

Are monetary policy regimes optimal?

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A research project submitted to the Gordon Institute of Business Science, University of Pretoria, in partial fulfilment of the requirements for the degree of Master of Business Administration.

6 November 2017

Abstract

The primary aim of monetary policy decisions made by central banks is to keep inflation low and, in doing so, to protect the currency. There have been multiple methods in which developed and developing economies have gone about this endeavour. Literature presented in the research provides evidence that inflation targeting appears to be more optimal than non-inflation targeting regimes.

The South African experience shows periods of high inflation in the late 1970's and 1980's. This leads us to believe that monetary policy was perhaps not implemented as optimally as it could have been. With this in mind, and based on the assumption on that central banks act optimally (Mishkin, 2017), the research applies the Taylor Rule and regression testing to determine whether the decisions made by the South African Reserve Bank were optimal. The research finds that over the period of 1960 to 2016, during which South Africa went through four different monetary policy regimes as well as a change of government and reintegration to the international community, monetary policy was implemented optimally.

Keywords

Monetary Policy, Taylor Rule, South African Reserve Bank

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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Abbreviations

Federal Open Market Committee (FOMC)

Federal Reserve Bank of America (The Fed)

Gross Domestic Product (GDP)

Global Financial Crisis (GFC)

International Monetary Fund (IMF)

Monetary Policy Committee (MPC)

M2 plus longer term time deposits (M3)

Organisation for Economic Cooperation and Development (OECD)

Quantitative Easing (QE)

South African Reserve Bank (SARB)

United States Dollar (USD)

Chapter 1 – Introduction to Research Problem

1.1 Research Title

Are monetary policy regimes optimal?

South Africa has been through multiple monetary policy changes from the 1960s to present. Catering for the transition period between the cost of cash reserves system to the initial repo rate system, which then evolved into fully fledged inflation targeting, there were four major monetary policy regime changes from the 1960s to 2000. The study looks at the period from 1960 to 2016.

The works of Clarida, Gali and Gertler (2000) and Taylor (2000) provide evidence that shows how changes to a country's monetary policy regime can impact macroeconomic volatility. The aim of this research is to determine how interest rates, predominantly, and inflation – both macroeconomic variables – were impacted, and whether the policies in place at specific times were the most optimal, given the interaction between interest rates and inflation. Monetary policy's primary goal is price stability (Mishkin, 2017). Today, this means keeping the exchange rate stable and competitive. Given that the role of the central bank is to maintain price stability, the management of inflation is the key metric by which the effectiveness of monetary policy is most often judged. In countries that are full inflation targeters or implied inflation targeters, this is predominantly done by manipulating the base interest rate. Countries that do not adopt inflation targeting may decide to pursue monetary targets or a fixed exchange rate. In South Africa's case, the repo rate is the base interest rate by which the South African Reserve Bank (SARB) applies its monetary policy decisions.

The assumption that central banks pursue price stability is further elaborated upon in the literature review. Mishkin (2017) gives reason to accept the assumption of price stability as a reasonable one. Currently, the main aim of most central banks around the world when applying monetary policy, is price stability. There are indeed some central banks that do target other economic measures. However, as per Loayza and Schmidt-

Hebbel (2002), the priority of most central banks is price stability and this is stipulated in the central bank laws in most countries.

How central banks go about achieving this is still a widely debated topic. Modern-day central banks use the policy tool of interest rate manipulation to control inflation. There is a general positive relationship between inflation and interest rates as illustrated by the Fisher Equation (Carvalho & Nechio, 2014). While the relationship varies from country to country, the general consensus is that when the economy is overheating, causing inflation to increase, central banks will tend to increase interest rates in an attempt to bring inflation within a level that is in line with the policy limits of the said country's central bank.

As previously stated, South Africa has been through numerous monetary policy regime changes from the 1960's to 2000. The four monetary policy regimes will be explained later in detail. The first and fourth regimes managed inflation effectively Rossouw and Padayachee (2008), as inflation was relatively low during the time periods of these two regimes. The second and third policy regimes appear to have been ineffective at managing inflation, given the excessively high levels of inflation and subsequent high interest rates during this period. However, what if the interest rates – or management of policy by way of interest rates – provided by the South African Reserve Bank, were in fact the best the reserve bank could do? What if not? How would we go about investigating this and how would the research show this? Could it be that that the policy rates in the first and fourth regimes were, in fact, not as effective as they could have been?

Since its introduction, the Taylor Rule has been a popular means of gauging the effectiveness of monetary policy (Taylor, 1993) both in developing and developed economies. The idea of the research is to describe the interpolated interest rate using the econometric model developed by John B. Taylor in 1993, named eloquently after him as The Taylor Rule, against that of each monetary policy regime, to determine whether the interest rate for the time period was in fact the best decision the Reserve Bank could have taken (Hofman and Bogdanova, 2012). The Taylor Rule has been shown to describe the short-term interest rate function which determines the benchmark interest rate. This will be explained in detail in the literature review.

Based on these policies and the subsequent interest rates applied, the research will investigate – through the application of the Taylor Rule – whether interest rates calculated by the rule does describe interest rate function in emerging markets and further, whether actual interest rates applied were in fact optimal.

The Taylor Rule is a simple rule developed by famed economist John Taylor. The rule is prescriptive in nature and its intended purpose is to describe the interest rate decisions of the Federal Reserve (The Fed) Bank of America’s Federal Open Market Committee (FOMC). The Taylor Rule was first introduced in 1993. The rule and its applicability to emerging markets are discussed in detail through the literature review.

1.2 What evidence verifies the identification of the problem?

A general study of monetary policy in the South African context will describe the interest rate and inflationary environment over time. The period of study for this research is from 1960 to 2016. A look into this time frame, broken down into the four major regimes, will evidence the interest rate and inflationary environment of the specific monetary policy regime.

Regime 1 – Liquid Asset-Based Ratio, 1960 - 1980

An investigation in to the first of the four monetary policy regimes in terms of the interest rate environment, reveals that interest rates fluctuated between 4% and 8% over the period.

Regime 2 – Mixed System, 1981 - 1985

An investigation in to the second of the four monetary policy regimes reveals that interest rates fluctuated between 4% and 22% over the period.

Regime 3 – Cash-based Reserve, 1985 - 1999

An investigation in to the third of the four monetary policy regimes reveals that interest rates fluctuated between 15% and 22% over the period

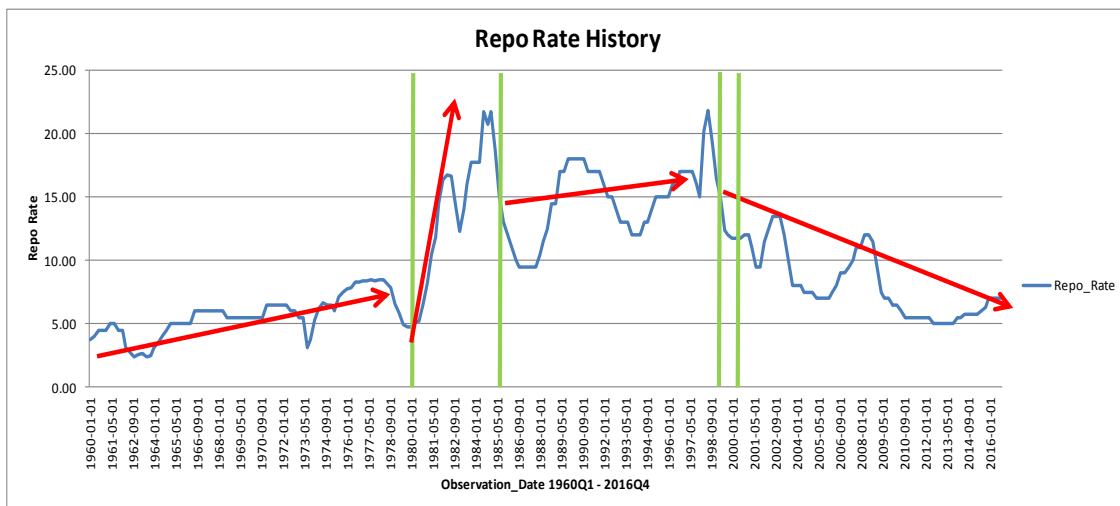
Regime 4 – Inflation Targeting, 2000 - present

An investigation in to the fourth of the four monetary policy regimes reveals that

interest rates fluctuated between 6% and 12% over the period

The results are summarised in Figure 1, below, which illustrates the interest rates during the various time periods and monetary policy regimes. The evidence shows that from 1960 to 1980, during the first monetary policy regime, interest rates were fairly stable yet upward sloping. The second phase, from 1981 to 1985, shows elevated spikes in interest rates. Phase three, from 1985 to 1999, shows vast swings and volatility, with interest rates falling from about 22% to just under 10%, and then back up near the 20% mark. The last phase, which is the beginning phase of Inflation Targeting, shows interest rates declining from the 15% mark to around 6%; the overall trend shows a decline in interest rates during this period.

Figure 1: History of Central Bank rates for South Africa



Source: Author's own calculations adapted from 'Central Bank Rates for South Africa' by Federal Reserve Bank of St.Louis (2017)

It is important to reflect on the socio-political environment within the country at the time. South Africa was expelled from the international community by way of sanctions due to the continuation of the Apartheid system and the imprisonment of Nelson Mandela. Further to this, the country was forced to refinance its debt with the International Monetary Fund (IMF) and other institutions. This led to what is commonly known as the 'debt standstill'. These are just a couple of the socio-political events that occurred during the time frame of the research. Using this socio-political background, we seek to

understand whether the interest rate decisions at the time were the best under the circumstances.

As mentioned above, the South African economy has undergone numerous changes to its monetary policy. Given that the Taylor Rule has been shown to predict what central banks adopt in terms of interest rate changes in developed economies, there is reason to determine whether the rule holds for developing economies such as South Africa. Aron and Muellbauer (2000) explore this topic, though the study looks only at monetary policy prior to inflation targeting. Their study, furthermore, changed the weights of the coefficients of the Taylor Rule. This proposed study will take the rule as is, as described in the literature review, but it will also look further back than the study by Aron and Muellbauer (2000).

The interpolation of the interest rate will be calculated using the Taylor Rule method. The Taylor Rule has been a topic of much scrutiny and study since its inception in 1993. Studies have been able to show that the policy actions taken by The Fed and other central banks in developed countries can be predicted by the rule. The rule has in general been able to approximate interest rates of The Fed as shown by former Fed chairman Dr Ben Bernanke see (Bernanke, 2015).

Rossouw and Padayachee (2008) provide insight into the monetary policy frameworks of the South African Reserve Bank. The paper provides insights into South Africa's experience with inflation from the perspective of a central bank over an extended period of time. It provides the necessary insights into monetary policy and the decision making process for the actions taken at the time.

Bold and Chatterjee (2016) find evidence supporting the accuracy of the Taylor Rule in describing the monetary policy reaction function for many countries, including South Africa.

Jonsson (2001) provides insights into South Africa's monetary policy regimes over time – from 1970 all the way up to the year 2000. Further, the study investigates relationships between inflation, money demand and purchasing power in South Africa. A working paper from the SARB by De Jager, Johnston and Steinbach (2015), shows an adapted Taylor Rule model for the period stretching from the first quarter of 2000 to

the fourth quarter of 2003.

1.3 What is the relevance of the topic?

South Africa has underwent four major monetary policy regime changes from the 1960's to 2000, when what we know as Inflation Targeting was first adopted. The study will look at the time period from 1960 to 2016. Over the 56-year horizon, interest rates moved from as low as 5% to as high as 26%. Intriguing, is the relationship between interest rates and inflation, a relationship illustrated by the Fisher Rule. During these four monetary policy regimes, do we know whether the policies were optimal? Mishkin (2017) provides evidence that central banks act in the interest of providing the most optimal monetary policy, an assumption that is explained in detail in the literature review. The Taylor Rule extrapolates an interest rate based on the relationship between inflation and Gross Domestic Product (GDP). Given this, if monetary policy can be shown to follow this in general, it illustrates that the central bank has been prudent in its mandate of maintaining price stability based on the inputs of inflation and GDP.

The research will attempt to investigate whether the four monetary policy regimes that South Africa has been through were optimal through the use of the Taylor Rule as a proxy of optimal monetary policy. The literature shows that the Taylor Rule both linear and nonlinear models are efficient in tracking central bank decisions in both developing and developed nations, as such if the rule tracks the decisions of the South African central bank we can show that the monetary policy applied at a specific time was in fact optimal.

1.4 Business need for the study

The Taylor Rule is a useful tool in understanding the decision making surrounding interest rates by central banks. This is not limited to central banks only, but applies to businesses and consumers as well. Why would this be important for parties other than central banks? Changes to interest rates impact the financing decisions of firms and consumers.

The rationale is fairly straightforward. Interest rates impact the cost of funding to all commercial banks. So, how does this impact the banks and how would it impact businesses? South African banks go through a weekly repo process every Wednesday, whereby they tender for available liquidity. Some banks tender for more and others for less, depending on their needs. Through this process, the SARB has its finger on the pulse in terms of the need for funding by banks, which is as an extension of the need for financing for all South Africans.

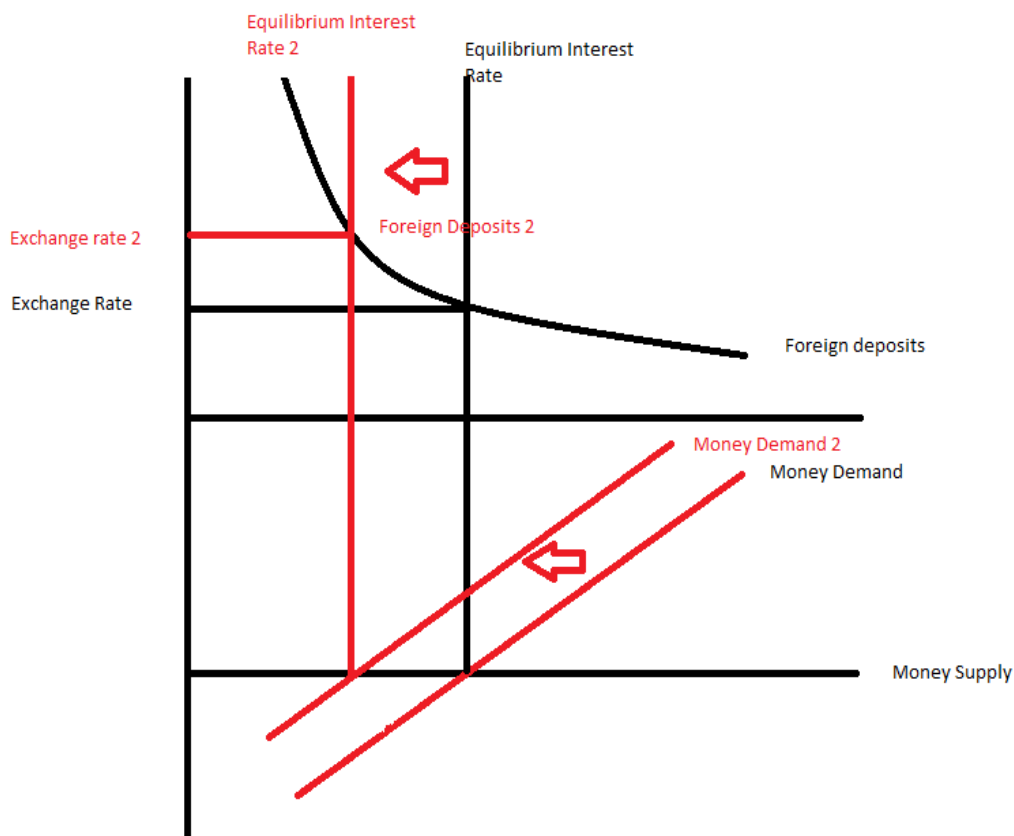
Should the repo process go through multiple episodes of being oversubscribed, the signal to the SARB is that the banks are in need of additional funding. The response to multiple oversubscriptions, as well as other economic variables that push inflation up, increases the likelihood of an increase in the repo rate, the rate at which commercial banks tender for liquidity from the SARB. The general response from commercial banks to an increase in the repo rate, is to pass this increase on to customers who have borrowed from the bank, while applying the benefit to those who have deposited money with the bank.

The main source of a bank's funding is from customer deposits, on which a rate of interest is paid to the customer. The bank uses these funds to loan to those customers who are in need of finance. The difference between what the bank pays on deposits versus what it receives on advances, is how a bank realises a profit. This increase in the overall cost of funding eventually makes its way through to borrowers by way of the monetary transmission mechanism, which is explained in detail in the literature review. In light of this, businesses that have large capital expenditure financed through the bank, should be prudent enough to risk-manage their businesses by determining the interest rate path, as this impacts the profitability and sustainability of their businesses directly.

From an economic perspective, based on an assumption that monetary supply is constant, changes in money demand and the interaction with money supply, would determine the equilibrium interest rate (see Figure 2, below). The interest rate subsequently has an impact on the rate of interest on foreign deposits in local currency, as well as the exchange rate.

A move in money demand from 'Money Demand' to 'Money Demand 2' illustrates the knock on impact of an interest rate change. The decrease in money demand illustrated in Figure 2, shows that the interest rate decreases, which subsequently has an impact on foreign deposits in local currency, as the rate of return is not as high as it was. Subsequently, the exchange rate weakens as foreign depositors pull their money out of the country, dumping Rands into the market and hence depreciating the currency. This simple illustration shows the impact that changes in interest rates can have for foreign investment, an important contributor to the struggling South African economy.

Figure 2: Illustration of the impact of a change in Central Bank rates



Above was a brief rationalisation of the need to understand interest rates and their impact on business as well as consumers. This question still remains: how do businesses and consumers easily, readily, and fairly accurately, determine the probable interest rate path?

Predominantly, the Taylor Rule uses historical data to determine whether the rule has applicability in approximating an interest rate path similar to the central bank, based on the inputs of GDP and inflation. In doing so, and with addition of a variety of variables and forecasting tools, the rule can be used to predict the future interest rate decision path of central banks. This is of particular interest to commercial, retail and investment banks as well as large corporates, all of whom can use the model to determine funding requirements into the future. This research sets out to determine the applicability of the rule through multiple regime changes in a developing economy, from a theoretical perspective.

Financial analysts from a wide variety of financial institutions use the Taylor Rule or similar models to attempt to predict the short-term interest rate decisions of the central bank. Further, analysts use the rule to determine whether monetary policy is good or not. It would be useful to determine the interest rate path using the rule and plotting the path against the actual inflation target path, as this would inform analysts whether the monetary stance taken by the central bank had in fact been working or not. The proposed research will test this theory. Bloomberg, the financial analysis tool, has many derivatives of the Taylor Rule.

1.5 Theoretical need for the study

As stated above, Aron and Muellbauer (2000) provide a similar analysis over the period just prior to inflation targeting in South Africa. Their research also calculates different coefficients for the input of GDP and inflation. This study will investigate monetary policy in South Africa from 1960 all the way through to what we know today as inflation targeting. For the sake of simplicity, it will keep the coefficients as stated in the original rule.

Literature within the realm of monetary policy regime switching, and discussions around whether the switches from one to another have been optimal in terms of controlling inflation, is both comprehensive and diverse. The bulk of the literature looks at countries that investigate the move to inflation targeting from other monetary policy regimes, such as exchange rate and other macroeconomic targeting.

Presently, the resounding view of the literature presented in this research is that the move to inflation targeting from non-inflation targeting monetary policy, has provided benefits in terms of lowering both inflation and inflation volatility. This view is presented predominantly in developing countries rather than developed countries. The literature shows that when studies were controlled for selection and timing biases, the impacts of the move to an inflation targeting monetary policy regime were not as sizeable as they were in developing countries. There are a number of reasons for this, the most notable of which centres around the credibility of central banks. Inflation targeting relies heavily on objectivity and the standardisation of an inflation target, hence the move to inflation targeting in developed countries may prove to be efficient, predominantly because of the credibility impact that the correct implementation of the policy brings. Furthermore, most developed countries do not suffer the social, economic and political disturbances that developing countries do. Add to this that developing countries are more resource intensive, so macroeconomic factors such as commodity prices do impact developing countries more so than developed countries.

Current literature looks at the movement from non-inflation targeting to inflation targeting monetary policy in emerging economies to determine whether the move has had positive impacts on the monetary environment of the countries in question. Based on the results detailed in the literature review, the move has proved to be beneficial for developing countries. This is highlighted in the research of Aizenman, Hutchison and Noy (2001), as well as (Mishkin and Schmidt-Hebbel, 2007). Mishkin and Schmidt-Hebbel (2007) note that the performance of monetary policy, when assessed through the lens of inflation and the output gap, can be explained by the Taylor Rule.

The purpose of this study is to ascertain, from a theoretical point of view, through the use of the Taylor Rule, whether the four monetary policy regimes that South African went through, were optimal.

The Taylor Rule has been, and still is, a widely researched and used economic tool to determine the short-term interest rate decisions of central banks. Originally developed by Taylor using data specific to the American market, the rule proved that it is indeed useful in showing what the interest rate path should be, based on the interaction

between inflation, GDP and potential GDP. Taylor, through his work in 1993, showed that the rule accurately depicted the interest rate path of The Fed. This led to a whole host of studies to determine whether the rule would be applicable to other countries, both developed and developing. Questions were raised as to whether the rule would be applicable in its standard form or whether manipulations to the rule would need to be made in order to be able to predict the interest rate path of a central bank.

Studies by Beju and Cuipac-Ulici (2015), and Moura and Carvalho (2010), show through investigation, that the Taylor Rule is applicable for use in emerging markets both in terms of the linear and non-linear versions of the rule. The literature presented later in this research shows evidence, through a number of studies, that the Taylor Rule is applicable in depicting central banking decisions regarding interest rates. Table 1, below, shows the monetary policy regimes that South Africa has been through. As mentioned earlier, the change to the Repo System from 1998 to 1999 is excluded from the total analysis.

Based on this literature, the research will attempt to show whether South Africa's four regime changes from the 1960's to 2000 have been optimal. Theoretically, the period of inflation targeting should show improvements in inflation management through the manipulation of the interest rate; however, given South Africa's diverse history and re-entry into global financial markets, this remains to be seen.

Table 1: Monetary policy regimes in South Africa

Years	Monetary Policy Regime
1960 – 1981	Liquid asset ratio based system with quantitative controls on interest rates and credit
1981 – 1985	Mixed system during transition
1985 – 1998	Cost of cash reserves based system with pre-announced monetary targets
1998 – 1999	Daily tenders of liquidity through repurchase transactions plus pre-announced M3 targets and informal targets for core inflation (Eclectic Mix)
2000 – current	Formal inflation targeting

Source: Adapted from “South Africa’s monetary policy framework,” by Casteleijn (2001)

The structure of the research will take the following path:

Chapter 2 provides a view of literature on monetary policy regime changes as well as the applicability of the Taylor Rule as an effective proxy by which to ascertain the decisions of optimal monetary policy. Chapter 3 introduces the research question of the study, followed by chapter 4 which illustrates the methodology of the research. Chapter 5 presents the results of the study, while chapter 6 elaborates on these results. Chapter 7 presents a conclusion, as well as recommendations and suggestions for future research.

Chapter 2 – Literature review

Chapter 1 introduced the theme of the research as an investigation into whether monetary policy regimes in South Africa from the 1960's up until today, have been optimal. The central assumption relied upon by the research, is that the South African Reserve Bank made the best possible decisions at the time, in the given monetary policy regime it implemented at each stage. To provide prudence that the assumption is rational, we refer to Mishkin (2017), who elaborates on the nine basic scientific principles of monetary policy. Two in particular stand out and support the assumption that central banks act in the interest of protecting the currency and keeping inflation down. Mishkin states that prior to the Global Financial Crisis (GFC), almost all central banks' monetary policies were guided by nine basic principles. The two that stand out to support the assumption of this research are as follows:

Inflation is always and everywhere a monetary phenomenon (Friedman,1963). This is derived from Milton Friedman's classic work in 1963 which implies that the ultimate source of inflation is excessive expansionary monetary policy. The second point relates to the importance of price stability, which relates to the point above in that it implies that central banks have the ability to control inflation and should keep it low and stable. Therefore, based on the two principles mentioned above, the assumption that the South African central bank acted in the best interest of optimal monetary policy, is a rational one.

It is the purpose of this research to determine whether the four monetary policy regimes have, in fact, been optimal. As mentioned in the first chapter, the proxy by which to determine whether the monetary policy regimes have in fact been optimal, is by making use of the Taylor Rule. The rule essentially uses GDP and inflation data to construct an interest rate path. Studies have shown that the rule does track monetary policy regime decisions as they relate to interest rates in developed and developing economies. Mishkin (2017) points out that the Taylor principle is necessary for price stability. The principle shows that inflation will be stable if monetary policy raises interest rates by more than the subsequent rise in inflation. This then leads to real interest rate increases in a response to real inflation.

The literature review will show evidence that monetary policy regimes are not all optimal – and this finding is the starting point of the research. The literature review will then present proof of the efficacy of the Taylor Rule as a tool for calculating the interest rate path of the central bank.

Evidence relating to monetary policy regime switching and subsequent performance, will be followed by an introduction to the Taylor Rule. Literature on monetary policy regime switching is explored in order to provide a lens on the performance of the respective policies in emerging and developed economies. The Taylor Rule and its relevance in developed and developing markets, followed by a history of the four monetary policy regimes implemented in South Africa – including a section on the transmission mechanism, as this plays a vital role in how monetary policy influences consumers – will be explored in this chapter.

2.1 Evidence of monetary policy regime switching and subsequent performance

Inflation targeting has slowly and surely become the operating monetary policy of central banks around the world. By mid-2008, the majority of the Organisation for Economic Cooperation and Development (OECD) countries had adopted inflation targeting (Aizenman, Hutchison and Noy, 2011).

The premise of this research is to determine whether South Africa's four monetary policy regimes were, in fact, optimal. There is recent literature which shows that inflation targeting countries adopt and maintain the policy framework due to it being perceived as successful in keeping a stable and low inflationary environment.

Mishkin and Schmidt-Hebbell (2007) found that inflation targeting shows greater success in developed economies than developing economies. However, the before-and-after inflation targeting reductions in inflation in emerging markets cannot be ignored. The IMF presented a study in which 13 emerging market economies were surveyed. The countries had all adopted inflation targeting as the monetary policy regime of choice. The study also took into account 29 other countries which followed monetary policy regimes other than inflation targeting. The study found that inflation

targeting countries showed a 4.8% reduction in inflation relative to other monetary policy strategies. Gonclaves and Salles (2008), Lin and Ye (2009), as well as De Mello (2008) all found similar results to the IMF study. De Mello and Moccerro (2011) found similar evidence in the study compiled on data from Brazil, Chile, Colombia and Mexico.

It is with these results in mind, that a reminder of the purpose of this study is reiterated. Given the results of the studies mentioned above, the research will attempt to determine – through application of the Taylor Rule – whether the monetary policy regimes implemented at particular times in South Africa were in fact optimal. As can be seen from the evidence provided above, in which South Africa was included, inflation targeting appears to have been a positive addition to the monetary policy tools in the Reserve Bank's hands.

It must be noted that inflation targeting is not the be all and end all of monetary policy regimes. Dueker and Fisher (2006) found no discernible difference between inflation targeting and non-inflation targeting countries in terms of management of monetary policy. Mishkin (2017) made mention of the time consistency problem, which arises when monetary policy is evaluated on a day-to-day basis, accounting for stresses as and as they arise, instead of taking a long-term outlook on inflation. This time inconsistency problem is one reason why inflation targeting, especially in emerging economies, appeared to be more optimal than non-inflation targeting. However, that does not mean that non-inflation targeters do not commit to other monetary policy metrics.

A study done by Aizenman, Hutchison and Noy (2011), showed that GDP growth is almost the same in non-inflation targeting countries as it is in inflation targeting countries. However, in inflation targeting countries, inflation is almost half of that of non-inflation targeting countries. The study found that the average level of nominal inflation in inflation targeting countries is 3.7% less than non-inflation targeting countries. This may very well be attributed to higher short-term interest rates in inflation targeting regimes as a proactive measure to directly attack inflation. The raising and decreasing of interest rates is an important consideration and, in light of this, the transmission mechanism will be discussed later in the literature review. The

transmission mechanism has critical involvement in the dissemination of the respective interest rate decisions made by a central bank. Typically, it takes between 18 and 24 months for an interest rate decision to be fully diffused into the economy.

The study by Aizenman, Hutchison and Noy (2011) found that for every one percentage point increase in inflation, the interest rate would increase by between 1.4 and 1.7 percentage points for inflation targeting regimes, compared to 0.15 and 0.58 in non-inflation targeting regimes. Whether this means that inflation targeting is more aggressive in attacking inflation, or whether non-inflation targeting regimes assess the inflationary environment in a less dramatic fashion, is yet to be seen. The point of this research is to determine whether the monetary policy regimes of South Africa from 1960 to 2016 are and were, in fact, optimal.

All central banks – whether employers of inflation targeting or non-inflation targeting – respond to real exchange rates in setting interest rates. This again supports the fact that the mandate of most central banks is to protect the value of the currency. Real exchange rate responses are smaller in inflation targeting regimes than in non-inflation targeting regimes. This could be due to the fact that monetary policy actions are constrained by the commitment to the policy target. Critical to this study, is the emphasis of external considerations on monetary policy. External consideration should play a major role in monetary policy, especially for commodity sensitive emerging market economies such as South Africa. The reason for this is that countries like South Africa have been identified as being vulnerable to terms-of-trade shocks as well as aggressive moves in foreign currencies. The point of external consideration is mentioned here as a precursor to the socio-political events during the 1970's and 1980's, such as the debt standstill and economic sanctions. Both of these events had huge impacts on the South African economy and cannot be ignored when discussing the monetary policy regimes and subsequent policy administration at these specific times. This will be discussed in detail later in the literature.

Ball's (2010) research provides similar evidence. The study looked at the performance of monetary policy regimes over a 25 year period. This included emerging and developed economies, as well as monetary union blocs such as the European Union. The choice of monetary policy is still a hotly contested debate, with discretionary policy

and the now commonly-adopted inflation targeting regime, having advocates on their side. Of particular interest to this research, is the focus of Ball (2010) on core macroeconomic variables such as output, inflation and interest rates. These are the exact inputs into the Taylor Rule.

The research conducted by Ball (2010) finds evidence that inflation targeting in developed economies does not provide major improvements in the management of inflation. However, there is substantial evidence that inflation targeting reduces average inflation in developing economies. Economists in favour of inflation targeting argue that the implementation of the policy solidifies the approach towards inflation, and also anchors the expectations of inflation, thereby making it easier to manage. Ben Bernanke, the former chairman of the Federal Reserve of America, holds that inflation targeting increases accountability in policy-making and in doing so, establishes a more efficient and optimal monetary policy regime (Bernanke, Laubach, Mishkin & Posen, 1999). There is, however, a contradictory voice in the argument, with sceptics arguing that the implementation of inflation targeting comes with the cost of a more volatile output, as illustrated by (Kohn, 2005).

Ball (2010) illustrated that most of the work done on advanced economies with regards to inflation targeting, revealed similar results in that the impacts were weak. However, once again, the evidence was clearer when the study investigated the impacts on emerging economies. Walsh (2009) indicated that inflation targeting is not as impactful on inflation for developed economies, but its implementation in emerging economies does matter.

Ball (2010) extended the research by looking into the long-run and short-run implications of the impacts of inflation targeting. The results for short-run expectation are summarised by the work of Johnson (2002). In Johnson's (2002) research, 11 countries were examined and the results of countries that did and did not implement inflation targeting, were compared. The research revealed that in the short-term, expected inflation fell quicker for inflation targeters than it did for non-inflation targeters, adding impetus to the credibility of inflation targeting as an optimal monetary policy regime.

In the long run, inflation expectations are close to the target, even if the actual inflation rate is not. Studies by Gurkaynak, Levin and Swanson (2008) revealed that news has a significant impact on expectation in countries that are not inflation targeters; however, the same is not true for inflation targeting countries such as Chile and Canada.

Dueker and Fisher (2006, p.431) asked “whether inflation targets impart an aversion to inflation and inflation variability among inflation targeting countries above and beyond that displayed by non-inflation targeting countries”. They provided evidence in their research against the pro-inflation targeting theory, arguing that even though the topic of inflation targeting enjoys considerable understanding, there is little evidence, or rather empirical evidence that showed inflation targeting as a monetary policy regime outperforming non-inflation targeters. Dueker and Fisher (2006) presented what appears to be evidence in favour of non-inflation targeting monetary policy regimes.

Dueker and Fisher (2006) pointed out in their research that one of the seminal issues when comparing inflation targeting to non-inflation targeting is the issue of noting the date of implementation or initiation of a policy of inflation targeting. The Dueker and Fisher (2006) article showed that authors in favour of inflation targeting set the adoption dates earlier. One such example is Australia’s adoption date, per Ball and Sheridan (2005), which stated the adoption date as quarter one of 1994, whereas the central bank of Australia announced the date as 1993. This is critical, as one of the pillars on which inflation targeting stands, is the announcement, communication and objectivity of an inflation target. If the dates were set earlier, does that imply that central banks were targeting inflation before the official announcement?

Another weakness in the comparison of inflation targeters to non-inflation targeters is that the conclusions are based on point estimates. There is no study, as Dueker and Fisher (2006) pointed out, that provides confidence bands to test if a central bank initiated a move sooner or decreased inflation dramatically more than another central bank.

Dueker and Fisher (2006) made reference to emerging markets inflation targeting versus non-inflation targeting. They also concluded that literature does suggest that the impacts are more favourable for industrialised countries; their methodology, however,

excludes the use of emerging market economies.

The study by Dueker and Fisher (2006) investigated empirical studies from evidence gained through survey data, on output, inflation persistence and changes in central bank reaction functions. The results of the study presented a varied view, at best, with some countries showing a gradual improvement in inflation performance in targeting countries. However, the study does maintain that it is hard to find convincing evidence to show that inflation targeting monetary policy regimes perform better than non-inflation targeting neighbours.

Evidence presented by Bernanke, Laubach, Mishkin and Posen (1999) showed that, through a decade of investigation, non-inflation targeting strategies performed well and had similar characteristics to inflation targeting countries.

Goncalves and Salles (2008) compared targeters and non-targeters in developing countries, the purpose of which was to determine whether inflation targeting provided a more beneficial response to inflation than non-inflation targeting countries. Literature has provided alleged gains for inflation targeting with regards to lower inflation and interest rates and more stable growth. However, is inflation targeting or other monetary policy regime really the best option of monetary policy?

A study by Ball and Sheridan (2005) provided evidence on 20 Organisation for Economic Cooperation and Development (OECD) developed countries. The results of the study showed a greater reduction in both inflation and variability in inflation for targeters than for non targeters. However, when the study was controlled for mean reversion, this benefit diminished. Ball and Sheridan (2005) argued that the drop in inflation experienced by those countries adopting inflation targeting, is simply based on the fact that they experienced initial higher inflation, in other words, they started from a high base. An interesting point, however, is that the developed countries that adopted inflation targeting did not suffer from political instability, severe inflation or other destabilising macroeconomic or socio-political events, hence the impact when compared to emerging market economies seems muted.

Goncalves and Salles (2008) adopted the idea from Ball and Sheridan (2005) and

applied the test to 36 emerging economies, 13 of which implemented inflation targeting. The time span of the study was from 1980 to 2005. The study investigated changes in inflation variability, growth and average inflation, to determine whether changes in these metrics were beneficial depending on whether the countries in question adopted inflation targeting or non-inflation targeting monetary policies.

The results of the study as they pertain to inflation, are summarised in Table 2 below.

Table 2: Inflation data Pre and Post Inflation Targeting

Inflation data				
Country	Adoption Year	Initial Inflation	Final Inflation	Fall
Brazil	1999	8.7	7.9	-0.8
Chile	1991	21.8	7.2	-14.6
Colombia	2000	22.8	6.9	-15.9
Czech Republic	1998	3.8	3.5	-0.3
Hungary	2001	15.6	5.9	-9.7
Israel	1992	17.2	6.1	-11.1
Mexico	1999	21.8	7.2	-14.6
Peru	1994	48.6	6.6	-42
Phillipines	2002	11.3	5.0	-6.3
Poland	1999	22.8	4.5	-18.3
South Africa	2000	12.3	5.2	-7.1
Thailand	2000	5.4	2.2	-3.2
South Korea	1998	7.4	3.4	-4.0
Targeters mean	1998	17	5.5	-11.5
Argentina	-	7.3	6.4	-0.9
Bulgaria	-	4.5	7.3	2.8
China	-	8	0.6	-7.4
Costa Rica	-	19.3	11.0	-8.3
Cote d'Ivoire	-	6.3	3.0	-3.3
Dominican Republic	-	17.9	9.2	-8.7
Ecuador	-	30.2	16.6	-13.6
Egypt	-	15.3	5.1	-10.2
El Salvador	-	16	2.7	-13.3
India	-	9.4	5.2	-4.2
Indonesia	-	9	10.2	1.2
Lebanon	-	14.6	1.3	-13.3
Malaysia	-	3.6	2.3	-1.3
Morocco	-	6.5	1.6	-4.9
Nigeria	-	18.5	12.8	-5.7
Pakistan	-	8.9	5.1	-3.8
Panama	-	2.3	1.1	-1.2
Tunisia	-	7.2	2.7	-4.5
Turkey	-	37.9	21.7	-16.2
Uruguay	-	33.9	9.4	-24.5
Venezuela	-	24.3	22.4	-1.9
Singapore	-	2.6	0.5	-2.1
Taiwan	-	4.1	0.8	-3.3
Non targeters mean	-	13.4	6.9	-6.5

Source: Adapted from “Inflation targeting in emerging economies: What do the data say?” by Goncalves and Salles (2008)

A study by Goncalves and Salles (2008) revealed that of the 36 countries investigated, the 13 countries that adopted inflation targeting showed a greater reduction in inflation – 11.4% – over the study period than when compared to the 23 non-inflation targeting countries which showed a mean reduction of 6.5%.

The data in the study included South Africa as an inflation targeting country. Interesting to note, however, is that the countries that did not apply inflation targeting also showed a reduction in inflation, with some countries, like Turkey and Uruguay, showing considerable decreases in inflation, albeit from high bases.

The study went on to show the impact that inflation targeting had on the volatility of growth. The results again supported the notion that the application of inflation targeting seems to be the more prudent and economically optimal monetary policy regime. The results of the study are highlighted in the table below, sourced from the Goncalves and Salles (2008) study.

Table 3: GDP volatility Pre and Post Inflation Targeting

GDP growth volatility data				
Country	Adoption Year	Initial growth volatility	Final growth volatility	Fall
Brazil	1999	4.0	1.7	-2.3
Chile	1991	6.7	3.3	-3.4
Colombia	2000	2.3	1.5	-0.8
Czech Republic	1998	3.5	2.2	-1.3
Hungary	2001	3.8	0.5	-3.3
Israel	1992	1.9	2.9	1.0
Mexico	1999	4.0	2.3	-1.7
Peru	1994	7.4	3.8	-3.6
Phillipines	2002	3.8	0.7	-3.1
Poland	1999	5.4	1.6	-3.8
South Africa	2000	2.5	0.9	-1.6
Thailand	2000	5.1	1.7	-3.4
South Korea	1998	3.0	5.1	2.1
Targeters mean	1998	4.1	2.2	-1.9
Argentina	-	5.7	7.5	1.8
Bulgaria	-	6.2	1.1	-5.1
China	-	3.4	1.1	-2.3
Costa Rica	-	3.9	2.8	-1.1
Cote d'Ivoire	-	3.8	2.5	-1.3
Dominican Republic	-	3.8	3.8	0.0
Ecuador	-	3.4	3.9	0.5
Egypt	-	2.3	1.6	-0.7
El Salvador	-	4.6	0.8	-3.8
India	-	1.6	1.6	0.0
Indonesia	-	2.0	6.3	4.3
Lebanon	-	23.0	2.4	-20.6
Malaysia	-	3.0	5.1	2.1
Morocco	-	5.7	2.7	-3.0
Nigeria	-	5.9	3.5	-2.4
Pakistan	-	1.5	1.8	0.3
Panama	-	5.6	2.5	-3.1
Tunisia	-	2.8	1.4	-1.4
Turkey	-	4.0	6.2	2.2
Uruguay	-	4.6	7.1	2.5
Venezuela	-	4.7	9.2	4.5
Singapore	-	3.3	4.5	1.2
Taiwan	-	2.3	2.7	0.4
Non targeters mean	-	4.7	3.6	-1.1

Source: Adapted from "Inflation targeting in emerging economies: What do the data say?" by Goncalves and Salles (2008)

As can be seen in the table, the adoption of inflation targeting brings overall volatility of growth as measured by GDP down. This is an important consideration as GDP estimates are inputs into the Taylor Rule. Less volatility will lead to a more consistent interest rate and inflation measurement. This all leads to the belief that inflation targeting as a monetary policy regime is optimal. It remains to be seen whether this is true in the case of South Africa and the four monetary policy changes the country has been through from the 1960's. Goncalves and Salles (2008) concluded by finding that countries that implemented inflation targeting showed improved reductions in inflation and GDP variability compared to countries that did not.

Inflation targeting has been a widely and thoroughly researched topic since the 1990's, and the belief is that the application of inflation targeting as a monetary policy regime lowers inflation and inflation variability. Lin and Ye (2009) postulated that this is still very controversial, at best, amongst the researchers and policy makers at the forefront of monetary policy. Lin and Ye (2009) showed similar results to Ball and Sheridan (2005). The Lin and Ye (2009) study controlled for self-selectivity. With this done, the results showed that there were no significant impacts on inflation and inflation variability in developed countries.

Lin and Ye (2009) made mention that inflation targeting is not just a policy regime that is adopted by developed countries but also by developing countries. They argued that developed countries did not have some of the socio and macroeconomic shocks that developing countries experienced. They further argued that credibility of developing countries' central banks pre inflation targeting was generally lower than the developed countries' central banks. Therefore, it is reasonable to postulate that the progress made by inflation targeting adoption in emerging markets may just be due to the credibility gain of committing to the inflation targeting regime. This is the Lin and Ye (2009) argument as to why the impacts are muted in developed countries compared to emerging market economies.

Lin and Ye (2009) studied 52 emerging market economies, the results of which showed that the implementation of inflation targeting has led to a decrease in the level of inflation in countries that are targeters. Interesting to note, is that the study controlled for self-selection and still showed a positive impact for targeters to the tune of 3%. Lin

and Ye (2009) concluded, through a number of scoring matching methods, that the adoption of inflation targeting led to a decrease of inflation, especially in emerging economies. There are, however, mitigating circumstances – such as the length of time of the policy adoption, the government’s commitment to fiscal prudence, and the central bank’s willingness to adapt to the rules of inflation targeting – for particular cases. This is of particular concern for this study as there are a number of socio-political and economic events that have impacted the South African economy. These events cannot be ignored as they had wide reaching consequences such as the change of government, the debt standstill and economic sanctions. Given that South Africa went through these events, it is the aim of this study to determine whether the monetary policy applied at this time was in fact optimal.

Roger (2010) compared inflation and output performance for countries that adopted inflation targeting. The study differs from others in that it looks at the countries of choice prior to inflation targeting and post inflation targeting, but then also compares these countries to non-inflation targeting countries. For emerging economies, the evidence revealed that both inflation targeting and non-inflation targeting regimes showed reductions in inflation and overall increases in growth. The non-inflation targeting countries were shown to have lower inflation and higher growth, which is contradictory to most of the literature. That said, countries that adopted inflation targeting during the study timelines did show larger improvements in overall performance.

The Rogers (2010) study regarding developed economies, is fairly similar to that of the other studies mentioned before. Inflation targeting countries experienced little change in the measure of output or the volatility of inflation when compared to non-inflation targeting countries. However, the study revealed that overall, the non-inflation targeting countries did experience greater output volatility.

A study by Ghosh, Ostry and Chamon (2015) supported the notion that inflation targeting is the optimal monetary policy regime in emerging market economies. They do make a point, however, that foreign exchange intervention is required as a second instrument to support the structures of inflation targeting.

Rogers (2010) went further and studied the resilience of inflation targeting through macroeconomic events. This is of particular interest to the research, as the South African experience contained macroeconomic, political and social shocks. The study showed that countries that implemented inflation targeting experienced smaller increases in inflation than countries that were not inflation targeting. Does this imply that inflation targeting is more resilient to macroeconomic shocks than non-inflation targeting? Although this seemed to be the case in the Rogers (2010) study, more detailed investigation is required and this is a topic for future research. For the purpose of this research, it does appear that inflation targeting may perhaps be the most optimal monetary policy regime, first and foremost for the outcome of controlling inflation, but also in protecting the economy from exogenous shocks like the Global Financial Crisis (GFC), the commodities boom and bust of the late 2000s. This is especially important for emerging market economies that export natural resources and import finished goods, a category into which South Africa fits.

Carare and Stone (2006) studied inflation targeting across developed and developing countries. The study split the definition of inflation targeting into Fully-fledged Inflation targeting, Inflation Targeting Lite, and Implicit Price Stability Anchor. The regimes are defined by the clarity and the credibility of the central banks' administration in applying the prescribed monetary policy. Credibility of the central bank is linked to the public announcement of the target of inflation and the central bank's commitment to attaining that target. The research mentioned this as key to the outcomes and success of inflation targeting. Carare and Stone (2006) revealed that the countries that adopted Fully- fledged Inflation Targeting showed the largest commitment to the policy and the least amount of discretion.

The countries that adopted Inflation Targeting Lite and Implied Price Stability, which can also be described as non-inflation targeting, showed definitive signs of discretion. The difference, however, is that countries that adopted Implied Price Targeting were extremely credible and stable in terms of monetary policy and inflation control. The table below, appearing in the study of Carare and Stone (2006), is cited from the study of Mahadeva and Sterne (2012)

Table 4: Commitment levels towards Inflation Targeting Regimes

Inflation targeting central banks, self reported policy indicators			
	Commitment to inflation	Discretion	Commitment to exchange rate
Fully fledged inflation targeting (16 of 18)			
Median	91	19	9.5
Average	79.8	24.6	21.9
Implicit price stability anchor (4 of 5)			
Median	19	51.5	9.5
Average	26.8	57.8	18.8
Inflation targeting lite (13 of 19)			
Median	44	47	25
Average	46.9	51.3	23.8

Source: Adapted from “Inflation targeting regimes,” by Carare and Stone (2006)

Overall, the study by Carare and Stone (2006) revealed that countries that adopted Fully-fledged inflation targeting and Implicit Price Stability showed the best results in terms of inflation variability and inflation control.

2.2 Introduction to the Taylor Rule

Traditionally, general economics textbooks introduced the Taylor Rule, named after famed economist John Taylor, to illustrate the link between inflation and nominal interest rates. Since the work of Taylor (1993), it has been standard for central banks to set interest rates according to Taylor Rules. As mentioned by Carvalho and Nechio (2014), the basic principle underlying the Taylor Rule is that benchmark interest rates tend to increase with inflation and to decrease with a slack in economic activity. As mentioned by Leith and Wren-Lewis (2009), the rule required the central bank to raise interest rates such that real interest rates rose above their steady value in response to inflation lying above a target.

The Taylor Rule is a numerical formula that relates the FOMC target for the federal funds rate to the current state of the economy. The rule is explained in Chapter 4. The rule has informed many a central bank’s thinking about monetary policy. It has framed policy actions as a systematic response to incoming information about economic conditions, as opposed to a period-by-period optimisation problem. It has emphasised

the importance of adjusting policy rates more than one-for-one in response to an increase in inflation (Asso, Khan and Leeson, 2010).

The rule is used by central banks to estimate the short-term interest rates when expected inflation is higher than the target inflation rate. The rule, as stated in Equation 1 which is examined in detail later in the research, implies that nominal rates (r) are a function of the equilibrium real interest rate (r), the current rate of inflation (p) and current inflation less the inflation target. The output gap is the differential between actual GDP and potential GDP.

The quantitative rule described by Taylor, provided a particularly specific route on monetary policy. Essentially, it called for the central bank, given the current state of the equation as depicted by Equation 1, to raise interest rates by 1.5 times any increase in the four quarter average inflation plus 0.5 times any increase in the output gap (Taylor, 2000).

It must be reiterated that the Taylor Rule is a tool which provides guidance as to what decision to make regarding the interest rate response to inflation. There are many factors other than inflation and GDP that impact the economy. The rule is advised by movements in the GDP gap and inflationary gap. In essence, increases in asset prices and credit growth generally lead to an expansion in aggregate demand, therefore a policy that is reactive to the GDP gap and inflationary gap would lead to a monetary policy response (Agénor, and Da Silva, 2012).

The Taylor Rule has been the bedrock of monetary policy and central banking for decades. In the aftermath of the global financial crisis, many developed economies found themselves in a low-growth environment. Following the Taylor Rule, the general response, as mentioned by Drakos and Kouretas (2014), from central banks would be to lower rates to incentivise borrowing and spending, thereby increasing aggregate demand.

Gabillon and Martimort (2004) state that the mandate of central banks is to maintain a level of inflation, whether to a certain percentage or inflation targeting. The traditional response to control inflation would be to intervene by way of manipulating the

benchmark interest rate.

The rationale behind the approach comes from the work of Taylor (1993), which showed that the traditional response to an increasing rate of inflation would be to raise the benchmark interest rate. The reason for this is that the increased rate made the cost of borrowing more expensive and hence in the short term, the buying habits of the consumer are slowed.

The impact of this increase in the benchmark rate results in the gradual decrease of inflation. This has been the traditional response of central banks around the world. In the case of the current situation of low to stagnant growth, in which most developed economies find themselves, central banks have resorted to unconventional tools – such as dropping rates close to zero benchmark interest rates or negative rates (Fratzscher, Lo Duca and Straub, 2014).

The incentive to borrow is so large that there is a punishment for deposits and holding cash in the bank, and a reward for borrowing in the form of the bank paying interest on loans taken out by customers. The reason for this push is to get consumers to borrow in an attempt to kick-start the economy.

2.3 The Taylor Rule in developed and emerging economies

As mentioned at the beginning of this chapter, a section of the literature is dedicated to the application of the Taylor Rule as it pertains to emerging market economies. A popular idea within monetary economics research, has been to use of the Taylor Rule to illustrate that a central bank should perhaps follow the Taylor Rule, and in doing so, take into account the inflation rate and the gap between potential GDP and actual GDP. Beju and Cuipac-Ulici (2015), in their study of the Romanian central bank, made mention that the Taylor Rule was considered an accurate description of how monetary policy decisions are taken, not only by The Fed, but by other central banks as well. This research aims to apply the Taylor Rule as a proxy to determine the optimal interest rate path of the South African Reserve Bank. Below is a collection of literature that supports the use of the Taylor Rule within an emerging market.

It is imperative to this study that the message the central banks portray is conveyed correctly. Monetary policy, no matter whether it is inflation targeting or non-inflation targeting, is administered for the purpose of optimal monetary management, in other words protecting the value of the currency to ensure price stability. Research by Aizenman, Hutchison and Noy (2011) has shown that the public announcement of a target range and adoption of inflation targeting in emerging markets, is sharply different from non-targeting emerging market countries. This perception of what inflation is, or will be within a specific range, tends to lower inflation expectations, which subsequently leads to the belief that inflation targeting as a monetary policy regime is better than non-inflation targeting. Aizeman, Hutchison and Noy (2011) employed Taylor-type rules in the study of 16 emerging market economies which employed inflation targeting and non-inflation targeting monetary policies.

The results aptly capture the central bank decision making of the countries selected in the study. The study showed that the Taylor Rule is applicable in emerging market economies; more important to this study, it showed that the Taylor Rule can be used to illustrate optimal central banking decisions through inflation targeting and other monetary policy regimes. The methods and administration of inflation targeting in South Africa, explained later in the literature, are important, as the effective administration of inflation targeting leads to lower inflation expectations, which can then result in the monetary policy being regarded as optimal.

Corbo, Landerretche and Schmidt-Hebbel (2001) employed Taylor-type rules on data captured for eight emerging market economies. The study looked at countries that applied inflation targeting, potential inflation targeters and non-inflation targeters. The results of the study show that the Taylor Rule employed, served as a satisfactory proxy by which to test the efficacy of monetary policy.

Benes, Berg, Portillo and Vavra (2012) tested interventions through central banks' balance sheets via open market transactions, and found that the Taylor Rule provided an efficient means to understand central banking decisions. Ghosh, Ostry and Chamon (2015), who tested monetary and exchange policies in emerging markets, employed the Taylor Rule on 15 emerging market economies, to estimate the reaction function. The study showed that emerging markets conduct optimal monetary policy in

accordance to a Taylor Rule principle. Ncube and Tshuma (2010) show that non-linear Taylor Rules hold for South African data.

A study by Gozgor (2012) found that the interest rate reaction function of the central bank of The Republic of Turkey is explained by the Taylor Rule. Guney (2016) adopted a forward-looking Taylor Rule on Turkish data from 2002 to 2014. The study found that the forward-looking Taylor Rule applied to the data, adequately described the interest rate decisions of the central bank of Turkey. Agenor and Luiz (2012) found that middle-income countries' optimal interest rate is described by the Taylor Rule.

Moura and Carvalho (2010) presented a study in which the Taylor Rule was implemented and applied on seven different South American emerging market economies. The aim of the study was to characterise the monetary policy decision of the central banks of each of the countries in question. The study went further by then evaluating the rigidity of each country's stance on inflation. The study focused on analysing the central bank's responsiveness to inflation deviations from a designated target and output deviation from the target output.

The study by Moura and Carvalho (2010) used the Taylor Rule to evaluate monetary policy in emerging economies, specifically the seven largest Latin American countries – Brazil, Argentina, Mexico, Chile, Colombia, Venezuela and Peru. Of these, only Argentina and Venezuela were not inflation targeters. This allowed the study a unique sample of emerging economies with different monetary policy regimes and exchange rate regimes. This provides prudence to the use of the Taylor Rule as a proxy for South Africa, which is an emerging economy that has been through multiple monetary policy regime changes.

The models employed by Moura and Carvalho (2010) looked at iteratively solving for the best model for each country using the Taylor Rule. The conclusion from the study was that monetary policy seemed to be endogenous and that the Taylor Rule was capable of capturing the optimal behaviour of monetary policy interest rates fairly well. As mentioned above, the study went further by looking at the coefficients of the Taylor Rule as they relate to inflation to determine the toughness of monetary policy in each country. The results revealed that Brazil and Mexico were the toughest, as they

increased interest rates by a greater amount and more quickly in response to inflation being out of the target.

The study by Moura and Carvalho (2010) collected data from January 1999 to January 2008 across the seven countries. The study involved running 16 forms of the Taylor Rule for each country and selecting the best one. The study concluded by showing that the Taylor Rules do a good job in describing the optimal monetary policy decisions by the seven South American countries.

Research by Mehrotra and Sanchez-Fung (2011) looked at monetary policy in 20 emerging economies, of which 14 countries apply inflation targeting and the other six countries apply monetary pr exchange rate targeting. The basis of the study was to determine whether Taylor Rules proved useful in formulating an understanding of monetary policy performance in inflation targeting economies. It is also worth noting that the study looked at countries that apply inflation targeting as well as other monetary policy regimes. The study also looked at another econometric model, the McCallum Model. The paper attempted to provide evidence about past monetary policy regimes performance by estimating the policy reaction functions from the McCallum Model and Taylor Rules. The paper is of particular interest to this research as the proxy for evaluating optimal monetary policy regime performance is the Taylor Rule. Furthermore, Mehrotra and Sanchez-Fung (2011) based their study on emerging market economies, one of which was South Africa. The study looked at the monetary policy of a range of countries from Africa, Asia, emerging Europe and South America. An extract from the study showing the monetary policy regimes, is presented below.

Table 5: Monetary Policy Strategies of Selected Emerging Markets

Country	Period	Monetary policy strategies	Inflation target and range
Peru	From 1994	Announced inflation targets Monetary targeting	CPI 2.5 ± 1%
	From January 2002	Full IT Interest rate overnight bank loans The Peruvian monetary strategy allows switching from targeting overnight interest to monetary aggregate due to dollarisation and potential adverse balance sheet effects	
Philippines	1984-1995	Monetary targeting (with free float)	CPI
	1995-2001	IT light	2002-2003: 4.5-4.5%
	2002-present	IT light	2004: 4-5%
		Interest rate repo	2005: 5-6% 2006-2007: 4-5% 2008: 4.0 ± 1%
Poland	Until 1998	Combination of monetary targeting and crawling peg	
	From 1999 to present	IT Interest rate: reference rate	1999: 6.6-7.8% 2000: 5.4-6.8% 2001: 6-8% 2002: 5 ± 1% 2003: 3 ± 1% Since 2004: 2.5 ± 1%
South Africa	From 1995	M3 monetary targeting During the 1990s: monetary package also looking at the exchange rate and bank credit	CPIX (overall price index excluding cost of changes in mortgages costs) 2002-2003: 3-6%
	From February 2000	Full IT: Monitoring of M3 as an information variable in the IT framework Targets announced in 2000 to be elective from 2002 Interest rate discount rate	2004: initially 3-5% but changed to 3-6% Since 2005: 3-6%
South Korea	March 1990-Dec 1997	Managed float (with monetary targeting)	CPI
	April 1998-present	IT (with free float) Interest rate: base rate	1999: 3 ± 1% 2000: 2.5 ± 1% 2001-2003: 3 ± 1% 2004-2006: 2.5 ± 3.5% 2007-2009: 3 ± 0.5%

Source: Adapted from “Inflation targeting regimes” by Mehrotra and Sanchez-Fung (2011)

Monetary policy in emerging markets has evolved from monetary targeting and exchange rate pegging, to inflation targeting, and many developed countries have been applying more advanced monetary policy regimes for some time, as alluded to in the paper by Bernanke, Laubach, Mishkin and Posen (1999). There is also evidence to suggest that while emerging market central banks have made progressive steps towards independence and delivering price stability, the countries have been hampered by underdeveloped and inefficient financial systems. As noted earlier, this is one reason why there seems to be a more positive impact of inflation targeting as a monetary policy regime in developing countries than in developed countries when comparing inflation targeters and non-inflation targeters.

The Mehrotra and Sanchez-Fung (2011) study investigated 14 countries that apply inflation targeting, while the remainder used monetary or exchange rate targeting. Some implemented partial inflation targeting before eventually moving over to full inflation targeting. This mirrors the South African experience with the move towards

inflation targeting. The Mehrotra and Sanchez-Fung (2011) study made mention of similar changes in monetary policy in South American countries, all of which were emerging economies.

An important consideration needs to be made regarding countries announcing changes to monetary policy and their respective central banks. Much has been said in literature about the benefits of independent central banks and the move to inflation targeting. It should be mentioned that that what a country says it's going to do, and what it can do, are two different things. This is why it is important to study the effectiveness of monetary policy and to determine whether the policies applied are, in fact, optimal in controlling inflation.

As mentioned in Chapter 1, the study aims to use the Taylor Rule as a proxy by which to extrapolate the SARB's reaction function or interest rate path. Hence, this section shows literature that illustrates that the Taylor Rule is an efficient mechanism by which to examine central bank decisions, not only in developed countries but also in developing countries such as South Africa. Studies by Taylor (1993), and Judd and Rudebusch (1998), revealed that the Taylor Rule proved to be useful in providing a benchmark for empirical analysis on central banks reaction function. Judd and Rudebusch (1998) revealed that the Taylor Rule fit the monetary policy decision more closely in the Alan Greenspan era. Alan Greenspan was the chairman of The Federal Reserve Bank of America from 1987 to 2006.

Mehrotra and Sanchez-Fung (2011) concluded by illustrating, through empirical analysis, that the behaviour of monetary policy is best described by a hybrid McCallum-Taylor Rule. That said, the study does show that the benchmark Taylor Rule is also effective in describing emerging market monetary policy decisions.

Castro (2011) illustrated that the central bank monetary behaviour of the European Central Bank as well as the Bank of England is best described by a non-linear Taylor Rule. Galimberti and Moura (2013), as mentioned earlier in the literature review, studied 15 emerging market economies using an exchange rate Taylor Rule model. Fendel, Frenkel and Rulke (2011a) examined the monetary policy decisions of five Latin American and Eastern European emerging markets using the Taylor Rule. The

study showed that countries that adopted inflation targeting followed a Taylor Rule principle. Fendel, Frenkel and Rulke (2011b) applied the study to G-7 countries and found that these countries were consistent with the principles of the Taylor Rule.

A study by Kuhn and Muysken (2012) investigated central banks that have adopted inflation targeting. The results of the study indicated that the standard Taylor Rule, takes into consideration the interest rate decisions of the central banks in question. The study also found that central banks which predominantly look at inflation stability as a key macroeconomic metric, followed the standard Taylor Rule. Beju and Ciupac-Ulici (2015) showed that depending on the values of the coefficients used, the Taylor Rule did describe the Romanian central bank's decisions.

The Taylor Rule was originally developed for the American economy, and the coefficients of the rule in Equation 1 are specific to the American economy. However, as many authors and academics have shown, the rule still describes monetary policy fairly well with modifications to the coefficients as well as adding additional variables to the equation. While it is not the purpose of this research to develop a rule strictly for the South African economy, it is noted that the rule provides guidance to emerging market economies as well.

Taylor argued that monetary policy rules such as the Taylor Rule are useful for emerging economies. Taylor identified five elements of consideration when addressing whether monetary policy rules will be useful for emerging market economies. The five steps are highlighted below from (Taylor, 2000):

The appropriate instrument in a monetary policy rule, in South Africa's instance this would be the repo rate within the framework of inflation targeting. The framework spells out an appropriate degree of specificity of the rule. The relationship of a monetary policy rule to inflation targeting and the implications of an underdeveloped long term bond market as well as the roll of the exchange rate in monetary policy.

The monetary policy instrument of choice is the short-term interest rate. Poole (1993) identified the pros and cons with regards to using either an interest rate or monetary target, the essence of which is if there is a substantial amount of volatility in the

measurement of the real interest rate or substantial shocks to investments and net exports, then the appropriate tool to apply would be monetary targets. However, if there are constant shocks to the velocity of money in which M3 targets are missed, then the application of the interest rate as a monetary policy tool is appropriate.

Inflation targeting in emerging economies such as South Africa, is both encouraging as well as essential. Focus allows for better policy coordination and management as the central bank is held accountable and responsible for the target. A prolonged period of inflation outside the target bracket indicates that the policy has not been as effective in meeting its mandate.

Monetary policy rules, such as the Taylor Rule, provide direction and purpose about how the target will be met (Taylor, 2000). Taylor summed up the use of a monetary policy rule with inflation by using the following analogy: “Inflation targeting is like the destination for a sailboat. A policy rule is how to sail the boat to get to the destination: for this you need to describe the angle of attack, the sail trim, the contingency for wind and so on” (Taylor, 2000, p11)

Monetary policy rules, like the Taylor Rule and variations of it, can provide central banks in emerging markets with an appropriate framework by which to determine monetary policy actions (Taylor, 2000). These rules – in the case of this research, The Taylor Rule – can assist a central bank’s layout plans for actions regarding monetary policy.

Emerging markets such as Brazil, Russia, China, India, South Africa and Turkey, to name a few, have become important members of the global economy. In the context of monetary policy, emerging markets are playing an increasingly important role.

Due to the disastrous impacts of the GFC, developed countries such as the United States, The United Kingdom, Switzerland, the Nordic bloc of countries and Japan, have abandoned the rules-based policies in favour of unconventional policy, namely Quantitative Easing (QE).

This has had two major impacts as mentioned by Taylor. The QE has blurred the good

effects of inflation targeting, and has now led to the belief that developing countries should steer away from inflation targeting frameworks. Comparing the interest rate path – as proposed by the Taylor Rule – of developed and developing countries against the actual path of the interest rate set by the respective central banks and inflation target, will illustrate the effectiveness of such a framework.

Inflation targeting as a monetary policy framework works effectively due to the commitment by the central bank to keep inflation within a certain barrier. In South Africa, this is 3% to 6%. As the former Governor of the Central Bank of Chile (also an inflation targeter) put it, “inflation targeting is an effective framework, the only question is whether to loosen or tighten monetary policy?” (Taylor, 2014, p.3). The answer to this question lies in the use of the Taylor Rule as a guiding mechanism. Similarly, the research will apply The Taylor Rule to South African data over multiple monetary policy frameworks, not only inflation targeting.

Countries that target inflation have been shown to have significantly less volatile exchange rates as shown by the research of Eichengreen and Taylor (2003). Policy simulation by Taylor (2014) shows that developed countries that move away from policy may put developing countries’ central banks under pressure to deviate from their desired and optimal policy rules.

Deviations can be caused by accommodating currency appreciation as well as foreign currency lending. Low interest rates in developed countries allow firms to borrow in dollars and receive returns in local currency. This causes speculatively risky capital inflows, and one way to curtail this is to lower the interest rate in the developing countries, which may very well be out of line with the policy stance in place.

One such example of this is when the Norges Bank, The Central Bank of Norway, readily admitted that their policy rate was issued at 2%, even though the policy rule called for a rate around 4%. Quantitative easing is one of the policy instruments that has been used in light of the economic climate caused by the GFC . After the GFC, the Japanese Yen significantly appreciated against the US Dollar as The Fed kept interest rates at near zero. An appreciating Yen made Japanese exports, a huge part of their economy, less desirable and more expensive. Accordingly, the Japanese government

urged the Central Bank of Japan to conduct its own version of quantitative easing, the result of which was a depreciating Yen.

Macro prudential shifts are another such policy tool that can blur the effectiveness of a committed monetary policy regime. These are changes to policy that impact the current monetary policy framework. The issue here is that these changes can become permanent, but worse is that these changes bring monetary policy and the central bank closer into politically sensitive areas. As mentioned above, for monetary policy to be effective, the central bank needs to maintain its independence without fear or favour. Monetary policy is one of many levers for economic growth, and structural issues, such as unemployment, need to be approached by structural changes.

In summary, the Taylor Rule is a useful framework used by central banks to outline their policy – both backward- and forward-looking, depending on the use of the rule. Since it has been established that the Taylor is useful in describing the interest rate path, this research will endeavour to determine whether the rule can explain the interest rate movements through multiple monetary policy regime changes in South Africa.

2.4 A brief history of The South African Reserve Bank

The South African Reserve bank was formally established on the 30th of June, 1921 and has, since that time, been privately owned with its shares listed on the Johannesburg Stock Exchange. The Reserve Bank Act (1989) illustrates that the SARB's functions are ultimately the priority and responsibility of the SARB's Board of Directors.

In lieu of this, the legal independence of the SARB is guaranteed by the South African constitution, which was approved by the Constitutional Court in December of 1996, and states: "The primary object of the SARB is to protect the value of the currency in the interest of balanced and sustainable economic growth in the Republic. The SARB, in pursuit of its primary object, must perform its functions independently and without fear, favour or prejudice, but there must be regular consultation between the Bank and the

cabinet member responsible for national financial matters.” (Rossouw, 2008, p11).

Prior to the formation of The Reserve Bank in 1921, banknotes were printed by commercial banks which were fully backed by gold as per the gold standard (Rossouw and Padayachee, 2008). This essentially meant that bank notes could be converted into gold at a fixed price.

2.4.1 Evolution of South Africa’s monetary policy framework

At no other time in history has the power of central banks been greater than it is today. Within the last 20 years, several central banks, including The Bank of England, The Reserve Banks of Australia and New Zealand, and the European Central Bank, have gained substantial independence and autonomy to set monetary policy. Most of these central banks, The SARB included, set policy to control inflation (Miles, Scott, and Breedon, 2012).

The mandate of independent central banks around the world is to control inflation. Put differently, a key purpose of a central bank should be to achieve and maintain price stability through the use of monetary policy techniques. That said, independence is a grey area as noted by Miles, Scott and Breedon (2012). Full independence applies to a bank that is able to set its own targets and monetary policy. In some cases, the target is set by the government and the central bank is independent in its choice of monetary policy to meet the target. The literature that follows will present a history of the policy regimes that have been used and are in use within the South African context from the 1960’s to the current day.

2.4.2 Liquid asset ratio based system 1960 – 1981

South Africa introduced the system we know today as ‘Rands and Cents’ with the official conversion rate at two Rands to one British pound. The Sharpeville incident of 1960 resulted in the outflow of capital from the country. This outflow could not be covered by the small surplus on the current account, and the Reserve Bank thus initiated exchange control measures which restricted foreign investment by residents

and any such sales in domestic securities were to be retained in South Africa (Rossouw and Padayachee, 2008).

By 1965, the world, including South Africa, belonged to the Bretton Woods System, which was characterised by fixed-but-adjustable exchange rates, with the US dollar as the anchor currency – convertible into gold at a fixed price of 35 dollars an ounce (Mohr and Fourie, 2004). The major issue with the Bretton Woods system, which eventually collapsed in 1971, was that the United States Dollar (USD) could not be devalued against other currencies. The Bretton Woods system had all the currencies of the world pegged to the USD and the USD was pegged to gold. The situation arose where the United States was running massive deficits due to oil shocks and the Vietnam War. The resulting deficit situation could disappear if adjustments to the value of the currency, with respect to the USD, were made. However, every other currency was pegged to the USD, which meant that all other countries would need to be convinced to adjust their currencies.

Following the breakdown in the Bretton Woods System, the South African authorities temporarily pegged the Rand to the British Pound and the USD, before moving to a managed float. In light of the events mentioned above, the Reserve Bank introduced the use of credit controls and ceilings along with deposit rate control (SA Reserve Bank, 1971). The system is formally known as the liquid asset ratio based system.

Casteleijn (2001) described the system as one that gave very low importance to the interest rate as an instrument tool for policy makers to impact monetary policy control. The principal policy tools available to the Reserve Bank were achieved through liquid asset requirements. This entailed that the commercial banks at the time were mandated to hold specific assets which were deemed as liquid by the Reserve Bank. The liquid assets would be in proportion to the amount of deposits the commercial bank had on its balance sheet.

The underlying thinking of this policy was that the limited supply and low return of liquid assets limited the commercial banks' lending and money supply growth (Casteleijn, 2001). This bears a very similar resemblance to the Basel Accords, which forces banks to hold a minimum level of liquid assets as collateral in the event of a run on the bank.

The resulting interest rates, which were not at market clearing levels, were adjusted on a number of occasions, hence the demand for funds was artificially controlled. The adjustment of rates by artificial measures did not reflect the equilibrium between the supply of loanable funds the demand for loanable funds.

As a result, the control of inflation over this period was not ideal. The level of inflation between 1965 and 1980 regularly established itself between the 10% and 20% level. The monetary policy at the time did not achieve its mandate of price stability. In light of the dissatisfaction of the liquid asset ratio based system, the new Governor of the Reserve Bank, Dr G P C De Kock, initiated a move to a market-orientated monetary policy. This was the beginning of what would later become the De Kock Commission.

Based on the recommendations of the De Kock Commission, the Cash Reserve base system, with pre-announced targets, was introduced. The system put forward explicit monetary growth targets and guidelines for M3 for the period 1986 to 1998. M3 is defined further on in the document.

2.4.3 Mixed system during transition 1981 – 1985

The period from 1981 to 1985 is one that is characterised by stubbornly high inflation. Given the unsatisfactory experience with the direct controls system, monetary policy took on a market-orientated approach. Casteleign (2001) described the system as a mixed system. The focus of the system was that of discretionary demand management.

The period in mention is one that is characterised by a number of socio-political issues, namely the Primrose Prime Incident, The Rubicon Speech of then President P W Botha, and The Commission of Inquiry into the monetary system and monetary policy of South Africa. This commission of inquiry would eventually be labelled as the De Kock Commission.

The National Party, the ruling party of the country at the time, was faced with a crucial

by-election in the Primrose constituency. The period in mention saw interest rates at record highs of 25% (SA Reserve Bank, 1985). The resulting excessively-high interest rate created widespread dissent and unhappiness around the management of the economy. What happened next is described as the Primrose Prime Incident. The Reserve Bank dropped rates in the face of stubbornly high inflation. Reasons for the drop in the rate were given as, “the cooling down of the economy and the improvement of the balance of payments and the exchange rate of the bank” (SA Reserve Bank, 1984 p.13).

The governor at time, Dr De Kock, vehemently denied any political meddling in the operations of the Reserve Bank. It is commonly believed that the drop in rates cost the National Party winning the by-election. This short-term meddling in the matters of the Reserve Bank cast serious doubt as to whether the Bank was serious about monetary policy. The intersection of policy decisions and election cycles is further illustrated in by Nordhaus, 1975. The transparency and credibility of the Reserve Bank was severely tarnished from the incident. Central Bank independence, credibility and transparency are introduced later in the literature review.

The balance of payments of the country severely deteriorated due to massive capital outflows following the infamous Rubicon Speech by former president P W Botha. The expectation of the speech was the announcement of a change of the political system of apartheid. This did not materialise. The economic ramifications were huge, and saw massive capital outflows from the country, and the withdrawal of foreign credit lines. This led to a moratorium on foreign debt and the Debt Standstill Agreements. The rescheduling of South Africa’s debt was negotiated, with the final tranche due by August 2001. It must be noted that South Africa has meticulously honoured all requirement of the agreements to foreign creditors (Mboweni, 2001).

As mentioned in the liquid asset ratio based system section, there was dissatisfaction with the previous system of monetary policy. As a result of the dissatisfaction, The Commission of Inquiry into the monetary system and monetary policy in South Africa was established. This later became known as the De Kock Commission. The commission proposed sweeping changes with regards to the monetary policy adopted, as well as the Reserve Bank’s independence. This may seem contradictory, as the

Primrose Prime incident had taken place only a year before. This either means that Governor De Kock had selective memory or none at all (Rossouw and Padayachee, 2008).

2.4.4 Cash reserve based system 1986 – 1998

From a monetary policy perspective, the Commission put forward the cash reserve model. This policy put forward explicit monetary growth targets and guidelines for M3. M3 is described as M2 plus longer-term time deposits, where M2 is M1 plus short-term time deposits. M1 is commonly known as 'narrow money', in other words notes and coins (Miles, Scott, & Breedon, 2012). M3 targets are a monetarist view of the world where the level of output, prices and unemployment, are linked to the supply of money.

The selection of targeting M3 was based on the premise of a stable relationship between M3 and GDP, as well as the fact the M3 was broad enough to reflect changes in budget deficits, credit extension and balance of payments (Aron and Muellbauer, 2006). The target ranges were set annually using a three month moving average announced in the March Budget.

The pre-announced targets were to be achieved by indirectly changing interest rates. The short-term interest rate became the central bank's primary policy tool as the central bank's discount rate was used to influence the cost of overnight funding and hence the market interest rates. This rate was the lowest rate at which the Reserve Bank would accommodate commercial banking institutions. In order to reduce the demand for bank credit, the Reserve Bank would increase its bank rate. The Reserve Bank adopted adjustable money supply growth targets as this allowed it flexibility in its implementation of monetary policy.

It is worth mentioning that at this point in time, the SARB had discretion to breach targets whenever it deemed it necessary to do so, with no penalty for breaching the target or any explanation as to why the targets were breached. This again led to credibility and commitment issues around the SARB's strategy implementation. The inevitability of political change in South Africa led to usefulness of the money target diminishing in the face of financial liberalisation and large capital inflows.

Eventually the cash reserve system was replaced in 1990 by an eclectic set of indicators which would monitor the economic environment, and subsequently provided a monetary policy response. These variables, in no particular order, were: the exchange rate; asset prices; output gap; balance of payments; wage settlements; total credit extension; and the fiscal stance (Stals, 1997).

Monetary policy's purpose is to in some way prevent booms and busts from developing, else what need would there be for monetary policy? Many economists, including John Taylor, believed that The Fed's view on monetary prior to the GFC, was way too liberal and loose, which exacerbated the impact of the crisis.

Each time monetary targets were missed, the reaction from the financial markets was unfavourable. This also led to doubts as to whether the central bankers knew what they were doing. The issue with monetary targets laid out by the central bank, is that it assumes the central bank has the power to determine the level of growth the economy will achieve, or is capable of achieving. This is not the task of monetary policy; the goal of monetary policy is price stability. That said, monetary policy is a key lever necessary for economic growth.

2.4.5 Repo system 1998 – 1999

Without abandoning the eclectic mix of indicators used for monetary policy on the 13th of March 1998, the decision was taken by the Reserve Bank to replace the bank rate with a repurchase rate (Van Der Merwe, 1997). The repurchase interest rate is market determined through repurchase transactions for liquidity. If there is a full provision of the estimated liquidity from commercial banks, this results in a neutral position on the part of the SARB. A situation of under-, or over- provision for liquidity signals a preference for the changing of the repo rate.

Auctions were initially done on a daily basis but have now been replaced by a weekly program. Further to the above decision by the SARB, it was also decided that the policy of maintaining inflation would be to align inflation with that of South Africa's

major trading partners. This result of this was that the informal inflation target was established of between 1% and 5% (Casteleign, 2001)

This was the beginning of informal inflation targeting. The problem with this was that the program did not warrant the same policy co-ordination and commitment as a formal target. The issues with transparency, commitment, communication and independence are addressed in the section related to formal inflation target below.

2.4.6 Introduction to inflation targeting 2000 – current

Inflation targeting is the most recent of all the monetary policy regimes adopted by South Africa. It is important to note that while the policy explicitly states a range of year-on-year inflation, the actual monetary policy tool that is available to the SARB is still the repo rate mechanism.

The literature provided below will give an insight into the model of inflation targeting, the transmission mechanism that allows the monetary policy tool of the repo rate to have an impact on inflation, as well the path and need for central bank independence, communication and commitment.

Rationale for adopting inflation targeting –

Changes to South Africa's financial system structurally caused M3 targeting to become less effective as a measure of inflation. These changes in the system were brought about due to an increasing level of liberalisation in the global economy as South Africa was reintroduced into the international community.

Inflation destroys value and distorts the decisions of savers and investors. Therefore, the focus of monetary policy should be to provide a stable outlook on price movements. Much has been said of targeting inflation to the levels of major trading partners and trading blocs. The reasoning for this is simple: excessively high and persistent inflation causes a reaction in the interest rate, the natural progression of which is upward. The result was a slowing down of credit which subsequently slowed spending and investment in the economy. These movements made the economy in question less competitive than its peers.

South Africa's reintegration into the global economy and financial markets, the increase in non-resident participation in South African financial markets due to the deregulation of restrictive exchange control, as well as banking services now being offered to the previously 'unbanked', led to the relationship between M3 and GDP being weakened. As a result of these changes, the Reserve Bank moved to a policy stance with a package of economic indicators used to inform monetary policy decisions. These were the beginnings of the eclectic regime of monetary policy (Casteleijn, 1999).

The repo system was introduced in March of 1998, whereby commercial banks would tender for a given amount of liquidity. Initially this was done daily, however the current system works on a weekly basis.

The previous cash reserve system created money shortages through open market transactions in the spot and foreign exchange markets, as well as the transfer of balances between government accounts (Casteleijn, 1999). The inherent problem with this system was that interest rates were not particularly responsive to changes in the amount of money borrowed from the Reserve Bank. This caused problems, with Reserve Bank signalling its intentions or views on the interest rates to the financial community.

In light of the inherent problems of the previous monetary policy regimes, South Africa, through the Reserve Bank and the Ministry of Finance, then took the decision to implement inflation targeting as the monetary policy regime of choice. There has been extensive analysis done by Bernanke and Mishkin, as well as others, around inflation targeting being superior to alternative approaches. A committed and credible approach to inflation targeting has the ability to reduce inflation expectations as economic participants begin to trust the process.

The four main reasons for the SARB's choice to adopt inflation targeting are clear.

Firstly, adopting the policy meant that the SARB had committed to stringent policy. The move came about as a development from the eclectic informal targeting that was initiated prior to formal inflation targeting. Given that SARB had adopted formal inflation

targeting, key to its implementation was the communication and transparency that went with the decision-making process. For example, in the 1990's, the growth of money supply and credit exceeded those of published guidelines, and as such, the public expected that the SARB would adopt an imminent increase in the repo rate. This, however, was not the case. Given the analysis of the situation at the time, the SARB realised that the growth in money supply was due to the structural changes in the economy as a result of financial liberalisation.

The second reason pertained to co-ordination and the decision making process. Inflation targeting is a defined process which stipulates the co-ordinated effort required to contain inflation in the pursuit of economic prosperity.

The third reason illustrated the need for accountability and discipline. The 1980's in particular were not particularly sound with regards to discipline of a monetary approach, especially since monetary targets could be exceeded with no response to the public as to this had happened.

Lastly, inflation targeting impacts inflationary expectations, which should facilitate a decrease in inflation, but only if inflation targets are deemed to be credible as they form the basis of wage and future price negotiations.

According to Mishkin (2001), inflation targeting is encompassed by five main principles: a public announcement of numerical targets for inflation; an institutional commitment to price stability as the main goal of monetary policy; an information inclusive strategy in which many variables, and not just monetary aggregates or the exchange rate, are used for setting of policy; increased transparency of the selected monetary policy strategy through communication with the public and markets about plans, objectives and decisions of the monetary authorities; and, lastly, increased accountability of the central bank.

There are three main inflation targeting regimes, namely Fully-fledged Inflation Targeting, Eclectic Inflation Targeting and Inflation Targeting Lite, (Carare and Stone, 2003). South Africa is a Fully-fledged Inflation Targeter.

All inflation targeting countries' target of inflation has been specified in terms of some consumer price index. South Africa has three main measures of consumer price inflation, namely, core consumer price index, headline consumer price index, and the overall index, which excludes the effects of changes in mortgages costs (CPIX).

In South Africa, the choice was made to target CPIX in metropolitan and other urban areas as this measure is more easily understood. Statistics South Africa compiles the index including rural areas as well. Overall, the decision was taken to target CPIX, fully realising that such a broad measure has the disadvantage of being impacted by exogenous shocks, over which monetary policy has no control (van der Merwe, 2004).

Setting of the target is of particular importance. As stated above, inflation targeting gives inflation expectations regarding future prices and wage negotiations. Therefore, if a central bank has specified a certain figure, they run the risk of being too narrow in their specific policy as well as of not having enough flexibility to allow for exogenous shocks. On the other hand, if the central bank puts forward a range too wide, it then sends the signal that the central bank is not serious regarding its mandate of price stability.

In conjunction with the selection of a specific target range, the central bank must indicate a time horizon over which the policy is intended to have its desired impact. If there is no time limit in place, the credibility of the policy comes into question.

In general the time lag for monetary policy to take effect is usually between 18 and 24 months. The reason for this lag is due to the mechanics of the monetary transmission mechanism in South Africa, which will be discussed in more detail later.

The decision-making process for the appropriate stance on monetary policy is taken by the Monetary Policy Committee (MPC). The MPC consists of eight members – the Governor, three deputies and four senior officials. With respect to the decision concerning monetary policy, a number of factors are taken into account, such as changes in nominal salaries and wages, the gap between potential output and actual output, the exchange rate, and the yield curve, to name but a few. The MPC relies on a number of models and macroeconomic data to come to the decision on the repo rate.

Once the decision has been made, a press conference is called and the decision is aired on live television.

Transparency and accountability of monetary policy –

The MPC meets six times a year to inform the public on the monetary policy issues within the country. The adoption of the inflation targeting system improves accountability of the Reserve Bank, as it must explicitly and publically provide a benchmark against which it is measured.

As previously noted, any changes to the policy and the repo rate must be made publically through a press conference and reasons for these changes must be given, unlike the Primrose Incident of the 1980's. Bléjer, Ize, Leone and da Costa Werlang (1999) show that there is a trade-off between flexibility and credibility in the central bank's application of inflation targeting. The more flexible a framework, the less credible it tends to be.

Earlier in the literature, the monetary transmission mechanism was mentioned as an integral part of the implementation of monetary policy. When a central bank makes a decision on a route to be taken, a number of events are triggered into motion. The sequence starts with the initial influence in the financial markets, such as commercial banks. This, in turn, eventually makes its way into private and public consumption and expenditure. Changes in the demand for service and products influence the production level, wages and employment, which eventually have an impact on inflation.

Monetary policy tends to be forward-looking in nature due the long lags for its intentions, in other words changes in the rate of inflation, to come to fruition (Mboweni, 2000). It is in this regard that the central bank must remain resolute and steadfast to the policy stance to which it has publically committed. The importance of commitment to the policy cannot be stressed sufficiently. The links of the monetary transmission mechanism are depicted in Diagram 1 in Appendix 1.

The repo rate is the main policy tool available to the SARB, changes to which have direct impacts on the economy through interest rates, the exchange rate, money and credit, as well as other asset prices including decision on investment and spending

(Smal & De Jager, 2001).

The interest rate channel is summarised by the framework of Mishkin (1995). If the repo rate is decreased, commercial interest rates issued by commercial banks decrease, which leads to an increase in investment and consumption due to cheaper credit, which then has the impact of increasing output.

Asset price channel is summarised as follows: A decrease in the repo rate, increases equity and housing prices, as the public find they have more disposable income, which leads to an increase in investment and output.

The credit channel is summarised as follows: a decrease in the repo rate leads to an increase in deposits due to more disposable income, which the commercial banks then use to increase bank loans. This leads to an increase in investment and consumption and, inevitably, output.

This concludes the evolution of monetary policy in the South African context.

The summation of the literature provides a view into the validity of monetary policy regimes as and when countries have decided to switch. The bulk of the literature illustrated that, more often than, not countries seem to move towards inflation targeting, South Africa included. The question remains however, whether the monetary policy decisions made by the South African Reserve Bank over the 56 year period from 1960 to 2016 have been optimal. Given the evidence presented above, the research aims to determine whether the monetary policies implemented by the South African Reserve Bank have indeed been optimal.

The literature illustrated that inflation targeting appears to be more beneficial to emerging market economies than developed economies, and the method by which this is tested as optimal, is by use of the Taylor Rule. Once again, the assumption that central banks make decisions optimally is critical to this research but one that is justified based on the work of (Mishkin, 2017). The literature illustrated that monetary policy switching has been the optimal decision in emerging markets by way of inflation targeting. The literature also showed that the Taylor Rule is an effective proxy by which

to test the optimality of central banking decisions in emerging markets. Orphanides (2001) noted that Taylor's Rule describes a reserve bank's monetary policy, as well as acts as a suitable proxy for judging whether monetary policy is appropriate. Based on the literature, it is the aim of this research to investigate whether the central banking decisions of the South African Reserve Bank have been optimal through multiple regime changes, by use of the Taylor Rule.

Chapter 3 – Research Question

The purpose of this research is to determine, by using the Taylor Rule and taking into account the relationship between inflation and interest rates, whether the interest rate decisions made during each monetary policy regime within the timeframe of 1960 to 2016, were the most optimal the SARB could have made. We know from the Fisher equation that there is a general positive correlation between interest rates and inflation, and while it is not the purpose of this study to test that correlation in the South African environment, it is important to take note of the relationship.

The research will adopt the Taylor Rule, as is, to determine whether the monetary policy decisions of the South African Reserve Bank were in fact optimal. Chapter 2 introduced the concept of optimal monetary policy implementation by central banks. Mishkin (2017) put forward the nine principles of monetary policy, two of which are particularly important to this research. Inflation is always and everywhere a monetary phenomenon (Friedman, 1963). This is derived from Milton Friedman's classic work in 1963 which implies that the ultimate source of inflation is excessive expansionary monetary policy. The second point relates to the importance of price stability, which relates to the point above in that it implies that central banks have the ability to control inflation and should keep it low and stable.

Based on the two afore-mentioned principles, the assumption that the South African central bank acted in the best interests of optimal monetary policy, is a rational assumption. Given this, how can we test whether the monetary policy decisions have in fact been optimal? Literature from Chapter 2 illustrates that if monetary policy decisions follow a Taylor Rule principle, then monetary policy tends to be optimal.

There has been wide debate of the use of the rule as a measure by which to investigate monetary policy as depicted in the table below cited from Carare and Tchaize, 2005.

Table 6: Taylor Rule methodologies

Paper	Rule
1. Taylor (1993)	$i_t = 1.00 + 1.50\pi_t + 0.5y_t$
2. Clarida, Gali, and Gertler (2000)	$i_t = 0.79i_{t-1} + 0.21(r^* - 4.12 + 2.15E_t\pi_{t+1} + 0.93E_t y_{t+1})$
3. Orphanides (2001)	$i_t = 0.66i_{t-1} + 0.34(1.80 + 1.64E_t\pi_{t+4} + 0.97E_t y_{t+4})$
4. Ball and Tchaidze (2002)	$i_t = 1.47 + 1.54\pi_t - 1.67(u_t - u_t^*)$
5. Orphanides and Williams (2003)	$i_t = 0.72i_{t-1} + 0.28(r^* + 1.26\pi_t - 1.83(u_t - u_t^*) - 2.39(u_t - u_{t-1}))$

Source: Adapted from “The use and abuse of Taylor Rules: How precisely can we estimate them?” by Carare and Tchaidze (2005)

The studies on South African data show diverse results of coefficients, as highlighted by Ruch (2011) and Aron and Muellbauer (2006). The debate is unresolved as to which coefficients describe the Reserve Bank’s decisions best, and it is therefore prudent to default to the original rule. Furthermore, a rule can be made to fit the South African Reserve Bank’s interest rate path by manipulating the coefficients, but this does not help the study in any way. The Taylor Rule will be adopted as is. The studies done on South African monetary policy involving the Taylor Rule do not go as far back as this research.

As mentioned in the introduction and detailed in the literature review, the Taylor Rule has been shown in many countries, both developed and developing, to construct a yield curve similar to that of the host country’s central bank.

The argument made earlier in the research proposes that the SARB makes decisions which are optimal within the realms of the specific monetary policy regime being employed at the specific point in time. The optimal approach in this regard is price stability. The literature review has also evidenced that the Taylor Rule is an efficient proxy by which to determine the interest rate decision of central banks, both in emerging and developed economies. Given the evidence that the Taylor Rule is efficient in extrapolating the optimal interest rate decisions of central banks, the expectation is that the SARB interest rate decisions should follow the derived Taylor Rule principle.

The research aims to test whether this is actually true for the four monetary policy

regimes from 1960 to 2016. There is reason to believe that the first and fourth monetary policy regimes were, in fact, optimal as measured by low interest rates and resultant low inflation. The second and third regimes were characterised by high interest rates and subsequently high inflation, however. It is the purpose of this research to determine whether all four regimes were optimal when compared to the proxy interest rate calculated by the Taylor Rule.

The general understanding is that the first and the last monetary policy regimes have been well managed and articulated in the decisions made by the SARB as they pertain to interest rates. The other two monetary policy regimes, unfortunately do not share the same esteem. This is mainly due to the excessively high interest rate and subsequent inflationary environment experienced during their tenure. Figure 1 graphically depicts the high interest rate environment during the second and third monetary policy regimes.

The research cannot ignore the impact of socio-political events as well as economic sanctions to which South Africa was exposed due to the political instability brought about by the apartheid system. It is with this in mind that the research will conduct a study to determine whether the interest rates of each monetary policy regime were in fact the optimal for the time. The literature review presented earlier in the paper illustrates that the Taylor Rule, using GDP and Inflation forecasts, can produce a similar yield curve to that of the reserve bank.

It is known within the financial and economic community, that the debt standstill and economic sanctions impacted the South African economy a great deal, but what if the monetary policy decisions made at the time were in fact the best the South African Reserve Bank could have implemented, especially during the second and third regimes?

Given that the rule has the ability to closely follow the interest rate decisions made by central banks, the model will be used in this research on South African financial data.

The purpose of this is as follows:

1. Construct a yield curve for each monetary policy regime; and
2. Construct a yield curve for the entire period 1960 – 2016

To represent this as a hypothesis,

H_0 : The SARB has not been optimal in its monetary policy decisions

H_1 : The SARB has been optimal in its monetary policy decisions

Chapter 4 – Methodology

Chapter 2 introduced the Taylor Rule as a mechanism by which to construct the interest rate path of a central bank. Below is the explanation of the Taylor Rule as per Taylor (1993).

The rule as adapted from Taylor (1993) is shown below as Equation 1 –

$$i = r^* + \pi + 0.5 (\pi - \pi^*) + 0.5 (y - y^*)$$

where:

r = the federal funds rate

π = rate of inflation over the previous four quarters

π^* = potential inflation or the inflation target

y = the percentage deviation from real output, that is $y = 100(y - y^*)/y^*$ where y = real GDP and y^* is the trend GDP

For the purpose of this research, the required data is quarterly central bank rates from January 1960 to December 2016, quarterly inflation statistics from 1960 to 2016, as well as quarterly real GDP statistics from 1960 to 2016.

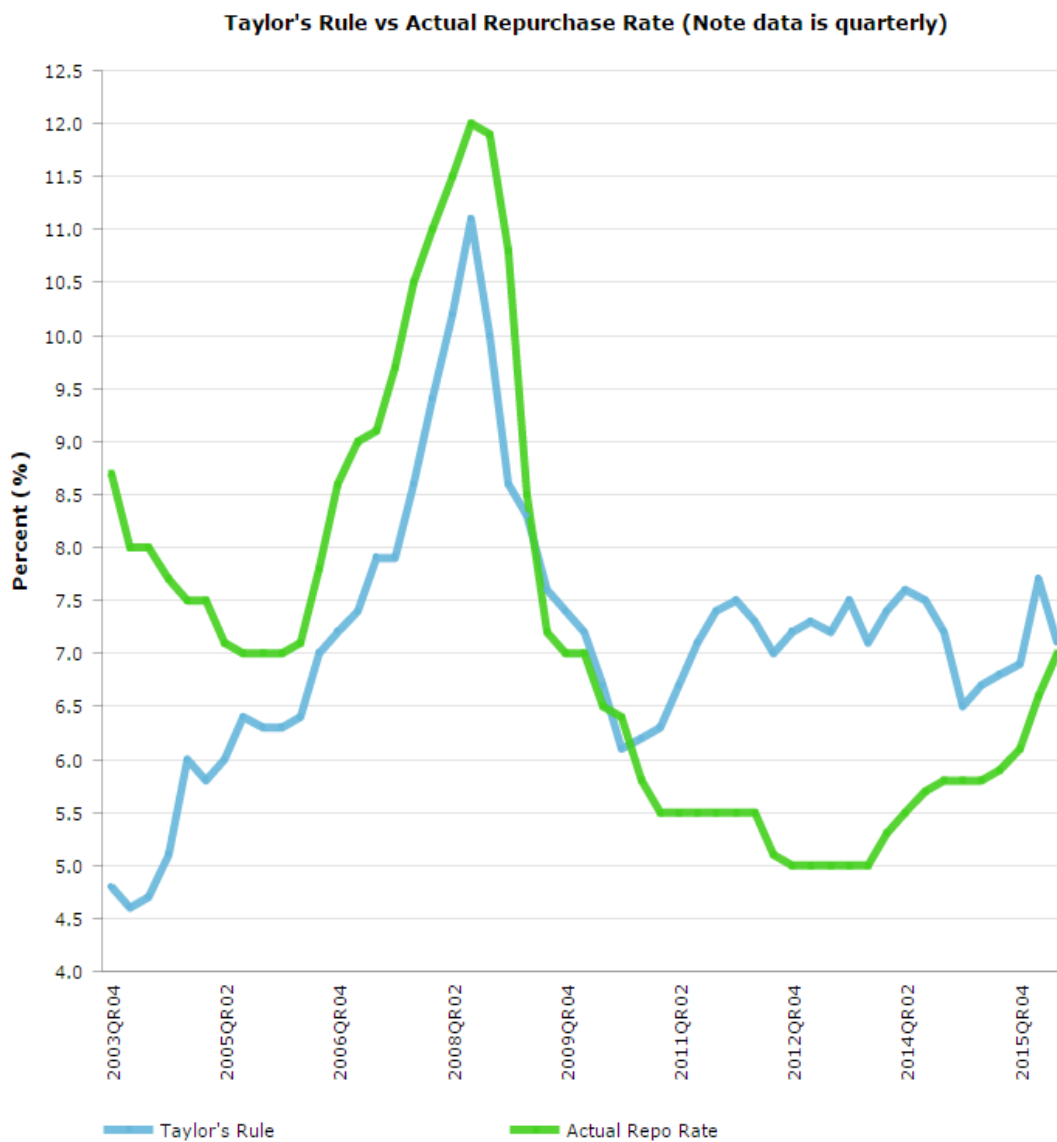
The data has been selected based on the inputs required for the Taylor Rule. The rule will not make changes to the coefficients. The research will make use of the rule as is. The data will be sourced from the public records made available by the World Bank, St. Louis Federal Reserve, and The OECD. The data will be used as inputs into the rule to determine the interest rate function over the specific periods of each monetary policy regime.

4.1 Choice of methodology

The purpose of the study is twofold. The first is to calculate the Taylor Rule interest rate for each of the four monetary policy regimes. A comparison will then be done by plotting the actual interest rate determined by the South African Reserve Bank and the Taylor Rule derived interest rate. The second part of the study will run a regression

analysis to test the relationship between the actual interest rate and the derived Taylor Rule interest rate. The outcome of this will allow it to be ascertained whether the South African Reserve Bank follows a Taylor Rule principle in its original form. Evidence does exist whereby the Taylor Rule in its original form, tracks the actual interest rate through inflation targeting, see Figure 3.

Figure 3: Taylor Rule adaptability to South African data



Source: Adapted from “South Africa’s Taylor’s Rule calculated,” by www.southafricanmi.com/taylors-rule (2016)

The study will use the SARB's official interest rate data from 1960 to 2016 and compare the outputs of the Taylor Rule over the same period through all monetary policy regime changes.

Given that the study will make use of an econometric model known as the Taylor Rule supplemented with publically available secondary data used as inputs, the study is quantitative in nature. Quantitative research approach is described by Kothari (2004) as a process that involves the generation of data in a quantitative form which can be subjected to rigid quantitative analysis in a formal and rigid manner. As this study is of a quantitative nature, it aims to explore the relationship between two variables – in this research this is the optimality of monetary policy using the Taylor Rule as a proxy. Explanatory variables which contribute to understanding the relationship, have been identified. The calculated Taylor Rule is the proxy used for optimality and has been identified as the independent variable. The South African Reserve Bank's monetary decisions, as they pertain to interest rates, is the dependent variable.

4.2 Population

The population of the study will include quarterly GDP data from 1960, quarter one, to 2016, quarter four, inflation data measured by the CPI index and central bank/repo rates for the same period. Potential GDP and inflation are derived using the Hodrick Prescott filter and the methodology applied by Rudebusch (2001).

4.3 Sampling method

The research will be conducted using secondary, longitudinal GDP, inflation and interest rate data for the period 1960, quarter one, to 2016, quarter four. Research data will be sourced from archival data in which the researcher makes use of secondary data. Secondary data as described by Saunders and Lewis (2012) is seen as data that has already been collected from other sources and is readily available. Since the data is constantly collated and collected through time, the data is of a longitudinal nature, with a time frame ranging from 1960, quarter one, to 2016, quarter four. Quarterly data

sampling is consistent with the approach taken by Mehrotra and Sanchez-Fung (2011). Existing literature on the efficacy of monetary policy regimes is diverse and well researched. Taylor Rule studies extend to the South African case as highlighted by Aron and Muellbauer (2000), and Aron and Muellbauer (2006), as well as Ncube and Tschuma (2010).

4.4 Unit of analysis

The unit of analysis is the quarterly data collected for the range 1960 quarter one to 2016 quarter four for GDP, inflation and interest rates. Real values for each variable are used. From a theoretical point of view, the unit of analysis is typically the major variable that is being studied, in the case of this study that would be monetary policy as it pertains to interest rates.

4.5 Measurement instrument

For the first part of the analysis, the Microsoft Excel software programme will be utilised to determine the Taylor Rule derived interest rate for the specific monetary policy regimes. The actual interest rate path from the SARB will then be plotted against that of the Taylor Rule derived interest rate path. The majority of the first section of the analysis will be presented in the form of graphs produced from Excel.

The second part of the analysis will use IBM SPSS to conduct statistical tests to determine how closely the Taylor Rule data fits the actual SARB interest rate data. Linear regression was used to test the relationship between the South African Reserve Bank monetary policy decisions on interest rates and the Taylor Rule-derived interest rates.

4.6 Data gathering process

Data was collected from the databases of the World Bank, St. Louis Federal Reserve, and the OECD. The data used in the study is publically available data that is published

by the institutions mentioned. The sample is free from selection bias as well as convenience sampling since it is secondary data (Saunders & Lewis, 2012).

4.7 Analysis approach

The Taylor Rule requires three main inputs, namely the central bank rate, the output gap, which measures the difference between GDP output and potential GDP output, as well as the difference between inflation and potential inflation. The rule depicts the changes in interest rate as GDP and inflation change. There have been multiple studies that have used a host of different variables to test the validity of the Taylor Rule. Taylor himself has noted that if one is to use the deviances of real output from a linear trend, such as that created by the Hodrick Prescott filter, as well as the year-on-year percentage change of the output deflator to measure inflation, the outcome would be described fairly well in the decision making of The Fed (Orphanides, 2010). Table 7, below, cited from Check (2015) highlights the various studies and variables used in testing the Taylor Rule. Check (2015) summarised that the popular measures of inflation include GDP deflator and CPI inflation, while the unemployment gap and GDP gap are most commonly used to measure output.

Table 7: Inflation and GDP inputs variations

Study	Inflation Measure	Output Measure	Horizon	Other
Taylor (1999)	GDP Deflator	GDP Gap	Contemp	-
Clarida et al. (2000)	GDP Deflator	GDP Gap	Forecast	-
Bernanke and Boivin (2003)	CPI	UN Gap	Forecast	Factor
Orphanides (2004)	GDP Deflator	Real-Time GDP Gap	Contemp	-
Cogley and Sargent (2005)	CPI	UN Rate	Past	-
Primiceri (2005)	GDP Deflator	UN Rate	Past	-
Schorfheide (2005)	CPI	GDP Gap	Contemp	-
Boivin (2006)	GDP Deflator	UN Gap	Forecast	-
Sims and Zha (2006)	Core PCE	GDP Growth & UN Rate	Past	M2, PCOM
Davig and Doh (2008)	GDP Deflator	GDP Gap	Contemp	-
Coibion and Gorodnichenko (2011)	GDP Deflator	GDP Gap & Growth	Contemp	-

Source: Adapted from “Interest Rate Rules in Practice – the Taylor Rule or a Tailor-Made Rule?” by Check (2015)

The methodology of the test follows the following sequence:

The first section of the test graphically plots the interest rate decisions of the South African Reserve Bank over the time period for each of the four monetary policy regimes. For each monetary policy regime, the Taylor Rule interest rate path was calculated using the inputs of GDP output and the difference between inflation and potential inflation. The interest rate path was then graphically plotted against that of the actual interest rate path of the South African Reserve Bank.

GDP output was measured using quarterly real GDP figures as an input for the Hodrick Prescott filter. The Hodrick Prescott filter is an algorithm that smoothes the original time series to estimate its trend component. The cyclical component is, as usual, the difference between the original series and its trend.

Literature shows that the Hodrick Prescott filter is most often used in Taylor-type research to measure the output gap. The research employed the Hodrick Prescott filter, as used by Mehrotra and Sanchez-Fung (2011), and Galimberti and Moura (2013). Teles and Zaidan (2009) investigated the Taylor Rule in emerging economies including South Africa, also using the Hodrick Prescott filter. Fedderker and Mengisteab (2016) estimated South Africa's output gap and showed that it is accurately captured by the Hodrick Prescott filter. The Hodrick Prescott filter is reasonable to use on real GDP, so that the first difference represents the growth rate and the gap is then expressed as the deviation from the trend.

For the measure of inflation and potential inflation, CPI is the measure most commonly used in Taylor Rule studies. Literature by Galimberti and Moura (2013), and Guney (2016) among others previously mentioned, employ CPI. For the purpose of this study, CPI data was used. It must be noted upfront that Taylor Rule studies with particular attention to the inflation gap, depend on the potential inflation estimates. South Africa has been through multiple regime changes where a host of macroeconomic variables were targeted. Potential inflation or inflation targets were not attributes that were captured throughout the timeframe of this study. Data capturing for an inflation target or potential inflation only came into existence once inflation targeting was initiated in 2000. With this in mind, potential inflation for monetary policy periods prior to inflation targeting have been estimated using either the Hodrick Prescott filter, as employed by Mehrotra and Sanchez-Fung (2011), or the formula denoted below as Equation 2, cited

from Carare and Tchaidze (2008) but developed by Rudebusch (2001). This formula was used for the purpose of the research. Potential inflation figures were also calculated using the Hodrick Prescott filter, and the results proved to be much the same as those produced using the methodology of Rudebusch.

Equation 2:

$$\pi_t = 0.70\pi_{t-1} - 0.10\pi_{t-2} + 0.28\pi_{t-3} + 0.12\pi_{t-4} + 0.14y_{t-1}$$

Where π denotes the inflation rate as measured by CPI, and y denotes the output gap. The second part of the analysis applies regression analysis and correlation to determine whether the SARB interest rate function follows that of the Taylor Rule principle for each monetary policy period, as well as the total time period of 1960 to 2016. IBM SPSS was used as the statistical tool for the regression and correlation coefficient testing. The results of the regression testing are explained in Chapter 6.

4.8 Limitations

The following have been identified as research limitations.

The SARB reaction function cannot wholly and precisely be summarised by the Taylor Rule. In Economics, models are used to simplify the world, and the Taylor Rule is one of those models. Furthermore, the monetary policy decision is not based purely on inflation and GDP data, and the Monetary Policy Committee, whose responsibility it is to determine the adequate response, takes into account a host of economic data. In the end, the response more often than not relies on judgement.

The nature of this research will keep the coefficients constant as they appear in the original Taylor Rule mentioned in the literature review. There are multiple cases where the coefficients are changed according to the amount of slack the central bank accepts in its policy approach. This research does not set out to determine the nature or size of the coefficients for the South African economy.

The input of CPI as an index does not include mortgage costs, as mentioned above. The decision was taken by the SARB to target inflation as it includes the rural areas

of the country. The analysis made use of the Hodrick Prescott filter to determine the output gap needed as an input to the Taylor Rule calculation. The Hodrick Prescott filter has its limitations, just as any other model does. Hamilton (2016) identified these limitations. The Hodrick Prescott filter produces a series with spurious associations that have no basis in the original data process. The filtered values, especially at end of the sample range, are very different from the filtered values in the middle of the sample range. A statistical formalisation of the problem typically produces values for the smoothing parameter vastly at odds with common practice, for example, a value for lambda far below 1600 for quarterly data.

The study made use of South African data and may not, therefore, be applicable to other countries. Monetary policy rules such as the Taylor Rule, are prescriptive in nature and thus provide a guideline, not an exact science, for officials.

Finally, it must be noted that due to the nature of policy implementation, different policies target different variables – not all policies target inflation, as was the case of South Africa's early experience with monetary policy from the 1960's to 1998. For the purpose of this research, potential inflation needed to be calculated in order to run the Taylor Rule. This potential inflation was calculated using a backward-looking formula.

A classic limitation of the original Taylor Rule is the implication that monetary policy should respond only to the target variables of the output and inflationary gap. Woodford (2001) pointed out that it is not generally true that an optimal monetary policy rule should make the nominal interest rate a function solely of the current values of the GDP and inflationary gap.

Chapter 5 – Results

As outlined in Chapter 3, the hypotheses under investigation are as follows:

H1: The SARB was not optimal in its monetary policy decisions for the period 1960 – 1981

H2: The SARB was not optimal in its monetary policy decisions for the period 1981 – 1985

H3: The SARB was not optimal in its monetary policy decisions for the period 1986 – 1999

H4: The SARB was not optimal in its monetary policy decisions for the period 2000 – 2016

H5: The SARB was not optimal in its monetary policy decisions for the period 1960 – 2016

Chapter 4 introduced the method by which monetary policy in South Africa is tested for optimality. The first part of the test involved graphically depicting the South African Reserve Bank's lending rate. The Taylor Rule interest rate path was then calculated using Equation 1. The GDP gap was calculated by entering the real GDP numbers for each quarter in the respective time frames into the Hodrick Prescott filter. The tool allows for a trend to be calculated which, in turn, depicts the output gap or the gap between real GDP and potential GDP. The inflation gap, or the difference between CPI and the target inflation, was calculated by using Equation 2 which was cited from Carare and Tchaidze (2005), but introduced by Rudebusch (2001).

The second part to the study involved a regression analysis of each of the monetary policy regimes mentioned above to determine how closely the central bank rates followed a Taylor Rule principle. As noted in the literature review, optimal monetary policy tends to follow a Taylor Rule principle. For the purpose of the study, the South

African Bank Rates were the dependent variable and the Taylor Rule interest rate path, the independent variable.

To test the optimality of the South African Reserve Bank's monetary policy, the next step in the analysis was to apply regression testing to the model. This was done in five steps. A linear regression test was applied to each one of the four monetary policy regimes. Once this was completed, a final linear regression test was applied to the entire data range from 1960 to 2016. For linear regression to take place, a number of assumptions need to be adhered to, six in particular.

Assumption one: the data should be measurable on a continuous level, either interval or ratio variable, interest rates are continuous variables.

Assumption two: is there a linear relationship between the two variables. Scatter plots in Chapter 5 provide evidence of a linear relationship.

Assumption three: there should be no significant outliers. Investigation of the scatter plots in Chapter 5 reveals no significant outliers.

Assumption four: there is independence of observations. To check this, we run a Durbin Watson test statistic.

Assumption five: the data must show homoscedasticity.

Assumption six: the residual errors of the regression line are normally distributed. Key to regression testing is the relationship of a linear nature. To test this, a scatter plot was created using IBM SPSS, the results of which revealed that there is a linear relationship between the South African Reserve Bank's interest rate decisions and the Taylor Rule derivations of the interest rate path. Once assumption two is valid, the regression test can be run and the rest of the assumptions can be tested using IBM SPSS. All the assumptions necessary for regression are met for the purposes of this research.

Below is a summary of the results. The graphs show the South African Reserve Bank rate for each time period as well as the interpolated Taylor Rule interest rate path for each period. Each of the four monetary policy regime's results are presented both graphically and statistically through regression testing. Finally, a graphical representation and regression model are presented for the entire data set from 1960 – 2016.

As mentioned in Chapter 4, the data used was quarterly real GDP, quarterly CPI and quarterly South African Reserve Bank rates. The South African Reserve Bank rates were converted to quarterly rates. The potential GDP trend was calculated using the Hodrick Prescott filter, from which the GDP output gap was calculated. The calculation of potential inflation employed the method developed by Rudebusch (2001). This summarises the inputs necessary for calculating the Taylor Rule.

Figure 4: Monetary policy regime one (1960 – 1981)

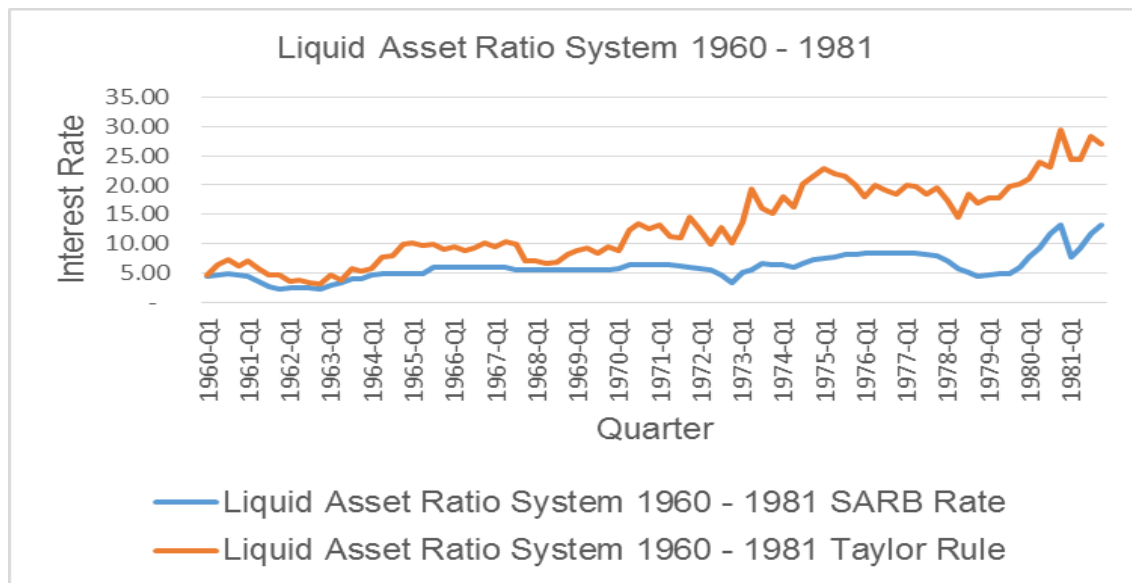


Figure 4 graphically represents the South African Reserve Bank official rates as the blue line, with the corresponding Taylor Rule interest rate path in orange. The regression modelling results are listed below for the time period 1960 to 1981.

Statistically, the output of the results revealed that the SARB rate and the Taylor Rule rate are very strongly correlated in their movements across this time period, indicating that the SARB's monetary policy decisions followed a Taylor Rule principle. A correlation coefficient of 0.865 in Table 8 indicates a strong positive correlation. Graphically, Figure 4 shows that the Taylor Rule reacts far more aggressively than the SARB reaction function, yet the two lines do move in harmony.

Table 8: Correlations (1960 – 1981)

	SARB Rate	Taylor Rule
Pearson Correlation SARB Rate	1.000	0.865
Taylor Rule	0.865	1.000

The purpose of the regression testing is to determine at each monetary policy interval, whether the monetary policy decisions taken by the SARB at the time were optimal. The study aims to determine whether the Taylor Rule is useful as a predictor of optimal monetary policy given a 95% confidence interval. If the Taylor Rule can be shown to be statistically significant in the prediction of the SARB rate, then we can conclude that monetary policy decisions made by the SARB follow a Taylor Rule process.

Figure 5: Scatter plot of the Taylor Rule and SARB Rate (1960 – 1981)

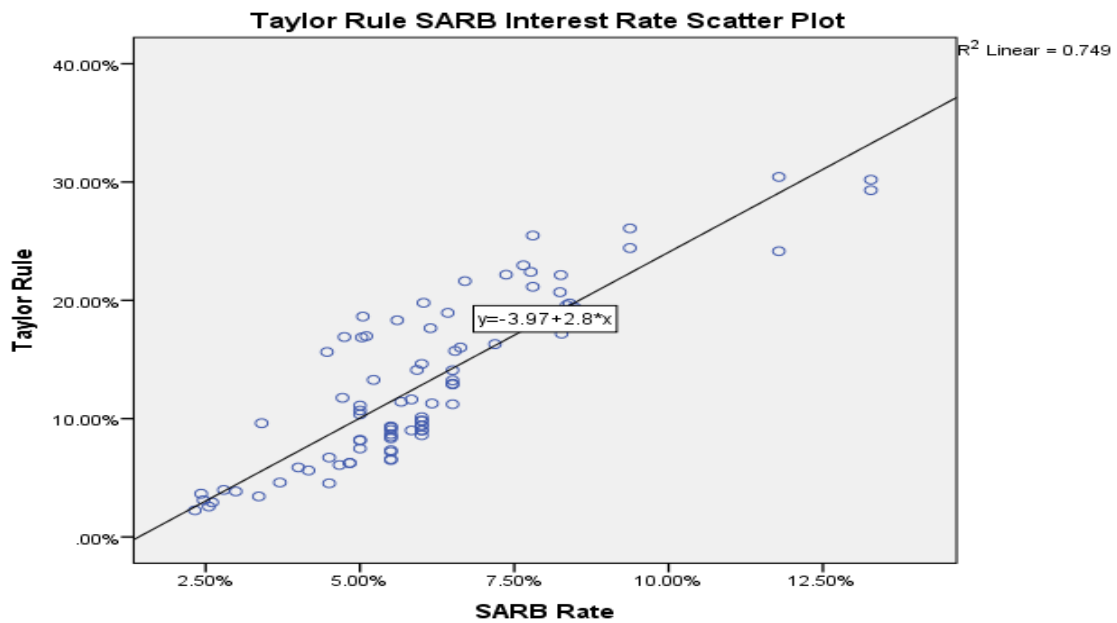


Table 9: Model summary (1960 – 1981)

Model	R	R Square	Adjusted R Square	Sig. F Change	Durbin Watson
1	0.865 ^a	0.749	0.746	0.000	0.545
a. Predictors (Constant), Taylor Rule					
b. Dependent Variable: SARB Rate					

Table 10: ANOVA (1960 – 1981)

Model		Mean Square	F	Sig.
1	Regression	300.434	256.250	0.000
	Residual	1.172		
	Total			
a. Dependent Variable: SARB Rate				
b. Predictors (Constant), Taylor Rule				

Table 11: Coefficients (1960 – 1981)

Model		B	Std. Error	Standardised Coefficients Beta	T	Sig.
1	Constant	2.594	0.248		10.470	0.000
	Taylor Rule	0.267	0.017	0.865	16.008	0.000
a. Dependent Variable: SARB Rate						

The Model summary (Table 9) provides a simple correlation value of 74.6%. This indicates the extent to which the variation from the dependent variable – the SARB interest rate – can be explained by the independent variable, the Taylor Rule. In this case, 74.6% of the SARB interest rate can be explained by the Taylor Rule.

The ANOVA report, Table 10, illustrates how good the regression model is or not; essentially whether the regression equation fits the data in predicting the dependent variable. The ANOVA table produces a p-value of 0.000, which is less than 0.05, indicating that overall, the model statistically significantly predicts the outcome variable, in this case the SARB interest rate.

The Coefficients report, presented in Table 11, provides the necessary information to predict the SARB interest rate from the Taylor Rule as well determine whether the Taylor Rule is statistically significant to the model. The p-value of the Taylor Rule for the period 1960 – 1981, is 0.000, which is less than 0.05 and therefore statistically significant.

The regression equation for the model is represented as follows –

SARB rate = 2.594 + 0.267 (Taylor Rule)

Figure 6: Monetary policy regime two (1981 – 1985)

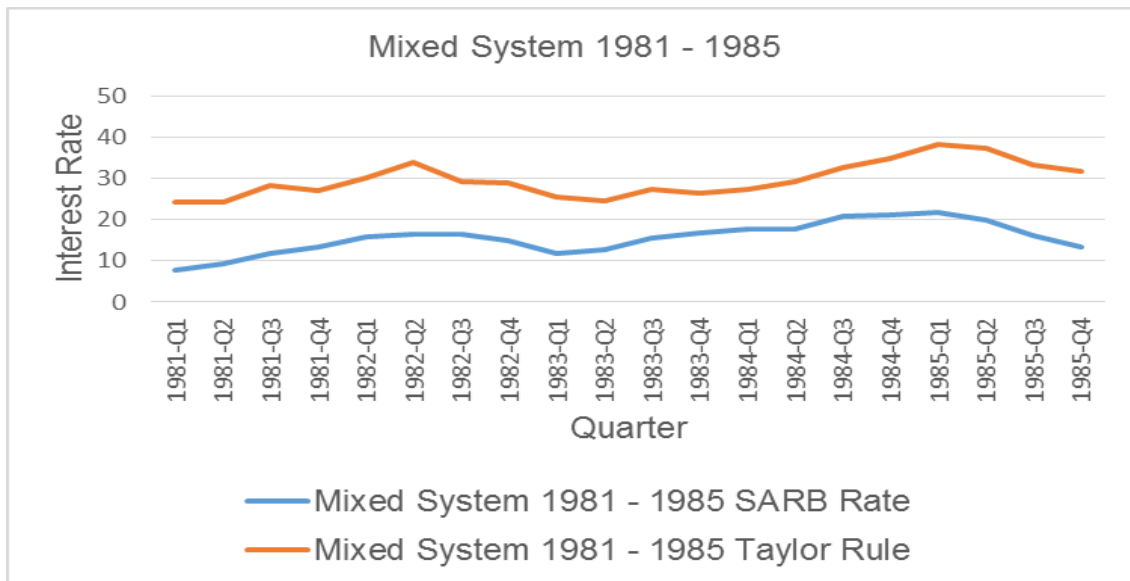


Figure 6, above, represents the South African Reserve Bank’s monetary policy decisions for the period 1981 – 1985 compared to that of the calculated Taylor Rule interest rate path for the same period. Below is a summary of the regression analysis.

Statistically, the output of the results revealed that the SARB rate and the Taylor Rule rate are strongly correlated in their movements across the time period of 1981 to 1985. A Correlation coefficient (Table 12) of 0.733 indicates a strong positive correlation. Graphically, Figure 6 shows that the Taylor Rule reacts far more aggressively than the SARB reaction function, yet the two lines do move in harmony.

Table 12: Correlations (1981 – 1985)

		SARB Rate	Taylor Rule
Pearson Correlation	SARB Rate	1.000	0.733
	Taylor Rule	0.733	1.000

Figure 7: Scatter plot of the Taylor Rule and SARB rate (1981 – 1985)

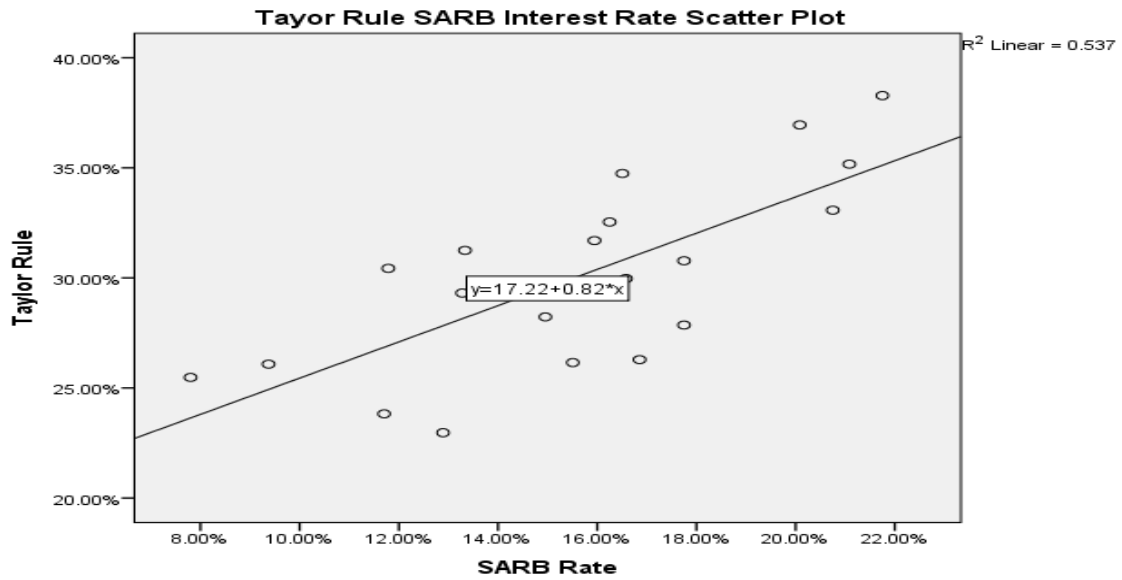


Table 13: Model summary (1981 – 1985)

Model	R	R Square	Adjusted R Square	Sig. F Change	Durbin Watson
1	0.733 ^a	0.537	0.511	0.000	0.313

a. Predictors (Constant), Taylor Rule
b. Dependent Variable: SARB Rate

Table 14: ANOVA (1981 – 1985)

Model		Mean Square	F	Sig
1	Regression	147.829	20.876	0.000
	Residual	7.081		
	Total			

a. Dependent Variable: SARB Rate
b. Predictors (Constant), Taylor Rule

Table 15: Coefficients (1981 – 1985)

Model		B	Std. Error	Standardised		
				Coefficients Beta	T	Sig
1	Constant	-4.013	4.333		-0.926	0.367
	Taylor Rule	0.652	0.143	0.733	4.569	0.000
a. Dependent Variable: SARB Rate						

The Model summary in Table 13 provides a simple correlation value of 51.1%. This indicates how much of the variation from the dependent variable, the SARB interest rate, can be explained by the independent variable, the Taylor Rule. In this case 51.1% of the SARB interest rate can be explained by the Taylor Rule.

The ANOVA report, Table 14, illustrates how good the regression model is or not, and essentially whether the regression equation fits the data in predicting the dependent variable. The ANOVA table produces a p-value of 0.000, which is less than 0.05, indicating that overall, the model statistically significantly predicts the outcome variable, in this case the SARB interest rate.

The Coefficients report, Table 15, provides the necessary information to predict the SARB interest rate from the Taylor Rule, as well as determine whether the Taylor Rule is statistically significant to the model. The p-value of the Taylor Rule for the period of 1981 – 1985 is 0.000, which is less than 0.05 and therefore statistically significant.

The regression equation for the model is represented as follows –
 SARB Rate = -4.013 + 0.652 (Taylor Rule)

Figure 8: Monetary policy regime three (1985 – 1998)

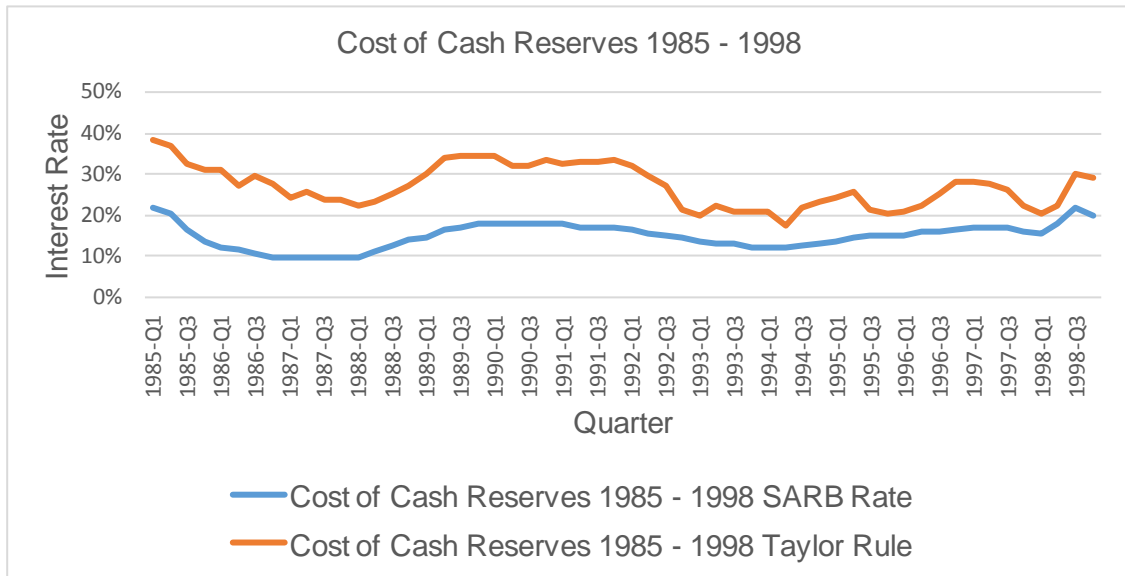


Figure 8 represents the South African Reserve Bank’s monetary policy decisions for the period 1985 – 1998 compared to that of the calculated Taylor Rule interest rate path for the same period. Below is a summary of the regression analysis.

Statistically, the output of the results revealed that the SARB rate and the Taylor Rule rate are relatively positively correlated in their movements across the time period of 1985 to 1998. A Correlation coefficient (Table 16) of 0.580 indicates a moderately positive correlation. Graphically, Figure 6 shows that the Taylor Rule reacts far more aggressively than the SARB reaction function, yet the two lines do move in harmony.

Table 16: Correlations (1985 – 1998)

		SARB Rate	Taylor Rule
Pearson Correlation	SARB Rate	1.000	0.580
	Taylor Rule	0.580	1.000

Figure 9: Scatter plot of the Taylor Rule and SARB Rate (1981 – 1985)

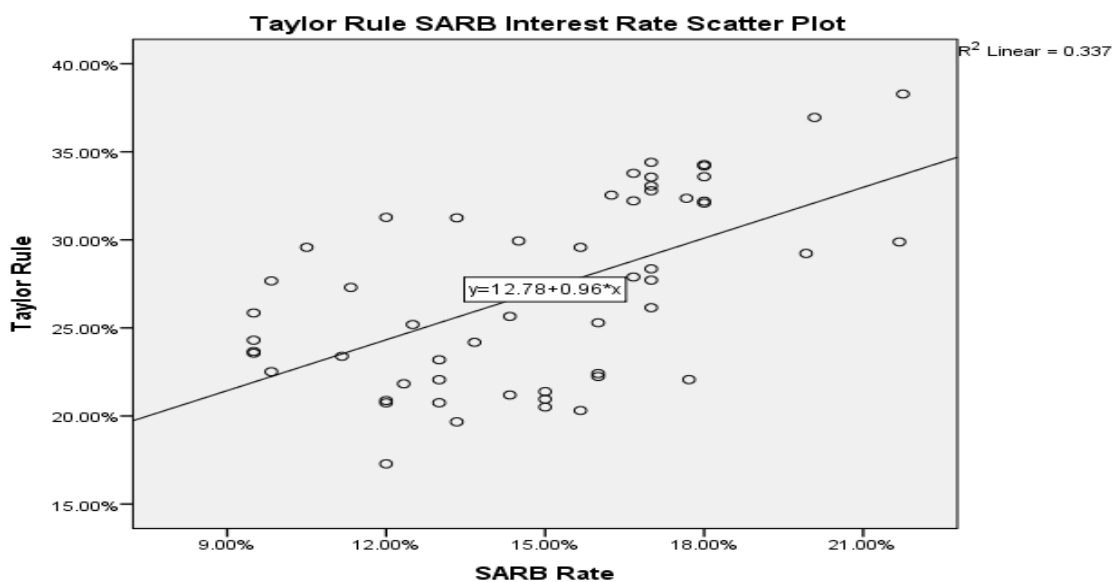


Table 17: Model summary (1985 – 1998)

Model	R	R Square	Adjusted R Square	Sig. F Change	Durbin Watson
1	0.580 ^a	0.337	0.324	0.000	0.131

a. Predictors (Constant), Taylor Rule
b. Dependent Variable: SARB Rate

Table 18: ANOVA (1985 – 1998)

Model		Mean Square	F	Sig
1	Regression	179.993	27.400	0.000
	Residual	6.569		
	Total			

a. Dependent Variable: SARB Rate
b. Predictors (Constant), Taylor Rule

Table 19: Coefficients (1985 – 1998)

Model		B	Std. Error	Standardised Coefficients Beta	T	Sig
1	Constant	5.399	1.843		0.293	0.005
	Taylor Rule	0.350	0.067	0.580	5.235	0.000

a. Dependent Variable: SARB Rate

The Model summary in Table 17 provides a simple correlation value of 32.4%. This indicates how much of the variation from the dependent variable, the SARB interest rate, can be explained by the independent variable, the Taylor Rule. In this case 32.4% of the SARB interest rate can be explained by the Taylor Rule.

The ANOVA report (Table 18) illustrates how good the regression model is or not, and essentially whether the regression equation fits the data in predicting the dependent variable. The ANOVA table produces a p-value of 0.000, which is less than 0.05, indicating that overall, the model statistically significantly predicts the outcome variable, in this case the SARB interest rate.

The Coefficients report in Table 19, provides the necessary information to predict the SARB interest rate from the Taylor Rule as well determine whether the Taylor Rule is statistically significant to the model. The p-value of the Taylor Rule for the period 1985 – 1998 is 0.000, which is less than 0.05 and therefore statistically significant.

The regression equation for the model is represented as follows –

$$\text{SARB Rate} = 5.399 + 0.350 (\text{Taylor Rule})$$

Figure 10: Monetary Policy regime four (2000 – 2016)

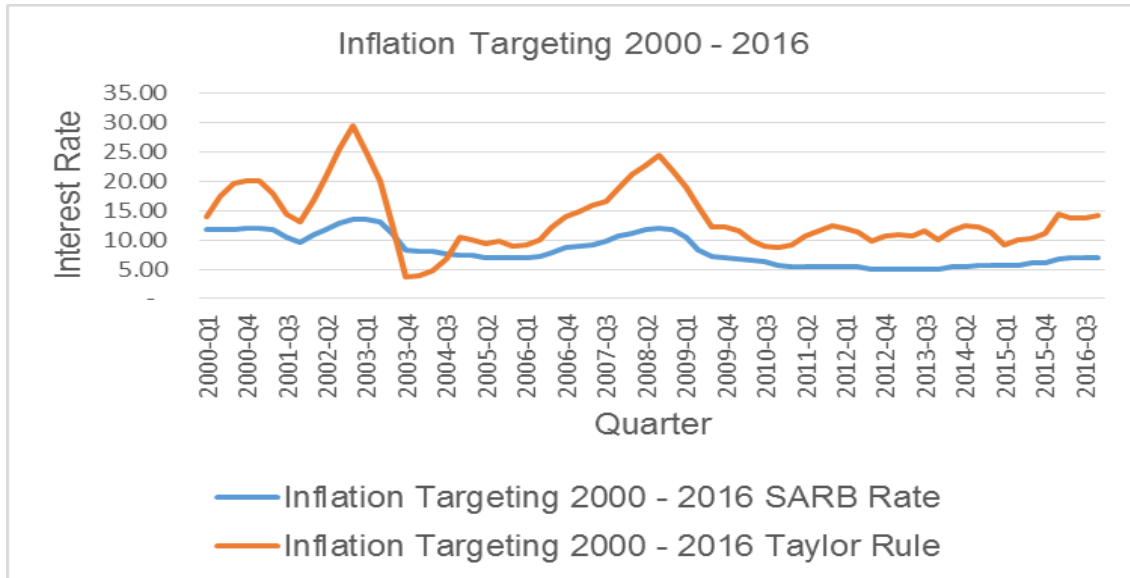


Figure 10 represents the South African Reserve Bank’s monetary policy decisions for the period 2000 – 2016 compared to that of the calculated Taylor Rule interest rate path for the same period. Below is a summary of the regression analysis.

Statistically, the output of the results revealed that the SARB rate and the Taylor Rule rate are strongly correlated in their movements across the time period 2000 to 2016, indicating that the SARB’s monetary policy decisions followed a Taylor Rule principle. A Correlation coefficient, from Table 20, of 0.781 indicates a strong positive correlation. Graphically, Figure 10 shows that the Taylor Rule reacts far more aggressively than the SARB reaction function, yet the two lines do move in harmony.

Table 20: Correlations (2000 – 2016)

		SARB Rate	Taylor Rule
Pearson Correlation	SARB Rate	1.000	0.781
	Taylor Rule	0.781	1.000

Figure 11: Scatter plot of the Taylor Rule and SARB Rate (2000 – 2016)

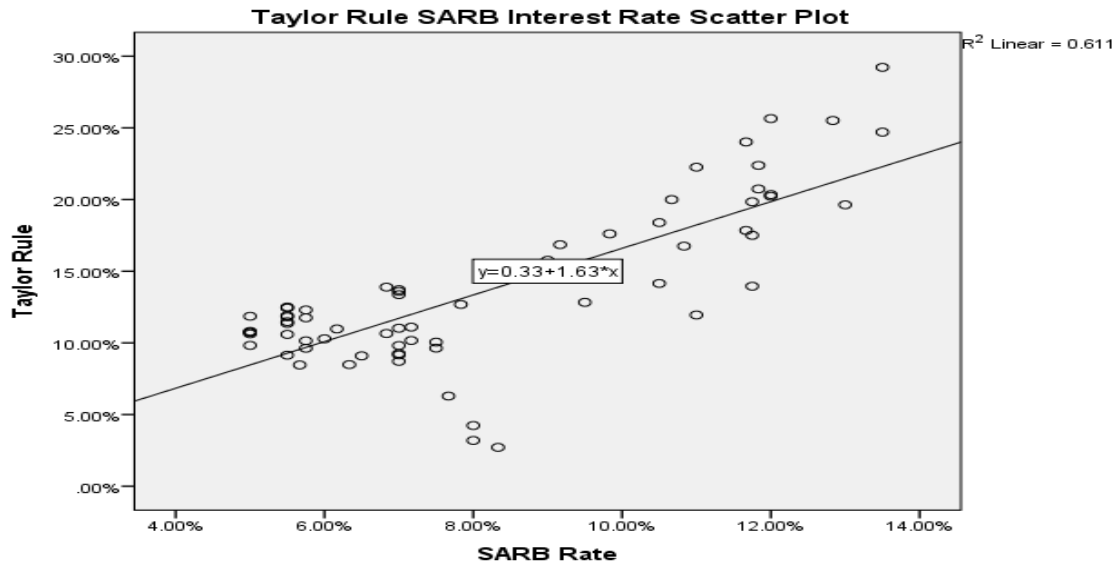


Table 21: Model summary (2000 – 2016)

Model	R	R Square	Adjusted R Square	Sig. F Change	Durbin Watson
1	0.781 ^a	0.611	0.605	0.000	0.118

a. Predictors (Constant), Taylor Rule
b. Dependent Variable: SARB Rate

Table 22: ANOVA (2000 – 2016)

Model		Mean Square	F	Sig
1	Regression	282.114	103.457	0.000
	Residual	179.973		
	Total			

a. Dependent Variable: SARB Rate
b. Predictors (Constant), Taylor Rule

Table 23: Coefficients (2000 – 2016)

Model		B	Std. Error	Standardised Coefficients Beta	T	Sig
1	Constant	3.064	0.542		5.565	0.000
	Taylor Rule	0.375	0.037	0.781	10.171	0.000
a. Dependent Variable: SARB Rate						

The Model summary in Table 21 provides a simple correlation value of 60.5%. This indicates how much of the variation from the dependent variable, the SARB interest rate, can be explained by the independent variable, the Taylor Rule. In this case 60.5% of the SARB interest rate can be explained by the Taylor Rule.

The ANOVA report, Table 22, illustrates how good the regression model is or not, and essentially whether the regression equation fits the data in predicting the dependent variable. The ANOVA table produces a p-value of 0.000, which is less than 0.05, indicating that overall, the model statistically significantly predicts the outcome variable, in this case the SARB interest rate.

The Coefficients report, Table 23, provides the necessary information to predict the SARB interest rate from the Taylor Rule as well determine whether the Taylor Rule is statistically significant to the model. The p-value of the Taylor Rule for the period of 2000 – 2016 is 0.000, which is less than 0.05 and therefore statistically significant.

The regression equation for the model is represented as follows –

$$\text{SARB Rate} = 3.064 + 0.375 (\text{Taylor Rule})$$

Figure 12: South African monetary policy compared to the Taylor Rule for the period (1960 – 2016)

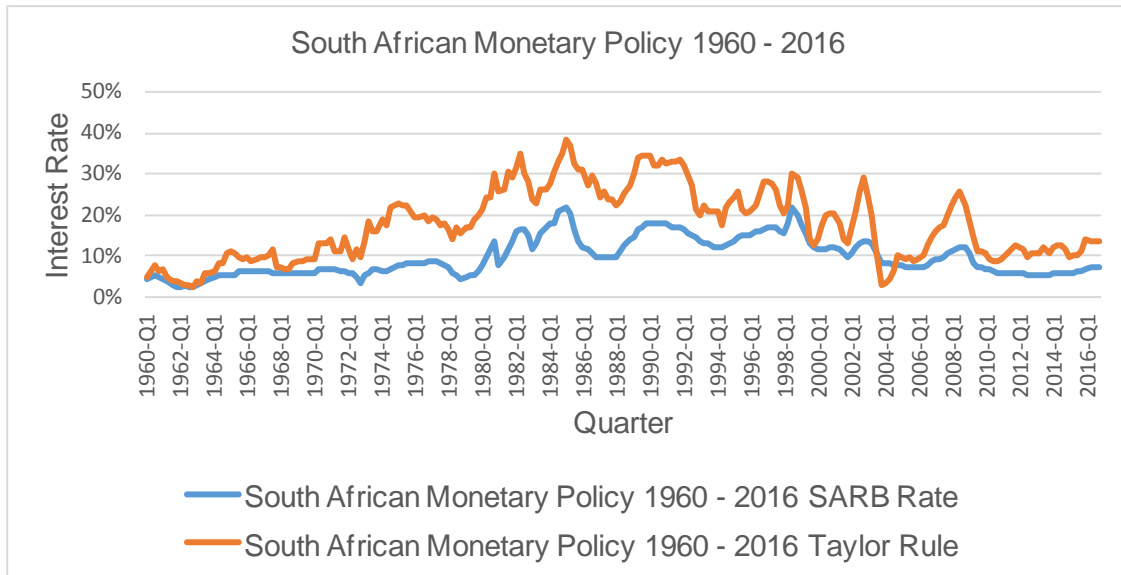


Figure 12 represents the South African Reserve Bank’s monetary policy decisions for the period 1960 – 2016 compared to that of the calculated Taylor Rule interest rate path for the same period. Below is a summary of the regression analysis.

Statistically, the output of the results revealed that the SARB rate and the Taylor Rule rate are very strongly correlated in their movements across the time period 1960 to 2016, indicating that the SARB’s monetary policy decisions followed a Taylor Rule principle. A Correlation coefficient (Table 24) of 0.869 indicates a very strong positive correlation. Graphically, Figure 12 shows that the Taylor Rule reacts far more aggressively than the SARB reaction function, yet the two lines do move in harmony.

Table 24: Correlations (1960 – 2016)

		SARB Rate	Taylor Rule
Pearson Correlation	SARB Rate	1.000	0.869
	Taylor Rule	0.869	1.000

Figure 13: Scatter plot of the Taylor Rule and SARB Rate (1960 – 2016)

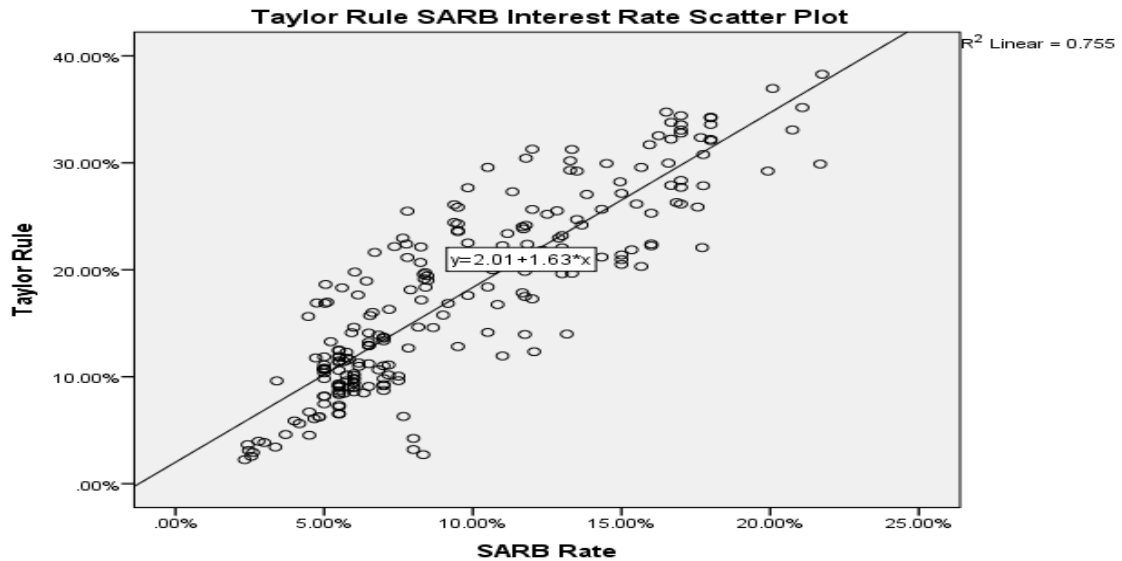


Table 25: Model summary (1960 – 2016)

Model	R	R Square	Adjusted R Square	Sig. F Change	Durbin Watson
1	0.869 ^a	0.755	0.754	0.000	0.156

a. Predictors (Constant), Taylor Rule
b. Dependent Variable: SARB Rate

Table 26: ANOVA (1960 – 2016)

Model		Mean Square	F	Sig.
1	Regression	3733.539	697.085	0.000
	Residual	1210.440		
	Total			

a. Dependent Variable: SARB Rate
b. Predictors (Constant), Taylor Rule

Table 27: Coefficients (1960 – 2016)

Model		B	Std. Error	Standardised Coefficients Beta	T	Sig
1	Constant	1.415	0.345		4.100	0.000
	Taylor Rule	0.462	0.018	0.869	26.402	0.000
a. Dependent Variable: SARB Rate						

The Model summary (Table 24) provides a simple correlation value of 75.4%. This indicates how much of the variation from the dependent variable, the SARB interest rate, can be explained by the independent variable, the Taylor Rule. In this case, 75.4% of the SARB interest rate can be explained by the Taylor Rule.

The ANOVA report (Table 25) illustrates how good the regression model is or not, and essentially whether the regression equation fits the data in predicting the dependent variable. The ANOVA table produces a p-value of 0.000, which is less than 0.05, indicating that overall, the model statistically significantly predicts the outcome variable, in this case the SARB interest rate.

The Coefficients report in Table 26, provides the necessary information to predict the SARB interest rate from the Taylor Rule, as well determine whether the Taylor Rule is statistically significant to the model. The p-value of the Taylor Rule for the period 1960 – 2016 is 0.000, which is less than 0.05 and therefore statistically significant.

The regression equation for the model is represented as follows –
 SARB Rate = 1.415 + 0.462 (Taylor Rule)

Chapter 6 – Discussion of Results

6.1 Introduction

The research explored whether monetary policy in South Africa has been implemented optimally. Previous studies by Goncalves and Salles (2006) have revealed that emerging market economies have shown benefits in the reduction of inflation and GDP stability when moving from non-inflation targeting towards inflation targeting regimes, thus suggesting that inflation targeting is a more optimal form of monetary policy. This is an interesting point to reflect upon as South Africa has been through four major monetary policy regimes since the 1960's as well as a change of government (Rossouw and Padayachee, 2008).

Research by Beju and Cuipac-Ulici (2015) and Gozgor (2012), have shown that optimal monetary policy tends to follow a Taylor Rule principle. The principle has been shown to apply in both developed and developing economies. Given that South Africa has been through four major monetary policy regimes and that the Taylor Rule has been shown to be an accurate proxy for optimal monetary policy, this study aims to determine whether monetary policy from 1960 to 2016 has, in fact, been optimal.

The research adopts a regression model, constructed with the Taylor Rule as the independent variable. The Taylor Rule is used as a proxy for optimal monetary policy, and we aim to test whether the independent variable of the Taylor Rule is a significant contributor to explaining the movement in the dependent variable, which is the South African Reserve Bank rate. The Taylor Rule formula given in Equation 1, relies primarily on the central bank rate, inflation and GDP. The coefficients applied to the GDP and inflation differential will not be discussed, as, while the coefficients for the South African economy remain a topic of debate, it is not the purpose of this research to determine them. Furthermore, the GDP and inflationary environment of each monetary period will be discussed alongside the statistical results.

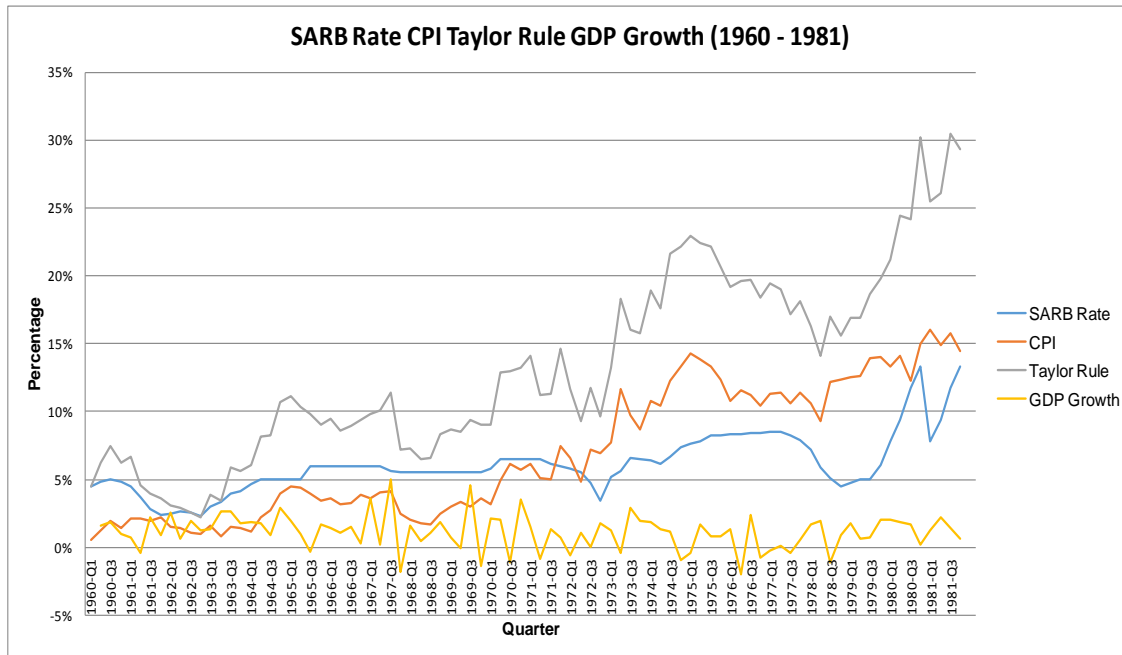
6.2 Hypothesis one: The SARB was not optimal in its monetary policy decisions for the period 1960 – 1981

Generally, there is a positive relationship between inflation and interest rates. Central banks around the world tend to raise interest rates in an attempt to bring inflation within a certain limit that is within the mandate of the central bank. A low interest rate environment typically allows consumers to consume cheaper credit and therefore spend more, which in turn, increases aggregate demand, thereby creating inflation. This is a simple explanation of how inflation, GDP and interest rates are related. Typically, inflation and interest rates should move in a similar direction.

GDP and inflation are inputs for the Taylor Rule. However, it seems that the inflation metric is more impactful to the equation than GDP, based on the structure of Equation 1. Figure 14 illustrates the GDP growth, CPI, SARB rate and Taylor Rule interest rate for the period 1960 to 1981. CPI, SARB rates and the Taylor Rule interest rate seem to move in unison over the time period, whereas GDP has a random pattern.

As was stated in the limitations section, the monetary policy regimes before inflation targeting did not target inflation entirely through interest rates. There were monetary targets, cash reserves, eclectic macroeconomic variables and wage controls, but these policies were managed for the outcome of price stability, in other words controlling inflation. Interestingly, the SARB rates over the period are below the recorded CPI figures for the period. However, as the time period ticked over into the 1970's, CPI spiked due to the international oil crisis. Subsequently, over the period of 1970 to 1981, CPI and the SARB rates increased dramatically. While the limitation that monetary policy regimes target different macroeconomic variables, they all do so to manage inflation. Figure 14, below, illustrates that the Taylor Rule is almost entirely above the SARB rate over the period, and this is due to the nature of the equation. The tendency of the Taylor Rule equation is to respond to inflation much more aggressively than the SARB. It must be noted that the SARB does not only look at GDP and CPI figures in its decision on monetary policy.

Figure 14: SARB Rate CPI Taylor Rule and GDP Growth (1960 – 1981)



Statistically, a regression model was run using the SARB rates as the dependent variable and the Taylor Rule as the independent variable. The output data reveals that the SARB rate and the Taylor Rule are very strongly positively correlated over the time period 1960 to 1981. The data for the period 1960 to 1981 produces a Pearson correlation of 0.865, the first indication that SARB interest rates follow a Taylor Rule principle.

The resulting regression model ANOVA results illustrate the model is good for fit as representative of the data, as the p-value is less than 0.05. The coefficients reveal the most important information of the regression model, that is, whether or not the independent variable is statistically significant in the prediction and explanation of the SARB interest rate. Given that the p-value is less than 0.05, we reject the null hypothesis in favour of the alternate hypothesis and can therefore determine that the South African Reserve Bank had been optimal in implementing monetary policy for the period 1960 – 1981, when the interest rate function is compared to the Taylor Rule derivation.

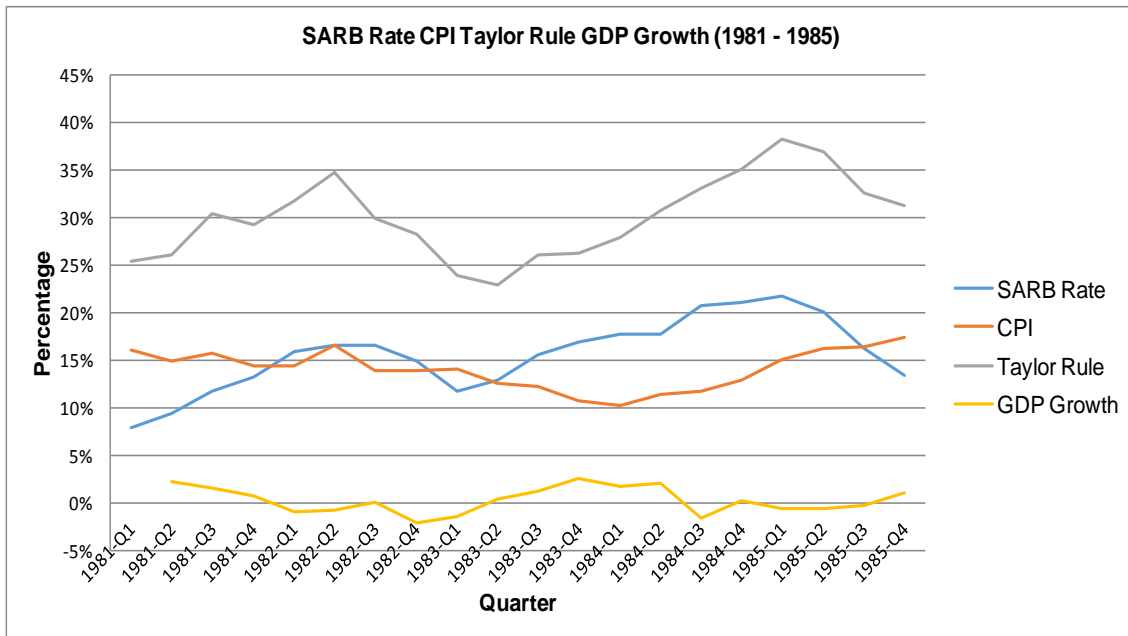
6.3 Hypothesis two: The SARB was not optimal in its monetary policy decisions for the period 1981 – 1985

The period from 1981 to 1985 is one that is characterised by stubbornly high inflation, which is understandable given the unsatisfactory experience with the direct controls system of 1960 to 1981. Monetary policy took on a market-orientated approach for the period 1981 - 1985. The period in mention is one that is characterised by a number of socio-political issues, namely the Primrose Prime Incident, The Rubicon Speech of then-President P W Botha and The Commission of Inquiry into the monetary system and monetary policy of South Africa. This commission of inquiry would eventually be labelled the De Kock Commission.

The balance of payments of the country was severely deteriorated by massive capital outflows following the infamous Rubicon Speech by former president P W Botha. The expectation of the speech was that there would be a change to the political system of apartheid. This did not materialise. The economic ramifications saw massive capital outflows from the country. More debilitating, was the withdrawal of foreign credit lines. This led to a moratorium on foreign debt and the Debt Standstill Agreements. The rescheduling of South Africa's debt was negotiated to be paid in full, with a final tranche by August 2001. It must be noted that South Africa has meticulously honoured all requirement of the agreements to foreign creditors (Mboweni, 2001).

The political and economic climate of this period in South Africa was rife with volatility. Claims that the South African Reserve Bank was being used to buy electoral votes were voiced in the public domain. This was strongly denied by then-governor, Dr De Kock. The Prime Minister of the country, P W Botha, gave his infamous Rubicon speech, which defied international condemnation to end apartheid, the result of which was additional sanctions on the country. The South African Reserve Bank could very well have leant the way of the National Party to adopt policies that may not have been the most optimal. Another important point to bring highlight, is that South Africa was an importing country and at the mercy of international markets. Figure 15, below, is a graphical representation of the inflationary, interest rate and GDP Growth climate for the period 1981 – 1985.

Figure 15: SARB Rate CPI Taylor Rule and GDP Growth (1981 – 1985)



Statistically, a regression model was run using the SARB rates as the dependent variable and the Taylor Rule as the independent variable. The output data reveals that the SARB Rate and the Taylor Rule are very strongly positively correlated over the time period 1981 to 1985. The data for the period 1981 to 1985 produces a Pearson correlation of 0.733, the first indication that SARB interest rates follow a Taylor Rule principle.

The resulting regression model ANOVA results illustrate that the model is a good fit as representative of the data, as the p-value is less than 0.05. The coefficients reveal the most important information of the regression model, that is, whether or not the independent variable is statistically significant in the prediction and explanation of the SARB interest rate. Given that the p-value is less than 0.05, we reject the null hypothesis in favour of the alternate hypothesis, and can therefore determine that the South African Reserve Bank had been optimal in implementing monetary policy for the period 1981 – 1985, when the interest rate function is compared to the Taylor Rule derivation.

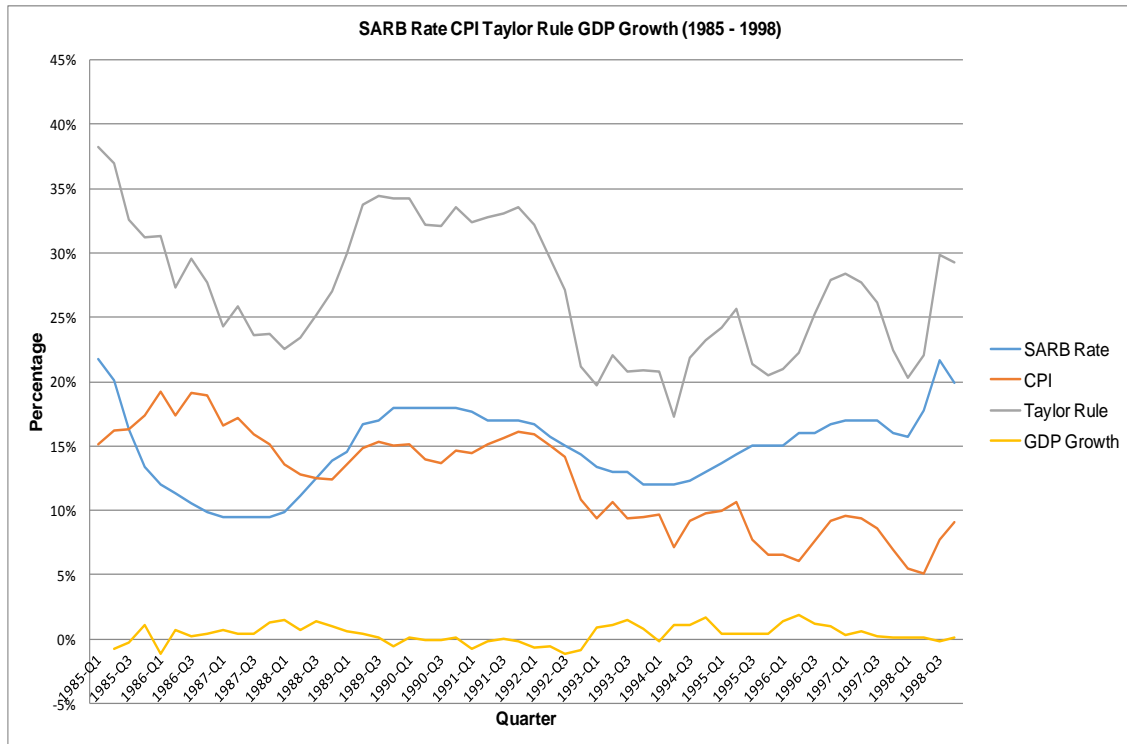
6.3 Hypothesis three: The SARB was not optimal in its monetary policy decisions for the period 1985 – 1998

From a monetary policy perspective, the cash reserve model was implemented after the experiment of the mixed system from 1981 to 1985 and the recommendations of the De Kock Commission. This policy put forward explicit monetary growth targets and guidelines for M3. M3 is described as M2 plus longer term time deposits, where M2 is M1 plus short-term time deposits. M1 is commonly known as ‘narrow money’, in other words notes and coins, (Miles, Scott, and Breedon, 2012). M3 targets are a monetarist view of the world where the level of output, prices and unemployment, are linked to the supply of money.

The pre-announced targets were to be achieved by indirectly changing interest rates. The short- term interest rate became the central bank’s primary policy tool as the central bank’s discount rate was used to influence the cost of overnight funding and hence the market interest rates. This rate was the lowest rate at which the Reserve Bank would accommodate commercial banking institutions. In order to reduce the demand for bank credit, the Reserve Bank would increase its Bank rate. The Reserve Bank adopted adjustable money supply growth targets as this allowed it flexibility in its discretion of implementing monetary policy.

It is worth mentioning that at this point in time, that the SARB had discretion to breach targets whenever it deemed it necessary, with no penalty for breaching the target or any explanation as to why the targets were breached. This again led to credibility and commitment issues in respect to the SARB implementing its strategy. The inevitability of political change in South Africa led to the usefulness of the money target diminishing in the face of financial liberalisation and large capital inflows. Figure 16 graphically illustrates the inflationary and interest rate environment for the period.

Figure 16: SARB Rate CPI Taylor Rule and GDP Growth (1985 – 1998)



Statistically, a regression model was run using the SARB rates as the dependent variable and the Taylor Rule as the independent variable. The output data reveals that the SARB rate and the Taylor Rule are very strongly positively correlated over the time period 1985 to 1998. The data for the period 1985 to 1998 produces a Pearson correlation of 0.580, an indication that perhaps the SARB interest rates does not follow a Taylor Rule principle.

The resulting regression model ANOVA results illustrate that the model is a good fit as representative of the data, as the p-value is less than 0.05. The coefficients reveal the most important information of the regression model, that is, whether or not the independent variable is statistically significant in the prediction and explanation of the SARB interest rate. Given that the p-value is less than 0.05, we reject the null hypothesis in favour of the alternate hypothesis and can therefore determine that the South African Reserve Bank was optimal in implementing monetary policy for the

period 1985 – 1998, when the interest rate function is compared to the Taylor Rule derivation.

6.4 Hypothesis four: The SARB was not optimal in its monetary policy decisions for the period 2000 – 2016

The period of inflation targeting is an interesting period to evaluate. The evidence provided in the literature review indicated that the move from non-inflation targeting to inflation targeting provides superior management of inflation and a reduction in GDP volatility (Goncalves & Salles, 2006). A section of the literature review introduced the dynamics of inflation targeting. The effectiveness of inflation targeting is dependent on its objectivity in its implementation. A target of inflation needs to be disclosed to the public and the central bank has the mandate to keep inflation within the band. This has proven to be an effective management of inflation in many OECD countries that have implemented inflation targeting.

South Africa experienced four major monetary policy regimes over the period 1960 to 2016. In that time, the country experienced social upheaval, a change of government and a reintroduction to the international community.

The literature illustrated that inflation targeting appears to be more beneficial to emerging market economies than developed economies, and the method by which this is tested as optimal is by use of the Taylor Rule. Once again, the assumption that central banks make decisions optimally is critical to this research, and one that is justified, based on the work of Mishkin (2017). The literature illustrated that monetary policy switching to inflation targeting has been the optimal decision in emerging markets. The literature also showed that the Taylor Rule is an effective proxy by which to test the optimality of central banking decisions in emerging markets. Orphanides (2001) noted that Taylor's Rule describes a reserve bank's monetary policy, as well as acts as a suitable proxy for judging whether monetary policy is appropriate. Based on the body of literature, it is the aim of this research, through the use of the Taylor Rule, to investigate whether the central banking decisions of the South African Reserve Bank

to move to inflation targeting, have been optimal. The literature presented has painted inflation targeting as a supposedly superior form of monetary policy. Should this be the case, the data is expected to reveal a correlation coefficient that is substantially higher than in the other monetary policy regimes.

Figure 17, below, graphically represents the inflationary and interest rate environment for the period 2000 – 2016

Figure 17: SARB Rate CPI Taylor Rule and GDP Growth (2000 – 2016)

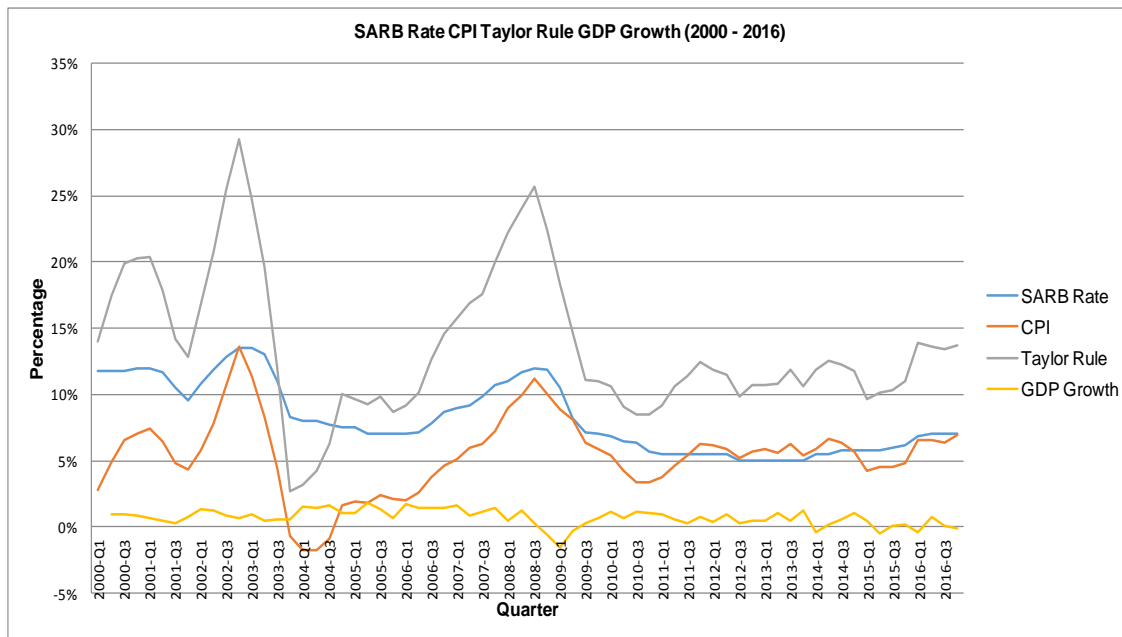


Figure 17, above, shows the inflation experience during the global financial crisis. This can be seen from the spike in CPI from 2007 to 2008. Interest rates subsequently spiked during this period and GDP declined as the global economy slipped into recession.

A comparison on the correlation coefficients over the four monetary policies reveals that the liquid asset pricing monetary policy regime has a stronger correlation and adjusted R squared when compared to the Taylor Rule.

A regression model was run using the SARB rates as the dependent variable and the Taylor Rule as the independent variable. The output data reveals that the SARB rate and the Taylor Rule are very strongly positively correlated over the time period 2000 to

2016. The data for this period produces a Pearson correlation of 0.781, the first indication that SARB interest rates follow a Taylor Rule principle.

The resulting regression model ANOVA results illustrate the model is a good fit as a representative of the data as the p-value is less than 0.05. The coefficients reveal the most important information of the regression model, that is, whether or not the independent variable is statistically significant in the prediction and explanation of the SARB interest rate. Given that the p-value is less than 0.05, we reject the null hypothesis in favour of the alternate hypothesis and can therefore determine that the South African Reserve Bank has been optimal in implementing monetary policy for the period 2000 – 2016, when the interest rate function is compared to the Taylor Rule derivation.

6.4 Hypothesis five: The SARB was not optimal in its monetary policy decisions for the period 1960 – 2016

Over the course of the analysis, the investigation has concentrated on the four monetary policy regimes over the period of 1960 to 2016. The statistics and analysis below represent monetary policy as a whole over the same period. It is no surprise that results proved that monetary policy has, in fact, been optimal given the results above.

South Africa's history over the course of the last 56 years has been tumultuous to say the least. The experience of other emerging markets such as Argentina has shown what can happen if central banking is not taken seriously. The results of the South African experience show that the central bank has, on the whole, been independent in its mandate of price stability.

It is again important to reiterate that South Africa is an importer of finished goods and, in so doing, imports inflation from the developed world. The spikes in inflation can be explained either by socio-political impacts such as the Rubicon speech and the subsequent debt standstill of the 1980's, or by the Global Financial Crisis. The most recent shock of the GFC pushed inflation up near the 10% mark, even though the country's banks were liquid and exceptionally well capitalised with very little exposure to toxic mortgage-backed assets from the big global banks. This is but a single example of how South Africa is exposed to global events.

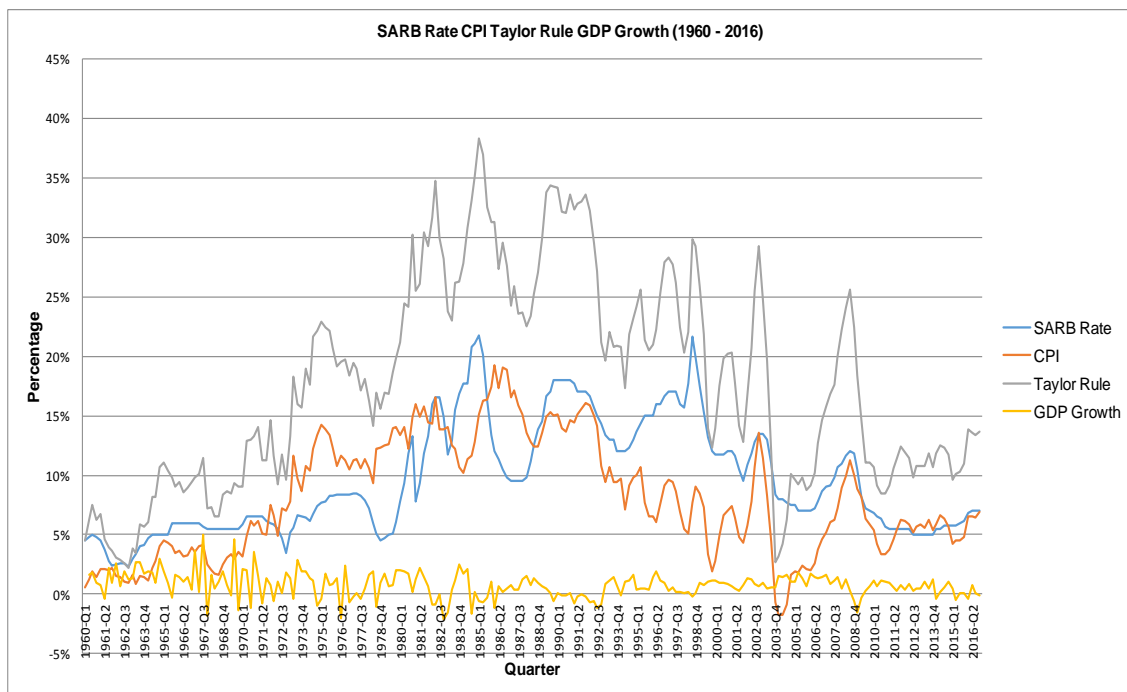
Statistically, a regression model was run using the SARB rates as the dependent variable and the Taylor Rule as the independent variable. The output data reveals that the SARB rate and the Taylor Rule are very strongly positively correlated over the time period 1960 to 2016. The data for this period produces a Pearson correlation of 0.869, the first indication that SARB interest rates follow a Taylor Rule principle.

The resulting regression model ANOVA results illustrate the model is a good fit as a representative of the data, as the p-value is less than 0.05. The coefficients reveal the most important information of the regression model, that is, whether or not the independent variable is statistically significant in the prediction and explanation of the

SARB interest rate. Given that the p-value is less than 0.05, we reject the null hypothesis in favour of the alternate hypothesis and can therefore determine that the South African Reserve Bank was optimal in implementing monetary policy for the period 1960 – 2016, when the interest rate function is compared to the Taylor Rule derivation.

Figure 18, below, graphically represents the inflationary and interest rate environment for the period 1960 – 2016.

Figure 18: SARB Rate CPI Taylor Rule and GDP Growth (1960 – 2016)



Chapter 7 – Conclusion

7.1 Conclusions

The purpose of this research was to assess whether monetary policy in South Africa has been optimal. South Africa has been through four monetary policy changes from 1960 to 2016. In this time period, there have been multiple impediments to South Africa's economy and its people. In the 1960's, the Sharpeville massacre caused a capital flight out of the country. The 1970's was characterised by the impacts of the international oil crisis. The 1980's saw the repercussions of the Rubicon speech, which isolated South Africa from the international business community. The 1980's also saw the South African economy face the ramifications of the debt standstill. The early 1990's ushered in the dawn of a new era in South Africa as Nelson Mandela was released from jail and the country began its journey of democracy.

During this 56 year period, South Africa went through four monetary policy changes. The first was the liquid asset ratio system, the second the mixed system, the third was the cost of cash reserves system and the last, and currently implemented system, was inflation targeting. The high inflation that characterised the late 1970's and 1980's leads us to believe that monetary policy perhaps was not implemented as optimally as it could have been.

The research presented in literature review communicated a view that inflation targeting has been the most optimal form of monetary policy in emerging markets. Specifically, countries that switched from non-inflation targeting to inflation targeting policies generally experienced a reduction in inflation as well as GDP volatility. The study by Goncalves and Salles (2006) presented evidence of a basket of 36 countries, of which 13 were inflation targeting countries and 23 were non-inflation targeting. The results showed that, on average, the inflation targeting countries experienced a greater reduction in inflation than the non-inflation targeting countries.

It must be noted that while the results of the Gonclaves and Salles (2006) research showed that inflation targeting worked better in emerging markets, other forms of

monetary policy also saw reductions in inflation on average in other emerging markets. Inflation targeting countries experienced larger drops, however. The results are a bit skewed in favour of emerging markets for a number of reasons. Firstly, inflation tends to be higher in these markets and the adoption of inflation targeting – and the subsequent objectivity of the regime – provides confidence in the market for investors. This has a positive impact on inflation. The same is not particularly true for developed countries, as they already have stable central banks and minimal socio- economic upheaval.

The evidence presented in the first section of Chapter 2 encapsulated the research on monetary policy regime switching both in emerging and developed economies. The evidence points to inflation targeting as being the most optimal form of monetary policy due to its impact on inflation. The South African case shows spikes in inflation and interest rates during the 1970's and 1980's, prompting questioning as to whether monetary policy was, in fact, optimal. The research aimed to test the optimality of the four monetary policy regimes that existed in South between 1960 and 2016. If the research presented in Chapter 2 is to be accepted and relied upon, then the results should show that inflation targeting is the most optimal form of monetary policy. The question remains as to how best to test for optimality in monetary policy. The answer begins with a view from Mishkin (2017).

Mishkins (2017) stated that there are nine principles that need to be met for monetary policy to be effective. Two in particular stand out to for the purposes of this study.

Firstly, inflation is always and everywhere a monetary phenomenon (Friedman, 1963). This principle is derived from Milton Friedman's classic work in 1963 which implies that the ultimate source of inflation is excessive expansionary monetary policy. The second point, which relates to the importance of price stability, implies that central banks have the ability to control inflation and should keep it low and stable.

Therefore, based on the two principles mentioned above, the assumption that the South African Reserve Bank acted in the best interest of optimal monetary policy is a rational assumption. Even though the evidence portrays inflation targeting in South African and other emerging markets as a better and more optimal form of monetary

policy, the aim of the research was to test this over the 56 year time period.

The research employed the use of the Taylor Rule to determine whether monetary policy decisions made by the South African Reserve Bank were, in fact, optimal. Beju and Cuipac-Ulici (2015), in their study of the Romanian central bank, noted that the literature considered the Taylor Rule an accurate description of how monetary policy decisions are taken by The Fed as well as other central banks.

Aizeman, Hutchison and Noy (2001) employed Taylor-type rules in the study of 16 emerging market economies employing inflation targeting and non-inflation targeting monetary policies. The results aptly capture the central bank decision-making of the countries selected for the study. The study showed that the Taylor Rule is applicable in emerging market economies. The assumption that central banks make optimal monetary policy decisions is central to the research. The evidence presented in Chapter 2 illustrated that the Taylor Rule aptly describes central banking monetary policy decisions. Therefore, if the monetary policy follows a Taylor Rule principle, in general, monetary policy tends to be optimal.

The research involved a calculation of the Taylor Rule series for each monetary policy regime over the period, as well as regression testing between the Taylor Rule interest rate function and the South African Reserve Bank function. The research found that the South African Reserve Bank was strongly correlated to the Taylor Rule and that the Taylor Rule was statistically significant in explaining the South African Reserve Bank's monetary policy decisions.

We can conclude, therefore, that the policy decisions taken by South African Reserve Bank were been optimal over the period 1960 to 2016.

7. 2 Recommendations

The research has implications concerning the governance and independence of the South African Reserve Bank. The South African Reserve Bank is mandated to protect the value of the currency and, in doing so, to keep inflation from destroying value. The independence of the South African Reserve Bank is of utmost importance to the stability of the country and its financial institutions. Any threat of malpractice or political

interference casts serious doubt on the ability of the South African Reserve Bank to carry out its mandate. Despite the political climate of the country over the past 56 years, as well as the current situation and attacks by the Public Protector, it is pleasing to note that the bank has maintained its independence and ability to pursue its mandate through multiple economic and social upheavals.

7.3 Future Research

Rogers (2010) studied the resilience of inflation targeting through macroeconomic events. The research specifically concentrated on inflation targeting, but future research could investigate whether non-inflation targeting or inflation targeting is more resilient to macroeconomic, socio-economic and political shocks within the South African context. From an economic viewpoint, South Africa is still a price taker in world markets and imports a bulk of finished goods. Although the economy is slowly moving away from mining to a knowledge- and services- based economy, South Africa is still susceptible to global economic events.

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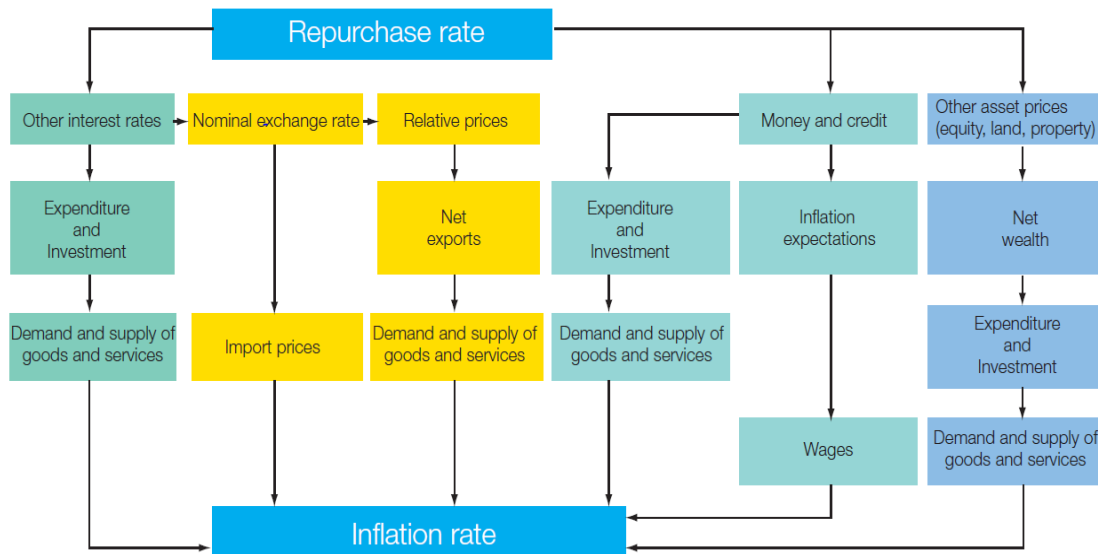
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Appendix 1



Source: Adapted from “The monetary transmission mechanism in South Africa” by Smal and De Jager (2001)

