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RETHINKING THE CURRENT INFLATION TARGET RANGE IN SOUTH AFRICA

BY

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Declaration

I, Ntsakeseni Letitia Lebese, hereby declare that this minor dissertation is my own work and that all sources were accurately referenced. I have also not submitted this minor dissertation to any other university for any other degree.
Abstract

The level of the inflation range matters where there is a trade-off between inflation and unemployment. Where there is a trade-off, setting the inflation range either too high or too low will place a country on that part of the Phillips curve that increases the unemployment rate.

The dissertation assesses whether or not the 3 to 6 percent inflation target range was set at a level that minimised the trade-off between inflation and unemployment from 2000 to 2012. The above is achieved by first estimating an expectations-augmented Phillips curve to determine the time-varying non-accelerating inflation rate of unemployment (the NAIRU). The estimated NAIRU is then used to calculate the corresponding inflation rate that minimises the trade-off between inflation and unemployment.

The estimation results provided an estimated inflation range that is wider than the current inflation target range that is pursued by the South African Reserve Bank. The estimation results yielded a NAIRU that ranged between 23.8 to 26.4 percent and the corresponding inflation rate which ranged between 0.4 to 11.2 percent, based on adaptive expectations, and 2.5 to 11.3 percent, based on CPI inflation expectations, from 2000 to 2012. The estimation results indicate that if South Africa were to put in place an inflation range based on the NAIRU, it would have to target an inflation rate that ranges from 0.4 to 11.3 percent.

A comparison of South Africa's current inflation target range with the inflation ranges that are implemented by other developing countries indicates that South Africa's inflation target range is aligned with inflation ranges that are targeted by other developing countries that compete with South Africa. However, given that the challenges of a high unemployment rate are unique to the South African economy; the dissertation proposes that the government should adopt supply-side policies to address the unemployment challenge.
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1. INTRODUCTION

1.1. Background of the Study

South Africa had relatively low levels of unemployment from the 1960s until the early 1990s (Banerjee, Galioni, Levinsohn, McLaren & Woolard, 2007:2). In 1960, the unemployment rate, based on the expanded definition, was recorded at 6.7 percent (Mahadea, 2003:25). Then, the expanded definition of unemployment increased, standing at 10.6 percent in 1983 (Mahadea, 2003:25). These unemployment rates were mainly achieved as a result of expansionary monetary and fiscal policies, which were adopted to stimulate economic growth and create employment opportunities (Casteleijn, 1999:3).

The South African government intervened directly in the economy from 1961 to 1980 in order to stimulate economic activity following its expulsion from the Commonwealth of Nations and sterling area (Rossouw & Padayachee, 2008:13). Interest rates were kept at low levels in order to stimulate demand (Ricci, 2005:192). Foreign exchange measures were implemented to restrict the flow of money outside the Republic (Ricci, 2005:192). Restrictions were placed on foreign investments by South African residents, and non-residents could not withdraw sale proceeds from shares that they held in South African companies (Rossouw & Padayachee, 2008:13).

The direct intervention by the government in the economy, and the expansionary policies it implemented, resulted in an increase in the inflation rate from the late 1960s to the early 1990s (Casteleijn, 1999:69; Ricci, 2005:190). The inflation rate accelerated from an average of 2.8 percent between 1961 and 1970 to an average of 10.6 percent between 1971 and 1980 (Rossouw & Padayachee, 2008:28). Further acceleration in the inflation rate was observed during the period 1980 to 1993 when the average inflation rate reached 14.8 percent (Casteleijn, 1999:64; Rossouw & Padayachee, 2008:19).

Following its re-integration into the international economy, South Africa was subjected to increased political pressure to reduce its inflation rate to levels
which were commensurate with its trading partners (Banerjee, Galioni, Levinsohn, McLaren & Woolard, 2008:717; van der Merwe, 2004:12; Padayachie, 2001:744; and Ricci, 2005:191). Subsequent to that, the government introduced inflation targeting as a monetary policy framework in 2000, as they believed that maintaining price stability would lead to macroeconomic stability and help to ease international pressure (Mboweni, 1999:404). The South African Reserve Bank was then tasked with the objective of creating a stable financial environment that would be conducive to economic growth and assist South Africa to achieve its development goals in the long run (Casteleijn, 1999:63 and Epstein, 2007:1).

The South African Reserve Bank’s stabilisation objective was supplemented by the introduction of the Growth, Employment and Redistribution strategy (National Labour and Economic Development Institute, 2004:2 and Department of Finance, 1996:11). In developing fiscal policy under the Growth, Employment and Redistribution strategy; development aspects, such as reducing the unemployment rate and stimulating economic growth, were left to be determined through the free market system (National Labour and Economic Development Institute, 2004:2 and Department of Finance, 1996:11). The government was of the opinion that maintaining price stability would improve co-ordination between monetary policy and other macroeconomic policies (Department of Finance, 1996:11 and Mboweni, 1999:404).

1.2. Research Problem

The pursuit of price stability by the South African Reserve Bank was successful in reducing the high inflation rate (National Labour and Economic Development Institute, 2004:3 and Ricci, 2005:191). For the first time since the 1960s, South Africa managed to achieve single digit inflation rates during the mid-1990s (Casteleijn, 1999:64). South Africa’s strong monetary discipline resulted in a substantial decrease in the inflation rate from a level of 10.6 percent during the second quarter of 1995 to 4.8 percent during the third quarter of 2001 and the inflation rate declined further to 0.7 percent in the last quarter of 2003 (Casteleijn, 1999:64 and Statistics South Africa, 2014). The inflation rate fell within the inflation target band from 2009 to 2012 (Statistics South Africa, 2014).
While the South African Reserve Bank succeeded in reducing inflation, the government failed to realise the development objectives as set out in the Growth, Employment and Redistribution strategy (National Labour and Economic Development Institute, 2004:3). The level of economic growth from 1994 to 2004 only reached 2.7 percent and fell 3.3 percent short from the projected 6 percent as anticipated by the government (Department of Finance, 1996:5; Kingdon & Knight, 2005:2). Thus, the level of economic growth realised during this period was inadequate to create sufficient employment opportunities for the South African population (Kingdon & Knight, 2005:2).

Government’s failure to realise the projected growth in the economy resulted in an increase in the unemployment rate in the country (National Labour and Economic Development Institute, 2004:3). South Africa experienced a continued increase in the unemployment rate from 1980 to 2010 (Department of Economic Development, 2010:11). Unemployment, based on the narrow definition, increased from 16.9 percent in the second quarter of 1995 to 26.2 percent during the third quarter of 2001; and it then reached 28.4 percent in the fourth quarter of 2003 (South African Reserve Bank, 2014). The aforementioned increase in the unemployment rate indicates the failure of government’s Growth, Employment and Redistribution strategy, which aimed to decrease the unemployment rate by maintaining price stability.

Empirical evidence (Akerlof, Dickens, Perry, Gordon & Mankiw 1996; Fortin, 2001; and Lundborg & Sacklén, 2006) indicates that a change in the inflation rate from a high level to a low level is associated with perpetual increases in the unemployment rate. Further empirical studies (Akerlof et al., 1996; Holden, 2002) endorse this, suggesting that, at low inflation rates, the Phillips curve — which illustrates the inverse relationship between rates of unemployment and corresponding rates of inflation — will be negatively sloped. A negatively sloped Phillips curve implies that there is a trade-off between inflation and unemployment (Lundborg & Sacklén, 2006:399; and Padayachee, 2001:762). The existence of a trade-off means that reductions in the inflation rate will be directly correlated with increases in the unemployment rate.
The trade-off results from; *inter alia*, the structure of the labour market, rigidities in nominal wages and external disturbances, all of which have an effect on the economy. In his study of European countries, Holden (2002:4) found that in countries where labour markets are regulated and employees are unionised; the pursuit of price stability resulted in higher unemployment rates due to the use of employment contracts, which make wages inflexible in the short run. In addition, Benigno and Ricci’s study (2009:29) revealed that countries that are subjected to high macroeconomic volatility will face substantial increases in their unemployment rates while they pursue price stability. Countries that experiences high macroeconomic volatility are vulnerable to external shocks. External shocks, in turn, have a negative impact on output as they disturb the long run relationship between inflation and unemployment and lead to a trade-off between inflation and unemployment.

South African literature (du Plessis & Burger, 2006; Fedderke & Schaling, 2005; Nell, 2002 and Pretorius & Smal, 1994) indicates the existence of a trade-off, in the short run, between inflation and unemployment; or, alternatively, between inflation and proxies for demand effects such as marginal costs and output gaps. Given the abovementioned existence of a trade-off and the fact that South Africa’s unemployment rate is ranked amongst the highest in the world (Department of Economic Development, 2010:14; Banerjee *et al.*, 2007:7; Klasen & Woolard, 2008:2); it is important to determine whether the pursuit of a low inflation target by the South African Reserve Bank had had an impact on the unemployment rate.

Further to the above, empirical studies (Leshoro, 2012; Phiri, 2010; Gupta & Uwilingiyewe, 2008) found that the current inflation target range was not set at an appropriate level since it imposes welfare costs on the economy. Leshoro (2012:9) asserted that an inflation rate greater than 4 percent had a negative effect on GDP growth rates. Gupta and Uwilingiyewe (2008:7) asserted that a 3 to 6 percent inflation target range results in a welfare loss, which ranges from 0.34 percent to 0.67 percent of GDP. Phiri (2010:354) found an inflation threshold of 8 percent and concluded that any inflation rate below and above the threshold will have an adverse effect on growth. Thus, to reiterate, the results in Leshoro (2012:9), Phiri (2010:354) and Gupta and Uwilingiyewe (2008:7) demonstrate that
the 3 to 6 percent inflation target range limits the level of economic growth in South Africa.

1.3. Research Question

The level of the inflation range matters where there is a trade-off between inflation and unemployment, as setting the inflation range either too high or too low will place a country on that part on the Phillips curve that increases the unemployment rate (Fortin, 2001:3). This means that a central bank can have an influence on the real economy by setting a country’s inflation range at an incorrect level (Erceg, 2002:85).

Recent studies (Arkerlof, Dickens, Perry, Bewley, & Blinder, 2000; Ball & Mankiw, 2002; Fortin, 2001; Lundborg & Sacklën, 2006 and Hsing, 2009), which were conducted internationally on the relationship between inflation and unemployment, indicate that there is a particular point on a non-linear Phillips curve where the trade-off is minimised. This means that when there is a trade-off between inflation and unemployment, there exists an optimal point on a non-linear Phillips curve where the trade-off is minimised (Fortin, 2001:9).

Given that South African literature indicates the presence of a trade-off, in the short run, between inflation and certain proxies for demand effects; this study aims to evaluate whether the 3 to 6 percent inflation target range, as agreed between the South African Reserve Bank and the government, was set at a level that minimises the trade-off between inflation and unemployment. This study will therefore seek to answer the following question: Was the 3 to 6 percent inflation target range set at a level that minimised the trade-off between inflation and unemployment from 2000 to 2012?

1.4. Research Design

The presence of a trade-off in South Africa, as supported by literature, implies that, in the short run, the Phillips curve is non-linear. Given the presence of a trade-off, the study will use a time varying non-accelerating inflation rate of
unemployment (NAIRU) to determine the inflation rate that minimises the trade-off between inflation and unemployment.

The methodology used in this study was developed by Ball and Mankiw (2002) and rests on the premise that there is a short run trade-off between inflation and unemployment (Ball & Mankiw, 2002: 115). Given the existence of the short run trade-off, Ball and Mankiw (2002) propose that there exists a level of unemployment that is consistent with stable inflation. The unemployment level that corresponds with a stable inflation is known as the NAIRU (Gordon, 1997:11 and Ball & Mankiw, 2002:115).

The NAIRU represents full employment in the economy (Hsing, 2009:469). As such, when the actual unemployment rate exceeds the NAIRU, theory suggests the implementation of expansionary monetary and fiscal policies to stimulate demand. The use of expansionary policies aimed at reducing the actual unemployment rate to the NAIRU will lead to an increase in the inflation rate. Similarly, when the actual unemployment rate falls below the NAIRU, theory suggests the use of contractionary policies to return the actual unemployment rate to the NAIRU (Hsing, 2009:469). The use of contractionary policies will be accompanied by a decline in the inflation rate.

The NAIRU is a preferred approach to be employed in this study since it uses both behavioural equations and statistical estimation methods to determine the unemployment rate that corresponds with a stable inflation rate (Boone, Giorno, Meacci, Rae, Richardson & Turner, 2003:176). Furthermore, the estimation approach based on the NAIRU uses an expectation-augmented Phillips curve as a theoretical framework for the formulation of sound policy decisions (Boone et al., 2003:172). The use of a theoretical framework and statistical tools assists in obtaining sound and robust estimation results.

The study will use an expectations-augmented Phillips curve to estimate a time-varying NAIRU for South Africa from 1980 to 2012. An expectations-augmented Phillips curve is a preferred approach to determine a stable unemployment rate that coincides with a stable inflation rate (Boone et al., 2003:181). According to literature (Gordon, 1997; Stiglitz, 1997; Hsing, 2009), the inflation rate that is set
at a level that corresponds to the NAIRU assists central banks and governments to analyse their policy decisions as the NAIRU represents a stable inflation rate and full employment in the economy. Furthermore, the NAIRU guides both governments and central banks to either pursue expansionary or contractionary monetary and/or fiscal policies in order to return the unemployment rate to its natural rate following economic disturbances (Hsing, 2009:469; Stiglitz, 1997:3; Gordon, 1997:11). The NAIRU is also used as a forecasting tool to predict the trend in the future movement of inflation (Claar, 2006: 2188; Ball & Mankiw, 2002: 121).

The NAIRU is not directly observable and has to be estimated (Staiger, Stock & Watson, 1997:195 and Boone et. al, 2003:176). The estimated NAIRU will, in turn, be used to determine a stable inflation rate for South Africa. The inflation rate, based on the estimated NAIRU, will then be compared to the inflation target range that is adopted by the South African Reserve Bank (i.e. 3 to 6 percent) to determine if it was set at a level that minimises the trade-off between inflation and unemployment. The variables used in this study are identical to those that were used to estimate the Phillips curve in Ball and Mankiw (2002:122) and in Hsing (2009:470). They are the current and previous unemployment data as well as the inflation rate [as measured by the consumer price index (CPI)]. The study also used CPI inflation expectations survey data to estimate a Phillips curve that is based on rational expectations.
1.5. Significance of the Study

South Africa has a huge unemployment problem (Klasen & Woolard, 2008; McCord & Bhorat, 2003). In 2010, it was ranked amongst the top 10 countries in the world that have high unemployment rates (Department of Economic Development, 2010:14). According to McCord and Bhorat (2003:125), South Africa has the highest unemployment rates compared to other developing countries in Africa, Asia and Latin America. South Africa also has the highest unemployment rates in Sub-Saharan Africa (Klasen & Woolard, 2008: 2).

The Congress of South African Trade Unions (COSATU) maintains that by targeting inflation, government failed to reduce the unemployment rate and proposes that inflation targeting should be abandoned in favour of an employment targeting framework (2011:15). COSATU asserts that by targeting low inflation rates and leaving the unemployment objective to be determined through the operation of the market; government policies have slowed down economic growth and inhibited the ability of the economy to create jobs (Motel, 2011:179; Potgieter, 2010:40). COSATU (2011:15) argues that the pursuit of price stability, at the current inflation target range, is inappropriate, given South Africa’s developmental needs.

In order to address South Africa’s unemployment challenges and the concerns raised by COSATU; this study will evaluate whether the 3 to 6 percent inflation target range was set at a level that minimises the trade-off between inflation and unemployment. Should the study conclude that the inflation target range was set at a level that does not minimise the trade-off between inflation and unemployment; this study will assist policy makers and the government to formulate effective policies that will address both the attainment of price stability and developmental aspects of the country, such as reducing unemployment.

It is imperative to understand whether the 3 to 6 percent inflation target range was set at a level that minimises the trade-off between inflation and unemployment since unemployment has serious cost implications and places huge pressure on the economy. This is due to three primary reasons. Firstly, unemployment has a high economic cost as it lowers output that is produced in
a country and leads to a deterioration of human capital (Kingdon & Knight, 2000:1). Secondly, an increase in the levels of unemployment can lead to political unrest as it threatens both social and political stabilities (Kingdon & Knight, 2005:2). Lastly, a high unemployment rate can lead to an increase in the incidence of crime (Klasen & Woolard, 2008:2).

The contribution of this study to the existing literature on the inflation and unemployment trade-off in South Africa is the determination of a stable inflation rate that minimises the trade-off between inflation and unemployment. By evaluating whether the 3 to 6 percent inflation target range was set at a level that minimises the trade-off between inflation and unemployment, this study will assist: the government; policy makers; the South African Reserve Bank; labour unions; businesses; and the general public to ascertain if the 3 to 6 percent inflation target range was set at an appropriate level for South Africa.

1.6. Chapters Overview

The study comprises five Chapters. As we have seen, the first chapter is an introductory one. The next chapter is the literature review which includes three sections: The first will discuss the evolution of the Phillips curve from Keynesian, Monetarist and Post-Keynesian perspectives; the second part will analyse empirical evidence; while the third section will discuss the concept of inflation targeting as well as South Africa's experience with inflation targeting. Chapter 3 provides a description of the research design that will be employed in the study. In Chapter 4, we present the results of the study and the implications of these findings on monetary policy in South Africa. In the last chapter, we provide the conclusion.
2. LITERATURE REVIEW

2.1. Introduction

The debate on the relationship between inflation and unemployment dates back to 1958 when Phillips (1958:238) found a nonlinear relationship between unemployment and changes in wages by conducting empirical tests on data from the United Kingdom for the period 1861 to 1951. Based on the results of his study, Phillips concluded that by accepting some degree of inflation, central banks could maintain lower rates of unemployment (Van der Merwe, 2004:11). Phillips' conclusion led to major disagreements among economists on the existence of a relationship between inflation and unemployment, and consequently the actions that should be taken to address the trade-off between these economic variables (Friedman, 1968; Burger & Marinkov, 2006; Fischer, 1996; and; Mankiw, 2001).

This literature review consists of three sections. In the first section, we commence by providing an overview of the history of the Phillips curve and debating whether there is a trade-off between inflation and unemployment. In the second section, we discuss empirical evidence that supports the existence of a trade-off. In the subsequent section, we discuss the issues of inflation targeting; the introduction of an inflation targeting framework in South Africa and the views of various stakeholders on this monetary framework and then culminate with a conclusion.

2.2. Evolution of the Phillips Curve

Phillips (1958) held the view that there is a trade-off between inflation and unemployment. Phillips' view was supported by Keynesian economists who asserted that the trade-off results from insufficient demand in the economy (Hodge, 2002:420). Although Keynesian economists held the view that unemployment was more costly than high inflation; they believed that it was possible to achieve both stable inflation and low unemployment through the direct intervention of government in the economy (Hodge, 2002:420).
The Keynesian views delineated above were supported by evidence from Japan, the United Kingdom and the United States of America who, through direct intervention by the government in each country's economy, achieved both stable inflation and low unemployment rates in the 1960s (Hodge, 2002:420). The results achieved by these countries led Keynesian economists to recommend government intervention in the economy through the use of expansionary monetary and fiscal policies as they believed that these policies were necessary to stimulate aggregate demand in order to achieve full employment and maintain a stable inflation rate (Hodge, 2002:420; Hodge, 2006:164; and Michie, 2003:7).

In the 1970s, the co-existence of high unemployment and inflation rates led to major criticism of the Keynesian hypothesis by monetarists as the Phillips curve failed to explain the simultaneous existence of high unemployment and inflation rates (Hodge, 2002:420). Friedman (1968) argued that Phillips' theory and the Keynesian economists' hypothesis were both flawed in that they were based on the assumption that nominal wages were constant. As such, monetarists claimed that these theories failed to account for variations in nominal wages, counteracting the trade-off between inflation and unemployment in the long run.

The monetarists argued that the Phillips curve is vertical in the long run (Friedman, 1968; Fischer, 1996; Michie, 2003). According to monetary economists (Hodge, 2002:420; Friedman, 1968:1), the trade-off between inflation and unemployment is temporary and mainly results from the behaviour of workers as they adjust their wage expectations following an increase in the unemployment rate. In the long run, following the full incorporation of inflation expectations in wage negotiations; there will be an increase in the inflation rate and the unemployment rate will remain unchanged as nominal wages adjust towards their real rate (Hodge, 2002:420). The unemployment rate will thus return to its natural rate, which remains stable in the long run (Friedman, 1968:8 and Michie, 2003:10).

A vertical Phillips curve, as hypothesised by the monetarists, implies that there is no permanent relationship between inflation and unemployment. Accordingly, monetarists dispute the Keynesian recommendation of government intervention
in the economy through the use of fiscal and monetary policies as they hold the view that monetary policy will not have an influence on the unemployment rate in the long run (Friedman, 1968:5).

Post-Keynesian economists contest the conclusion reached by monetary economists. Although the post-Keynesian economists agree with the monetary economists’ conclusion of a natural rate of unemployment, they argue that it is possible for the trade-off to exist due to the way that economic agents form expectations (Michie, 2003:14). Post-Keynesian economists assert that monetary economists did not find evidence of a trade-off between inflation and unemployment as their hypothesis was based on the assumption that economic agents use rational expectations when they make decisions (Holden, 2002:2). Post-Keynesian economists are of the view that workers base their wages on adaptive expectations; and that a trade-off between inflation and unemployment will depend on how quickly workers adopt their future inflation expectations following disturbances in the economy and on the bargaining power of employers during wage negotiations (Hodge, 2002:420 and Michie, 2003:14). The post-Keynesian economists maintain that at any unemployment rate, besides the natural rate of unemployment, there will be a trade-off between inflation and unemployment (Michie, 2003:14).

Although they found evidence of a trade-off between inflation and unemployment, post-Keynesian economists, like monetary economists, did not believe that the government should intervene directly in the economy. Post-Keynesian economists held the view that if the government were to intervene when the unemployment rate was increasing, due to short run variations, which causes the trade-off, their intervention would lead to an increase in the inflation rate (Michie, 2003:10). As a high inflation rate is undesirable, post-Keynesian economists were of the view that government should allow the unemployment rate to fall back to its natural rate (Michie, 2003:10).

The debate between the Keynesian, monetary and post-Keynesian economists can only be resolved by evaluating empirical evidence to conclude whether or not there is a relationship between inflation and unemployment. The empirical evidence is presented below.
2.3. Empirical Evidence

2.3.1. International experience

Empirical evidence supports the existence of a trade-off between inflation and unemployment. Research — conducted for European countries (Holden, 2002); certain member countries of the Organisation for Economic Corporation and Development (Ball, Mankiw & Nordhaus, 1999) as well as for the United States of America (Banarjee et al., 2008; Akerlof, Dickens, Perry, Bewley & Blinde, 2000) — demonstrate that there is a trade-off between inflation and unemployment. The trade-off results from, *inter alia*, expectations about future inflation coupled with rigidities in nominal wages (Akerlof et al., 1996; Akerlof et al., 2000); regulated and highly unionised labour markets (Holden, 2002) and shocks to economies (Svenssens, 1999).

Akerlof et al. (2000) proposed that the trade-off is caused by the way that workers form expectations about future movements of inflation. Akerlof et al. (2000:41) argue that workers do not form expectations in accordance with the rational expectations hypothesis, as assumed by monetary economists. In their study, Akerlof et al. (2000:3) found that employees' expectations deviate from rational behaviour at low inflation levels and that economic agents, such as workers and employers, tend to ignore the impact of low inflation when they negotiate wages and prices.

Akerlof et al. (2000:4) used survey data based on inflation expectations of economic agents to determine the inflation rate and the unemployment level, which minimise the trade-off between inflation and unemployment. In contrast to models based on rational expectations; Akerlof et al. (2000:41) found that the Phillips curve was not vertical at low inflation levels, and that there was a trade-off between inflation and unemployment.

In their study, Benigno and Ricci (2009:29) found that macroeconomic disturbances and the resulting change in output will lead to an increase in the unemployment rate. Benigno and Ricci (2009:29) concluded that countries
which are subject to high macroeconomic volatility will face substantial increases in their unemployment rate. This will occur as they pursue price stability due to their vulnerability to withstand external shocks that have a negative impact on output. The presence of external shocks leads to a trade-off as this disturbs the relationship between inflation and unemployment.

In his study based on European countries, Holden (2002:4) found that countries that had regulated labour markets, and where the majority of workers were unionised, face a trade-off between inflation and unemployment when they target low inflation rates. This situation will arise because, in unionised labour markets, wages can only be changed through mutual consent between employers and workers (Holden, 2002:2). As wages can only be changed through mutual agreement, workers and their labour unions possess bargaining power, which they can use to prevent employers from affecting a cut in nominal wages when inflation is low (Holden, 2002:4). The inability of employers to reduce nominal wages unilaterally means that, in the long run, increases in nominal wages will lead to an increase in the inflation rate (Holden, 2002:3).

The existence of a trade-off means that there is an optimal inflation target. An appropriate inflation target would ideally be close to the optimal inflation rate on a nonlinear Phillips curve. Given the presence of a trade-off, studies were conducted in certain developed countries (Akerlof et al., 2000; Fortin, 2001; Lundborg & Sacklén, 2006; Maugeri, 2010; Wyplosz, 2000) to evaluate whether the inflation target was set at a level that minimises the trade-off between inflation and unemployment. Provided below is a summary of these studies.

The majority of studies (Fortin, 2001; Lundborg & Sacklén, 2006, Maugeri, 2010) used survey data based on expectations of economic agents to estimate the inflation rate that minimises the trade-off between inflation and unemployment. The estimated inflation rates were then compared with the inflation target that is pursued by central banks. These studies found that the inflation targets were set at levels that cause a trade-off between inflation and unemployment.
Fortin (2001:7) conducted the analysis for Canada over the period 1992 to 2002 and found that the inflation target, which was set by the Bank of Canada, was set at a rate that causes a trade-off between inflation and unemployment. The Bank of Canada targeted an inflation rate of between 1 to 3 percent while Fortin (2001:5) found that an optimal inflation target for Canada fell between 2 to 3 percent.

In a study that was conducted for Sweden, Lundborg & Sacklén (2006:2) found that the inflation target of 2 percent, which was pursued by the European Central Bank, was not set at a level that minimises the trade-off between inflation and unemployment. Lundborg & Sacklén (2006:24) analysed data from 1963 to 2000 and found that the trade-off would be minimised if the European Central Bank targeted an inflation rate of 4 percent.

A similar study was conducted by Maugeri (2010) for Italy for the period 1960 to 2003. Maugeri (2010:17) found that the inflation target of 2 percent, which was pursued by the European Central Bank, was not optimal for Italy. The results in Maugeri's study indicated that the inflation rate that would minimise the trade-off between inflation and unemployment fell between 15 to 20 percent (Maugeri, 2010:17). The study rejected the estimated inflation range on the basis that the reduction in the unemployment rate would not outweigh the loss in Italy's competitiveness. In addition, instability would be observed in the financial systems from the implementation of an inflation targeting regime, which targets high inflation rates (Maugeri, 2010:14).

Wyplosz (2000:15) determined the inflation rate that would minimise the trade-off by making use of survey data on inflation expectations of economic agents; taking into account the regulated and unionised labour markets of France, Germany, the Netherlands and Switzerland from 1960 to 1999. Wyplosz found that the 2 percent inflation target, which was pursued by the European Central Bank, resulted in a trade-off between inflation and unemployment. The results from Wyplosz's study (2000:30) suggest that an optimal inflation rate for France, Germany, the Netherlands and Switzerland should be 5 percent.
2.3.2. Empirical studies done in South Africa

In this section we rely on empirical evidence, based on South African studies, to determine whether there is a trade-off between inflation and unemployment.

In South Africa, studies were done to determine whether there was a trade-off between inflation and unemployment pre- and post the introduction of inflation targeting. Empirical evidence supports the existence of a trade-off.

Early studies, which were conducted in the 1960s and 1970s, found a trade-off between inflation and unemployment and between inflation and output gaps (i.e. the real GDP growth rate). Early studies evaluated the Phillips curve with respect to both the relationship between inflation and unemployment and between inflation and output gaps. Output gaps measure the difference between potential output and actual output, that is, GDP growth rates (Pretorius & Janse van Rensburg, 1996:1). According to Hodge, (2002:425) when the aggregate production function is constant, the trade-off between price inflation and output gaps and the trade-off between price inflation and unemployment produces similar results.

Gallaway, Koshal and Chapin (1970) and Hume (1971) in Hodge (2002:426) and in du Plessis and Burger (2006:67) estimated the relationship between inflation and unemployment from the 1940s to the late 1960s and found a significant negative relationship between these variables. Krogh (1967), Truu (1975) and Strydom and Steenkamp (1967) in du Plessis and Burger (2006:67) estimated the relationship between inflation and output gaps for the period between the 1940s and the late 1960s, and found evidence of a significant trade-off between inflation and output gaps.

Hodge (2002:429) questioned the accuracy and reliability of studies that were conducted in the 1960s and 1970s. The main concern that Hodge (2002:429) expressed with early studies was that they did not give a true representation of developments in the economy as they were mainly based on wage inflation rather than price inflation. In addition, early studies excluded black unemployment and only analysed the existence of a trade-off with regard to the
relationship between inflation and white, Asian and coloured unemployment data (Hodge, 2002:429). Furthermore, early studies did not take inflation expectations into account and thus ignored the impact of inflation persistence in their estimations (du Plessis & Burger, 2006:65).

In later studies, economists recognised the need to account for the inadequacies that were raised in early studies and to overcome the challenges of the unavailability of time series data for black unemployment. Burger & Marinkov; Fedderke & Schaling and Hodge (2006, 2005 and 2006, respectively) then determined the trade-off by analysing the relationship between price inflation and output gaps.

Later studies based on output gaps (Pretorius & Smal, 1994; Fedderke & Schaling, 2005; Nell; 2002) found evidence of a trade-off between inflation and output gaps. Nell (2002:16) evaluated the Phillips curve hypothesis by estimating a non-linear convex Phillips curve for the period 1971 to 1991. Nell (2002:17) found evidence of a trade-off between inflation and output gaps during periods when inflation was increasing and the economy was overheating and during deflationary periods when the economy was weak.

South African studies, based on expectations-augmented Phillips curve (Pretorius & Smal, 1994:67 and Fedderke & Schaling, 2005:88), found that the trade-off occurs indirectly through labour costs rather than through prices. These studies illustrate that there is a trade-off between labour costs and unemployment.

Du Plessis and Burger (2006) introduced the New Keynesian Phillips Curve model to South African literature. Du Plessis and Burger (2006:72) estimated a New Keynesian Phillips curve model for South Africa using marginal costs as a proxy for demand effects. In their study, du Plessis and Burger (2006:72) found that changes in inflation had a significant effect on marginal costs. The results of Du Plessis and Burger’s study (2006) suggest that there is a trade-off between inflation and marginal costs. Their findings can be relied upon to analyse the Phillips curve relationship, since the study is based on the new
Keynesian Phillips Curve model, which takes both rational expectations and nominal rigidities in the goods market into account.

As proxied by output gaps, labour and marginal costs; empirical evidence indicates that there is a trade-off between inflation and unemployment in South Africa. However, the unavailability of reliable time series data for unemployment has prevented researchers from evaluating whether the 3 to 6 percent inflation target range was set at a level that minimises the trade-off between inflation and unemployment (Phiri, 2010:355; Hodge, 2002:429).

As an alternative to the Phillips curve relationship, which requires both inflation and unemployment data in order to address the unavailability of unemployment data; recent studies (Leshoro, 2012; Phiri, 2010; Gupta & Uwilingiye, 2008) evaluated the appropriateness of the 3 to 6 percent inflation target on the South African economy with respect to the relationship between inflation and economic growth.

Leshoro (2012:4) tested the impact that the 3 to 6 percent inflation target range has on economic growth by using quarterly data from 1980 to 2010. The results of his study suggest that inflation rates greater than 4 percent limit GDP growth (Leshoro, 2012:8). The results from Leshoro’s study indicate that the current inflation target is set at a level where there is a trade-off between inflation and economic growth, which ultimately translates into a trade-off between inflation and unemployment given that GDP reflects output that is produced in the country.

In his study, Phiri (2010:357) determined the threshold level at which inflation has an impact on economic growth by analysing the effects that developments in the financial sector have on the real sector from February 2000 to July 2010. Through the transmission mechanism from the financial sector to the real sector, Phiri used OLS estimation techniques to evaluate the effects of inflation on economic activity, and found that an optimal inflation target for South Africa should be 8 percent. Phiri (2010:354) found that any level of inflation that varies from 8 percent had a negative impact on finance-growth activity and concluded
that the 3 to 6 percent inflation target range limits the level of economic growth in South Africa.

Gupta and Uwilingiye (2008:2) estimated a money demand function for South Africa for the period 1965 to 2007, following which they used the Johansen cointegration technique to estimate the welfare cost of inflation. Gupta and Uwilingiye (2008:7) found that the 3 to 6 percent inflation target range imposes welfare costs on the South African economy. The econometric study indicated that the 3 to 6 percent inflation target range results in a welfare loss which varies from 0.34 percent to 0.67 percent of GDP (Gupta and Uwilingiye, 2008:7).

2.3.3. Conclusion on empirical evidence

Empirical evidence indicates that the monetarist economists’ view of a vertical Phillips curve was not entirely correct: there is a trade-off between inflation and unemployment at low inflation rates in the short run. If a trade-off exists, it means that there is an optimal inflation rate at which level the trade-off is minimised.

The next section evaluates: issues surrounding inflation targeting; support of and opposition to inflation targeting; and the nature of the inflation target that needs to be adopted in order to minimise the negative effect of the trade-off between inflation and unemployment.

2.4. Inflation targeting

Inflation targeting is a monetary framework that focuses on price stability as the overarching goal of monetary policy (Jonsson, 1999:3; van der Merwe, 2004:4; Kahn, 2008:124). In an inflation targeting framework, an explicit inflation target, which the central bank must achieve, is announced publicly (Kahn, 2008:124; van der Merwe, 2004:2).

The public announcement of an explicit inflation target has a three-fold advantage. Firstly, an explicit inflation target helps the central bank to manage
inflation expectations of various stakeholders in the economy (Kahn, 2008:125). Secondly, an explicit inflation target increases transparency since the objectives and goals of the central bank are known by the public (Kahn, 2008:124; van der Merwe, 2004:2). Thirdly, the central bank is held accountable for the attainment of the announced inflation target (Padayachee, 2001:750; van der Merwe, 2004:2).

Although inflation targeting has desirable benefits for the economy, there are institutional and economic requirements that must be satisfied prior to the adoption of an inflation targeting framework (Kahn, 2008:130). The institutional requirements are: that the central bank should be independent in carrying out its function; they must be transparent in how they execute their mandate; and they must have the technical capabilities to determine the future trend of inflation (Kahn, 2008:130; Padayachee, 2001:757). Further, the central bank should be credible and show a commitment to achieving the stated inflation objective and be held accountable should it fail to meet its mandate (Kahn, 2008:130).

On the economic side, the implementation of an inflation targeting framework requires well developed financial and capital markets to assist with the transmission mechanism (Jonsson, 1999:4; Padayachee, 2001:757; Kahn, 2008:132). In addition, foreign exchange movements should be determined through supply and demand conditions and the economy should not be sensitive to external shocks (Kahn, 2008:131; Padayachee, 2001:757).

Critics argue that inflation targeting is not an appropriate monetary policy framework for developing countries (Kahn, 2008:124). Critics maintain that developing countries are more susceptible to the negative effects of external shocks due to the uncertainty perceived by investors with respect to their political and economic stability (Ricci, 2005:207). Investor uncertainty, coupled with the requirement of a flexible foreign exchange market, means that developing countries are likely to be negatively affected by external shocks due to their small size in comparison to developed countries (Kahn, 2008:124; Ricci, 2005:207). Further, critics argue that the sole pursuit of the price stabilisation objective in developing countries inhibits their growth and development, as
central banks in these countries do not assist their governments to achieve other social objectives, such as reducing unemployment (Kahn, 2008:126).

2.5. The South African Experience with Inflation Targeting

Inflation targeting was introduced in South Africa in 2000 following increased international pressure for the government to reduce its inflation rate to levels commensurate with its trading partners (Banerjee et al., 2008:717; Padayachee, 2001:744; Ricci, 2005:191). Although South Africa satisfied all the requirements for the successful introduction of inflation targeting; there were disagreements between: the government; the South African Reserve Bank; policy makers; labour unions; and businesses; on whether inflation targeting was an appropriate monetary policy framework for South Africa.

On the one hand, policy makers; the government; the South African Reserve Bank and some economists believed that there was no trade-off between inflation and unemployment or inflation and output gaps (Jonsson, 1999:3; van der Merwe, 2004:11; Fischer, 1996:9). As such, these stakeholders supported the introduction of inflation targeting since they believed that high inflation hampered and hindered the ability of the economy to create jobs (van der Merwe, 2004:1; Fischer, 1996:8). As a result, the government and policy makers advocated inflation targeting as a suitable monetary policy framework for South Africa. The government was of the view that reducing inflation and attaining price stability would enhance the country’s prospects for economic growth and employment creation (van der Merwe, 2004:1; Department of Finance, 1996:11; Mboweni, 1999:404).

Labour unions, on the other hand, were in strong opposition to the introduction of inflation targeting. Labour unions were of the view that the range of the inflation target band was too low for South Africa’s developmental needs (Padayachee, 2001:755; Aron & Muellbauer, 2005:11). Labour unions maintain that the South African Reserve Bank keeps interest rates high in order to achieve its inflation target. High interest rates suppress demand and ultimately lead to low economic activity. Low economic activity, in turn, has a negative impact on growth and employment creation (Padayachee, 2001:755; Aron &
Muellbauer, 2005:11). Labour unions also argue that inflation targeting does not only suppress economic activity, but also affects the ability of businesses to compete in the export market (van der Merwe, 2004:10). The pre-requisite of a flexible exchange rate, for the implementation of inflation targeting, means that the rand is subject to external shocks. External shocks, depending on how severe they are, can hinder the ability of companies involved in export and import industries to compete effectively, since the currency with which they trade is vulnerable to external shocks (van der Merwe, 2004:10).

2.6. Conclusion

The literature review outlined the historic development of the relationship between inflation and unemployment. Empirical evidence supports the view held by Keynesian and post-Keynesian economists as it indicates that there is a trade-off between inflation and unemployment. The existence of a trade-off implies that there is a conflict between achieving price stability and reducing the levels of unemployment. However, where a trade-off exists between inflation and unemployment, socially and economically desirable results can still be achieved by choosing an appropriate inflation rate. A fitting inflation rate for a country will be that part on a nonlinear Phillips curve where the trade-off between inflation and unemployment is minimised.
3. RESEARCH METHODOLOGY

The purpose of this chapter is to provide an outline of the methodology which is used in this study to determine the NAIRU and the corresponding inflation rate that minimises the trade-off between inflation and unemployment. The study makes use of an expectations-augmented Phillips curve and the section below describes the procedure that is followed to determine the estimation approach.

3.1. Background on the model employed

The classical theory that money is neutral does not hold (Ball & Mankiw, 2002:116). There are various factors which cause money to have an impact on economic variables. These include, amongst others: long-term employment contracts; imperfect information; the cost of price adjustments and deviations from full rational behaviour by economic agents (Ball & Mankiw, 2002:116). This study is particularly concerned with analysing the impact that departures from full rational behaviour, by economic agents, have on inflation and unemployment.

Inflation expectations can cause a trade-off between inflation and unemployment as money is not neutral in the short-term (Ball & Mankiw 2002:117). For instance, if inflation expectations vary significantly from the actual inflation rate; changes in the quantity of money will have an effect on relative prices, production and employment. Inflation expectations will thus affect the relationship between inflation and unemployment gradually over time as economic agents incorporate the impact of supply shocks and other demand pressures in their decision-making processes (Boone et al., 2003:173).

The premise behind the expectations-augmented Phillips curve is the Lucas "surprise" aggregate supply function. The Lucas "surprise" aggregate supply function states that output will only vary from its natural level when the actual inflation rate deviates from expected inflation levels (Snowdon & Vane, 2005:235). Mathematically, the Lucas "surprise" aggregate supply function is represented as follows:
\[ Y_t = Y_{Nt} + \alpha (P_t - P_t^e), \alpha > 0 \ldots \ldots (3.1) \]

Where:

- \( Y_t \) represents output that is produced;
- \( Y_{Nt} \) represents the natural rate of output;
- \( P_t \) represents the actual inflation rate;
- \( P_t^e \) represents the expected inflation rate; and
- \( \alpha > 0 \) is a parameter that measures how output responds to changes in the inflation rate.

The Lucas "surprise" aggregate supply function assumes that economic agents are rational and base their decisions on all available information. The Lucas "surprise" aggregate supply function which takes into account inflation expectations is represented by equation 3.2 below.

\[ Y_t = Y_{Nt} + \alpha [P_t - E(P_t - |\Omega_{t-1}|)] \ldots \ldots (3.2) \]

Where:

- \( E(P_t - |\Omega_{t-1}|) \) represents expectations that economic agents form about inflation based on information available until period \( t - 1 \).

An expectations-augmented Phillips curve, as represented by equation 3.3 below, is derived by applying Okun’s law to the Lucas "surprise" aggregate supply function. Okun’s law states that “there is a stable and predictable relationship between unemployment and GDP” (Snowdon & Vane, 2005:235). In an expectations-augmented Phillips curve, output and the natural rate of output (from equation 3.2) are replaced by the unemployment rate and the natural rate of unemployment in order to derive equation 3.3.

\[ P_t = [(P_t|\Omega_{t-1} - \alpha(U_t - U_{N1})] \ldots \ldots (3.3) \]

Where:

- \( U_t \) represents the unemployment rate; and
- \( U_{N1} \) represents the natural rate of unemployment.
Empirical evidence (Ball & Mankiw, 2002; Holden, 2002; Karanassou, Sala & Snower, 2010; Banerjee et al., 2008; Akerlof et al., 1996 and Svensson, 1999) supports the theory that stipulates that changes in the supply of money and aggregate demand, cause inflation and unemployment to move in opposite directions in the short run. The movement of inflation and unemployment in opposite directions implies that there is a trade-off and a negative relationship between inflation and unemployment in the short run, as illustrated by equation 3.4 below.

\[ \pi = k - aU \ldots \ldots (3.4) \]

Where:
- \( \pi \) represents the inflation rate;
- \( U \) represents the unemployment rate;
- \( k \) is a parameter that represents a constant term in the equation; and
- \( a > 0 \) is a parameter that measures how the inflation rate responds to changes in the unemployment rate.

The Phillips curve has evolved since its inception and is presently used to evaluate the relationship between price inflation and unemployment (Pallis, 2005:81). The Phillips curve, which captures the relationship between the rate of wage inflation and unemployment, is represented as per equation 3.5 below.

\[ \pi = -a(U - U^*) \ldots \ldots (3.5) \]

Where:
- \( U^* \) is the natural rate of unemployment.

Ball and Mankiw (2002:117) represented the expectations-augmented Phillips curve that takes inflations expectations into account as follows:

\[ \pi = \pi^e - a(U - U^*) \ldots \ldots (3.6) \]

Where:
- \( \pi^e \) represents inflation expectations.

In their approach to calculate an expectations-augmented Phillips curve Ball and Mankiw (2002:118) based their analysis on adaptive expectations. As a
result, Ball and Mankiw (2002) relied on the trend that inflation followed over time in order to take into account the effect of inflation expectations on the trade-off between inflation and unemployment. If inflation followed a random walk, Ball and Mankiw (2002:119) believed that using adaptive expectations would produce optimal results since economic agents relied on past inflation rates to form expectations about future inflation rates. The expectations-augmented Phillips curve, which is based on adaptive expectations, is thus presented as per equation 3.7 below:

$$\pi = \pi_{-1} - a(U - U^*) \ldots \ldots (3.7)$$

Where:

- $\pi_{-1}$ represents the inflation rate that was observed during the previous period.

Supply shocks also affect the inflation process and the trade-off between inflation and unemployment in the short run. In the literature (Ball & Mankiw, 2002:118 and Hsing, 2009:470), the Phillips curve, which takes short-term disturbances into account, is represented as per equation 3.8 below:

$$\pi = \pi_{-1} - a(U - U^*) + \nu \ldots \ldots (3.8)$$

Where:

- $\nu$ represents supply shocks.

The model further assumes that the natural rate of unemployment ($U^*$) varies over the period under analysis and that supply shocks ($\nu$) are uncorrelated to the unemployment rate ($U$).

The expectations-augmented Phillips curve, as represented by equation 3.6 above, is used as a base to derive an estimate of a time-varying NAIRU that is used to determine a stable inflation rate. The expectations-augmented Phillips curve is estimated through the use of ordinary least squares (OLS) while the value of the NAIRU and the corresponding inflation rate that stabilises the trade-off between inflation and unemployment; are estimated by applying the Engle-Granger cointegration test and the Hodrick-Prescott filter.
3.2. Research Methodology

The procedure outlined below illustrates the process which was followed to determine a time-varying NAIRU and the corresponding inflation rate that minimises the trade-off between inflation and unemployment. The NAIRU is not directly observable but is estimated based on variables which are used to determine an expectations-augmented Phillips curve (Staiger, Stock, & Watson, 1997:197; Boone et al., 2003:172). In order to calculate a time-varying NAIRU for South Africa, the study followed the procedure suggested by Ball and Mankiw (2002), which is described in the remainder of this section.

The study deviates from Ball and Mankiw (2002:119) who evaluated whether the expectations-augmented Phillips curve would be an appropriate model for their study by testing whether inflation expectations are based on adaptive expectations: that is, they tested whether inflation expectations followed a random walk. For this study, we performed a single-equation cointegration test, namely, the Engle-Granger cointegration test to evaluate whether there is a cointegrating relationship between inflation and unemployment in order to estimate the cointegrating parameters, as in equation 3.4 above.

After obtaining an estimate of parameter $a$, the expectations-augmented Phillips curve, as represented by equation 3.6, was transformed in order to obtain the natural rate of unemployment. Equations 3.6.1 to 3.6.6 below reflect the transformations which were performed on equation 3.6.

\[
\begin{align*}
\pi &= \pi^e - a(U - U^*) + \nu \quad \ldots \ldots \quad (3.6.1) \\
\pi - \pi^e &= aU^* - aU + \nu \quad \ldots \ldots \quad (3.6.2) \\
\Delta\pi &= aU^* - aU + \nu \quad \ldots \ldots \quad (3.6.3) \\
aU^* + \nu &= \Delta\pi + aU \quad \ldots \ldots \quad (3.6.4) \\
\frac{aU^*}{a} + \frac{\nu}{a} &= \frac{\Delta\pi}{a} + \frac{aU}{a} \quad \ldots \ldots \quad (3.6.5) \\
U^* + \frac{\nu}{a} &= U + \frac{\Delta\pi}{a} \quad \ldots \ldots \quad (3.6.6)
\end{align*}
\]

The variables on the left hand side of equation 3.6.6 represent factors which cause the Phillips curve to move over time. The natural rate of unemployment
\((U^*)\) represents the long-term trends that are often caused by variations in demographics or other changes in labour market institutions; while the parameter \(\frac{\Delta u}{a}\) captures movements which are caused by short-term shocks to the inflation process, such as significant fluctuations in the foreign exchange market. The right hand side of equation 3.6.6 (i.e. \(U + \frac{\Delta \pi}{a}\)) is computed using available data and the results thereof are used to obtain estimates of the natural rate of unemployment.

The third step is to extract the natural rate of unemployment \((U^*)\) from the series which captures movements in the Phillips Curve (i.e. \(U + \frac{\Delta \pi}{a}\)). The natural rate of unemployment \((U^*)\) is extracted from \(U + \frac{\Delta \pi}{a}\) by making use of the Hodrick-Prescott filter. The Hodrick-Prescott filter is a procedure which breaks a time series into two components. The first component represents a smooth trend and captures the long-term fluctuations in a series (i.e. movements in unemployment), while the second component captures cyclical movements that are caused by short-term fluctuations (Hodrick & Prescott, 1997:3; Claar, 2006:2183). This step yields an estimate of the time-varying natural rate of unemployment.

The final step is to use the estimated natural rate of unemployment to derive the corresponding inflation rate that minimises the trade-off between inflation and unemployment. In our analysis, we estimated the inflation rate based on both adaptive expectations and CPI inflation expectations data. The inflation rate based on CPI inflation expectations is estimated by imputing values of parameter \(a\) and \(U^*\) into equation 3.6 while the inflation rate, based on adaptive expectations, is estimated by imputing values of parameter \(a\) and \(U^*\) into equation 3.8.

The procedure outlined above provided us with the estimated values for parameter \(a\) and the natural rate of unemployment \((U^*)\). The estimated values are in turn used to calculate a stable inflation rate that corresponds to the natural rate of unemployment, as represented by equations 3.6 and 3.8 above. The unemployment rate, CPI inflation expectations and historic values of the
inflation rate do not need to be estimated and are sourced from databases, such as Quan tec, or from government agencies, such as Statistics South Africa and the South African Reserve Bank, who keep historic records of economic variables. To obtain the inflation rate that corresponds to the natural rate of unemployment, we use equations 3.6 and 3.8 and impute values for \( \pi^e, \pi_{-1}^{\alpha}, U \) and \( U^* \) to determine the inflation rate that stabilises the unemployment rate.

3.3. Conclusion

The basic requirement for estimating a time-varying NAIRU is that there must be a trade-off in the short run between inflation and unemployment. Since South African evidence supports the argument that there is a trade-off between inflation and unemployment; we can use an expectations-augmented Phillips curve, which was developed by Ball and Mankiw (2002), to estimate the inflation rate that minimises the trade-off between inflation and unemployment.
4. ECONOMETRIC ESTIMATION AND RESULTS

The purpose of this chapter is to present the results of the econometric analysis. The econometric analysis is executed by estimating a time-varying NAIRU for South Africa, and using the estimates thereof to determine a stable inflation rate. This chapter is organised as follows: we commence by discussing the data used in the study, followed by a discussion of how the model was estimated, and conclude by providing the results and implications of the study.

4.1. Data

This section provides a description of the data used in the study.

The following variables are used to evaluate the appropriateness of the current inflation target range: the headline inflation rate (Infla), the official unemployment rate (Unemplo) and CPI inflation expectations (Inflaexpt).

The headline inflation rate represents the year-on-year percentage change in the consumer price index and is thus considered to be an accurate measure of inflation in the economy. CPI inflation expectations refer to survey data which reflects the views of economic agents (i.e. businesses, analysts, trade unions, households) on the trend that the consumer price index is expected to follow in the future (Rossow, Padayachee & Bosch, 2010: 2). The official unemployment rate used is the unemployment rate based on the narrow definition. The narrow definition of unemployment classifies a person as unemployed only if they took active steps to find employment, prior to the unemployment survey that is conducted by Statistics South Africa, without success (Fourie, 2000:370).

The study makes use of quarterly data from 1980 to 2012. The sample period starts from 1980 as South African unemployment data is not publicly available prior to 1980. Data for the official unemployment rate and the headline inflation rate were sourced from Quantecc. CPI inflation expectations data is only available from the third quarter of 2000 as South Africa introduced inflation targeting in 2000. CPI inflation expectations data was sourced from the Bureau for Economic Research.
4.2. Model Estimation

4.2.1. Unit root test

Table 1 presents the results of the unit root tests namely, the Augmented Dickey-Fuller (ADF) test and the Dickey-Fuller GLS test (DF-GLS). The results reported in Table 1 show that both series, Infla and Unemplo, are stationary at first difference.

<table>
<thead>
<tr>
<th>Table 1: Unit root tests for inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>variable</td>
</tr>
<tr>
<td>Level</td>
</tr>
<tr>
<td>Infla</td>
</tr>
<tr>
<td>Unemplo</td>
</tr>
<tr>
<td>First difference</td>
</tr>
<tr>
<td>Infla</td>
</tr>
<tr>
<td>Unemplo</td>
</tr>
</tbody>
</table>

***, ** denote rejection of the null hypothesis of unit root at 1, 5 and 10%, respectively.

Given that both inflation and unemployment have a unit root, we then tested if there was a cointegrating relationship between these variables by making use of the Engle-Granger cointegration test. The Engle-Granger cointegration test evaluates whether there is any linear combination, among non-stationary variables, that is stationary. If the error term, based on a linear estimation of non-stationary variables is stationary; then we say that the resulting series are ‘cointegrated’.

The results of the Engle-Granger cointegration test are reflected on Table 2. The results reported in Table 2 show that the null hypothesis of no cointegration between Infla and Unemplo is rejected when inflation is an endogenous variable.
4.2.2. Estimation of the NAIRU

Table 2: Results of the Engle-Granger cointegration test for inflation and unemployment

<table>
<thead>
<tr>
<th>Variable</th>
<th>z-statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infla</td>
<td>-29.6342</td>
<td>0.0214</td>
</tr>
<tr>
<td>Unemplo</td>
<td>-18.20813</td>
<td>0.2031</td>
</tr>
</tbody>
</table>

The study proceeded based on the results of the Engle-Granger cointegration test and estimated the cointegrating parameter in the relationship between unemployment and inflation. The estimation, as per equation 3.4, yielded a value of -0.85 for parameter $a$. Knowing the value of parameter $a$, we proceeded to estimate the natural rate of unemployment as per equation 3.6.6.

$$U^* = U + \frac{\Delta \pi}{a}$$

As explained in Chapter 3, $U^*$ is not an observed economic variable. It is derived by estimating the observed series that captures movements in the Phillips curve (i.e. $U + \frac{\Delta \pi}{a}$) in equation 3.6.6. $U^*$ is then obtained by decomposing the observed series through the application of the Hodrick-Prescott filter. The value of the smoothing parameter for the Hodrick-Prescott filter was set at 1600, given that the analysis was based on quarterly data. Figure 1 below provides a diagrammatic representation of South Africa's NAIRU from 1980 to 2012.
Figure 1: Graphical representation of South Africa’s estimated time varying NAIRU from 1980 to 2012

The estimated NAIRU reported in Figure 1, show that the NAIRU in South Africa increased substantially from single digit figures in the 1980s to double digits from the late 1980s until 2012. From the year 2000 to 2012, the NAIRU stabilises around 23.8 to 26.4 percent in South Africa.

The final step of the analysis was to obtain estimates of the stable inflation rate that would minimise the trade-off between inflation and unemployment. As indicated in Chapter 3, the approach that was followed in calculating a stable inflation rate was to take into account both adaptive expectations and survey data on CPI inflation expectations. The section below provides the results for each estimation approach.

4.2.3. Estimated Inflation based on adaptive expectations

As per equation 3.8, a stable inflation rate was determined by substituting the estimated NAIRU, the unemployment rate, lagged values of the inflation rate and parameter $\alpha$ into equation 3.8. Equation 3.8 is summarised below for ease of reference:
\[ \pi = \pi_{-1} - a(U - U^*) + \nu \ldots \ldots \ldots \ldots (3.8) \]

The estimates from equation 3.8 yielded a rate of inflation, based on the NAIRU, which ranged from 0.4 percent to 11.2 percent from 2000 to 2012.

**Figure 2: South Africa’s inflation range based on adaptive expectations**

4.2.4. Estimated Inflation based on CPI inflation expectations

As per equation 3.6, a stable inflation rate was determined by substituting the estimated NAIRU, the unemployment rate, CPI inflation expectations and parameter \( a \) into equation 3.6. Equation 3.6 is summarised below for ease of reference:

\[ \pi = \pi^e - a(U - U^*) \ldots \ldots (3.6) \]

The estimates from equation 3.8 yielded a rate of inflation, based on the NAIRU, which ranged from 2.5 percent to 11.3 percent from 2000 to 2012.
Figure 4 compares the actual inflation rate (Infla) to the inflation rate based on adaptive expectations (InflaN) and CPI inflation expectations (Inflaexpt).

Figure 4: Comparison of the actual inflation rate with the inflation rate based on adaptive expectations and CPI inflation expectations.
The results reported in Figure 4 above shows that Infla, InflaN and Inflaexpt have a similar trend, but, in spite of this, they have different ranges. Moreover, these results indicate that, if South Africa were to put in place an inflation range based on the NAIRU and adaptive expectations, it would have to target an inflation rate that ranges from 0.4 to 11.2 percent. If South Africa were to implement an inflation range based on the NAIRU and CPI inflation expectations it would target an inflation rate that ranges from 2.5 to 11.3 percent.

There is evidence that when South Africa implemented inflation targeting, it chose a range that coincided with its trading partners rather than a range that corresponded to its unemployment rate and the NAIRU. It is in this context that stakeholders, such as the trade unions, continue to believe that the South African Reserve Bank has been too restrictive in the conduct of monetary policy due to its restraining inflation target.

Nonetheless, it is worth mentioning that the introduction of monetary policy aimed at maintaining a stable NAIRU can have undesirable consequences for the economy. According to Arkerlof et al. (1996:51), as inflation moves from a higher rate towards zero, the rigidities in prices and nominal wages will make it difficult for employers to automatically adjust wages downward. Rigidities in wages will inhibit an increase in average prices and ultimately lead to an increase in the unemployment rate (Arkerlof et al., 1996:2).

Moreover, Arkerlof et al. (1996), Fortin (2001) and Lundorg and Sacklén (2006) maintain that targeting a zero inflation rate is not optimal for any country as it leads to an increase in the unemployment rate. The increase in the unemployment rate emanates from rigidities in nominal wages and prices which make it difficult for wages and prices to adjust at low inflation levels (Lundorg & Sacklén, 2006:413; Arkerlof et al., 1996:2; Fortin, 2001:3).

In light of the increase in globalisation, it is important to ponder whether South Africa would remain competitive with an inflation range that is significantly different to its trade partners, at least as far as the broadening of the range is
concerned. Table 3 below provides the inflation targets that are adopted by a number of emerging economies.
Table 3: A list of South Africa’s competitors who adopted inflation targeting

<table>
<thead>
<tr>
<th>Developing countries with an explicit inflation range</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
<td><strong>Inflation target</strong></td>
</tr>
<tr>
<td>Chile</td>
<td>2 – 4 %</td>
</tr>
<tr>
<td>Israel</td>
<td>1 – 3 %</td>
</tr>
<tr>
<td>Brazil</td>
<td>1.5 – 8.5 %</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>2 – 4 %</td>
</tr>
<tr>
<td>Thailand</td>
<td>0 - 3.5 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Developing countries with an explicit inflation target point¹</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
<td><strong>Inflation target</strong></td>
</tr>
<tr>
<td>Columbia</td>
<td>6 %</td>
</tr>
<tr>
<td>Hungary</td>
<td>3.5 %</td>
</tr>
<tr>
<td>Mexico</td>
<td>3 %</td>
</tr>
<tr>
<td>Peru</td>
<td>2.5 %</td>
</tr>
<tr>
<td>Poland</td>
<td>3 %</td>
</tr>
<tr>
<td>South Korea</td>
<td>3 %</td>
</tr>
</tbody>
</table>


A comparison of the inflation target bands that are implemented by emerging markets indicate that a vast majority of them are adopting low and stable inflation rates. Table 3 indicates that South Africa’s inflation target range lies within the inflation target bands that were adopted in Chile, Czech Republic, Hungary, South Korea, Mexico, Poland and Columbia. The inflation targets in Thailand, Peru and Israel are slightly below South Africa’s inflation target range. Brazil is the only developing country that targets a wide inflation range. If South Africa implemented the estimated inflation rate based on the NAIRU, its inflation range would have exceeded the current inflation target bands that are implemented by its competitors in the global economy.

Considering all the factors discussed above and the inflation targets that are implemented by other developing countries; the evidence suggests that a country would be better off if it maintained inflation rates above zero.

¹ Please note that all emerging markets, except Columbia, that target an inflation point allow the inflation target to vary from the actual target by 1 percent.
5. CONCLUSION

The size of the inflation target range really matters as setting the inflation range either too high or too low will result in a trade-off between inflation and unemployment. This means that the South African Reserve Bank can influence the real economy as the size of the inflation target range essentially determines whether there is a trade-off between inflation and unemployment. Empirical studies, which were done for developed countries, support the fact that the size of the inflation range determines whether or not there is a trade-off between inflation and unemployment.

A growing body of literature argues that inflation targeting is not an appropriate monetary policy framework for developing countries. Studies suggest that the pursuit of price stability by central banks in developing countries makes them abandon crucial development aspects, such as reducing unemployment and growing their economies. It is also argued that the size of these countries makes them vulnerable to the negative effects of external shocks, and the requirement of a flexible foreign exchange market inhibits their ability to deal with external shocks.

Studies done in developed countries found that targeting a low inflation rate causes a trade-off, in the short run, between inflation and unemployment. In addition, empirical evidence from developed countries indicates that countries with a high concentration of labour unions and sound employment legislation face a trade-off between inflation and unemployment when they target low inflation rates.

In light of developments in developed countries, with respect to the relationship between inflation and unemployment and in order to resolve the dispute between the South African Reserve Bank and labour unions, this study evaluated whether the introduction of a 3 to 6 percent inflation target range was set at a level which minimises the trade-off between inflation and unemployment. To this end, the study calculated an expectations-augmented
Phillips curve to determine the NAIRU and the corresponding inflation rate that minimises the trade-off between inflation and unemployment for South Africa. The NAIRU is the equilibrium level of unemployment that the economy should achieve. Therefore, if the actual unemployment rate deviates from the natural rate of unemployment, inflation will have to increase or decrease in order to return the economy to its equilibrium rate of unemployment.

The estimated inflation range, which minimises the trade-off between inflation and unemployment, lies between 0.4 to 11.3 percent. This suggests that if South Africa wants to minimise the short run trade-off between inflation and unemployment; the South African Reserve Bank should target an inflation rate that ranges from 0.4 to 11.2 percent, based on adaptive expectations, and an inflation rate which ranges from 2.5 to 11.3 percent, based on CPI inflation expectations in order to achieve a NAIRU that ranges from 23.8 to 26.4 percent.

In South Africa, there is a constant debate between the South African Reserve Bank and labour unions that the inflation target range was not set at an appropriate level to assist South Africa to achieve its development objectives of reducing unemployment and growing the economy. On the one hand, trade unions strongly advocate a high inflation rate since they believe that a low inflation rate increases the level of unemployment in the country. On the other hand, the South African Reserve Bank and government support the adaptation of a low inflation range as it creates an environment that is conducive to economic growth, thus enabling the economy to create jobs.

Our findings provided an estimated inflation range that is wider than the current inflation target range pursued by the South African Reserve Bank. Furthermore, South Africa’s inflation target range compares well with inflation targets that are targeted by other developing countries. However, even though South Africa’s inflation target range compares well with the inflation targets that are implemented by other developing countries; the country faces a unique challenge compared to its developing countries’ counterparts in that it has a particularly high unemployment rate.
The high unemployment rate continuously leads to a criticism of inflation targeting as trade unions hold the view that the South African Reserve Bank pursues its price stabilisation objective at the cost of employment. However, the high unemployment rate that is experienced today might result from policies which were implemented by the government under the apartheid regime (McCord & Bhorat, 2003:114; Lewis, 2001:33). As the government was excluded from participating in the global economy during apartheid, it relied heavily on capital and mineral exports to grow the economy. At the end of apartheid, there was an increase in the unemployment rate that mainly reflected the previous policies which were adopted by the government. The root of South Africa’s unemployment problem is therefore structural and the government should adopt supply-side policies, such as those proposed in the Skills Development Act No. 97 of 1998, as amended, in order to address the unemployment challenge.
6. REFERENCES


