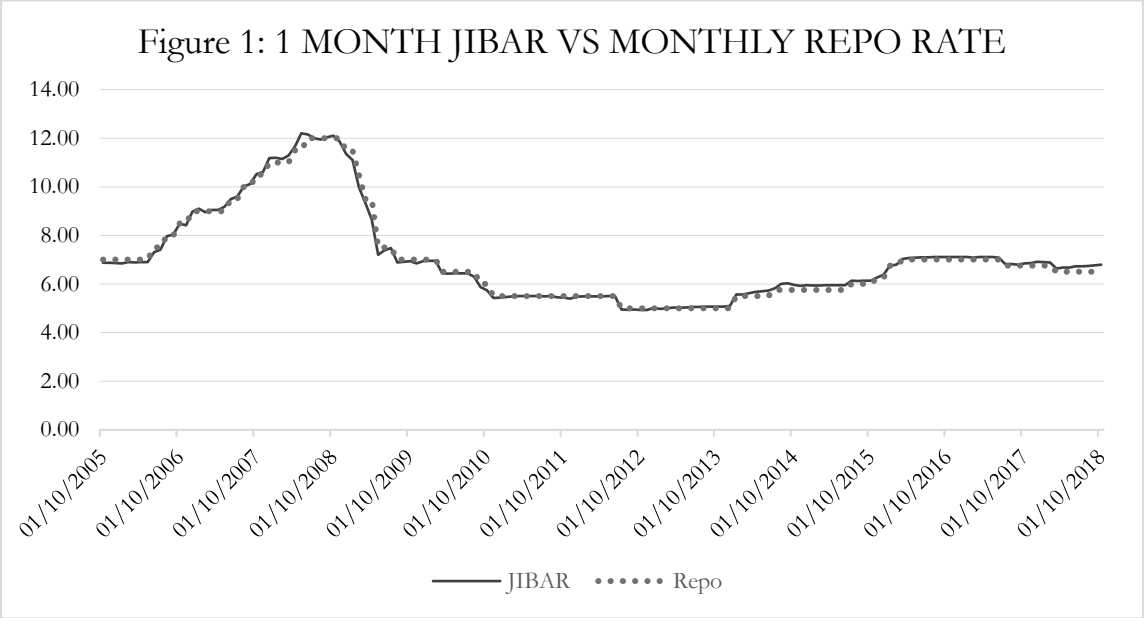
JSE All-Share total return at time *t*, and Δi_t is the change in the repo rate. On the other hand, the regression results in column (b) of Table 6 explicitly account for the expected and unexpected components of repo changes. This can be formally expressed as:

$$\Delta J_t = \alpha + \beta^{e} \Delta i^{e}_t + \beta^{u} \Delta i^{u}_t + \varepsilon_t \tag{8}$$

Where Δi^{e}_t and Δi^{u}_t are the expected and unexpected components respectively, as expressed in Equations 5 and 6 above. In Equations 7 and 8, ε_t is an error term accounting for other factors that affect equity returns other than Monetary Policy on days where interventions took place. As can be seen in Column (a) of Table 6, the response of the stock market to raw Repo changes confirms theory and shows a negative relationship between monetary policy and equity returns. However, the response is small and insignificant.

Figure 1: One month JIBAR compared to the SARB repo rate.

The figure below shows the movement of the one month JIBAR relative to the SARB repo rate over the period 2005 – 2018.



Source: Bloomberg, SARB

From a South African perspective, the link between monetary policy and financial markets has not been as extensively documented[11]. Data availability is frequently cited as a limitation, and often warrants a sceptical interpretation of results. This is not the first paper to use the JIBAR as a proxy for the repo rate, for example Ballim and Moolman (2005), use 3 month JIBAR daily futures data to investigate whether market traders accurately predict interest rate changes by the SARB before each Monetary Policy Committee (MPC) meeting. However, to evaluate expectations, shorter duration futures contracts are arguably more appropriate. If the MPC meetings are approximately 6-weekly (SARB, 2019), the 3 month futures contract effectively incorporates expectations of two meetings, and thereby does not accurately depict the market's expectation of a given policy intervention.

To this end, by using shorter duration futures contract, this paper seeks to more evidently isolate the unexpected component of policy interventions. As Jarocinski and Karadi (2018) state, to measure the causal effect of monetary policy, it becomes necessary to control for the variation in economic fundamentals that the policy rate endogenously responds to. Further to this, using central bank announcements potentially eliminates the problem of endogeneity and more closely

[11] The few studies available include Gupta and Reid (2012) who investigate the sensitivity of stock market returns to monetary and macroeconomic shocks. Other South African studies like Mpofu and Peters (2017) and Roussow et al (2017) focus on the foreign exchange market and how it responds to unanticipated monetary policy interventions.

captures the impact of monetary policy on real activity and prices (Gertler and Karadi, 2015; Nakumura and Steinsson, 2013). Moreover, providing an economic explanation (established using a VAR technique) for the observed response of the market improves on existing South African literature which has largely documented the response (or lack thereof), but provides a limited explanation for why the market moves.[12]

Descriptive Data

Table 3 below displays a summary of statistics for a sample of Index Returns for the JSE All Share, Financials, Resources and Industrials. It also includes a summary of the repo rate and the 1 month JIBAR, which is the proxy for the repo rate employed in this paper.

Table 3: Descriptive Data

	Mean	Median	Max	Min	SD*	JB**	Pr	Obs
JIBAR	0.07	0.06	0.12	0.04	0.02	46.69	0.00	154
FINANCIALS	10.08	10.07	10.75	0.01	0.89	70456.23	0.00	154
INDUSTRIALS	2.30	2.31	2.38	-0.003	0.19	126540.9	0.00	154
ALL SHARE	10.32	10.37	10.94	0.03	0.92	66232.97	0.00	154
RESOURCES	9.33	10.13	10.60	0.00	2.72	638.74	0.00	154
REPO RATE	0.07	0.06	0.12	0.05	0.02	43.86	0.00	154
UNEXPECTED	0.00001	-0.00001	0.00020	-0.00040	0.00007	182.09	0.00	154
EXPECTED	0.00030	0.00030	0.00070	-0.00900	0.00156	469.62	0.00	154

Note: Monthly Equity Returns are measured in Rand Terms. All returns are the first difference of the natural log of the Index.

*denotes Standard Deviation ** denotes Jarque Bera Test for Normality

The mean monthly equity returns at a disaggregated level are higher for the financial and resource indexes. Average returns in the industrials sector are well below other sectors and the All Share index in general. The outperformance of the resource sector relative to Industrials can be attributed to the commodity price super cycle which persisted from mid-2000 and peaked in 2008. Commodity prices (energy, metals and agriculture) rose tremendously over the period. For

[12] Investigating **why** the South African market moves when it does not anticipate a change in the Repo is frequently cited as an area demanding further research (see for example Arora 2007; Aron and Muellbauer 2007).

example Brent crude oil reached highs of $133 per barrel (up 94% from the year before) and nominal prices for energy and metals surged 230% (Baffes and Haniotes, 2010). The industrials underperformed the market on average over the period mainly because of the sector's cyclicality and investor sentiment weighing it down (Nelissen, 2018; Dash and Mahakud; 2013). Results from the Jaque-Bera test indicate the Index Returns are non-normal, an unsurprising characteristic of equity returns.

Short term interest rate variables and spreads have long been key areas of interest for researchers and policy makers (Li and Hu, 1998). Any change in the short term interest rate is a signal for the path that monetary policy officials are embarking on. The average short term interest rate (JIBAR futures) in South Africa during the period was 7%. The variation of interest rates was substantially lower than it was for equity prices, highlighting the volatile and risky nature of stock returns (the standard deviations of 0.02 and 0.92 respectively). The Jarque-Bera test for interest rates also highlights non-normality.

Table 3 also highlights that Resource and Financial stocks are more volatile than Industrials stocks. Volatility describes the price variance of a stock from its lowest to its highest point over time (Hecht, 2018). The standard deviation for Resources is 2.72, which is higher than the market standard deviation of 0.92. Financials have a standard deviation of 0.89, which is relatively aligned to the JSE All Share Index. The JIBAR and Repo rate have very little price variance (the standard deviations of 0.04 and 0.05 respectively) when compared to the equity market highlighting the higher risk attached to equity investments (Ioannidis and Kontonikas, 2006).

The Augmented Dickey-Fuller test (David Dickey and Wayne Fuller, 1979) and the Phillip Perron test are common tests researchers employ when conducting stationarity testing (Wooldridge, 2013). The null hypothesis postulates that a series contains a unit root. Unit root testing is a critical step in any time series empirical analysis because it enables the researcher to establish if shocks to the series have had transitionary or permanent effects (Nielsen, 2005). In addition, regressing two series that are non-stationary and contain unit roots increases the likelihood of obtaining a spurious regression (Washington, 2014).

The Phillips-Perron (PP) tests are advantageous over the Augmented Dickey Fuller (ADF) test because they correct for serial correlation and are robust against heteroscedasticity. In addition, performing PP tests over ADF means it is not a requirement to specify lag length (Qiu, 2019). However for robustness, both tests were performed on all variables. The first round of the test includes trend and intercept in level form which showed that all variables besides the "expected" and "unexpected" contained unit roots and were non-stationary. The second round of test was

performed on the JALSH, Financials, Industrials and Resources in first difference (including the intercept). The Table 4 below shows PP and ADF results for the series. The results show that after the variables have been first differenced, one can reject the null hypothesis at 95% confidence level, and conclude that the series is stationary.

Table 4: Unit Root Test

	Phillips Perron				Augmented Dickey Fuller				
Variables	Coefficient	Test Statistic	Standard Error	P Value	Integrated	Coefficient	Test Statistic	Standard Error	P Value
JALSH	(1.08)	(13.10)	0.08	0.00	I(2)	(1.07)	(13.01)	0.08	0.00
Expected	(1.49)	(20.69)	0.07	0.00	I(0)	(1.38)	(13.20)	0.11	0.00
Unexpected	(1.65)	(26.41)	0.06	0.00	I(0)	(0.76)	(6.03)	0.13	0.00
Financials	(1.01)	(12.21)	0.08	0.00	I(1)	(1.00)	(12.24)	0.08	0.00
Industrials	(1.00)	(12.18)	0.08	0.00	I(1)	(1.00)	(12.21)	0.08	0.00
Resources	(1.01)	(12.33)	0.08	0.00	I(1)	(0.09)	(3.72)	0.02	0.00

In addition, the variables JALSH, Financials, Industrials and Resources were log transformed to improve skewness and ideally ensure that the relationship between monetary policy and the stock market is linear.

Table 5: Monetary Policy and Returns

	SARB Monetary Policy 2005 - 2018
Number of Expansionary periods	10
Total number of Expansionary months	115
Average All Share Return during expansionary periods	-0.01
Number of Restrictive periods	15
Total number of Restrictive months	138
Average All Share Return during restrictive periods	-0.04

Note: An expansive (restrictive) policy stance is defined as the most recent decrease (increase) of the repo rate.

Table 5 shows that during the sample period, the MPC adopted more restrictive interventions than expansionary ones[13]. The MPC considers international developments (oil price, exchange rate and growth prospects) as well as domestic factors (current and forecasted levels inflation and growth

[13] Table 9 in the Appendix shows a detailed list of all the dates that the monetary policy committee made changes to the policy rate

expectations) when deciding which stance to take on monetary policy. The average return from the All Share Index was -0.01% during expansionary periods and -0.04% during restrictive periods. While average returns are generally flat, this shows that equity price returns were marginally lower during restrictive periods relative to expansionary periods.

5. Results

5.1. Baseline Specification Results

Table 6 below reports the baseline estimates of equity returns' response to monetary policy interventions. The results displayed in column (a) are based on a time series regression of the JSE All-Share return on repo rate changes, where the expected and unexpected components of the intervention are *not* accounted for.

Table 6: Dependent Variable: All-Share Return (ΔJ_t)

The table reports the results from regressions on the All-Share returns on changes in the Repo rate. Column (a) reports results where no distinction is made between expected and unexpected policy interventions whereas column (equation 7) (b) reports results where this distinction is explicitly controlled for (equation 8). Estimates of coefficients and t-ratios are robust to residual heteroscedasticity and auto-correlation.

	Dependent Variable: All-Share Return (ΔJ_t)	
	Coefficient	
	(a)	(b)
Intercept	**9.63**	**-0.445** (1.416)
Repo Change	**-0.371** (7.62)	-
Expected Change	-	**1.212*** (0.473)
Unexpected Change	-	**-2.710*** (2.15063)
R^2	**0.03**	**0.04**

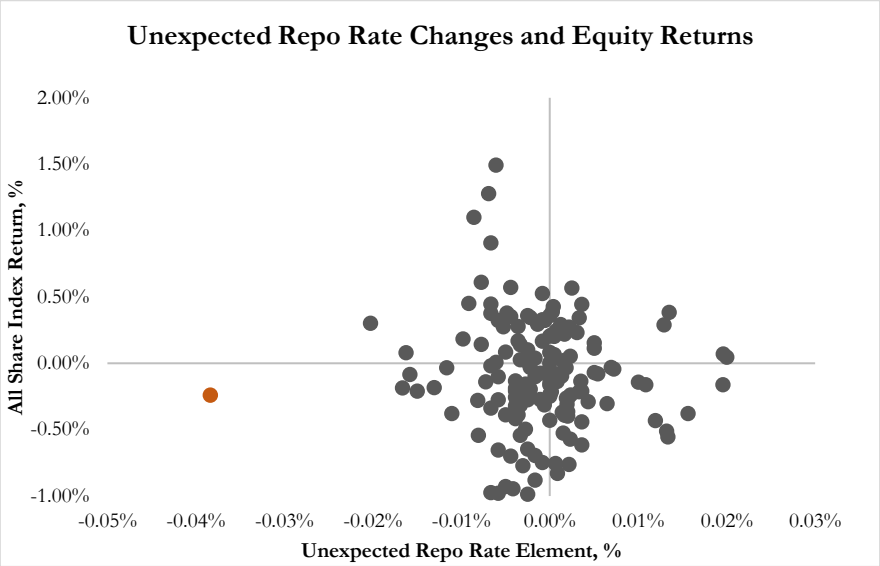
(a) and (b): Equity Market: Number of observations: 154 (monthly data), period: October 2005 – October 2018. Driscoll and Kraay standard errors reported in parenthesis
*Significant at the 10% level

When the Repo rate changes are decomposed into their expected and unexpected components, the stock market reaction is seen to change. Specifically, the market's reaction to the unexpected intervention is negative and highly significant (t stat >2). The results imply that a 1% surprise rate increase is estimated to reduce stock market returns by 2.7%. The direction of the results is consistent with earlier findings by Ioannidis and Kontonikas (2006); Bernanke and Kuttner (2005); and reinforce Keynesian Transmission Mechanism. This mechanism asserts that restrictive

(expansive) monetary policy changes decreases (increases) expected returns in the stock market. The reported R^2 for column (b) implies that 4% of the volatility in stock market prices in the month where rates were unexpectedly adjusted could be attributable to monetary policy interventions. Reserve Bank policy action therefore accounts for a negligible portion of the volatility in stock market reinforcing the rationale that stock market alpha is by and large determined by firm specific factors.

Figure 2: Unanticipated Repo Rate and All Share Index Returns using monthly data

The figure below is a scatterplot of the monthly JSE All Share Index Returns compared to changes in the repo rate for the sample of 154 months.



The scatterplot exhibits the slight negative relationship between the JSE All Share Index returns and surprise repo rate changes. Figure 2 also highlights one notable outlier. This data point is found in May 2009, which was during national elections when Jacob Zuma was elected as President of South Africa. The SARB made no changes to the repo rate (see table 9 in the appendix) and the JSE All Share was up 6.5% during the month (Bloomberg, 2019). Bernanke and Kuttner (2005) found that excluding outliers did not significantly modify their results. The outlier does not change our results and is thus included in this paper's analysis.

5.2. Extended Specification: Industry Analysis Results

So far the paper has focussed on the responses of broad market-level indexes; however, it will now examine the responses at a more disaggregated level. As such, we will now isolate the equity price responses of all major industry-level indexes. This is an interesting exercise given that each of these portfolios has a different underlying risk profile (assigning each profile with a unique market beta in the Capital Asset Pricing Model (CAPM).

Table 7

Dependent Variable: 1 Day All-Share Return (ΔJ_t)

This table shows the results from time series regressions of 1 month industry portfolio returns (described in the row headings) on the expected and unexpected components of the 1 month average change in the Repo rate. All values are expressed in percentage form, The full sample comprises of 154 policy actions observations over the period October 2005 to October 2018. Driskoll and Kraay standard errors are displayed in parenthesis. Estimates of coefficients and t-ratios are robust to residual heteroscedasticity and auto-correlation.

	Coefficient		
	Expected	**Unexpected**	**R^2**
Oil and Gas	- 3.612**	- 1.204	0.26
	(1.236)	(1.24)	
Basic materials	- 0.396	0.421	0.04
	(0.602)	(0 .359)	
Industrials	- 0.533	- 3.33**	0.097
	(0.389)	(0.65)	
Consumer Goods	0.249	- 2.20**	0.40
	(0.511)	(0.117)	
Health Care	- 0.205	- 3.27**	0.34
	(0.502)	(1.180)	
Consumer Services	- 0.091	- 0.05	0.04
	(0.711)	(1.62)	
Telecommunications	- 0.839	- 4.01**	0.48
	(0.982)	(1.712)	
Utilities	0.563	- 2.10**	0.36
	(0.418)	(0.55)	
Financials	0.076	- 2.94**	0.45
	(0.55)	(0.73)	
Technologies	0.042	- 1.038	0.13
	(0.416)	(1.10)	

* p<0.05; ** p<0.01

Table 7 above reports the estimates of each industry's response to the expected and unexpected changes in the repo rate. Akin to Bernanke's findings, consumer services and basic materials industries were the least responsive to the policy changes. Interestingly, the technology industry does not react as strongly as would usually be anticipated (coefficient is both small and insignificant). The South African telecommunications industry appears to have the largest adverse response to the unanticipated policy changes with a 1% surprise rate cut estimated to reduce technology stock returns by approximately 4%, a finding largely consistent with that of Bernanke and Kuttner (2005). The industrial and consumer goods industry portfolios are also seen to react strongly to unanticipated changes in the Repo, with a 1% surprise rate cut estimated to reduce industry returns by 3.33% and 2.2% respectively.

These discrepancies in industry responsiveness can largely be explained by the inherent differences in the systematic risk associated with investment projects within each industry (Gilbertson, 2008). As explained by Gilbertson (2008), industries with larger market betas assume a higher risk premium. As such, the return volatility for these industries are exacerbated by unexpected repo rate changes. These differential return volatilities are therefore suggestive of certain industries being more vulnerable to unfavourable adjustments in official monetary policy.

5.3. Economic Estimations underpinning stock market responses

This paper has until this point measured and discussed the reaction of equity markets in South Africa to surprise monetary policy actions. An important contribution of this paper is to also establish the economic reasons that explain the observed reaction. In section 2, the paper mentioned three broad reasons why equity markets respond negatively to surprise policy tightening as highlighted by Bernanke and Kuttner (2005). They are worth echoing again:

a) The decline in stock prices may be attributed to a cut in expected future dividends
b) Tightening may lead to an increase in the rate used to discount the dividends
c) A rise in interest rates may lead to an increase the equity premium/excess return associated with investing in equities

This paper employs a structured approach, very similar to Campbell and Ammer (1991: 1993) and improved by Bernanke and Kuttner (2005). Campbell and Ammer (1991: 1993) used log linear estimations to categorise equity premiums (excess returns) in order to ascertain which returns are attributable to news relating to real interest rates, dividends and future excess returns. The authors then employ a VAR methodology to attain proxies for the relevant expectations. This paper derives the surprise element of monetary policy from the use of one month JIBAR futures which serves as a robust proxy for news regarding the path of monetary in South Africa as with Bernanke & Kuttner (2005). The surprise policy action variable allows us to estimate the impact that surprise policy actions have on future expected dividends, interest rates and expected future excess returns which is an improvement to the Campbell and Ammer (1991: 1993) framework.

The linearization model presented by Campbell and Ammer (1993) is presented below:

$$u_{t+1}^{y} = e_{t+1}^{*d} - e_{t+1}^{*r} - e_{t+1}^{*y} \quad (9)$$

The variable of interest is the log excess return (expressed as y_{t+1}) on equities and can be defined as the total return of equities (gross of dividends), less the risk free rate.[14] The returns over period *t+1* can be estimated over period *t* which is essentially from the start of time *t* to the start of time *t+1*. The variable u_{t+1}^{y} denotes the unexpected excess return at time *t*. The unexpected excess return is the difference between expectations at time *t* and *t+1* (i.e. r_{t+1} - $E_t r_{t+1}$). The "es" in equation 9 represent revised expectations between period *t* and *t+1* and the asterisk (*) represents a discounted sum in order that:

$$e_{t+1}^{*d} = (E_{t+1} - E_t) \sum_{k=0}^{\infty} \delta^k \Delta d_{t+1+k} \quad (10)$$

$$e_{t+1}^{*r} = (E_{t+1} - E_t) \sum_{k=0}^{\infty} \delta^k r_{t+1+k} \quad (11)$$

$$e_{t+1}^{*y} = (E_{t+1} - E_t) \sum_{k=0}^{\infty} \delta^k y_{t+1+k} \quad (12)$$

The factor δ represents a steady state ratio of the stock price to the stock price *plus* dividends and is predetermined at 0.9962 (Campbell, 1991; Bernanke and Kuttner, 2005). Equation 9 is essentially a mathematical relation of current excess returns to revisions in expectations about dividends, interest rates and future excess returns. Furthermore, for simplicity, this paper implements a VAR to model the expectations denoted in equation 10 -12 using only excess returns, interest rates, and future excess returns and no other indicators[15].

An important consideration is that the VAR does not include dividends explicitly as a variable to be estimated (just the revised expectation thereof). While it possible in principle to forecast in the VAR, it proves difficult practically as dividends are highly seasonal and the process is non-stationary (unit root close to 1) (Bernanke and Kuttner, 2005). As far as the VAR underestimates the explanatory power of excess returns, classifying dividends as a residual may result in the model ascribing "too much" of the return variability to dividends (Bernanke and Kuttner, 2005).

[14]This paper uses the 10 year SA Bond yield as a proxy for the risk free rate.

[15] To implement the categorization/ decomposition of excess returns, equations 10 -12 require empirical proxies for all the expectations denoted. Campbell (1991:1993) utilise the VAR approach using variables like excess returns and real interest rates, including other indicators that would be considered in forecasting. For example Bernanke and Kuttner (2005) use the relative bill rate, dividend price ratio, and the yield spread between the 1 month and 10 year treasury bonds.

Table 8: Results from VAR decomposition

This table shows the effect of unexpected monetary actions on the JSE's All Share current excess returns, future excess returns, interest rates and dividends. For simplicity, this paper utilises a VAR with 4 variables to build interest rate and excess return forecasts and is estimated over the full sample of the years 2005 – 2018.

	Sub Sample: 154 observations used for VAR analysis
	2005 – 2018
Current Excess Returns	-21.84 (-2.0371)*
Future Excess Returns	5.94 (2.9561)*
Interest Rates	11.38 (2.5699)*
Dividends	-4.52 (-2.8451)*

Data Source: Bloomberg. Calculations by author. *Significant at 10% level. Standard errors are reported in parenthesis.

Table 8 reports results from the VAR estimation. The results show that in South Africa, contrary to the United States (see Jensen and Johnson, 1995; Bernanke and Kuttner, 2005: Maio, 2013) and Germany (Fausch, 2018), all three economic reasons that could plausibly explain equity market reaction to policy changes are large and significant. Interestingly, news regarding the discount rate accounts for a sizeable and significant portion of current excess returns (total share over 50%). See section 2 for a theoretical explanation of the relationship between interest rates and the discount rate. This reinforces findings by Li and Hu (1998) who argue that the response is justified by the liquidity effect. When stock market participants perceive monetary policy to be tighter than expected, their response (through equity prices) is larger and stronger.

This can be attributed to the different interest rate regimes and geographical nuances prevailing within each financial market (Fausch and Sigonius, 2017). The USA and Europe have implemented similar monetary policy interventions (example quantitative easing), while South Africa's interest rates were never negative during the sample period and remained relatively higher. Moreover, revisions of future excess returns and dividends account for just over 27% and 20% of the response of current excess returns respectively.

6. Conclusion

This paper has examined the relationship between stock market returns with monetary conditions in South Africa. Theoretically, it was identified that monetary policy actions impact stock prices through two channels of influence, namely (a) the discount rate and or (b) future expected cash flows. Based on the aforementioned theoretical considerations, it established that in South Africa, the equity market will respond strongly to unexpected monetary policy interventions using one month JIBAR futures as a proxy for policy expectations. The results show that a 1% surprise hike leads the JSE All Share index to decline by 2.71%. The result is significant and robust.

Furthermore, it is shown that the reaction of different industries is heterogeneous. Some industries like technology, telecommunications and commodities display a higher sensitivity to changes in the policy rate. Finally, a VAR technique was utilised to decompose the response of stock returns. The results show that current excess returns in the equity market were attributable to revisions in future dividends, interest rates and future excess returns. This result differs somewhat to some literature, particularly that news on the discount rate has a sizeable and significant impact on excess returns. However, the difference in the results highlights an important consideration – stock market responses are strongly influenced by the prevailing interest rate regime. Interestingly, the SARB implemented more restrictive policy actions that expansionary ones during the sample period, explaining the strong reaction of equity markets to unexpected monetary policy.

Such a relationship has crucial implications for both monetary policy authorities and market participants. For the former, understanding transmission channels for policy action is key and for the latter, the relationship is an important consideration for stock price valuations, portfolio formations and asset allocations. Although the aim of monetary policy is to somewhat influence real macroeconomic variables such as inflation, output and employment (Bernanke and Kuttner, 2005), central bankers and stock market participants should be aware of the relationship outlined above so that the effects of policy shifts can be better understood (Ioannidis and Kontonikas, 2008).

Another important implication for the SARB is whether or not it should respond to stock price movements: one argument is that monetary policymakers should change the repo rate to reduce overall macroeconomic volatility caused by developing stock price bubbles. However, another approach is for monetary authorities to wait for a stock price reversal, and if it happens, to react tentatively if there are implications for inflation and output stability (Ioannidis and Kontonikas,

2008). The evidence of cyclical variation having an effect on the influence of monetary policy on stock prices and foreign exchange returns should also be taken into account by monetary authorities who may want to react with a lighter hand during recessions to try to ensure overall market stability (Basistha and Kurov, 2008). Taking into account the differential effect by industry in the South African context, the SARB may want to consider the effects of repo rate changes on industries fundamental to South Africa's employment capability and general economic growth.

Lastly, there is sufficient scope to improve on this study. Firstly, one can employ a longer time period to compare how the stock market behaved under different interest rate regimes in South Africa. Moreover, one can also simultaneously study the effects of monetary policy and other political and macroeconomic news on the stock market. This would improve the robustness of the VAR analysis which would contain more variables and thus further account for the endogeneity problem.

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Appendix

TABLE 9

Monetary Policy Events 2005 - 2018

Table 9 displays all changes the MPC and their corresponding dates, made during the sample. The text in red highlights restrictive stances while the green highlights expansionary stances. The table highlights that the MPC have been more restrictive over the sample period.

Date	Repo Rate	Change in Policy	Date	Repo Rate	Change in Policy
10/02/2005	7%	No	20/01/2011		No
14/04/2005		No	24/03/2011		No
9/06/2005		No	21/07/2011		No
11/08/2005		No	19/01/2012		No
13/10/2005		No	24/05/2012		No
8/12/2005		No	19/07/2012	5%	Yes: 50bp
2/2/2006		No	20/09/2012		No
13/04/2006		No	22/11/2012		No
8/06/2006	7,50%	Yes:50bp	24/01/2013		No
3/08/2006	8,00%	Yes:50bp	18/07/2013		No
12/10/2006	8,50%	Yes:50bp	22/05/2013		No
15/02/2007		No	22/05/2014		No
12/04/2007		No	17/07/2014	5,75%	Yes: 25bp
16/08/2007	10,00%	Yes: 50bp	20/11/2014		No
11/10/2007	10,50%	Yes: 50bp	20/07/2017	6,75%	Yes:25bp
10/04/2008	11,50%	Yes: 50bp	20/09/2018		No
12/06/2008	12%	Yes: 50bp			
14/08/2008		No			
11/12/2008	11,50%	Yes: 50bp			
22/09/2009		No			
13/05/2010		No			
22/07/2010		No			
09/09/2010	6%	Yes: 50bp			
18/11/2010	5,5%	Yes: 50bp			

List of Figures

Figure 1

One month JIBAR compared to the SARB repo rate.

The figure below shows the movement of the one month JIBAR relative to the SARB repo rate over the period 2005 – 2018.

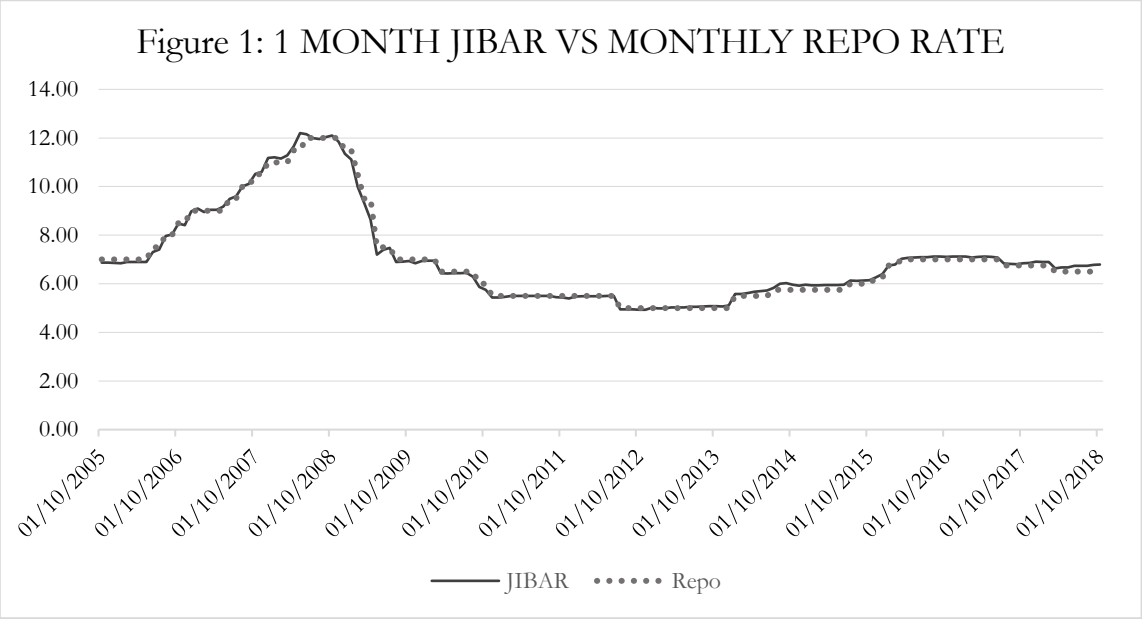
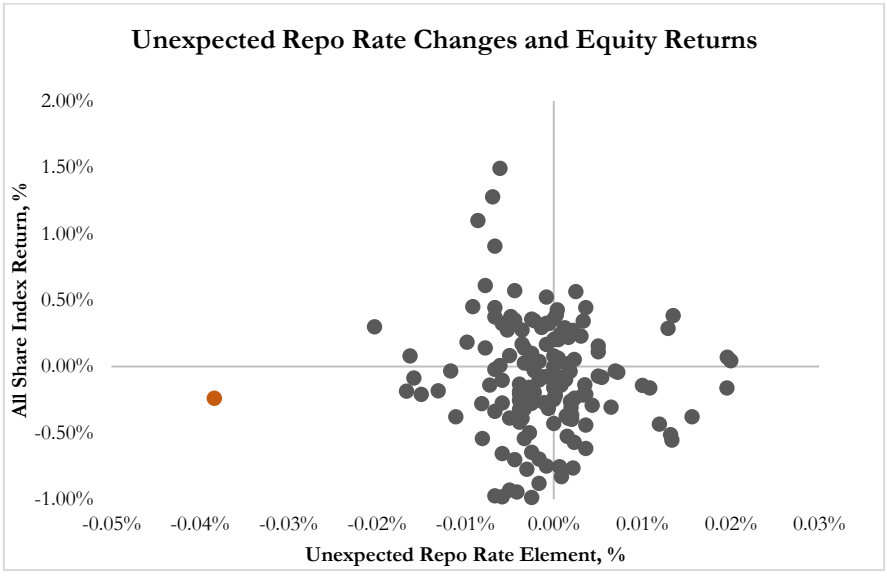


Figure 2: Unanticipated Repo Rate and All Share Index Returns using monthly data

The figure below is a scatterplot of the monthly JSE All Share Index Returns compared to changes in the repo rate for the sample of 154 months.



Results from various Time Series Tests

1. Auto Correlation Test (Excluding Industry Analysis)

Auto Correlation

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Sample: 2005M10 2018M10
Included observations: 154

Lags	**LM-Stat**		
1	7.575859	**Prob**	
2	15.25091	0.5774	First Lag sufficient
Probs from chi-square with 9 df.		0.0843	

2. Auto Correlation Test (Including Industry)

Auto Correlation *

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Sample: 2005M10 2018M10
Included observations: 154

Lags	**LM-Stat**		
1	18.88609	**Prob**	
2	27.58831		0.8025
3	16.10723		0.3272
Probs from chi-square with 25 df.			0.9116