THE EFFECTS OF INFLATION TARGETING ON ECONOMIC GROWTH IN SOUTH AFRICA

By

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DECLARATION

I declare that the dissertation hereby submitted to the University of Limpopo, for the degree of master of commerce in economics has not previously been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

Mokgola A (Mr)   : 31 December 2014

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ABSTRACT

South Africa is among a number of countries that have adopted inflation targeting as their monetary policy framework since 1990. This policy was adopted in the year 2000 in South Africa, and there have been a growing number of concerns about the effects of inflation targeting on economic growth in South Africa. The main purpose of this study is to determine these effects of inflation targeting on economic growth in South Africa. In this paper, the author used co-integration and error correction model to empirically examine the long-run and short-run dynamics of inflation targeting effects on economic growth. A final conclusion that inflation targeting does not have significant negative effects on economic growth is drawn from two interesting results. Firstly, there is an insignificant negative relationship between inflation targeting and economic growth. Secondly, the influence that inflation targeting has on the relationship between the lag of inflation and economic growth is also insignificant. These findings have important policy implications. Therefore, the critique that the SARB achieves relatively low inflation at the expense of low economic growth is a misconception. This led to the conclusion that the SARB should maintain its monetary policy framework of inflation targeting which has helped it to reduce inflation.

Keywords: *Inflation targeting, inflation, economic growth, error correction model, monetary policy.*

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CHAPTER 1
INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

A growing number of countries have adopted inflation targeting as their monetary policy framework since 1990. According to Brimmer (2002), there are more than 30 countries using an inflation targeting monetary policy framework. Inflation targeting has sometimes been criticised for being 'inflation only' centred but ignoring economic growth considerations. Bernanke (2003) on the other hand, has argued that the idea of inflation targeting focusing exclusively on control of inflation and ignoring output and employment objectives is a misconception. It is therefore crucial at this stage to provide a clear and brief explanation about this policy before going into details.

Inflation targeting refers to an economic policy in which the Central Bank estimates and announces in public a targeted inflation rate, and then attempts to steer the actual inflation towards the targeted range through the use of interest rate changes and other monetary policy instruments (Mishkin, 2000). According to Mishkin (2006), "inflation targeting is a recent monetary policy strategy that includes five main elements:

➢ the public announcement of medium-term numerical targets for inflation;
➢ an institutional commitment to price stability as the primary goal of monetary policy, to which other goals are subordinated;
➢ an information inclusive strategy in which many variables, and not just monetary aggregates or the exchange rate, are used for deciding the setting of policy instruments;
➢ increased transparency of the monetary policy strategy through communication with the public and markets about the plans, objectives, and decisions of the monetary authorities; and
➢ increased accountability of the Central Bank for attaining its inflation objectives".

Therefore, inflation targeting entails more than the announcement of a numerical target over a specific time horizon. In a study of inflation targeting for Turkey, Civcir

and Akcaglayan (2010) have found that the adoption of inflation targeting has increased the credibility of the Central Bank of Turkey.

In setting an inflation target a decision has to be made about the level of the target. According to Van der Merwe (2004) the target can be specified in terms of a range, a single point or a ceiling. A fixed single point target is much more difficult to achieve than a range or ceiling. A range or ceiling leaves some discretion to the Central Bank and can provide flexibility in the case of unforeseen price shocks. In South Africa, the initial target range of 3 to 6 percent was set by the Minister of Finance in consultation with the SARB. South Africa thus opted for a target range rather than a point target and in February 2000 the Minister of finance announced publicly that formal inflation targeting was to be adopted in the country as the monetary policy framework (Van den Heever, 2001).

There is no obvious theoretical consensus that inflation targeting could affect output growth. Although there is no theoretical and empirical consensus about the overall impact of inflation targeting on output growth, it is accepted that all inflation targeting Central Banks "not only aim at stabilizing inflation around the target but also put some weight on stabilizing the real economy" (Svensson, 2007). On the other hand, some economists argue that inflation has a global negative impact on medium and long-run economic growth (Kormendi & Meguire, 1985; Barro, 1991; Chari et al., 1996; and Gylfason & Herbertsson, 2001). However, the common view is that inflation targeting does affect inflation behaviour which then lays a foundation for economic growth. There is an indirect relationship between inflation targeting and economic growth. The adoption of a monetary policy framework that focuses explicitly on inflation is a realisation that, to promote economic growth in South Africa, the authorities must maintain a low and stable inflation rate. Low and stable inflation is supportive of high and stable long-term growth and a monetary policy supportive of long-run growth can be viewed as more credible (Sarel, 1996).

There has been a growing concern about the use of inflation targeting by SARB as its monetary policy framework. There have been questions about the extent to which inflation targeting affects economic growth in South Africa. For example, inflation targeting has been a source of political debate between the African National

Congress (ANC) government and its allies in the South African Communist Party (SACP) and trade union movements (COSATU). The SACP and COSATU argue that inflation targeting has negative impacts on economic growth and that it should therefore be abolished. Instead they propose that the SARB commitment should be on employment stability (Mboweni, 2006).

However, the Central Banks of many countries (such as New Zealand, Mexico, Egypt and Australia among others) have pursued inflation targeting since the 1990s and evidence shows that the policy has in general resulted in the reduction of the inflation rate (Petursson, 2004). During the implementation of inflation targeting if inflation appears to be above the target range the Central Bank is more likely to raise interest rates, and if inflation is below the target the Central Bank is more likely to reduce the interest rates (ibid). These actions by the Central Bank are aimed at maintaining price stability in the interest of balanced and sustainable economic growth over time.

1.2 Research Problem

There are conflicting opinions and disagreements amongst politicians, professionals, labour organizations and economists about whether inflation targeting has a favourable or unfavourable impact on economic growth in South Africa. Because money can affect many economic variables that are important to the well-being of our economy, politicians and policy makers throughout the world care about the conduct of monetary policy, the management of money and interest rates (Mishkin, 2010). For example, the Finance Minister (Pravin Gordhan) has argued that South Africa should keep its policy of targeting inflation, which has helped to stabilize prices and encourage economic growth, whereas the labour organization (COSATU) argued that inflation targeting leads to overemphasis of monetary stability at the cost of growth and development (COSATU, 2007). The extent to which the pursuit for inflation targeting exerts measurable influences on economic growth (real GDP) is therefore the main concern in this study.

Previous studies have attempted to address inflation targeting related problems by comparing the average level and fluctuations of real output between inflation

targeting countries and non-inflation targeting countries. For instance, Batini and Laxton (2006) and the IMF (2006) have provided positive evidence about the performance of inflation targeting regimes in developing countries, with lower inflation rates and less volatile inflation and output growth. To the best of my knowledge the study of how inflation targeting affects the level of real output growth in the context of a single semi-developed country such as South Africa has not yet been carried out and therefore the need for this study arises.

1.3 Hypothesis

The relevant null and alternative hypotheses include:

H_0: the Inflation targeting monetary policy framework as employed in South Africa does not significantly influence economic growth.

H_1: the Inflation targeting monetary policy framework as employed in South Africa does significantly influence economic growth.

1.4 Research Questions

Research questions investigated include the following:

➢ How does inflation-targeting affect economic growth?

➢ Does inflation targeting reduce or promote economic growth in South Africa?

➢ What differences may exist between output growth variability prior and after inflation targeting?

➢ What are the challenges facing the inflation targeting objective to ensure stable inflation, while maintaining high and stable long-term economic growth?

➢ What can be done to ensure high and stable long-term economic growth at the same time keeping inflation rate within the target range?

1.5 Purpose of the Study

1.5.1 Aim

The purpose is to determine the effects of inflation targeting on economic growth in South Africa. It is hoped that our findings might help to reconcile disagreements, resolve conflicts and clarify existing speculations and uncertainties among

politicians, labour organizations and policy makers about how inflation targeting affects economic growth.

1.5.2 Objectives of the Study

 ➢ To explore the effects of inflation targeting on economic growth.
 ➢ To determine whether inflation targeting reduces or promotes economic growth in South Africa.
 ➢ To determine whether inflation targeting leads to high or low variations in the level of economic growth.
 ➢ To identify the challenges facing inflation targeting monetary policy framework objective to ensure stable inflation, while maintaining high and stable long-term economic growth in South Africa.
 ➢ To find out whether inflation targeting is conducive for high and stable long-term economic growth in South Africa as a semi-developed country.

1.6 Rationale and Motivation for the Study

The motivation for this study is to contribute to the existing body of knowledge in economic theories and empirical studies on inflation targeting. The problem addressed in this study concerns the lack of studies or information that focus on the effects of inflation targeting on economic growth for a specific country. It is noted in section 1.2 that studies such as that of Batini and Laxton (2006) and IMF (2006) have found inflation targeting to have positive effects on economic growth. However, these studies do not give adequate information on its effects on a specific country. It could be that the negative effects of inflation targeting in some countries within the chosen sample was smoothed out by higher positive economic growth in other countries within the sample. In view of the afore-mentioned, this study attempts to address this gap in knowledge.

CHAPTER 2
ECONOMIC GROWTH

2.1 Defining Economic Growth

There are numerous definitions of economic growth. For instance, Solow (1956) defines economic growth as the increase in the amount of goods and services produced by the economy overtime. Economic growth can be measured in real or nominal terms. Real terms have been adjusted for inflation and nominal terms are not adjusted for inflation. Economic growth is usually measured as the percentage rate of increase in real gross domestic product or real GDP (Swan, 1956). Mohr et al (2008) defines GDP as the value of all final goods and services produced within the boundaries of the country in a given time period.

Like in many semi-developed countries the primary focus of policies in South Africa is to have high and sustainable economic growth. However, to achieve and maintain high growth rate policy makers need to understand the determinants of economic growth as well as how government economic policy (monetary and fiscal policy) affects economic growth. Numerous studies have been carried out to find the long run growth path. Early studies were conducted by Solow (1956) and Swan (1956) on the theory of economic growth. In contrast to the Solow-Swan growth models, there emerged an Endogenous Growth Model that assumes constant and increasing returns to scale. Lastly, the Neo Classical Theory gives a different view of a country's economic growth (see section 2.2.3 below).

2.2 Theories of Economic Growth

2.2.1 The Solow-Swan Growth Model

The Solow-Swan growth model predicts that in a steady state-equilibrium the level of economic growth will be determined by the prevailing technology and the rates of savings, population growth and technical progress (Solow, 1956; and Swan, 1956). A key element of this model is the assumption that technological change is exogenous and that technological opportunities are available across countries. In

other words, the model predicts that poor countries should be able to converge towards richer countries. They conclude that different saving rates and population growth rates will affect different countries' steady-state levels of economic growth. Other things being equal, countries that have higher saving rates tend to have higher levels of economic growth, and vice versa. Following the analysis by Harrod (1939) and Domar (1966), the actual growth rate of output of an economy (Y) could be defined as:

$$Y = \frac{s}{k}$$

Where:

Y = rate of growth

s = savings

k = capital output ratio

From the equation above, if there is a high level of saving in a country (s), it provides funds for firms to borrow and invest. Investment can increase the capital stock of an economy and generate economic growth (Y) through the increase in production of goods and services. The capital output ratio (k) measures the productivity of the investment that takes place. If capital output ratio decreases the economy will be more productive, so higher amounts of output is generated from fewer capital inputs. This again, leads to higher economic growth (Ghatak and Sanchez-Fung, 2007).

2.2.2 Endogenous Growth Theory

An Endogenous Growth Theory assumes constant and increasing returns to capital. It describes economic growth as generated by factors within the production process, for example, economies of scale, increasing capital or induced technological changes as opposed to exogenous factors such as the increases in population. In the Endogenous Growth Theory, the growth rate depends on one variable, namely, the rate of return on capital. Inflation tends to reduce this rate of return, which in turn decreases capital accumulation and reduces the growth rate. In the simplest version of this theory output continues to increase because the return on capital does not fall below a positive lower bound. Models of endogenous growth also permit increasing

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returns to scale in aggregate production; they also focus on the role of externalities in determining the rate of return on capital (Romer, 1986).

2.2.3 Classical Growth Theory

According to Fischer (1993), classical theorists laid the foundation for a number of growth theories. The foundation for the Classical Growth Model was laid by Adam Smith in his book, *An inquiry into the nature and causes of the wealth of nations (1789)*, first came with a Supply Side Driven model of growth and his production function stated as follows:

$Y = f(L, K, N, T)$
Where:

Y = is output

L = is labour

K = is capital

N = is Nature

T = is Technology

According to Adam Smith output growth is driven by population growth, investment, land growth and increase in overall productivity. Smith argued that growth was self-reinforcing as it showed increasing returns to scale. Moreover, he viewed savings as a source of investment and hence growth, and saw income distribution as one of the most important determinants of how fast or slow a nation would grow.

Barro (1995) pointed out the importance of government policies in determining where the economy will go in the long run. Favourable public policies lead to higher levels of real per capita GDP in the long run. Similarly, a greater willingness of private sector to save raises living standard in the long run. There are two channels through which policies may influence economic growth, namely, efficiency and reliability (Barro, 1991). Efficiency reflects the implementation of macro and micro-economic policies in a timely manner, and reliability of policies refers to the stability surrounding their implementation.

2.3 Inflation Targeting Countries' Growth Experience

Epstein and Yeldan (2009) conducted a study on the moving average annual GDP growth rate of Brazil during 1994-2006 and found that the inflation targeting period had a slower rate of growth than the exchange rate targeting period, and also a smaller volatility as well. In their report, the average GDP growth rate was 3.8 percent during the exchange rate targeting period, against 2.7 percent during the inflation-targeting period. On the other hand, the maximum and minimum GDP growth rates during exchange rate targeting were 8.5 percent and zero, respectively, whereas during inflation targeting the maximum and minimum rates were 5.7 percent and minus 0.8 percent, respectively. Epstein and Yeldan (2009) concluded that the trend growth rate was stationary or declining during the exchange rate targeting periods, but rising during the inflation targeting periods. Brazil and South Africa share most important features, since they are both classified by the World Bank as upper-middle income countries. That means the results reported above may not differ significantly from the South African case.

Sheridan and Ball (2005) have compared the mean and the standard deviation of real output growth between inflation targeting countries and non-inflation targeting countries using measures of central tendency/dispersion. Data on annual output were used and they found that average output growth increased by a substantial amount from 0.7 to 1.3 percent in the inflation targeting countries and decreased slightly in the non-inflation targeting countries. Even though inflation targeting countries have experienced real output growth, it should be noted that economic growth rates vary greatly across countries depending on the nature of the economy. Sheridan and Ball (2005) also found that economic growth is more stable for non-inflation targeting countries than for inflation targeting countries. They concluded that Inflation targeting causes output fluctuations. The present study narrows the focus to a single country case.

Svensson (2010) reported that for both industrial and non-industrial countries inflation targeting has proven to be a most flexible and resilient monetary – policy regime and has succeeded in surviving a number of large shocks and disturbances including the recent financial crisis and deep recession. More importantly, he

concluded that there is no evidence that inflation targeting has been detrimental to growth productivity, employment or other measures of economic performance in either developed and developing economics. In fact, inflation targeting has stabilized long term inflation expectation. No country has so far abandoned inflation targeting after adopting it or even expressed any regret. In his results he found that inflation targeting countries suffer smaller output losses in terms of sacrifice ration during disinflationary periods than non-targeting counter parts.

Johnson (2002) has compared fluctuations in output growth before and after inflation targeting, where output growth fluctuations were measured with standard deviations of output growth. It showed that growth variability has decreased in general after the adoption of inflation targeting with the largest gain in emerging market countries. These findings are consistent with the view that flexible inflation targeting does not only reduce variability in inflation but due to inflation expectation also in growth. It is, however, hard to conclude whether this reduced variability can be attributed to the inflation target or whether this is simply due to a more stable external environment in the targeting period. He concluded that increased focus on the inflation targeting will lead to low output variability. At the empirical front, Batini and Laxton (2006), Mishkin and Schmidt-Hebbel (2007), and Svensson (2010) find no evidence that inflation targeting has affected productivity growth, employment, or other measures of economic performance.

Brito and Bystedt (2010) examined the impact of inflation targeting on the level and volatility of emerging countries inflation and output growth. The inflation targeting impacts on the volatilities of inflation and output were small. In their conclusion there was no significant evidence to conclude that inflation targeting has achieved its main goal of stabilizing inflation and output growth in emerging economies.

According to Bernanke and Mishkin (1997) one potential explanation for the low levels of inflation persistence in the inflation targeting countries is the practice of an active monetary policy quickly stamping out deviations of inflation from target levels. If this were the case one would expect to see heightened levels of output volatility in the inflation targeting countries as the monetary authorities manipulated the output gap to reverse shocks of inflation. They then investigated the standard deviation of

real Gross Domestic Product (GDP) growth for the sample of inflation targeting and non-inflation targeting economies computed from 1994 to 2010. Inflation targeting economies do not seem to display heightened volatility of real GDP growth relative to non-inflation targeting economies. In particular, the five inflation targeting economies tested are spread relatively even throughout the distribution of GDP volatility. This suggests that the low levels of inflation persistence in inflation targeting countries have not come at the expense of heightened output growth volatility. This is suggestive evidence that inflation targeting has improved the trade-off between inflation and unemployment policy makers face in these countries.

Sheridan and Ball (2005) argued that there is no obvious theoretical reason that inflation targeting should affect average output growth. It might if it affected inflation behaviour and inflation affects growth. In support of the last statement, Mishkin (1999) suggests that a conservative conclusion might be: once low inflation is achieved, inflation targeting is not harmful to the real economy. Given the strong economic growth after disinflation was achieved in many countries that have adopted inflation targets, a case can be made with New Zealand, being one outstanding example, that inflation targeting promotes real economic growth in addition to controlling inflation.

2.4 South African Growth Experience

The South Africa economy is among the largest economies in Africa, accounts for 24% of its gross domestic product in terms of purchasing power parity and is ranked as an upper-middle income economy by the World Bank. Since 1996, at the end of more than twelve years of international sanctions, South Africa's GDP has almost tripled to $400 billion. South Africa has a comparative advantage in the production of agricultural and mining products. South Africa has shifted from a primary and secondary economy in the mid-twentieth century to an economy driven by the tertiary sector which at present accounts for an estimated 77% of the total GDP growth in 2000s (Du Plessis and Smit, 2006). South Africa, unlike other emerging markets, has struggled through the late 2000s recession and the recovery has been largely led by private and public consumption growth, while export volumes and private foreign investment have yet to fully recover (Laubcher, 2013).

The average real GDP growth rate for the decade since 1994 (i.e. 1995 to 2004) was 3.0%, while per capita income has proved mediocre, though improving, growing by 1.0% a year from 1994 to 2004 compared to the world growth of 3.1% over the same period. South African democratic transition in 1994 created expectations of dramatic turnaround in the economic performance. Trade and financial sanctions and internal political opposition to the apartheid government had contributed to the poorest ten year growth performance (1984 to 1993). The accelerated growth followed on an international slump and a fairly severe drought in the early nineties can therefore be attributed to the political transition in 1994 (Du Plessis and Smit, 2006). The main reason for the improvement in South Africa's growth performance after 1994 lies in the lifting of economic sanctions and the subsequent reintegration of the South African economy with the global economy. The important marked feature of the economic growth performance since 1994 was the sustained acceleration in private sector investment from 8% of GDP in 1992 to 14% in 2008, after which it levelled off to 13% of GDP in response to the recession. However, South African economic growth still compares unfavourably to those of other upper-middle income countries, such as Brazil, Australia, Turkey and Indonesia. Therefore, South Africa still has to work hard towards achieving high and sustainable economic growth (Laubcher, 2013).

CHAPTER 3
INFLATION

3.1 Define Inflation

According to Gillepie (2011), inflation occurs when there is a sustained increase in the general price level over a given period. If the annual inflation rate is 3 per cent, for example, this means that the average price level increased by 3 per cent during the specified year. Inflation measures the change in average price level on a year on year basis-that is:

$$\text{Inflation} = \frac{(\text{Prices t} - \text{Prices t}-1)}{\text{Prices t}-1} \times 100$$

Where:

t is a particular year in time; and

t-1 is the year before.

In South Africa inflation is generally measured by the Consumer Price Index (CPI). CPI compares the price of a typical basket of consumer goods and services with the price of the same basket the year before. The items in the typical basket of consumer goods and services used to calculate the CPI are regularly reviewed to make sure that they match the current spending patterns of consumers. (ibid)

3.2 Theories of Inflation

3.2.1 Keynesian Theory

The Traditional Keynesian Model is comprised of the aggregate demand and aggregate supply curves, which illustrates the inflation-growth relationship. According to this model, in the short run, the AS-curve is upward sloping rather than vertical, which is its critical feature. If the AS-curve is vertical, changes on the demand side of the economy affect only prices. However, if it is upward sloping, changes in aggregate demand affect both prices and output. This holds with the fact that many factors drive the inflation rate and the level of output in the short run.

These include changes in expectations "labour force" prices of other factors of production; fiscal and monetary policy (Dornbusch et al, 1996). Keynes contends that changes in the money supply affect output and employment indirectly through the effect that it has on the interest-rate level and because the economy normarlly operates below the full-employment level. However, adjustments in the money supply will only have an impact on real economic activity to the extent that investment spending is affected. Monetary policy will be ineffective if investment is not responsive to interest-rate changes, it would be better to rather rely on fiscal policy for demand-management purposes (McConnell, 2005). According to Van der Merwe (2010) the Keynesian theory can be illustrated by means of aggregate-demand and supply analysis, as shown in figure 3.1.
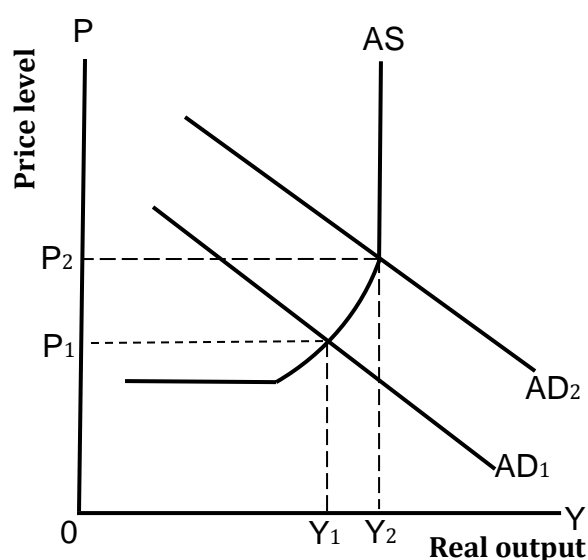
Figure 3.1: The Keynesian Theory in terms of aggregate-demand and aggregate-supply curves

As shown in the figure the real output (Y_1) of the economy at aggregate demand (AD_1) is below full production capacity and is produced at price level P_1. If the authorities stimulate aggregate demand to rise to AD_2, they will be able to increase real output to Y_2 and the price level will rise to P_2. At this higher price level the real wage rate of the economy has declined, which leads to an increase in employment. Such a stimulation of real economic activity can continue until the economy is producing at full production capacity. At this point the aggregate-supply curve

becomes vertical, and any further increases in aggregate demand will only lead to price increases and have no effect on real economic activity.

3.2.2 Money and Monetarism

Monetarism has several essential features with its focus on the long-run supply side properties of the economy as opposed to short run dynamics. Milton Friedman, who coined the term "monetarism", emphasized several key long run properties of the economy, including the Quantity Theory of Money (MV = PT) and the Neutrality of money (Dornbusch et al., 1996). Friedman proposed that inflation is the product of increase in the supply and velocity of circulation of money at a rate greater than the rate of growth of the economy: $\frac{MV}{T} = P$. The change in money supply will change the price level as long as the demand for money is stable; such a change also affects the real value of national income and economic activity, but in the short run only. For Friedman, as long as the demand for money is stable it is possible to predict the effects of changes of money supply on total expenditure and income (Ghatak and Sanchez-Fung, 2007). In reaction to the Keynesian views that monetary policy is relatively ineffective and that discretionary policy measures should be applied to maintain stable economic conditions, Friedman and Schwartz came to the conclusion in their book *Monetary History of the United States* 1867 – 1960 (1963) that 'inflation is always and everywhere a monetary phenomenon' and that 'money matters'. They accordingly argued that government should rather apply monetary targeting than discretionary measures (Van der Merwe, 2010).

Friedman also challenged the concept of the Philips curve. His argument was based on the premise of the economy where unemployment and the inflation rate increase at the same time. In summary, Monetarism suggests that in the long run, prices are mainly affected by the growth rate of money, while having no real effect on income growth. If growth in the money supply is higher than the income growth rate, inflation will result. Whenever a country's inflation rate is extremely high for a sustained period of time, its rate of money supply growth is also extremely high (Dornbusch et al., 1996). According to Van der Merwe (2010) the Monetarists believe that changes in money supply have significant impact on real output and employment over the

short term, not in the long run. This is illustrated in figure 3.2 by means of aggregate-supply (AS) and aggregate-demand (AD) curves.
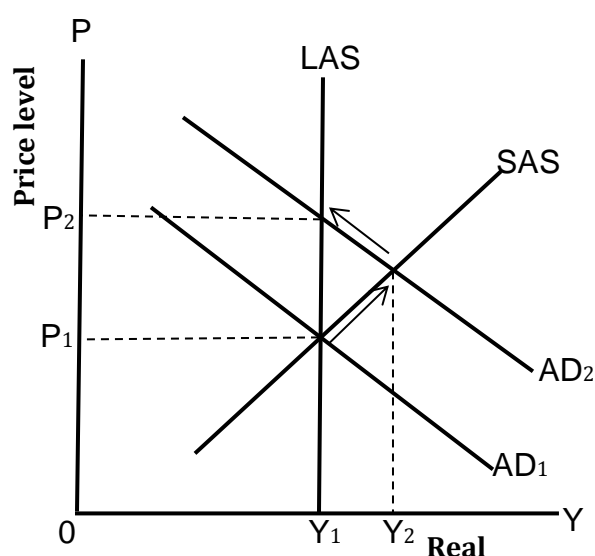
Figure 3.2: The effect of an increase in the money supply according to the monetarists

In this figure it is assumed that the money supply is increased by the monetary authorities. The monetarists argue that such an increase in cash balances will encourage people to spend more. The AD curve therefore shifts upwards from the original equilibrium demand level AD_1 to AD_2. As a result, real output in the economy shifts above its full-employment level Y_1 to Y_2. Wages and prices start to rise, moving real output from the short-term AS curve (SAS) to the long-term AS curve (LAS). Real output moves back to Y_1, its original full-employment level, and the price level rises to P_2. Over the long term, the increase in money supply causes only the price level to rise (Blanchard, 2006, and Pentecost, 2000).

3.3 Why Does Inflation Matter?

According to Arnold (2008), inflation can cause a number of problems for an economy, such as the following:

➢ Inflation may damage business confidence because of fears about the future impact on costs. This may reduce levels of investment. Uncertainty about

future inflation rates will make it difficult to estimate future profits and therefore may deter many projects, damaging economic growth;

➢ If prices are increasing this creates costs for firms, because they may have to update their promotional material to list the higher prices;

➢ Inflation erodes the purchasing power of individuals' earnings. If wages do not increase as much as prices, then, in real terms, wage earners are worse off. Their real income has fallen;

➢ If the prices of firms in South Africa are increasing faster than those of their trading partners, then this may make the South African products uncompetitive compared to those of foreign firms;

➢ Tax thresholds often do not increase in line with inflation. If employees gain a wage increase to match inflation, then they are not better off in real terms. However, with higher nominal wage, individuals may enter a higher tax bracket and therefore be worse off. This is called bracket creep.

➢ Inflation redistributes income from one individual to another. Debtors benefit during inflation moments at the expense of creditors, and the government gains at the expense of the private sector; and

➢ Inflation creates inflation expectations and it actually feeds on these expectations. It is often said that the greatest cost of inflation is the one inflation causes itself.

The effects of inflation will depend partly on whether it is anticipated or unanticipated inflation. If inflation levels are regularly unanticipated, then this will lead to high levels of uncertainty in the economy, which may deter investment and affect spending, and impact saving decisions.

3.4 What Causes Inflation?

The causes of inflation include the following:

> **Demand pull inflation**: This is shown by an outward shift of the aggregate demand curve. If demand is growing faster than supply, this will pull prices up, therefore causing Demand pull inflation. Demand pull inflation is characterized by shortages, low levels of stocks, long waiting

lists and queues (Begg et al, 2005). Inflation caused by an increase in demand is shown in the figure below:
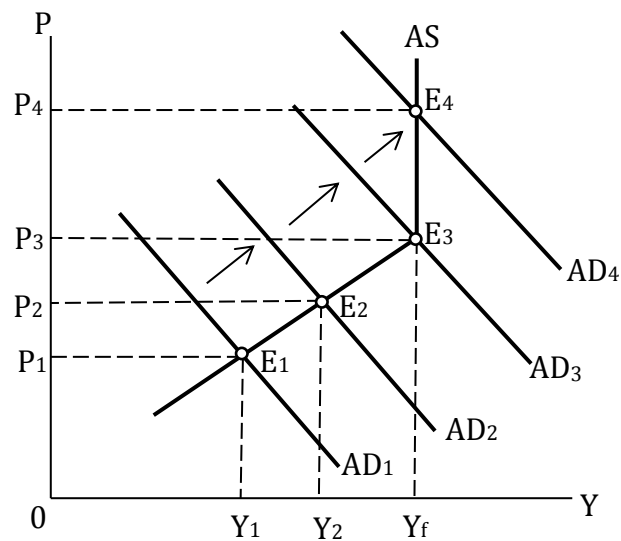
Figure 3.3: Demand pull inflation

Demand pull inflation is illustrated by a rightward shift of the AD curve. An increase in the aggregate demand (from AD_1 to AD_3) leads to an increase in the price level (P) and an increase in production and income (Y). A continuous rise in aggregate demand (from AD_3 to AD_4) beyond the full employment level of income Y_f, will only results in an increase in the average price level.

Cost push inflation: This type of inflation is caused by an increase in the cost of production. For example, Cost push inflation could be the result of:

➢ Higher wages that are not related to productivity gains;

➢ Higher import prices (due to a depreciation of the rand;

➢ Increase in profit margins;

➢ Decreased productivity; and

Changes in one of the above-mentioned factors would shift the aggregate supply curve to the left causing Cost push inflation. An inward shift of the aggregate supply will also lead to a decline in output and an increase in the price level (ibid). (See the figure 3.4.
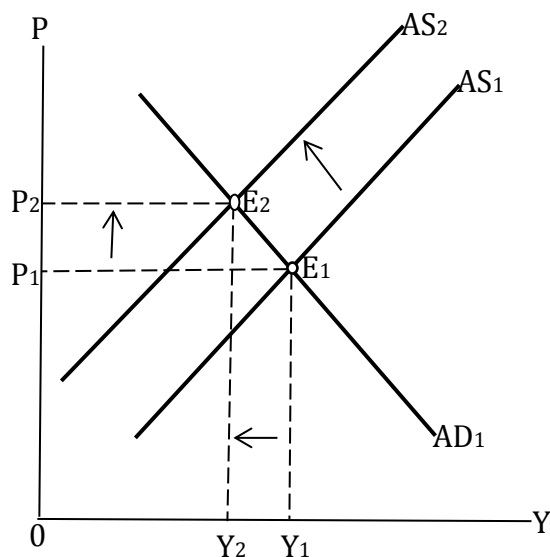
Figure 3.4: Cost push inflation

Cost-push inflation is illustrated by an upward (leftward) shift of the AS-curve from AS_1 to AS_2. Increases in the price level are accompanied by reductions in aggregate production or income Y. In the diagram, the price level increases from P_1 to P_2 and the income level falls from Y_1 to Y_2.

3.5 Controlling Inflation

Gillepie (2011) found the following methods that the government may use to control inflation:

➢ Reducing aggregate demand – to control demand pull inflation, the government will want to reduce the level of aggregate demand in the economy relative to supply. This may be done by using deflationary fiscal or monetary policy, for example reduced government expenditure, higher taxes, and higher interest rates;

➢ Reducing costs – to control cost-push inflation, government may do the following:

- the government may introduce wage restraint in the public sector, where it can control wages. This is known as an income policy.
- the government may try to influence the exchange rate to make the external value of the rand stronger. This gives SA-based firms, more purchasing power, making it cheaper to buy supplies from abroad and

➢ Setting inflation targets – by setting clear targets for inflation and giving the relevant authorities the autonomy to take actions to achieve these. The

government can try to convince foreign investors, households and business people that such targets must be met.

In this study, focus is placed on inflation targeting as this is the SARB monetary policy framework.

3.6 Inflation and Economic Growth Trade Off

The magnitude of the inflation-economic growth trade-off differs in the economic literature. According to Barro (1991), there is a negative, but weak, relationship between inflation and the growth rate of real GDP. Pollin and Zhu (2006) have reported that higher inflation is associated with moderate gains in real GDP growth of up to a 15 to 18 percent inflation threshold. Some commentators on monetary policy, particularly labour organizations, argue that inflation targeting over-emphasizes price stability at the cost of economic growth (Van der Merwe, 2004). Although they agree that low inflation and high economic growth are both desirable objectives they are of the opinion that, in the current situation of high unemployment and low economic growth in South Africa, the cost of keeping inflation rate within the target range is unacceptably high. It is also found that the trade-off that exists between inflation and economic growth in the short-run does not hold in the long run (ibid). The trade-off between inflation and unemployment is explained by the use of the Phillips curve below (first explained by Phillips in 1958).
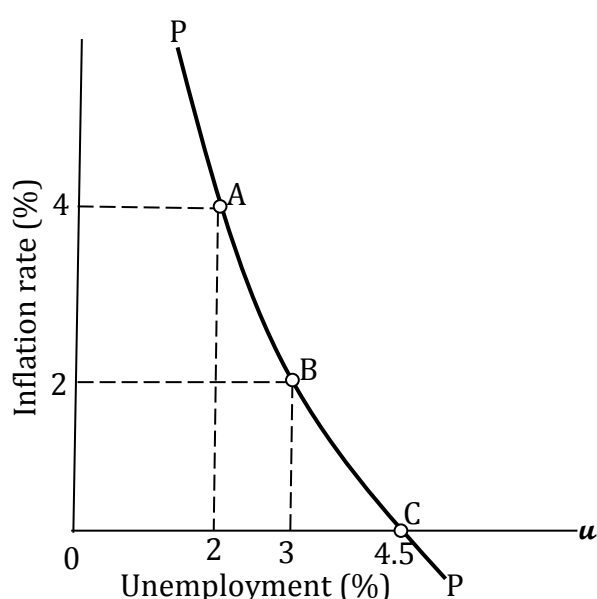
Figure 3.5: The Phillips curve

The Phillips curve relates the unemployment rate (u) to the inflation rate. Lower inflation is related to higher unemployment and vice versa.

Phillips argued that there is a negative relationship between inflation and unemployment in the short run, but over the long term the Central Bank can only influence inflation, and has no control of economic growth and employment. As can be seen from the diagram above, a lower inflation rate of 2 per cent can be achieved by allowing the unemployment rate to increase to 3 per cent and vice versa. The effect of high inflation on economic growth and employment creation is a great concern. High inflation distorts the allocation of resources and favours investment in non-productive hedge assets (Ammer & Freeman, 1995). In view of these disadvantages of inflation, most economists agree that high inflation is harmful to economic growth and employment. There are arguments too that moderate rates of inflation, below 8 per cent, do not have significant negative effects on economic growth and employment (Ammer & Freeman, 1995). Inflation uncertainty which increases inflation further and reduces growth significantly is potentially harmful to the economy (Bhar, 2010).

Ammer and Freeman (1995) have also argued that the acknowledgement of a short-run trade-off between inflation and economic growth has probably contributed to the application of inflation targeting in a flexible rather than strict manner. Strict inflation targeting is applied where the Central Bank attempts to reach the long-term inflation objective as quickly as possible, while Central Banks following a flexible approach will attempt to reduce inflation gradually to the desired long-term level, taking the effect of its actions on other economic variables into consideration.

Mignon (2011) has found that the growth effects of inflation appears strongly non-linear and the impact of inflation on GDP growth depends on the level of the inflation rate in the sense that negative effects only begin after some threshold has been reached. This result further indicated that the growth-effect of inflation is zero for inflation rates below 15%, and in the case of high inflation the impact of inflation on growth is negative and significant. Other things being equal (population growth,

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quantity of labour, Capital), an increase in the inflation rate of 1% contributes to a reduction in GDP per capita growth of 0.75 percentage points.

3.7 Inflation, Growth and Central Bank (SARB)

Monetarists regard the behaviour of monetary policy makers as exogenous. Currently, Monetarists are of the view that inflation is the result of sustained increase in the money supply. Therefore, this leads to the conclusion that long-run price stability can be achieved by limiting that rate of money growth to long-run real rate of growth in the economy (Haslag, 1995). The dominant trend in theory and practice of monetary policy over the last decade in South Africa has been its dedication to price stability. The SARB has undertaken this commitment by the mandate from the government. The results of dedicating monetary policy to price stability are perceived differently on the real macroeconomic outcomes, unemployment, real GDP and its growth rate.

Some consequences of Central Bank actions are permanent whereas others are only temporary. These complex and badly understood dynamics present particular difficulties for monetary policy makers, especially in the face of the short-run inflation and output trade off. General consensus exists amongst policy makers and Central Banks that inflation is indeed harmful to economic growth. The South Africa Reserve Bank has been more transparent in its dealings and operations to instil confidence in the economy and that the bank is committed to maintaining price stability (Gokal, 2004). Since 2000, the SARB adopted the inflation targeting regime, with the belief that dedication to price stability would contribute to high economic growth.

CHAPTER 4
INFLATION TARGETING

4.1 Measuring Inflation Targeting

When the monetary authorities (SARB) decided to adopt a policy of inflation targeting in south Africa in the year 2000, a decision had to be made about which consumer price index to target, because there are three such measures in South Africa, namely: the headline Consumer Price Index, the Core Consumer Price Index and the Consumer Price Index excluding the mortgage interest from the consumer basket. According to Meyer (2002), all inflation targeting Central Banks use a measure of consumer price inflation for their target. The use of consumer price index seems appropriate because it is the most relevant to the calculation of real income for households.

After a careful consideration and much research the SA monetary authorities decided to use the index rate calculated on the basis of Consumer Prices for metropolitan and other urban areas, but excluding mortgage interest from the basket (CPIX). Prices in rural areas were originally excluded from the target measurement, because of lack of information (SARB, 2006). This decision to target CPIX was taken irrespective of the realization that such a broad measure is subject to the pitfall that it could be affected by exogenous shocks over which the monetary policy makers have no control. Exogenous shocks in this case refer to changes in international prices. South Africa decided to target the CPIX, because the public can more easily understand this index than the core index and it excludes any direct effects that come with changes in the repo rate. Repo rate is the rate at which banks borrow money from South African Reserve Bank (SARB, 2006). Setting the target includes the following two steps:

1. Specifying the target.
2. Who set the target?

4.1.1 Specifying the Target

The adoption of inflation targeting does not merely require that an appropriate Consumer Price Index be selected to measure inflation, but also that the exact level of the target be determined. According to Van der Merwe (2004), the inflation target can be specified in terms of a range, a single point, or a celling. A fixed single point target is much more difficult to achieve than a range or a ceiling. A single point however provides the best focus for inflation expectation and avoids the disadvantages of a range or ceiling.

A range or ceiling though leaves some discretion to the Central Bank and can also provide flexibility in the case of unexpected price shocks. A ceiling has a pitfall in comparison to a range that it places the total focus on the upper boundary of the target, without indicating where the lower boundary should be. South Africa thus opted for a range of 3-6 percent rather than a point target and similarly most inflation targeting countries have specified their targets in terms of a range (Van der Merwe, 2004).

Apart from determining the target range, the time horizon over which the target is specified could also affect the target credibility. In South Africa the time horizon chosen is approximately two years with the target being revised every year on a regular basis.

4.1.2 Who Sets the Target?

Among inflation targeting countries, the implementation of inflation targeting also differs or varies with regard to who should set the target. According to Meyer (2002) the government identifies price stability as a target. The government in consultation with the Central Bank sets the numerical value of the inflation on target. In SA, the Minister of Finance (Trevor Manuel) announced the adoption of inflation targeting framework for monetary policy in 2000. The initial target set by the minister in consultation with SARB was to achieve an average inflation rate of between 3 and 6 percent in 2002. It is then within the discretion and autonomy of the SARB to decide which instruments are appropriate to achieve the target range of inflation.

The SARB's functional independence in the determination of monetary policy is clearly stated in *The Constitution of the Republic of South Africa* (Act 108 of 1996) section 224(2) that, "in pursuit of its primary objective, the bank must perform its functions independently and without fear, favour or prejudice".

4.2 Rationale for Inflation Targeting

In South Africa, arguments by which inflation targeting was adopted include the following (Van der Merwe, 2004):

➢ Inflation targeting improves co-ordination between monetary policy and other economic policies provided that the target is consistent with other objectives. Inflation targeting is a formalized approach defining precisely the coordinated effort needed to contain inflation in pursuit of the broader economic objectives of sustainable high economic growth and employment creation.

➢ Inflation targeting creates a degree of certainty among the public about the monetary policy stance adopted by the authorities. Intermediate objectives fall away with inflation targeting and policy becomes more transparent.

➢ Inflation targeting serves to increase the Central Bank's accountability, because the Central Bank has to explain what went wrong when the actual inflation rate deviates from the target. This disciplines the Central Bank and leads to a better understanding on the part of the public why monetary decision are made.

➢ The application of inflation targeting minimizes inflationary expectations, i.e. inflation targeting is perceived to be credible and forms the basis for future price and wage setting.

4.3 The Flexibility of Inflation Targeting

Mohr et al (2008) contend that high inflation is detrimental to economic growth. High inflation distorts the allocation of resources and favours investment in non-productive hedge assets. High inflation also discourages saving and results in greater consumption in anticipation of still higher prices. In view of these costs of inflation

Van der Merwe (2004) has reached the conclusion that the inflation rate of a country should be kept within a certain target range relative to that of its main trading partners and competors. The Reserve Bank's task of achieving the inflation target does not mean that the bank is not concerned with economic growth (ibid). However, if the Bank realizes that the attainment of the target level can only be achieved at a high cost to the economy over the short run, the Reserve Bank can at most advise the government to reconsider the level or time horizon of the target.

According to Svensson (2010) Inflation targeting has been a considerable success, as measured by the stability of inflation and the stability of the real economy. There is no evidence that inflation targeting has been detrimental to growth, productivity, employment, or other measures of economic performance. No country has so far abandoned inflation targeting after adopting it or even expressed any regrets. For both industrial and non-industrial countries, inflation targeting has proved to be a flexible and resilient monetary-policy regime and has succeeded in surviving a number of large shocks and disturbances, including the 2008 financial crisis and recession. Reservations against inflation targeting have mainly suggested that it might give too much weight to price stabilization to the detriment of the stability of the real economy or other possible monetary-policy objectives. The fact that real world inflation targeting is flexible rather than strict, the empirical success of inflation targeting in the countries where it has been implemented seem to confound those reservations. While macroeconomic experiences among both inflation-targeting and non-inflation targeting developed economies have been similar, inflation targeting has improved macroeconomic performance among developing economies (Svensson, 2010). Importantly, there is no evidence that inflation targeting has been detrimental to growth, productivity, employment, or other measures of economic performance in either developed or developing economies.

4.4 Critiques of Inflation Targeting

Critiques of inflation targeting tend to fall into one of the following three categories, namely (Kuttner, 2004):
1) Inflation targeting does not matter

This critique is based on the fact that the performance of inflation targeting countries is indistinguishable from that of comparable non-inflation targeting countries. Corbo et al., (2002) have found that inflation targeting countries were able to reduce their inflation rates and hit their inflation targets quite reliably while also reducing the volatility relative to the pre-adoption period.

2) Inflexibility of inflation targeting

This critique is based on the notion that inflation targeting goes too far in constraining the Central Bank's response to economic conditions particularly, real side fluctuations in employment and output. In other words, inflation targeting forces the Central Bank to pay attention only to inflation to the exclusion of output stabilization and other Central Bank objectives such as financial stability.

3) Inflation targeting neglects output stabilization

All inflation targeting Central Banks' pledges of flexibility are not fulfilled in real terms. One might argue that what matters is that inflation targeting Central Banks actually do not do what they say. Inflation targeting achieves low inflation at a cost of low economic growth and increased unemployment.

Wray and Forstater (2006) have established that inflation targeting takes lay a foundation for economic growth, and that there is also a hierarchical mandate with price stability over economic growth. However, they argue that targeting inflation is not the best route to achieve economic growth. Using inflation targeting to maximize economic growth is a fallacy for four reasons, namely:

1) It offers no practical guidance for the Central Bank on how to achieve economic growth;
2) There is lack of consensus on the numerical definition of price stability. A long term neutrality of money is therefore needed to justify price stability;

3) In an uncertain environment, price stability is not automatically the right objective to pursue in order to stabilize the economy. No price stability can be achieved without focusing on economic growth; and

4) Fixing preferences on price stability will in turn, lead to anti-democratic arrangements. Moreover, in a democratic society, the Central Bank's preference cannot for long differ from those of stakeholders (labour unions, banks, investors etc.) because the Bank is ineffective without these stakeholders' support.

4.6 Economic Growth and Inflation Targeting

Currently, many economists are convinced that high inflation is undesirable, advocating therefore, measures and institutional changes to guarantee low or stable inflation. For instance, Kakwani (2008) found that low inflation is associated with pro-poor growth, defined as the type of growth that benefits the poor proportionally more than the rich. Conversely high level of inflation is associated with anti-poor growth. His conclusion is in line with Gregorio (1992), and Barro (2001), both of whom have found that inflation is harmful to growth. An independent Central Bank is therefore mandated to keep inflation levels within a specific target range. Under inflation targeting, an agreement between a nation's government and its Central Bank commits the latter to achieve a quantitative target by a certain date. Typically, the target is specified as a low but positive rate of inflation, although allowances are made for a margin of error and for unexpected price shocks (Brimmer, 2002).

Handa (2000) has found that managing inflation is among the ultimate goals of monetary policy. Monetarists argue that money is neutral in the long run so that monetary authorities cannot change the level and path of full employment output either by increasing or decreasing the level of money supply. The Central Bank can only ensure a stable value of money; hence its target is to maintain a stable price level or inflation rate. The Monetarist argument is that a stable price level reduces uncertainty in the economy and promotes the formulation and realization of optimal saving and investment which in turn increase output and employment (Handa, 2000).

Mollick et al (2011) have examined the relationship between inflation targeting and real per capita income growth for a group of industrial and emerging economies. They found that the adoption of an inflation targeting regime results in higher output and income per capita for both industrial and emerging economies. According to Epstein and Yeldan (2009), inflation targeting is usually aimed at stabilizing economic growth at its potential level by means of eliminating excess demand pressures that tend to increase inflation.

According to Ball (1997) monetary authorities find it difficult to satisfy simultaneously their output gap and inflation rate targets, since the economy is continuously subjected to various supply and demand shocks. Therefore, the monetary authorities have to decide how fast to correct any divergence of the inflation rate from its target; they can chose to minimize the variance of inflation around its target at the expense of a larger output gap; or to maintain a small output variance and accept a more volatile inflation rate around its target. Through this decision process, the monetary authorities have to reach an optimal decision concerning inflation (Cecchetti & Ehrmann, 2000). Debelle (1995) argued that the perception that inflation targeting has been successful in achieving low and stable inflation at the expense of low economic growth is misplaced. The pursuit of flexible inflation targeting is a reflection of the Central Banks still placing more weight on output growth. Too rigid inflation targeting may result in unnecessary output variability.

Debelle argued further that the adoption of a framework that focuses explicitly on inflation reflects the growing realization that the major contribution monetary policy can make to economic growth and welfare in the long run is the maintenance of low and stable inflation rate. He concluded that the inflation targeting policy framework has sufficient flexibility to allow policy makers to make use of the short-run trade-off between output and inflation. Kuttner et al., (1996) have criticized inflation targeting for its perceived focus on inflation as the only goal for monetary policy to the exclusion of other goals, most notably output. They argue that though the empirical evidence suggests the absence of a trade-off between inflation and output in the long run, there is ample evidence of a trade-off in the short run. Therefore, an exclusive focus on returning inflation to the target rate as quickly as possible may come at the expense of excessive volatility in output.

CHAPTER 5
METHODOLODY

5.1 Introduction

In this chapter the research methodology used in the study is described and explained in details. According to Babbie (1992) research methodology is an account of the overall research, research design, research methods, data collection and the statistical analysis that will be carried throughout the study. This chapter is classified into three groups. In the first group the research design, research settings, population, sample and data collection methods are discussed. The second group consists of those statistical techniques which are used for establishing relationships between the data and the parameters. The third group comprises those methods that are used to evaluate the accuracy and validity of the obtained results.

5.2 Research Design

Robson (1993) states that a research design can be considered as a blueprint for research, dealing with at least four problems, namely: which questions to study, which data are relevant, what data to collect and how to analyse the results? Webster (1984) defines research design as a plan or protocol for carrying out or accomplishing something.

This study followed a quantitative research approach to identify, analyse and describe the effects of inflation targeting on economic growth in South Africa. The quantitative approach (a research method based on analysing the figures, comparing such figures and deliberating on the effects produced) has provided a confirmation of the effects of inflation targeting policy on economic growth rates (real GDP). The use of the quantitative research approach to analyse information assisted in the validation of the information gathered during the course of this study. This comprehensive measure allowed for a successful review of the research problem and the critical analysis of the effects of inflation targeting on economic growth rates. The identified factors included the rate of inflation, real interest rates and unemployment rate. In this study, secondary data were collected from government

institutions responsible for the publication of data on the above identified variables including economic growth.

5.3 Research Setting

In this research study for South Africa, secondary data were obtained from the South African Reserved Bank and the Statistics South Africa website. The South African Reserved Bank is the Central Bank of the Republic of South Africa and Statistics South Africa is the national statistical service of South Africa. These two institutions produce and publish data on a number of economic variables including the ones analysed in this study.

5.4 Research Populations and Sampling

According to Bailey (1987), population can be defined as all elements (individuals, objects and events), which are of interest to the researcher and to whom the research results can be generalized. In this study, the population consists of all published statistical data on economic growth, inflation rise, real interest rates and unemployment.

Gay (1987) describes sampling as a process of selecting a group of subjects for a study in such a way that the selected elements represent the group from which they were selected. In this study, a convenient sample of 30 annual data was used of which 19 observations were selected from 1981 to 1999 representing the period before inflation targeting and another sample of 11 observations selected from 2000 to 2010 represents the period after inflation targeting.

5.5 Data

According to Polit and Hungler (1999) data can be defined as information obtained during the cause of an investigation or study. In this study, secondary data was obtained in consideration of its relevancy to the study's objectives and research question. The purpose of this study is to determine the effects of inflation targeting on economic growth in South Africa. For this purpose, data on economic variables

considered relevant to the study's objectives and research question were obtained and analysed.

5.5.1 Data sources

The data in this study was obtained using Easy data facility subscribed by the economics department. In South Africa there are two important organizations Statistics South Africa and South African Reserve Bank, responsible for the publication of the SA Quarterly Bulletin, which contains the most important economic data about the South African economy.

5.6 Data Analysis

After the data were collected, it was organized and analysed. For analysis, a statistical package called E-views was used. The results were presented in tabular form, graphs and curves. The histogram of each variable (both independents and dependent) were analysed and variations in these variables were also identified and explained. All variables were tested for stationarity and variables that were found to be non-stationary in their level form were then differenced. Only stationary variables and those which became stationary when differenced were included in the model specified in order to avoid spurious regression that may lead to high R^2 and misleading results. Unit root tests, such as the Augmented Dickey Fuller tests and the Phillips-Perron tests, were performed to test for stationarity. Further tests were performed following Augmented Engle-Granger approach to determine whether the variables in the model are co-integrated in the long run.

5.7 Model Specification

In the model specified below, economic growth (Y) is included as the explained variable and inflation targeting as an independent variable, because the main purpose of this study is to determine the effects of inflation targeting on economic growth in South Africa. Included in the model is real interest rate because the monetary authority makes use of interest rates as a tool to influence economic activity. According to Chetty et al., (2010), there is an inverse relationship between

unemployment and economic growth. Therefore, the following model specifies that economic growth is a function of the inflation rate (X_t), real interest rate (R_t), unemployment (U_t) and inflation targeting (D_t).

$$Y_t = f\ X_{t,}R_{t,}U_{t,}D_{t,}$$

$$-\ \ -\ \ -\ \ \pm$$

5.8 Econometric Techniques used in this study

5.8.1 The Long Run Relationship

The ordinary least squares (OLS) method is used to estimate the long-run relationship between the dependent variable and independent variables. These variables were used in their level form, which means without having been tested for stationarity. According to Halcoussis (2005), OLS is a regression estimation technique that calculates the parameters so as to minimize the sum of the squared residuals. Studenmund (2006) stated that regression analysis can be defined as a statistical technique that attempts to explain movement in the dependent variable as a function of movements in a set of independent variables through the quantification of a single equation. The following linear regression equation was used to describe the long run relationship between the dependent variable (economic growth) and the independent variables (inflation targeting, lagged inflation rate, lagged real interest rate, and unemployment):

$$Y_t = \beta_0 + \beta_1 X_{t-1} + \beta_2 R_{t-1} + \beta_3 U_t + \mu_t \dots\dots\dots\dots\dots\dots\dots (1)$$

where;

Y_t is the level of economic growth rate

X_{t-1} is the lagged inflation rate

R_{t-1} is the lagged real interest rates

U_t is the unemployment rate

μ_t is the error term

$$\beta_1 < 0,\ \beta_2 < 0,\ \beta_3 < 0$$

The functional form in the above equation represents the relationship between the dependent variable and independent variables where μ_t is the error term, which represents all factors (nature, investment, etc.) that affect economic growth but are not analysed in this study. The βs are parameters used to estimate the changes in output growth with respect to changes in inflation, real interest rate, and unemployment.

5.8.2 Augmented Engle-Granger Approach (AEG)

The Augmented Engle-Grange Approach is followed in order to determine whether variables are co-integrated in the long run. According to Gujarati and Porter (2009) for a long run relationship to exist the Engle-Granger approach requires that a linear combination of two or more non-stationary variables become stationary. Augmented Dickey-Fuller (ADF) was therefore performed to find the degree of integration between the variables used. For example; if two variables y_t and z_t, both integrated of the order one, the long run equilibrium relationship would have the following form:

$$y_t = \beta_0 + \beta_1 z_t + e_t \dots\dots\dots\dots\dots\dots\dots (2)$$

According to the simplest definition of co-integration, two or more variables are co-integrated if the residuals of the long run equation are stationary. The auto regression of the residuals takes the following form:

$$\Delta e_t = \alpha_1 + e_t - 1 + e_t \dots\dots\dots\dots\dots\dots\dots (3)$$

The null hypothesis (H_0: no co-integration) is tested against the alternative hypothesis (H_1:co-integration exist] using the ADF test. The critical values for the Augmented Engle-Grange approach are not estimated unlike the ADF critical values, which are estimated. Therefore, we use the Mackinnon formula presented below to calculate them:

$$C\ P\ =\ \varphi_\infty + \varphi_1 T^{-1} + \varphi_2 T^{-2} \dots\dots\dots\dots\dots\dots\dots (3)$$

If the ADF test statistics is found to be significant at 1%, 5% or 10%, then it can be compared with the AEG critical values. ADF t-statistics greater than the AEG critical values at any of the three levels of significance implies that the variables in the model are co-integrated and therefore a long run relationship exists.

5.8.3 Error Correction Model (ECM)

The error correction model has been used to estimate the short run effects of inflation targeting on economic growth including other explanatory variables' effects on the explained variable. According to Noula (2012), the error correction model works effectively at capturing the short run dynamics, which are consistent with the long run dynamics.

Asteriou and Hall (2011) state that when co-integration exists between two or more variables, the residuals obtained from the ordinary least squares regression can be applied to estimate the error correction model and examine the effects of the variables in the long run and short run and therefore understand how the coefficient of the lagged residual terms adjusts periodically. Equation (4) below shows the error correction model used in this study.

$$Y_t = \beta_0 + \beta_1 \Delta X_{t-1} + \beta_2 \Delta R_{t-1} + \beta_3 D_t + \beta_4 \Delta X_{t-1} D_t + \beta_5 \Delta U_t$$
$$+ \text{RESID01} - 1 \ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

Note that only stationary variables are included in the error correction model in order to avoid spurios results. The dependent variable (Y) is not differenced, because it is stationary at level form and all the independent variables were differenced, because they were only stationary at first difference.

5.8.4 Diagnostic Tests

Diagnostic tests are performed in order to ensure the validity and reliability of the error correction model used in this study. Firstly the Jarque-Bera (JB) test were

performed. According to Gujarati (1998) the JB test is used to determine whether residuals are distributed normally in the model.

Secondly, the Ljung Box Q and the Breusch-Pagan tests are performed to test for auto correlation and serial correlation in the model, respectively. According to Gujarati and Porter (2009) auto correlation can be defined as the correlation between members of series of observations ordered in time or space. The Ljung-Box Q test is calculated of the order 6 and the Breusch-Pagan is performed with a number of 2 lags.

Lastly, the ARCH and White tests (with cross terms and no cross terms) need to be carried out in order to test for heteroskedasticity in the model. According to Asteriou and Hall (2011), a series of random variables is heteroskedastic if the random variables have random variances.

5.8.5 Stability Tests

In addition to the diagnostic tests, the Ramsey RESET test is run in order to determine whether the error correction equation is correctly specified or not. According to Asteriou and Hall (2011), an incorrectly specified equation may lead to misspecification bias and wrong functional forms that would results into a high R^2 and yielding misleading results.

5.8.6 Hypothesis Testing

At the beginning of this study a null and alternative hypotheses were made about the relationship between economic growth and inflation targeting. According to Pereira (2009), hypothesis testing is a statistical tool that provides an objective framework for making decisions using a set of rules (probabilistic methods) rather than relying on subjective impression. The usual process of hypothesis testing consists of a number of steps. The steps are the formulation of the null hypothesis and alternative hypotheses, selection of the test statistics, choice of the acceptable significance level, computation of the R^2 and adjusted R^2, computation of the probability of the value from the data, and comparison of computed value with significance level.

5.8.7 The Null Hypothesis

The null hypothesis in this study denoted by H0, specified a value for the parameter $\beta3$. The hypothesis is stated as H0: $\beta3=0$, which means that inflation targeting does not have a significant effect on economic growth in South Africa and, therefore, there would be no need for the authorities to worry about inflation targeting effects on economic growth.

5.8.8 The Alternative Hypothesis

In contrast to the null-hypothesis is the alternative hypothesis, H1, which would be accepted if the null-hypothesis would be rejected. According to Judge, Hill and Griffiths (2001), there are three possible alternative hypotheses, arranged as follows:

1) H1: $\beta3 \neq 0$. Reject the null hypothesis that $\beta3 = 0$ (the two tailed test implies that $\beta3$ takes some other values greater than or less than 0).

2) H1: $\beta3>0$. Rejecting the null hypothesis that $\beta3 = 0$ (the single tailed test), which then lead to the conclusion that $\beta3$ is greater than 0.

3) H1: $\beta3< 0$. Rejecting the null hypothesis that $\beta3=0$, then leading to the conclusion that $\beta3$ is less than 0

In this study the decision to reject H0 would lead to the conclusion that inflation targeting does significantly affect economic growth in South Africa.

5.8.9 The Test Statistics

Studenmund (2006) stated that the t-test is the test usually used to test the hypothesis about the individual regression slope coefficient. Test statistics was carried out for the slope coefficient between economic growth and inflation targeting. According to Gujarati and Porter (2009), a statistic on which the decision can be based whether to accept or reject a hypothesis is called a test statistic. Sample information about the null-hypothesis is embodied in the value of a test statistic. Based on the value of a test statistic, which itself is a random variable; we are able to decide either to reject the null-hypothesis or not. For example, a t-statistic for a parameter βk can be stated as follows:

$$t_k = \frac{\hat{\beta}_k - \beta_{H0}}{Se\left(\hat{\beta}_k\right)} \quad \text{(k=1, 2,……………., k)}$$

$$t_k = \frac{\hat{\beta}_k}{Se\left(\hat{\beta}_k\right)} \quad \text{(k=1, 2,……………., k)}$$

Where;

t_k is the test statistic

$\hat{\beta}_k$ is the estimated regression coefficient of the kth variable

$Se\left(\hat{\beta}_k\right)$ is the estimated standard error of $\hat{\beta}_k$

$\hat{\beta}_{H0}$ is the broader value (usually zero) implied by the null hypothesis for β_K

5.8.10 Significance Testing

According to Gujarati and Porter (2009), the level of significance denotes the probability of observing an estimated t-value greater than the critical t-value if the null hypothesis were correct. The recommended level of significance is 5 percent. The test for which we use a 0.05 level of significance can also be said to have a 95 percent level of confidence.

5.8.11 Confidence Interval

Confidence interval is a range which contains the true value of an item a specified percentage of the time. This percentage is the level of confidence associated with the level of significance used to choose the critical t-value in the interval. For an estimated regression coefficient, the confidence interval was calculated using the two-sided critical estimated coefficient.

Confidence interval = $\hat{\beta} \pm t_c \cdot Se(\hat{\beta})$

The confidence interval is also called the standard error of mean prediction. Some 95 times out of a hundred, then true mean of Y_t will be within the confidence limits around the observed interval mean of n sample cases. That is, the confidence interval is the upper and lower bounds for the mean predicted response (Gujarati and Porter, 2009).

5.8.12 Correlation

Correlation is a statistical technique that can show whether and how strongly pairs of variables are related. Correlation in this study is used to explain how much variations in economic growth are related to real interest rates, inflation targeting, inflation and unemployment.

5.8.12.1 The R^2

According to Judge et al., (2011), the R^2 can be defined as the measure of the multiple correlations or the coefficient of multiple determinations, and it is the percentage of the variation in the dependent variable explained jointly by the changes in independent variable. The R^2 can also be interpreted as the proportionate reduction in error in estimating the dependent variable when knowing the independent variables. The measures of the R^2 lie between zero and one; the closer the R^2 is to one, the better the results in explaining the variances in the dependent variable and the greater is the predictive ability of the model over all the sample observations. The equation of the R^2 is represented as follows:

$$R^2 = 1 - \frac{SSE}{SST}$$

Where;

      SSE is the error sum of squares

      SST is the total sum of squares

5.8.12.2 Adjusted R^2

When comparing models with different numbers of independent variables, Gujarati (2006) suggested that it is good practice to find the adjusted R^2 value because it explicitly takes into account the number of variables included in the model. According to Studenmund (2006), R^2 measures the percentage of the variation of Y around its mean that is explained by the regression equation, adjusted for degrees of freedom. The R^2 can be mathematically expressed as follows:

$R^2 = 1 - [(1 - R^2)(n - 1)/(n - k - 1)]$

Where;

      n is the sample size,

      K is the number of terms in the model excluding the constant.

5.8.12.3 F Test

The F test is used to test the significance of the R^2. If Probability (F) <0.05, then the model is of a good fit and considered significantly better than would be expected and therefore reject the null hypothesis of non-linear relationship of the dependent variable to the independent variables. F is given as follows:

$$F = \frac{\left[\dfrac{R^2}{k}\right]}{\left[\dfrac{1 - R^2}{n - k - 1}\right]}$$

5.9 Conclusion

In this chapter, the research methodology used in this study is presented and describes how the study is designed to address the research objectives and research problem. In addition, the research setting, data collection, procedures, and data analysis for this study is discussed. Lastly, the focus is placed on describing the statistical techniques used to explain the economic relationship between economic growth and inflation targeting.

CHAPTER 6

DATA INTEPRETATION AND RESULTS DISCUSSION

6.1 Introduction

In this chapter the emphasize is first on the graphical presentation of each variable and comparing difference in average changes of economic growth prior and after inflation targeting. Thereafter, the discussion is on the long run results together with the unit roots tests on residuals under the Augmented Engle Granger approach. Lastly, the discussion focuses on the results of unit roots tests (both ADF and the Phillips-Perron tests) and the error correction model together with the diagnostic and stability tests as performed.

6.2 Unit Root Test with Graphs

6.2.1 The Graphical presentation of Economic Growth

Figure 6.1A illustrates the trend in economic growth rates of South Africa from 1981 to 2010. As shown, growth rates remained low with an average of 1.75% and in so many years remained negative in the period before inflation targeting (1981 to 1999). However, economic growth has consistently remained steady and relatively high with an average of 3.5% during inflation targeting period (2000 to 2010). The average economic growth rate experienced during the inflation targeting period is greater than the average economic growth rate experienced during non-targeting period by 1.8%.

Figure 6.1A shows that the variable (Y) is not stationary at level form because its means does not hover around the zero, but it shows stationarity when differenced once (DY). However, the ADF test and Philips-Perron test indicate that the variable, Y, is stationary at its level from (see Table 6.1).
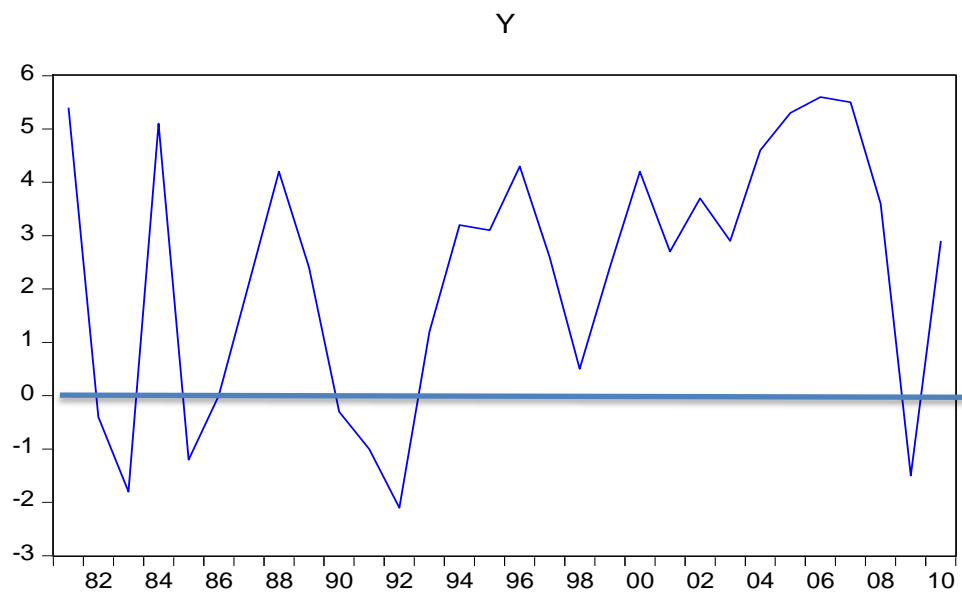
Figure 6.1A: Economic growth in level form (Y)
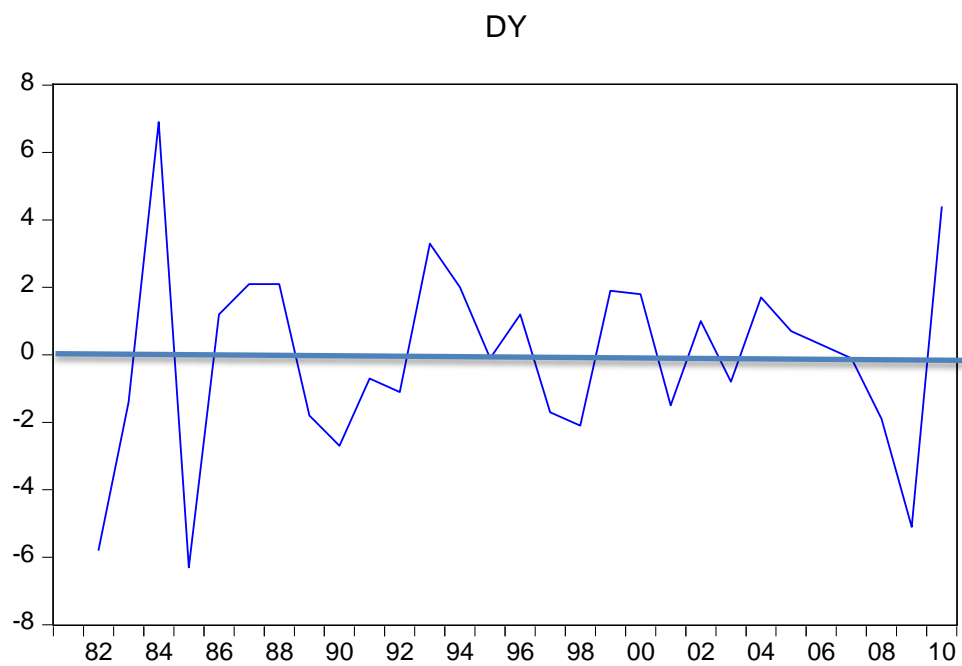
Figure 6.1B: Economic growth at first difference (DY)

6.2.2 Graphical Representation of Inflation Rate

Figure 6.2A illustrates the trend in inflation from 1981 to 2010. It portrays that; inflation rate (X) is not stationary at its level form. In figure 6.2B, the variable (X) becomes stationary at first difference (DX).

X
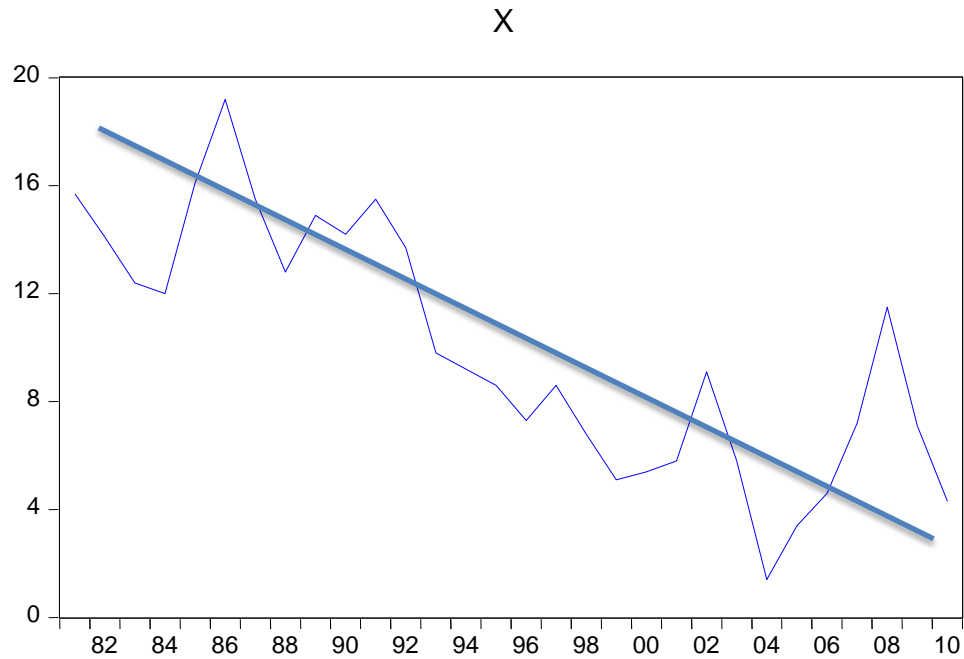
Figure 6.2A: inflation in level form (X)

DX
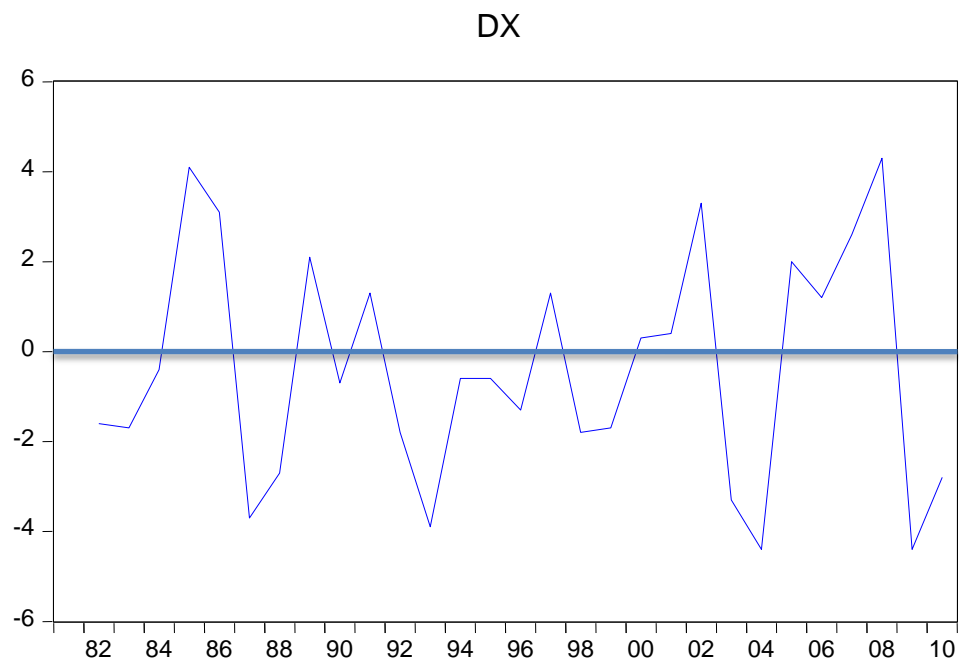
Figure 6.2B: inflation at first difference (DX)

6.2.3 Graphical Representation of Interest Rates

Figure 6.3A below illustrates the trend in real interest rates from 1981 to 2010. Real interest rate appears to be non-stationary in its level form (R), but becomes stationary when differenced once (DR) in figure 6.3B.

R
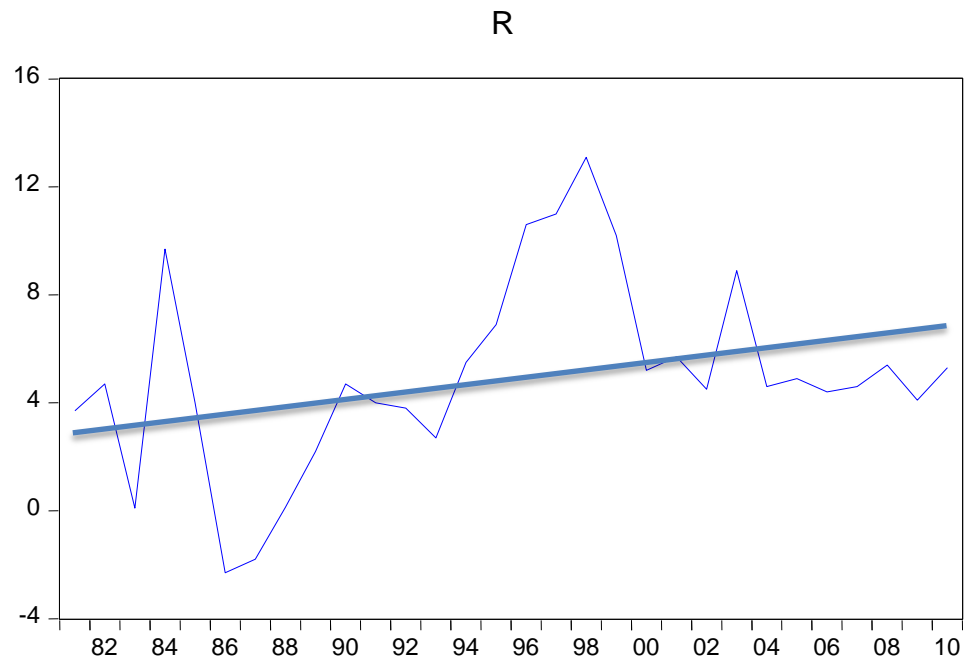
Figure 6.3A: Real interest rates in level form (R)

DR
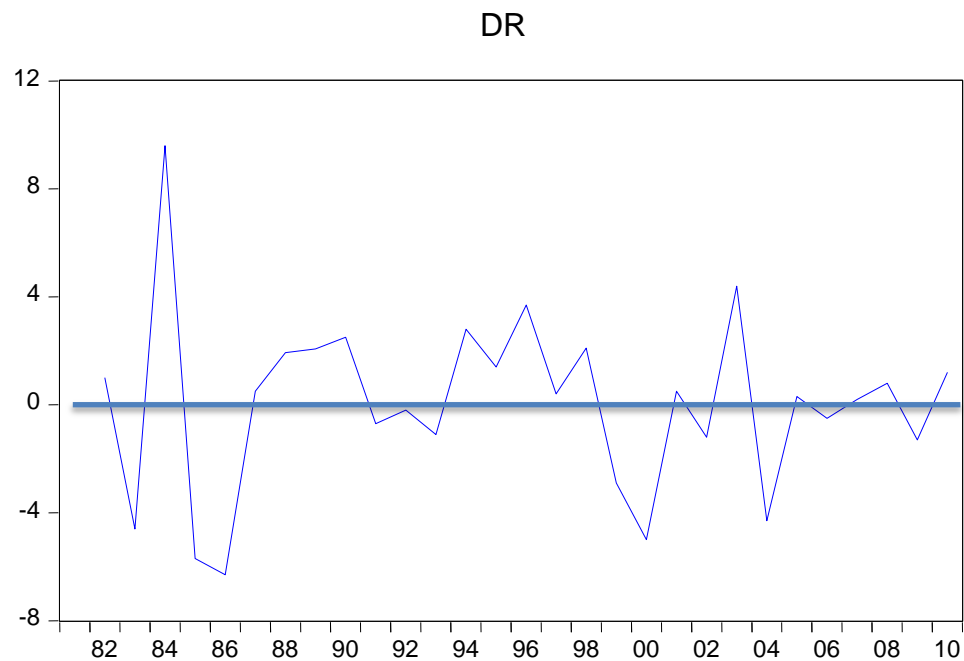
Figure 6.3B: Real interest rates at first difference (DR)

6.2.4 Graphical Representation of Unemployment Rate

Figure 6.4A: the unemployment rate (U) is not stationary in its level form, but becomes stationary at first difference (DU) in figure 6.4B.

UT
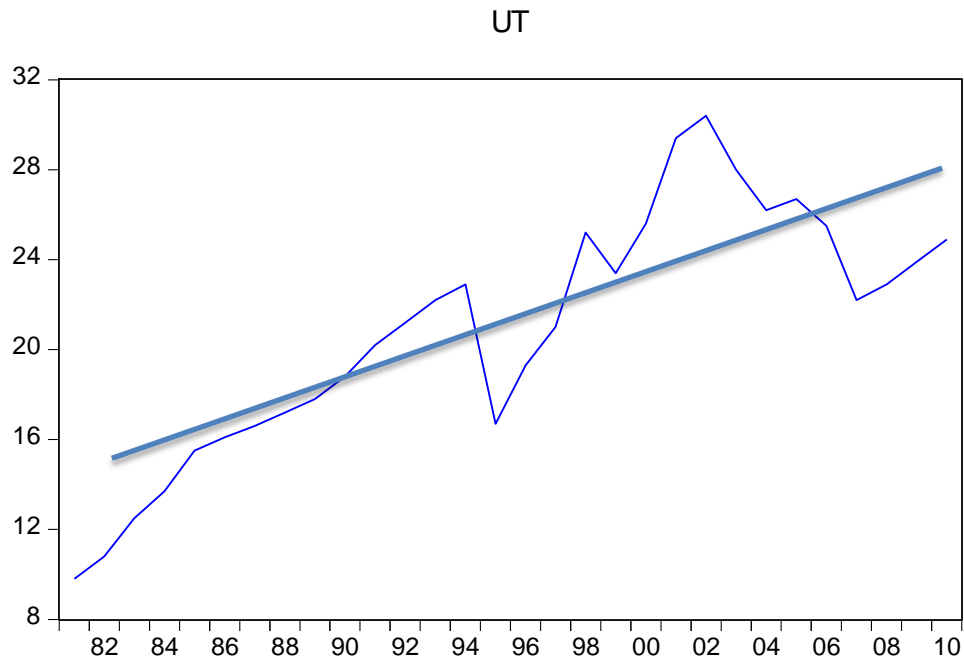
Figure 6.4A: Unemployment rate in level form (U)

DU
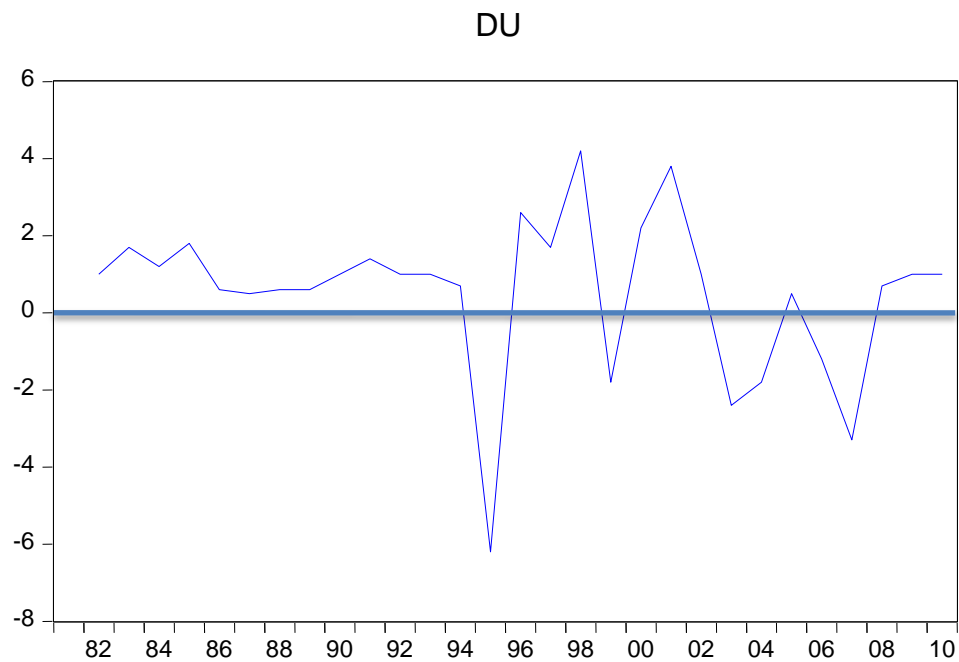
Figure 6.4B: Unemployment rate at first difference (DU)

6.3 Unit Root Test Results

This section involves testing for the stationarity of the individual variables using both the Augmented Dickey-Fuller and Phillips–Perron tests. Table 6.1 on the next page (47) indicates the unit root test results performed in this study-following both the ADF test and PP test. The Phillips-Perron test is used to verify the results obtained from the ADF tests. Both tests are tested at a 1%, 5% and 10% level of significance and are based on trend and intercepts, intercept and none. A maximum number of 3 lags were used for both the ADF and Phillips-Perron tests (as determined automatically by E-views statistical package).

The dependent variable (Y) was found to be the stationary in its level form. This can be seen by comparing the observed values of both the ADF test and PP test with the critical values of the test statistics at all three levels of significance. Therefore, the Null-Hypothesis is rejected and it is sufficient to conclude that there is no unit root in the variable (Y) in its level form.

On the other hand, all independent variables are found be non-stationary in their level forms. As a result, these variables were differenced once and both the ADF test and PP test were performed on them as indicated in Table 6.1. Comparing the observed values of both the ADF test and PP test with the critical values of the test statistics revealed that all the independent variables were stationary at first difference, and thus the Null-Hypothesis of non-stationarity is rejected followed by the conclusion that all these variables are stationary.

Table 6.1: Results of units roots tests

Series	Model	ADF Test			Phillips-Perron Test	
		Lags	t_t t_u t	ϕ_3 ϕ_1	Lags	t_t t_u t
	t_t	3	-4.419***	5.383	3	-4.849***
Y_t	t_u	0	-4.030***	16.240***	3	-4.102***
	T	0	-2.777***	-	3	-2.799***
	t_t	1	-3.489*	4.155	3	-2.628
X_t	t_u	1	-1.032	2.531	3	-1.414
	T	1	-1.103	-	3	-1.465
	t_t	3	-8.573***	-34.124***	3	-7.299***
DX_t	t_u	3	-8.397***	-41.377***	3	-7.465***
	T	3	-8.640***	-	3	-7.648***
	t_t	0	-2.800	3.926	3	-2.816
R_t	t_u	0	-2.685*	7.208***	3	-2.682
	T	-	-			-1.183
	t_t	3	-8.573***	34.124***	3	-7.299***
DR_t	t_u	3	-8.397***	41.377***	3	-7.465***
	T	3	-8.640***		3	-7.648***
	t_t	0	-1.968	2.654	3	-1.952
U_t	t_u	0	-2.040	4.161**	3	-2.070
	T	-	-	-	3	0.880
	t_t	2	-6.175***	23.206***	3	-11.272***
DU_t	t_u	2	-6.316***	32.329***	3	-11.472***
	T	2	-6.439	-	3	-11.740***

Note : H_0: Series contains a unit root

: * [**] (***) indicate rejection of the null hypothesis at 10%, 5%, and (1%) level of significance:

: Y_t; R_t; X_t; U_t indicate variables in level form

: DX_t; DR_t; DU_t; indicate variables at first difference

: t_t - Trend & Intercept; t_u- Intercept; t- None

: The ADF & PP tests were computed using Econometric E-Views Package.

Source: Author

6.4 The Long Run Relationship

Table 6.2 below presents the results of the long-run relationship between the dependent variables and the independent variables. In this case, the variables are used in their level forms and the model is tested for co-integration existence between the dependent and independent variables. The model used in this study indicates that a negative relationship is found between economic growth and the lagged inflation rate.

TABLE 6.2: Results of long run relationship

Dependent Variable: Y

Independent Variables	Coefficient
X_{t-1}	-0.589564
R_{t-1}	-0.101113
U_t	-0.378553
C	12.19889

R-squared	0.686686
Adjusted R-squared	0.649088
S.E. of regression	1.406553
F-statistic	18.26405
D-W statistic	1.736202

Source: Author

6.5 Co-Integration Test Results: Augmented Engle-Granger Approach

Table 6.3 below indicates the unit root test performed on residuals. The test is performed in order to determine the existence of co-integration between economic growths (Y) and the independent variables (X_t, U_t and R_t). Comparing the Mackinnon (1991) critical points and the ADF test statistic, it is decided to reject H_0 at 10% level of significance. It is therefore concluded that there is co-integration between the variables in the model, and thus, a long-run relationship does exist between the variables.

Table 6.3: Co-integration test results

Variable	Model	Mackinnon (1991) Critical values	Lags	ADF t-statistic
RESID01	None	0.01: C(1) = -5.288	0	-4.249*
		0.05: C(5) = -4.4822	0	-4.249*
		0.10: C(10) = -4.094	0	-4.249*

Note : Ho: No Co-integration; H1: Co-integration exists

: * [**] (***) indicate rejection of the null hypothesis at 10%, 5%, and 1% level of significance:

: The ADF test statistic was computed using Econometric E-Views Package.

Source: Author

6.6 Error Correction Model

Table 6.4 below presents the results on error correction model. The estimated results indicate that the model is significant at 0.01 level of significance. Therefore, it is sufficient to conclude that this model is of a good fit. Our findings denote that the short-run effect of inflation targeting on economic growth is insignificant at all levels of significance.

The error correction-term [RESIDOI (-1)] required magnitude of -0.844100 (which indicates the speed of adjustment towards equilibrium) appears to be statistically significance at 0.01. The estimated results also denote the R^2 of 0.794050, which means that about 79% change in the dependent variable (economic growth) are explained by changes in the independent variables. In addition the coefficient of the interaction dummy shows that the adoption of inflation targeting leads to a positive effect of inflation on economic growth. However, such effect is not significant.

Table 6.4: Results of Error Correction-Model

Dependent variable (DY$_t$)					
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**P-Value**	**Conclusion**
DX$_{t-1}$	-0.669684	0.165605	-4.043857	0.0006	Significant at 1
DU$_t$	-0.273310	0.132559	-2.061799	0.0518	Significant at 10%
D$_t$	-0.682766	0.562723	-1.213325	0.2385	Not significant
DR$_{t-1}$	-0.483156	0.088153	-5.480886	0.0000	Significant at 1%
D$_t$*DX$_{t-1}$	0.013754	0.221666	0.062048	0.9511	Not significant
RESID01$_{-1}$	-0.844100	0.211500	-3.991019	0.0007	Significant at 1%
C	0.356233	0.365106	0.975698	0.3403	Not significant

R-squared   0.794050
Adjusted
R-squared   0.735207
S.E. of regression 1.394197
F-statistic   13.49444
D-W statistic   2.133524

Source: Author

6.7 Diagnostic Tests

Table 6.5 presents the results of diagnostic tests which were carried out in order to determine the quality of the model used. These results are tested based on the levels of significance (L.O.S) 1%, 5% and 10%. According to Jargue-Bera test performed in this study, the residuals of the regression are normally distributed in the model because the p-value of 60% is greater than all the three levels of significance.

According to the Ljung-Box Q test of order (6), the model does not contain an autocorrelation problem, because the P-value of 47% exceeds all three levels of significance. The Breusch Godfrey test shows that there is no serial correlation in the model, because the P-value is 11%, and greater than all the three levels of significance.

Several other tests were performed in order to test for the heteroskedasticity problem in the model, where first the Breusch-Pagan Godfrey test was performed and revealed that the model is free from the heteroskedasticity problem, since the P-value of 64% is greater than the three levels of significance. According to ARCH test performed with a number of 2 lags, there is no problem of heteroskedasticity in the model, because the P-value of 58% is greater than the three levels of significance.

In compliments to the ARCH results is the White test (with no cross terms (NCT) and with cross terms (CT), which confirms that there is no heteroskedasticity in the model, because the P-values of 74% for NCT and 48% for CT are greater than all the three levels of significance.

In view of the diagnostic tests performed, it can be concluded that the model used in this study is robust and as such reliable.

Table 6.5: Results from diagnostic tests

Test	H_0	t-stat	P-value	Conclusion
Jarque-Bera	Residuals are normally distributed	1.017	0.602	Do not reject Ho since PV > L.O.S. Hence, residuals are normally distributed
Ljung-Box Q	No autocorrelation (order 6)	5.625	0.466	Do not reject Ho since PV > L.O.S. Hence, there is no autocorrelation in the model
Breusch-Godfrey	No-Serial correlation	4.371	0.1124	Do not reject Ho since PV > L.O.S. Hence, there is no serial correlation in the model
Breusch Pagan Godfrey	No Heteroskedasticity	4.282	0.639	Do not reject Ho since PV > L.O.S. Hence, there is no heteroskedasticity in the model
Arch	No-Arch Heteroskedasticity	0.303	0.582	Do not reject Ho since PV > L.O.S. Hence, there is no heteroskedasticity in the model
White (NCT)	No Heteroskedasticity	3.529	0.740	Do not reject Ho since PV > L.O.S. Hence, there is no heteroskedasticity in the model
White (CT)	No Heteroskedasticity	22.623	0.483	Do not reject Ho since PV > L.O.S. Hence, there is no heteroskedasticity in the model

Note : L.O.S means "level of significance"
: PV means probability value
: NCT means "*no cross terms*"; CT means with "*cross terms*"

6.8 Stability Tests

The stability test is performed using Ramsey Reset test in order to test for stability of the model used. Table 6.6 below shows the results of stability test performed. According to this test, the model is correctly specified because the P-value of 0.68 is above all the three levels of significance. Therefore, it is insufficient evidence to reject the null hypothesis (H_0) and that the model is correctly specified.

Table 6.6: Results of stability test

Test	H$_0$	t-statistic	P-value	Conclusion
Ramsey RESET	Equation is correctly specified	0.174036	0.6765	Do not reject H$_0$ since PV > L.O.S. Hence, equation is correctly specified

6.9 Average Output and Output Variability

Table 6.7: Mean and variability

Period	Mean	Standard Deviation
Prior inflation targeting	2.1	2.4
After inflation targeting	3.7	2

Descriptive statistics were used to compare the mean and standard deviation of economic growth between the period prior inflation targeting and after inflation targeting. Table 6.7 shows that the average economic growth rate during inflation targeting period is higher than the growth rate during the period prior to inflation targeting by 1.6%. It also shows that growth variability has decreased by 0.4% after the adoption of inflation targeting.

6.9 Conclusion

In this chapter, it has been possible to present and discuss the E-views estimated results in both table and graphical forms. Annual time series data from 1981 to 2010 were used to estimate the coefficients of the error correction model used. The ADF tests and the Phillips-Perron tests appear to be supporting the Error Correction model used. For the purpose of reference, further tables showing complete results of the analysis can be found in the appendixes on pages 60-71.

CHAPTER 7
CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

The major conclusions are drawn and recommendations made on the basis of literature reviewed in Chapter 2, research objectives and the research problem as outlined in Chapter 1 and, most importantly, the hypotheses made in Chapter 1. In this chapter, the format of the research report begins to widen again. It begins with a review of conclusions drawn from a theoretical perspective followed by the conclusions drawn from the findings of this study. It continues to outline its limitations, followed by suggestions for future research. Lastly, possible recommendations are given for the purpose of clarity and policy decision making in South Africa.

7.2 Conclusions from the Theoretical Perspective

Stockton (1996) surveyed the existing literature related to price objectives for monetary policy. In that survey Stockton identified several well-known established empirical relationships pertinent to this topic. They included the following:

- ➢ The evidence from both cross-country and time-series supports the notion that Inflation reduces the growth of real output (or productivity).
- ➢ In general relative price variability and inflation uncertainty adversely affect real output.
- ➢ In his recent book entitled *Inflation Targeting* (2003), Truman summarizes the principal conclusions of the empirical literature on inflation targeting. In particular, inflation targeting has had favourable effects on inflation, inflation variability, inflation expectations and the persistence of inflation. But it has not had a negative effect on economic growth, the variability of growth, or unemployment.

7.3 Conclusions from Findings in the present study

After a decade of adopting inflation targeting by the SARB as its monetary policy framework, debates have erupted among politicians, economists, labour unions etc., about the effects of this policy on economic growth in South Africa. The main purpose of this study was to determine the effects of inflation targeting on economic growth in South Africa. In order to achieve this purpose a comprehensive literature review was carried out to review what other authors found when making similar studies. An Error Correction model was used to achieve the following research objectives:

- ➢ To establish how inflation targeting affected economic growth;
- ➢ To determining whether inflation targeting reduced or promoted economic growth in South Africa;
- ➢ To determining whether inflation targeting led to high or low variations in the level of economic growth;
- ➢ To identify the challenges facing inflation targeting monetary policy framework objective to ensure stable inflation, while maintaining high and stable long term economic growth in South Africa; and
- ➢ To establish whether inflation targeting has been conducive to high and stable long term economic growth in South Africa as a semi-developed country.

These objectives have been achieved as discussed in the last four chapters. Most importantly, an error correction model was used to estimate the short-run effects of inflation targeting on economic growth and the long run effects were estimated using a multiple regression model. The error correction model used was tested for robustness using diagnostic tests which showed that the model is robust and therefore reliable. In addition to the diagnostic tests a stability test showed that the model is correctly specified. The following decision rule on the hypotheses and conclusions were drawn from the findings of this study:

HYPOTHESES

H_0: the Inflation targeting monetary policy as employed in South Africa does not significantly influence economic growth.

H₁: Inflation targeting monetary policy as employed in South Africa does significantly influence economic growth.

Decision: Do not reject the null hypothesis at 0.1 level of significance; implying that there is no adequate evidence to reject the null hypothesis.

Based on descriptive statistics a preliminary conclusion could be drawn from the evidence below that inflation targeting has positive effects on economic growth.

➤ The average economic growth rate was compared between the period before inflation targeting and after inflation targeting. It was found that average economic growth rates remained low and, in many instances, remained negative during the period prior to inflation targeting. However, the average economic growth rate has consistently remained steady and relatively high during the inflation targeting period.

➤ The period prior to inflation targeting shows that there was high output variability as compared to output variability for the period during inflation targeting. This leads to the conclusion that inflation targeting does not only reduce variability in inflation but also in economic growth, though, it is hard to prove whether this reduced variability can be attributed to inflation targeting alone or due to other-external-factors that may have played a role.

Based on the following important findings (obtained by using Error Correction Model which is tested for robustness and reliability) a final conclusion is drawn that inflation targeting monetary policy, as employed in South Africa, does not have significant negative effects on economic growth.

➤ There is a negative relationship between inflation targeting and economic growth in South Africa. However, this negative relationship between inflation targeting and economic growth was found to be statistically insignificant.

➤ The influence that inflation targeting has on the relationship between the lag of inflation and economic growth is also statistically insignificant.

7.4 Limitations of the Study

It should be noted that it is not possible to cover all the aspects of a particular field of enquiry in a single study. In this section, the aspects of research that were not covered are highlighted and these will identity priorities for future research.

➢ This study focuses on the effects of inflation targeting on economic growth in South Africa. This means that it is limited to a South African context; and therefore, is not applicable to any other region outside South Africa.

➢ The comparison between economic growth before the inflation targeting period and after inflation targeting may lead to bias. The period before inflation targeting was characterized by several changes in the monetary policy regime, such as the monetary aggregate target and exchange rate targeting.

➢ This study used annual time series data from 1981 to 2010 to compare the period prior and after inflation targeting. The data were not enough because inflation targeting was only adopted in the year 2000.

➢ Considering the fact that the inflation targeting policy framework was adopted in 2000 in South Africa, there is a limited research conducted on similar subjects like this one.

7.5 Future Research

➢ The results found here were based on annual time series data from 1981 to 2010. This means that the impact of inflation targeting on economic growth in South Africa should be monitored and compared with the findings in this study and beyond the year 2010.

➢ The present research focuses on a few casual variables and there may still be a need to study other relevant variables to determine whether they give the same findings as the ones found in this study.

➢ This study narrowed its focus to a South African context. This means a similar approach can be used to study other countries cases.

➢ This study used the error correction model to estimate the relationship between inflation targeting and economic growth. Therefore, it invites the researcher to criticize this model and prove its relevancy.

7.6 Recommendations

The possible impact of inflation targeting on economic growth is a concern in South Africa and continues to receive a lot of attention in monetary economics literature. Based on the findings of this study the following recommendations can be made:

> ➢ It is generally accepted that instability in the general level of prices causes substantial economic distortions, leading to inefficiencies, both in aggregate employment and output. It is also evident that the effects of inflation targeting on economic growth in South Africa are relatively insignificant. There is no evidence that inflation targeting promotes or reduces economic growth in SA. The critique that the SARB achieves low inflation at the expense of low economic growth is probably a misconception. Therefore, the SARB should maintain its monetary policy framework which has helped it to reduce inflation and most importantly inflation expectations.

> ➢ It has also been realized that certain SARB stakeholders (COSATU and SACP) often criticize the decisions of the Monetary Policy Committee (MPC) without adequate information. For the purpose of clarity these stakeholders need to be invited to monetary policy seminars that are regularly held by the SARB MPC. This will ease the difficulty these institutions have to better understand certain decisions taken by the SARB.

> ➢ It is important for different SARB stakeholders to note that the SARB long term primary objective is to ensure price stability. It is not primarily responsible for achieving economic growth. Therefore, critique of inflation targeting impact on economic growth should bear in mind this objective as stated clearly in the SA Act 108 of 1996.

> ➢ Last but not least, a successful inflation targeting policy will require the support of labour unions, businesses, the private sector and the government sector to show confidence in the monetary policy of the SARB.

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APPENDICES

Appendix A: Long Run Equilibrium Equation

Dependent Variable: Y
Method: Least Squares
Date: 12/11/13   Time: 17:09
Sample (adjusted): 1982 2010
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X_{t-1}	-0.589564	0.094299	-6.252086	0.0000
U_t	-0.101113	0.076311	-1.324998	0.1972
R_{t-1}	-0.378553	0.086694	-4.366566	0.0002
C	12.19889	2.510014	4.860089	0.0001

R-squared	0.686686	Mean dependent var		2.200000
Adjusted R-squared	0.649088	S.D. dependent var		2.374417
S.E. of regression	1.406553	Akaike info criterion		3.647603
Sum squared resid	49.45976	Schwarz criterion		3.836195
Log likelihood	-48.89024	Hannan-Quinn criter.		3.706667
F-statistic	18.26405	Durbin-Watson stat		1.736202
Prob(F-statistic)	0.000002			

Appendix B: Error Correction Model (ECM)

Dependent Variable: DY
Method: Least Squares
Date: 12/11/13   Time: 17:27
Sample (adjusted): 1983 2010
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DXT(-1)	-0.669684	0.165605	-4.043857	0.0006
DRT(-1)	-0.483156	0.088153	-5.480886	0.0000
DUT	-0.273310	0.132559	-2.061799	0.0518
DT	-0.682766	0.562723	-1.213325	0.2385
DT*DXT(-1)	0.013754	0.221666	0.062048	0.9511
RESID01(-1)	-0.844100	0.211500	-3.991019	0.0007
C	0.356233	0.365106	0.975698	0.3403

R-squared	0.794050	Mean dependent var		0.117857
Adjusted R-squared	0.735207	S.D. dependent var		2.709387
S.E. of regression	1.394197	Akaike info criterion		3.714832
Sum squared resid	40.81946	Schwarz criterion		4.047883
Log likelihood	-45.00764	Hannan-Quinn criter.		3.816649
F-statistic	13.49444	Durbin-Watson stat		2.133524
Prob(F-statistic)	0.000003			

DIAGNOSTIC TESTS ON ECM

Appendix C: Autocorrelation

Date: 12/12/13   Time: 06:07
Sample: 1983 2010
Included observations: 28

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. *| . |	. *| . |	1	-0.154	-0.154	0.7346	0.391
. | . |	. | . |	2	0.056	0.033	0.8364	0.658
. | . |	. | . |	3	0.012	0.026	0.8414	0.840
. |* . |	. |* . |	4	0.133	0.140	1.4564	0.834
.**| . |	.**| . |	5	-0.336	-0.311	5.5855	0.349
. | . |	. *| . |	6	0.032	-0.075	5.6252	0.466

Appendix D: Normality Tests on Residuals
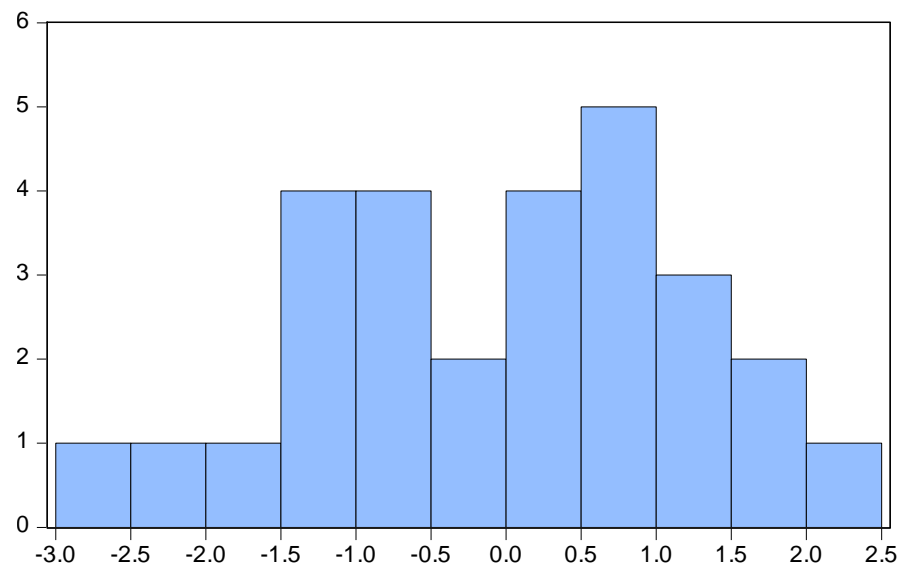
Series: Residuals	
Sample 1983 2010	
Observations 28	
Mean	1.63e-16
Median	0.219484
Maximum	2.003010
Minimum	-2.597492
Std. Dev.	1.229566
Skewness	-0.264878
Kurtosis	2.231415
Jarque-Bera	1.016591
Probability	0.601520

Appendix E: Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.757503	Prob. F(2,19)	0.1994
Obs*R-squared	4.371314	Prob. Chi-Square(2)	0.1124

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/12/13   Time: 06:12
Sample: 1983 2010
Included observations: 28
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DXT(-1)	0.021294	0.163336	0.130370	0.8976
DRT(-1)	-0.015550	0.086438	-0.179899	0.8591
DUT	0.013535	0.128439	0.105383	0.9172
DT	0.321599	0.577911	0.556485	0.5844
DT*DXT(-1)	-0.029565	0.221556	-0.133441	0.8952
RESID01(-1)	0.879471	0.515820	1.704995	0.1045
C	-0.130217	0.359618	-0.362099	0.7213
RESID(-1)	-1.047577	0.565889	-1.851206	0.0797
RESID(-2)	-0.086403	0.249392	-0.346457	0.7328

R-squared	0.156118	Mean dependent var	1.63E-16
Adjusted R-squared	-0.199200	S.D. dependent var	1.229566
S.E. of regression	1.346473	Akaike info criterion	3.687946
Sum squared resid	34.44680	Schwarz criterion	4.116154
Log likelihood	-42.63124	Hannan-Quinn criter.	3.818853
F-statistic	0.439376	Durbin-Watson stat	1.725065
Prob(F-statistic)	0.882483		

Appendix F: Heteroskedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.631833	Prob. F(6,21)	0.7033
Obs*R-squared	4.281712	Prob. Chi-Square(6)	0.6386
Scaled explained SS	1.482909	Prob. Chi-Square(6)	0.9606

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/12/13   Time: 06:14
Sample: 1983 2010
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.310929	0.450234	2.911661	0.0083
DXT(-1)	-0.130374	0.204218	-0.638404	0.5301
DRT(-1)	-0.037776	0.108707	-0.347504	0.7317
DUT	0.053348	0.163467	0.326355	0.7474
DT	0.199286	0.693928	0.287185	0.7768
DT*DXT(-1)	-0.153094	0.273350	-0.560066	0.5814
RESID01(-1)	0.104404	0.260813	0.400301	0.6930

R-squared	0.152918	Mean dependent var	1.457838
Adjusted R-squared	-0.089105	S.D. dependent var	1.647437
S.E. of regression	1.719268	Akaike info criterion	4.133992
Sum squared resid	62.07353	Schwarz criterion	4.467043
Log likelihood	-50.87589	Hannan-Quinn criter.	4.235809
F-statistic	0.631833	Durbin-Watson stat	1.506802
Prob(F-statistic)	0.703342		

Appendix G: Heteroskedasticity

Heteroskedasticity Test: ARCH

F-statistic	0.283335	Prob. F(1,25)	0.5992
Obs*R-squared	0.302572	Prob. Chi-Square(1)	0.5823

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/12/13   Time: 06:16
Sample (adjusted): 1984 2010
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.137520	0.345670	3.290766	0.0030
RESID^2(-1)	0.083007	0.155942	0.532292	0.5992

R-squared	0.011206	Mean dependent var	1.261944
Adjusted R-squared	-0.028345	S.D. dependent var	1.304847
S.E. of regression	1.323211	Akaike info criterion	3.469187
Sum squared resid	43.77220	Schwarz criterion	3.565175
Log likelihood	-44.83403	Hannan-Quinn criter.	3.497730
F-statistic	0.283335	Durbin-Watson stat	1.863122
Prob(F-statistic)	0.599223		

Appendix H: Heteroskedasticity

Heteroskedasticity Test: White

F-statistic	0.504725	Prob. F(6,21)	0.7978
Obs*R-squared	3.528903	Prob. Chi-Square(6)	0.7401
Scaled explained SS	1.222185	Prob. Chi-Square(6)	0.9758

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/12/13   Time: 06:17
Sample: 1983 2010
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.106953	0.824142	2.556541	0.0184
DXT(-1)^2	-0.071785	0.085015	-0.844386	0.4080
DRT(-1)^2	-0.005168	0.017930	-0.288207	0.7760
DUT^2	-0.024004	0.047654	-0.503702	0.6197
DT^2	-1.134780	1.011791	-1.121556	0.2747
(DT*DXT(-1))^2	0.170687	0.108735	1.569756	0.1314
RESID01(-1)^2	-0.087738	0.184368	-0.475887	0.6391

R-squared	0.126032	Mean dependent var	1.457838
Adjusted R-squared	-0.123673	S.D. dependent var	1.647437
S.E. of regression	1.746339	Akaike info criterion	4.165239
Sum squared resid	64.04372	Schwarz criterion	4.498290
Log likelihood	-51.31334	Hannan-Quinn criter.	4.267056
F-statistic	0.504725	Durbin-Watson stat	1.307144
Prob(F-statistic)	0.797785		

Appendix I: Heteroskedasticity

Heteroskedasticity Test: White

F-statistic	0.731772	Prob. F(23,4)	0.7237
Obs*R-squared	22.62334	Prob. Chi-Square(23)	0.4829
Scaled explained SS	7.835266	Prob. Chi-Square(23)	0.9986

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/12/13   Time: 06:18
Sample: 1983 2010
Included observations: 28
Collinear test regressors dropped from specification

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.417504	2.488167	0.167796	0.8749
DXT(-1)	-0.005361	0.673886	-0.007955	0.9940
DXT(-1)^2	-0.186375	0.315613	-0.590515	0.5866
DXT(-1)*DRT(-1)	-0.085708	0.133621	-0.641424	0.5562
DXT(-1)*DUT	-0.585247	0.401257	-1.458532	0.2184
DXT(-1)*DT	0.726800	0.921712	0.788533	0.4745
DXT(-1)*(DT*DXT(-1))	0.099689	0.391631	0.254548	0.8116
DXT(-1)*RESID01(-1)	-0.171734	0.593438	-0.289388	0.7867
DRT(-1)	1.149128	1.090800	1.053472	0.3516
DRT(-1)^2	0.094712	0.086029	1.100931	0.3327
DRT(-1)*DUT	-1.404810	0.904118	-1.553791	0.1952
DRT(-1)*DT	1.305015	1.644248	0.793685	0.4718
DRT(-1)*(DT*DXT(-1))	0.987933	0.728865	1.355441	0.2468
DRT(-1)*RESID01(-1)	0.139757	0.291041	0.480196	0.6562
DUT	3.094611	1.845106	1.677199	0.1688
DUT^2	-0.194367	0.189084	-1.027939	0.3621
DUT*DT	-3.350076	2.387857	-1.402963	0.2333
DUT*(DT*DXT(-1))	-0.459688	0.719104	-0.639251	0.5574
DUT*RESID01(-1)	-1.446379	0.939580	-1.539390	0.1985
DT	0.670967	2.765903	0.242585	0.8203
DT*RESID01(-1)	-1.406037	1.937360	-0.725749	0.5082
(DT*DXT(-1))*RESID01(-1)	0.108628	0.818919	0.132648	0.9009
RESID01(-1)	1.874701	1.619532	1.157557	0.3115
RESID01(-1)^2	-1.014135	0.668474	-1.517090	0.2038

R-squared	0.807976	Mean dependent var	1.457838
Adjusted R-squared	-0.296160	S.D. dependent var	1.647437
S.E. of regression	1.875591	Akaike info criterion	3.864100
Sum squared resid	14.07136	Schwarz criterion	5.005989
Log likelihood	-30.09740	Hannan-Quinn criter.	4.213187
F-statistic	0.731772	Durbin-Watson stat	2.250085
Prob(F-statistic)	0.723716		

MISSPECIFICATION

Appendix J: Stability Test

Ramsey RESET Test
Equation: ECM
Specification: DY DXT(-1) DRT(-1) DUT DT DT*DXT(-1) RESID01(-1) C
Omitted Variables: Squares of fitted values

	Value	Df	Probability
t-statistic	0.353126	20	0.7277
F-statistic	0.124698	(1, 20)	0.7277
Likelihood ratio	0.174036	1	0.6765

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.252929	1	0.252929
Restricted SSR	40.81946	21	1.943784
Unrestricted SSR	40.56653	20	2.028327
Unrestricted SSR	40.56653	20	2.028327

LR test summary:

	Value	df
Restricted LogL	-45.00764	21
Unrestricted LogL	-44.92062	20

Unrestricted Test Equation:
Dependent Variable: DY
Method: Least Squares
Date: 12/12/13   Time: 06:22
Sample: 1983 2010
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DXT(-1)	-0.677479	0.170602	-3.971098	0.0008
DRT(-1)	-0.474708	0.093173	-5.094900	0.0001
DUT	-0.258727	0.141568	-1.827577	0.0826
DT	-0.675998	0.575150	-1.175342	0.2537
DT*DXT(-1)	0.010813	0.226589	0.047722	0.9624
RESID01(-1)	-0.871834	0.229882	-3.792522	0.0011
C	0.410160	0.403016	1.017728	0.3210
FITTED^2	-0.011603	0.032858	-0.353126	0.7277

R-squared	0.795326	Mean dependent var		0.117857
Adjusted R-squared	0.723691	S.D. dependent var		2.709387
S.E. of regression	1.424193	Akaike info criterion		3.780045
Sum squared resid	40.56653	Schwarz criterion		4.160674
Log likelihood	-44.92062	Hannan-Quinn criter.		3.896407
F-statistic	11.10236	Durbin-Watson stat		2.103852
Prob(F-statistic)	0.000011			

Appendix K: Data (1981-2010)

obs	Y	XT	UT	RT	DT
1981	5.4	15.7	9.8	3.7	0
1982	-0.4	14.1	10.8	4.7	0
1983	-1.8	12.4	12.5	0.1	0
1984	5.1	12	13.7	9.7	0
1985	-1.2	16.1	15.5	4	0
1986	0	19.2	16.1	-2.3	0
1987	2.1	15.5	16.6	-1.8	0
1988	4.2	12.8	17.2	0.13	0
1989	2.4	14.9	17.8	2.2	0
1990	-0.3	14.2	18.8	4.7	0
1991	-1	15.5	20.2	4	0
1992	-2.1	13.7	21.2	3.8	0
1993	1.2	9.8	22.2	2.7	0
1994	3.2	9.2	22.9	5.5	0
1995	3.1	8.6	16.7	6.9	0
1996	4.3	7.3	19.3	10.6	0
1997	2.6	8.6	21	11	0
1998	0.5	6.8	25.2	13.1	0
1999	2.4	5.1	23.4	10.2	0
2000	4.2	5.4	25.6	5.2	1
2001	2.7	5.8	29.4	5.7	1
2002	3.7	9.1	30.4	4.5	1
2003	2.9	5.8	28	8.9	1
2004	4.6	1.4	26.2	4.6	1
2005	5.3	3.4	26.7	4.9	1
2006	5.6	4.6	25.5	4.4	1
2007	5.5	7.2	22.2	4.6	1
2008	3.6	11.5	22.9	5.4	1
2009	-1.5	7.1	23.9	4.1	1
2010	2.9	4.3	24.9	5.3	1

Appendix L: Descriptive Statistics

1981-1999

	Y
Mean	1.563158
Median	2.1
Maximum	5.4
Minimum	-2.1
Std. Dev.	2.350463
Skewness	0.02542
Kurtosis	1.798807
Jarque-Bera	1.144313
Probability	0.564307
Sum	29.7
Sum Sq. Dev.	99.44421
Observations	19

2000-2010

	Y
Mean	3.590909
Median	3.7
Maximum	5.6
Minimum	-1.5
Std. Dev.	1.99171
Skewness	-1.48668
Kurtosis	4.977552
Jarque-Bera	5.844466
Probability	0.053813
Sum	39.5
Sum Sq. Dev.	39.66909
Observations	11