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Analysing inflation dynamics in South Africa: a New-Keynesian approach

by

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DECLARATION

I declare that "**Analysing inflation dynamics in South Africa: A New-Keynesian approach**" is my work, that it has not been submitted for any degree or examination in any university, and that all the sources that I have used or quoted have been indicated and acknowledged by complete references.

Kayla Bennett

Signature: ……K BENNETT…….

Date: ……02/12/2023…….

ABSTRACT

Inflation is a monetary daily process that occurs over a period of time. Monetary policy is based on the Phillips Curve (PC) which is a tool used to analyse and describe inflation dynamics or the process of inflation. The PC basically shows that inflation and unemployment move in opposite directions; a negative relationship exists (Phillips, 1958). However, this relationship only occurs in the short run. Output gap or marginal cost measures can be used in the empirical specification of the PC instead of unemployment. These measures represent economic slack, which means that the correlation with inflation will change. The measure of slack will therefore determine the type of PC used. The different types are: traditional PC, the New Classical Phillips Curve (NCPC), the New Keynesian Phillips Curve (NKPC), and the Hybrid New Keynesian Phillips Curve (HNKPC).

Inflation and monetary policies have gone through various changes over the years. These include implementing different regimes and policies to achieve stable prices and increase economic growth and employment. However, although monetary policies are significant in determining inflation, fiscal policy plays a minor role. Consequently the empirical analysis of this thesis focuses on fiscal variables.

The study employed the HNKPC to investigate inflation dynamics in South Africa (SA). Additionally, the Autogressive Distributed Lags (ARDL) model was used to examine the hypothesis of the study. The study aimed to find the hybrid curve in SA and to determine if monetary and fiscal variables affect inflation. Using quarterly data the study found the relationship between inflation and unemployment to be positive in both the short and long run. As a result, no HNKPC existed in SA. In addition, lagged inflation, government spending (a fiscal variable) and repurchase rate (a monetary variable) influence inflation. The study concluded that fiscal and monetary factors have a role to play in determining price levels in SA.

KEYWORDS – inflation, PC, HNKPC, unemployment, SA, ARDL, ECM
JEL CODES – E12, E13, E24, E31, E42

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I am grateful to God for this opportunity and for what He can still do in my life. I haven't always been the most faithful in prayer this year but still you have come through for me. Thank you for all you have done for me and for what is to come. Matthew 6 verses 25 and 26 says "I tell you not to worry about your life. Don't worry about having something to eat, drink or wear. Isn't life more than food or clothing? Look at the birds in the sky! They don't plant or harvest. They don't even store grain in barns. Yet your Father in heaven takes care of them. Aren't you worth more than birds". Thank you for your provision! Also, you have become such a big part of life the past couple of years and honestly, prayer as helped me through everything.

To my parents and family, thank you for your support. Also, a special thank-you to my supervisor (Professor Sheefeni) and postgraduate coach (Leigh Frantz). I did not believe that completing this could be possible within one year, especially when I was told that it could be done. Thank you for your encouragement and support throughout this journey. Lastly, to the Department of Economics, it has been a pleasure working as a graduate assistant this year and being exposed to teaching.

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List of abbreviations

AD	Aggregate Demand
ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lags
AS	Aggregate Supply
ASEANs	Association of Southeast Asian Nations
BIC	Bayesian Information Criterion
BOP	Balance Of Payments
CEE	Central and Eastern Europe
CPI	Consumer Price Index
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Squares
DF	Dickey-Fuller
DSGE	Dynamic Stochastic General Equilibrium
DSP	Difference Stationary Process
DW	Durbin-Watson
ECM	Error Correction Model
FIT	Flexible Inflation Targeting
FPE	Final Prediction Error
FRED	Federal Reserve Bank of St. Louis
FTPL	Fiscal Theory of the Price Level
GDP	Gross Domestic Product
GMM	Generalised Moment of Methods
HNKPC	Hybrid New Keynesian Phillips Curve
HP	Hodrick-Prescott
HQC	Hannan-Quinn Criterion
IIP	Index of Industrial Production
IMF	International Monetary Fund
KPSS	Kwiatkowski-Philips-Schmidt-Shin
M3	Money supply
MC	Marginal Cost
NAIRU	Non-Accelerating Inflation Rate of Unemployment

NCPC	New Classical Phillips Curve
NKPC	New Keynesian Phillips Curve
NZ	New Zealand
OLS	Ordinary Least Squares
PC	Phillips Curve
PP	Philip-Perron
PPI	Producer Price Index
PPP	Purchasing Power Parity
QPM	Quarterly Projection Model
REER	Real Effective Exchange Rate
RGDP	Real Gross Domestic Product
SA	South Africa
SARB	South African Reserve Bank
SIC	Schwarz Information Criterion
SSA	Sub-Saharan Africa
StatsSA	Statistics South Africa
STR	Smooth Transition Regression
TJIVE	Tikhonov Jackknife Instrumental Variable Estimator
TSP	Trend Stationary Process
UK	United Kingdom
US	United States
VAR	Vector Autoregression
VECM	Vector Error Correction Model
VPC	Vertical Phillips Curve
WPI	Wholesale Price Index

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CHAPTER ONE: INTRODUCTION

1.1. Background of the study

Inflation and unemployment are global phenomena and economically important. According to Wardhono, Nasir, Qori'ah, and Indrawati (2021) inflation occurs when the general price levels of an economy increase. In addition, Totonchi (2011) stated that the cause of inflation in developed countries is a rise in money supply, which means it is a monetary phenomenon. However, in developing countries various other factors lead to changes in inflation. These are related to fiscal imbalances and include growth in money and exchange rates among other factors. As a result, there are various theories of inflation. These include: quantity theory of money, monetary theory of inflation, demand pull and cosh push theory, rational expectations and neoclassical synthesis.

The main aim of reserve banks around the world is to maintain price stability. The process of inflation therefore needs to be understood to effectively manage monetary policy (Constancio, 2015). In addition, expectations are an important instrument that policymakers need to control and manage when dealing with inflation, and the Phillips Curve (PC) is used as a tool to analyse inflation dynamics. In South Africa (SA), inflation targets are based on the PC (Leshoro and Kollamparambil, 2016), which displays a negative relationship between inflation and unemployment (Blanco, 2018). In addition, Blanco (2018) stated that SA has high unemployment levels and low economic growth, which renders the PC important. This study aimed to investigate inflation dynamics in SA.

Clerc (2021) related inflation dynamics to the New Keynesian Phillips Curve (NKPC) via the curve's slope, and the price-setting behaviour of firms. In this economic theory, inflation dynamics occur in the short run when marginal cost (MC) and marginal wage are equal. Changes in marginal wages lead to fluctuations in the price level or inflation rates; however, movements in marginal wages have an indirect dampening effect on inflation. This indirect effect occurs when firms change their prices with regard to working hours. As a result, productivity and demand may increase or decrease leading to MC changes. If MC increases, firms align to the general price level, alleviating pressure. Accordingly, the NKPC's slope flattens.

The PC originated in 1958 and, as already stated, posits a negative relationship between inflation and unemployment (Gordon, 2011). Samuelson and Solow (1960) simplified the work by Phillips and made the PC well-known. The PC also presented policymakers with the option of exploiting this trade-off in an effort to increase employment at the cost of inflation. During the 1960s to 1970s Lucas and Sargent (1969) showed that the value of the PC changed from negative to positive, and that the negative or positive correlation depends on the source of shock to inflation, the policy response used, and the length of the delayed responses. The new Keynesian approach means that inflation is influenced by persistence and inertia, which is the approach used in this thesis. Phiri (2016) identified different forms of the PC, namely, the traditional PC, the New Classical Phillips Curve (NCPC), NKPC and the Hybrid New Keynesian Phillips Curve (HNKPC).

Global economies are interlinked. Wardhono et al. (2021) studied inflation dynamics for five Association of Southeast Asian Nations (ASEANs). ASEANs includes countries with regional growth and economic differences causing different price variations. As a result, a region's ability to adjust to inflation shocks differ depending on each country's inflation dynamics. In addition, the effectiveness of monetary policies is influenced by the role of inflation expectations in different countries due to their respective inflation dynamics. The authors stated that demand and supply factors influence the inflation process in ASEAN countries. Monetary and fiscal policies therefore need to be credible.

Zobl and Ertl (2021) state that many central banks experience low inflation for long periods. Even though economic growth may increase, inflation can still be disappointing. This means that in the short run the relationship between real activity and inflation weakens. As a result, many banks felt that a reinspection of the PC and NKPC was needed. The NKPC was however, mainly tested in advanced economies and little evidence exists for developing nations.

Abbas (2022) states that the United States (US) is a "closed" economy and has a role to play in the inflation processes of other countries. These countries include New Zealand (NZ), Australia, Canada, and the United Kingdom (UK). The author found that a NKPC existed for these countries. However, inflation dynamics also depend on the economic state of a country; high or low periods of inflation and expansionary or contractionary regimes. This leads to different price changes of domestic and imported goods. In conclusion, the trade-off in the PC depends on the economic state of the country.

Similar to most central banks globally, the objective of the South African Reserve Bank (SARB) is to promote price stability and create employment (Phiri, 2016; Ahiadorme, 2022). However, Ahiadorme (2022) stated that the unemployment rate remains high in Sub-Saharan Africa (SSA) and SA records the highest unemployment rates. Real output has also declined. Therefore, due to the persistence of high unemployment and low economic growth, the relationships between inflation, output and unemployment needs to be revisited and applied to economic policy. Most countries, including SA, experience high inflation levels. This implies that disinflation policies are important but not at the cost of economic activity and employment as this leads to more poverty and inequality in SA. The author concluded that in the short term, a significant inflation-unemployment trade-off should be made in favour of long-run gains. In the long run, significant economic growth can be seen, which translates into lower unemployment levels and increased welfare gains.

1.2. Problem statement

Inflation, unemployment and economic growth are important indicators of an economy. According to Leshoro and Kollamparambil (2016), the SARB uses a PC when deciding on monetary policy objectives of inflation targeting. SA has in recent years seen the highest levels of unemployment and the lowest economic growth rates. Therefore, testing for the PC is critical in SA as it presents policymakers with the opportunity to exploit the relationship between the variables of interest, namely inflation and unemployment.

Moreover, price stability is central to monetary policy worldwide, including SA (Vermeulen, 2015; Phiri, 2016). Inflation targeting was adopted in SA in 2002 and the main aim was to keep inflation between 3% and 6%. To achieve this, the repurchase rate is used. However, although targeting inflation has led to less persistence[1], it still results in high unemployment levels, low economic growth and high real interest rates. According to Vermeulen (2015), SA's unemployment rate for the last 25 years has ranged around 20-25%. In addition, Statistics South Africa (StatsSA) (2023) indicate that although the unemployment rate has decreased in 2022, it still remained high at 30%. The SARB's (2023) quarterly bulletin states that economic growth has a low growth trend and has declined by 2% in the last two years. Furthermore,

[1] Dossche and Everaet (2005) defined it as the tendency of inflation to slowly revert back to central bank's inflation target in response to macroeconomic shocks.

global interest rates remain high in SSA (Regional economic outlook, 2023). In addition, the International Monetary Fund (IMF) (2023) projected that inflation, real GDP (RGDP) and the unemployment rate will decline in 2023-2024. However, unemployment will still be above 30%. Therefore, Vermeulen (2015) suggested that employment should be targeted instead of inflation.

Botha, Khan and Steenkamp (2020) stated that the PC is important in modelling inflation dynamics. In addition, it captures how much economic slack[2] affects inflation. Also, SA's situation can be described by the fact that a persistently negative output gap has not translated into lower inflation after the financial crisis. Furthermore, global inflation has been relatively stable despite fluctuations in unemployment. As a result, questions about whether the PC has flattened and become a less useful monetary policy tool arose. However, after inspecting SA data, the authors concluded that the PC is still a relevant analytical tool. For this reason, this study explores inflation dynamics using the PC, more specifically, the NKPC.

Leshoro and Kollamparambil (2016) used a HNKPC and found no PC in SA. On the other hand, Fedderke and Liu (2018) found that the NKPC performed poorly due to its theoretical and empirical assumptions. Leshoro (2020) also found that no PC exists in SA, while Botha et al. (2020) found a PC relationship in SA. Lastly, Zobl and Ertl (2021) stated that little empirical evidence exists for NKPCs in developing countries, including SA. This study aims to fill the research gap and investigate the need for analysing inflation dynamics in SA. The PC relationship was examined using a new Keynesian approach.

1.3. Objectives of the study

The study's general objective was to analyse inflation in the SA context using a new Keynesian approach for the period 2000-2022. It also included the following specific objectives:

a.) To investigate the existence of the Hybrid New Keynesian Phillips Curve in SA.
b.) To determine the fiscal and monetary variables that significantly influence inflation in SA.

2 Economic slack can be measured by unemployment or output gap.

1.4. Hypothesis

Based on the above objectives, the study stated the following hypotheses:

a.) H_0: The HNKPC curve does not exist in SA.
H_1: The HNKPC does exist in SA.

b.) H_0: Both fiscal and monetary variables do not significantly influence inflation in SA.
H_1: Both fiscal and monetary variables significantly influence inflation in SA.

1.5. Significance of the study

According to Akinsola and Odhiambo (2017) "inflation is the continuous and sustained increase in the general level of prices of goods and services over time". It thus affects all individuals and firms economically. In addition, an increase in prices affects purchasing power and economic growth. Mohr, van Zyl and Pretorius (2018) defined economic growth as a state when total production or income increases in the economy. Price levels are inversely related to unemployment via aggregate demand (AD) or total income, which is economic growth. Therefore, if production and prices increase, unemployment will decrease. This study is significant due to its potential impact on the economy and employment in SA.

There are few studies relating to developing nations and SA, contributing to its importance. In addition, using a new Keynesian approach (i.e., the NKPC) can have significant long-term economic payoffs if the relationship between inflation and unemployment is correctly exploited. This could lead to higher employment levels, thereby decreasing poverty (Ahiadorme, 2022). Lastly, the PC is important in the inflation targeting process and is used when the SARB decides on policy (Leshoro and Kollamparambil, 2016). Hence, the trade-off between inflation and unemployment becomes the cornerstone of policy for the SARB to achieve its objectives. Finally, Botha et al (2022) stated that the PC is still relevant in SA.

1.6. Outline of the study

This thesis is divided into six chapters. Chapter one introduces the thesis. It includes the background to the study and states why it is important. Objectives and hypotheses are stated. Chapter two provides an overview of SA's monetary policy regimes and inflation trends. Chapter three discusses the literature reviewed on inflation dynamics and reviews the theoretical and empirical literature underpinning the study and identifies the research gap. Chapter four provides a detailed outline of the methodology followed in the empirical study. It

describes the theoretical and empirical models followed and identifies the variables used in the study. Chapter five discusses the findings based on the methodology followed. Finally, Chapter six concludes the study and provides suggestions and policy implications of the results.

CHAPTER TWO: MONETARY POLICY AND INFLATION TRENDS

2.1. Introduction

This chapter provides an overview of monetary policy, and section 2.2 discusses the monetary policy regimes in SA. These are: the reinstatement and demise of the gold standard, the revival of monetary policy, the liquid asset and cash reserve system, eclectic approach, repurchase system and inflation targeting. Section 2.3 describes the transmission mechanisms of monetary policy which eventually affects inflation and output in the economy. Lastly, section 2.4 concludes the chapter.

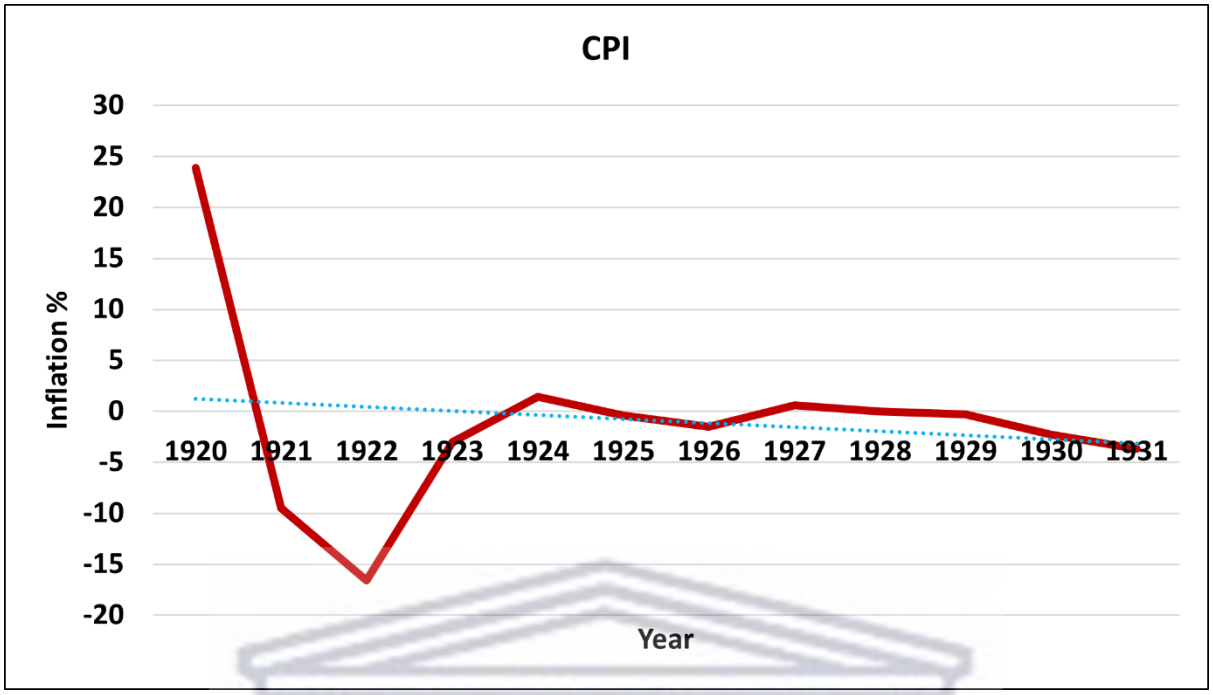
2.2. Monetary policy regimes

Monetary policy is key to understanding inflation dynamics. Mohr, van Zyl and Pretorius (2018) defined monetary policy as measures taken by reserve banks to influence money and interest rates in order to achieve stable prices and full employment and to stimulate economic activity. South Africa is no different, and the SARB, established in 1921, has the authority to implement monetary policy (Moleka, 2015). Section 2.2 discusses the various monetary policy regimes that were present in SA.

2.2.1. Reinstatement of the gold standard

Before the reinstatement of gold, monetary policy went through various negative phases. According to Van De Merwe and Mollentze (2010) these included an embargo on the minting of gold in 1914 which led to gold smuggling in SA. As a result, inconvertible gold certificates were temporarily issued in 1920. Thereafter, the official reinstatement of gold began with the Kemmerer-Vissering commission. The main objective of monetary policy during this period was maintaining the exchange rate close to mint parity, which means keeping the price of gold on a par with the national currency. Gold was then officially reinstated in 1925, and this period was characterised by high interest rates; the commercial bank minimum overdraft rate reached 1.6%. The real prime rate was approximately 10%, leading to a decrease in inflation. Finally, high interest rates lead to high unemployment levels in SA.

Figure 2.1: Annual inflation during the reinstatement of the gold standard



Source: Author, data from StatsSA (2023)

Figure 2.1 shows a decreasing trend in inflation rates during the reinstatement period. This confirms the notion in the literature that if interest rates are high, inflation decreases, and it was what SA experienced during this period. As a result of temporary certificates being issued in 1920, the inflation rate drastically fell to negative values between 1921 and 1923. The above graph agrees with Rossouw and Padayachee (2008; 2011) that inflation in SA declined during the reinstatement period; in fact, SA suffered deflation at an average price decline of 3.3% per year. Furthermore, the UK left the gold standard in 1931 while SA maintained it. This had disastrous effects as the SARB had to keep up with the demand for gold by selling foreign currency. As a result, millions of rands were lost and the SARB's financial stability was questioned. Only the gold mining sector benefited from the high international gold price while other sectors suffered.

Swanepoel and Fliers (2021) concur with Van De Merwe and Mollentze (2010) that the main goal of monetary policy during this period was to "maintain parity with gold to achieve exchange rate stability". According to Swanepoel and Fliers (2021), the regime achieved its goal, however, debates about continuing with the gold standard intensified after the UK dropped it in 1931. Although SA continued with the gold standard, it had negative economic and political effects with a favourable balance of payments (BOP) position and large reserves of gold. The argument in favour of gold was that it would strengthen SA's position to repay its

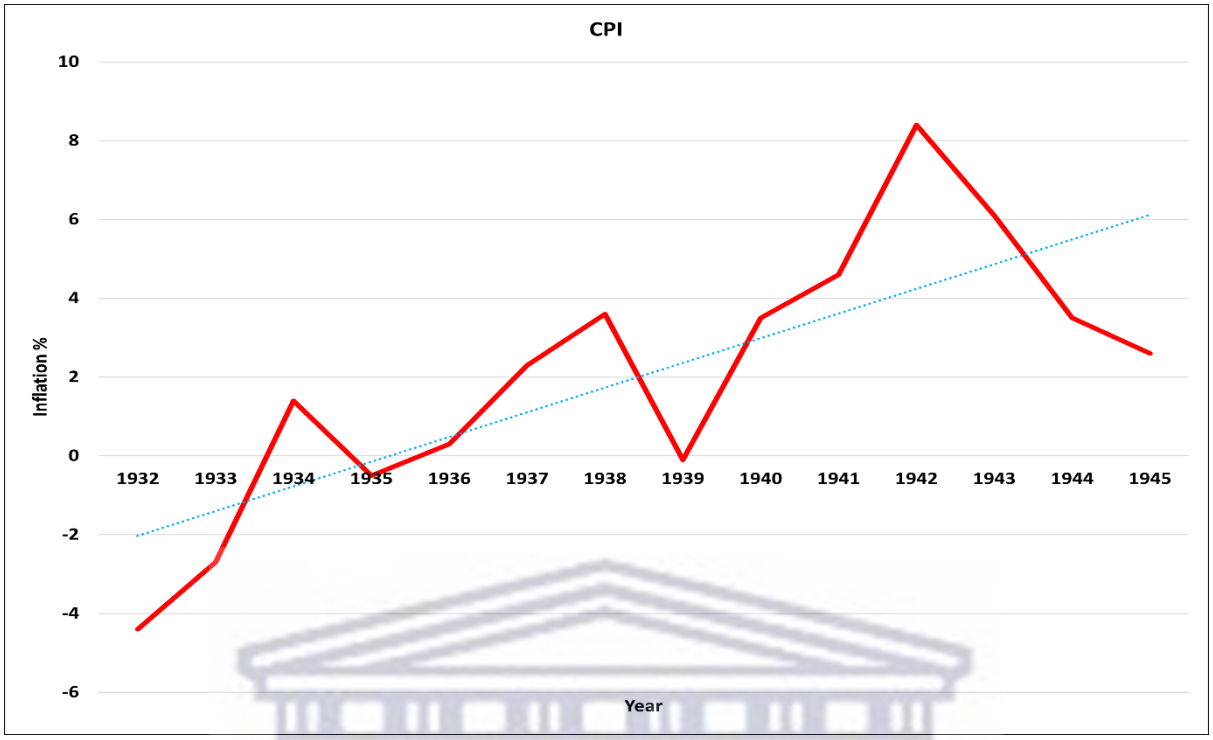
debt. On the other hand, those who favoured gold's demise cited two reasons. These were that the South African pound be depreciated, and its debtor and creditor relationships be refocused in order to achieve higher prices. As a result, the gold standard was dropped, and other policies were tried to achieve a stable price level.

2.2.2. Demise of the gold standard

SA dropped the gold standard in 1932 and its exchange rate to the British pound was fixed the following year (Van De Merwe and Mollentze, 2010). As a result, SA became part of the sterling area. During the abandonment of the gold standard, the aim of monetary policy changed. It became concerned with ensuring that the exchange rate's link to the sterling was fixed. This was done in an effort to stimulate the economy. Interest rates were decreased, and money supply and liquidity increased from 1933-1940. However, banks were unable to accommodate large scale withdrawals. At this point, the reserve bank allowed more open market transactions to occur in the form of short-term government securities. Simultaneously, increases in liquidity, more money balances and credit extensions led to the inflation rate rising from 1936 to 1942. Next, SA implemented an exchange control system and was only allowed to interact with countries who formed part of the sterling area.

Swanepoel and Fliers (2021) stated that the SARB handed over monetary policy decisions to government due to dropping the gold standard and joining the sterling area. As a result, the minimum gold and cash reserve requirement was further reduced by the Currency and Exchanges Act. This extended the favourable BOP position of the previous period until 1939. Moreover, repatriation of funds occurred, which improved the terms of trade and boosted SA's income. Consequently, high liquidity occurred, and money supply continued to rise, lowering the exchange rate. Thereafter, the policy rate was decreased, and monetary policy changes during this period can be seen as reactionary, based on the situation. On the other hand, the risk of increased inflation was considered since gold previously provided an anchor against it.

Figure 2.2: Annual inflation during the demise of the gold standard



Source: Author, data from StatsSA (2023)

Figure 2.2 above shows the increasing trend of inflation peaking in 1942 at 8.4%. In addition, the above data confirms that inflation during this period increased, especially during 1936 to 1942. Rossouw and Padayachee (2008) support the idea that inflation accelerated during this period, leading to price stability not being achieved. As a result of increasing inflation, the SARB's ability to control it was questioned (Rossouw and Padayachee, 2011). Although economic activity and liquidity increased, unnecessary credit extensions occurred. Therefore, according to Swanepoel and Fliers (2021) the SARB was unable to absorb excess liquidity. In addition, the SARB opted to increase capital inflows instead of maintaining monetary policy independence. As a result of the SARB's abilities being questioned, monetary policy needed to undergo changes, leading to the next monetary policy regime.

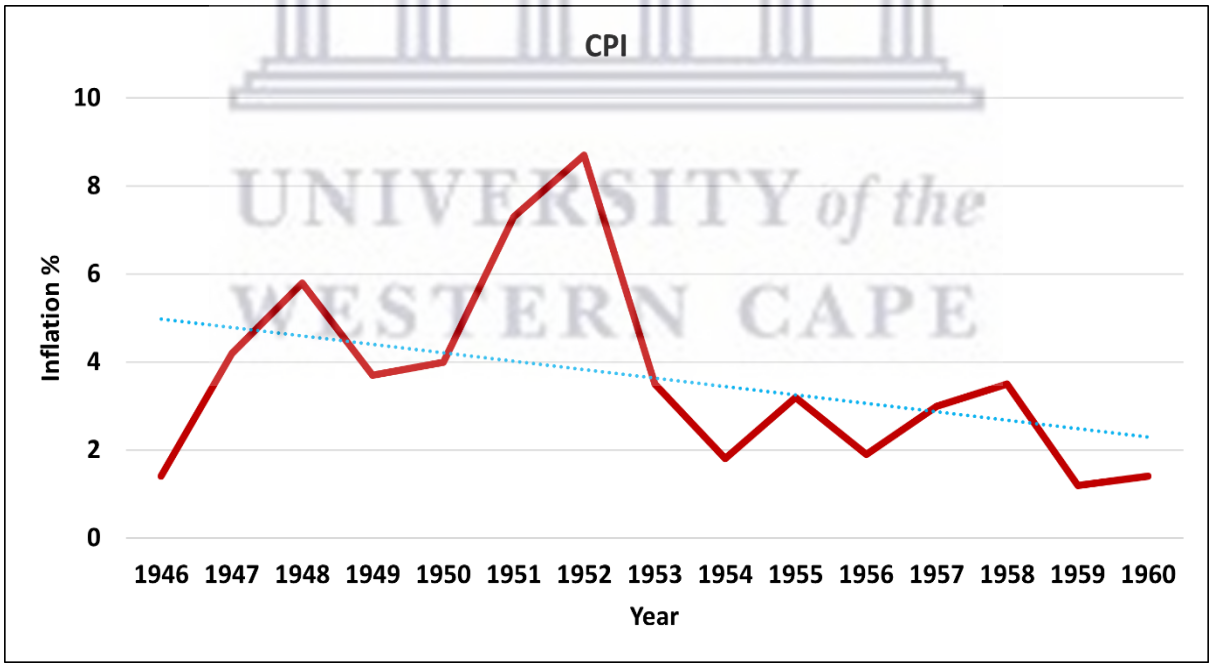
2.2.3. Reviving monetary policy

During this period, SA's financial system was underdeveloped and consisted only of the SARB and commercial banks (Mollentze, 2000; Rossouw and Padayachee, 2008). Money and the underdeveloped financial system formed the basis of monetary policy. Money supply could affect expenditure, income, prices, credit, and interest rates, in turn affecting investment and consumption. Moreover, policy was Keynesian in nature and aimed to stabilise economic growth. As a result, maintaining exchange rates became the main goal, among others. Rossouw

and Padayachee (2008) state that interest rates decreased during this period, indicating the success of monetary policy in stabilising inflation.

Van De Merwe and Mollentze (2010) state that a revival of monetary policy' occurred from 1946 to 1960 as a result of money supply and credit extensions increasing and a current account deficit. The Bretton Woods Monetary Agreement was put into place and exchange control still applied in SA. Meanwhile, SA's currency was pegged to the pound. However, maintaining these fixed rates was difficult as the BOP deteriorated. Consequently, this led to a drop in forex reserves. For this reason, the sterling and pound was devalued and SA's rand value and foreign exchange transactions stabilised in the 1950s. Thereafter, SA mostly made use of exchange controls, and monetary policy was more flexible. This included increases in interest rates and cash reserves. In addition, changes in liquid asset requirements and credit control occurred. Furthermore, SA's monetary policy mainly targeted commercial banks, and money played a key role. As a result of these policies, inflation declined. Finally, these good results were disturbed by political unrest during the 1960s.

Figure 2.3: Annual inflation during the revival of monetary policy



Source: Author, data from StatsSA (2023)

Figure 2.3 above confirms that policies during this period worked to bring down inflation to between 2% and 6% for most of the period. The biggest outlier occurred in 1952 when the

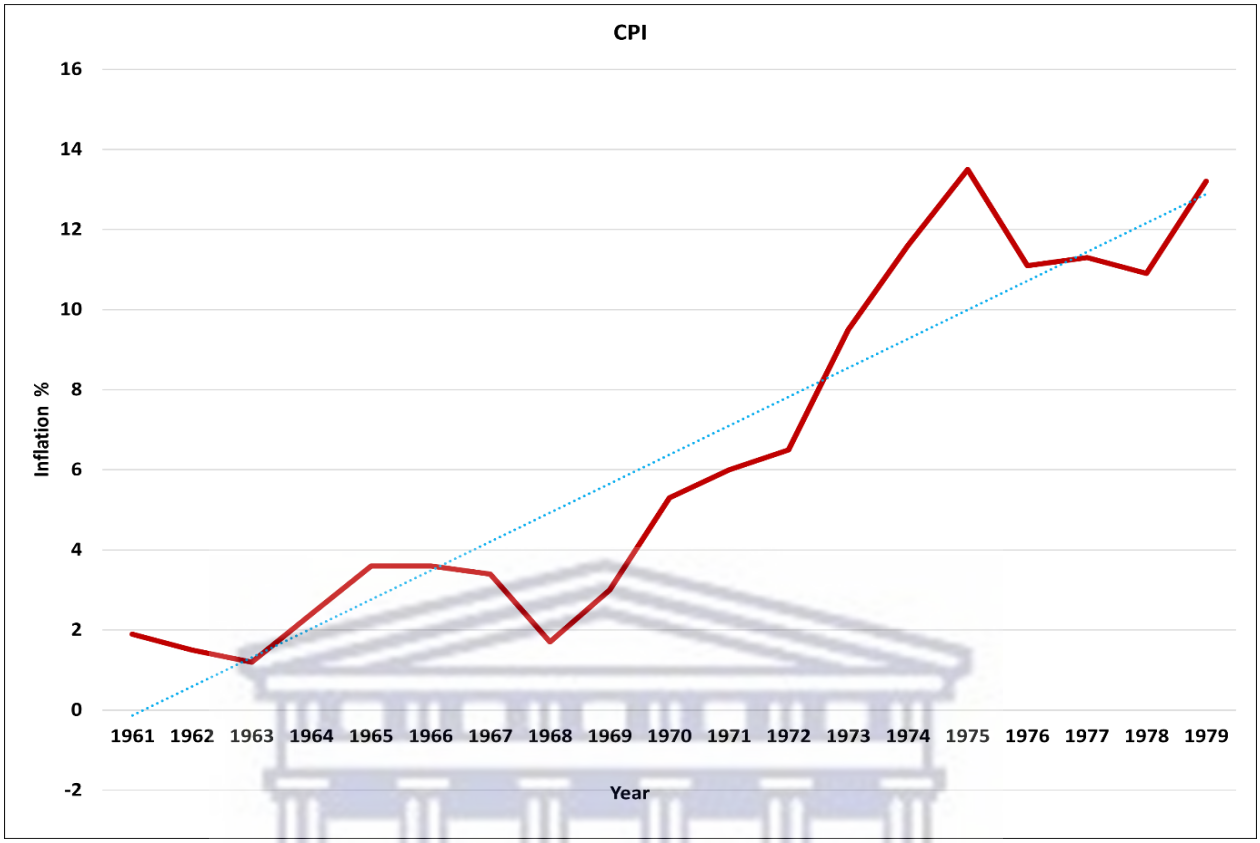
Consumer Price Index (CPI) was at its highest value of 8.7%. Therefore, this period can be considered successful in keeping inflation low and reviving monetary policy objectives. Rossouw and Padayachee (2011) claim that although these direct measures to control inflationary pressures worked, inflation rates do not always reflect economic and inflationary conditions.

2.2.4. Liquid asset system

Mollentze (2000) states that a Technical Committee was appointed in 1961 in SA. This was done to advise on laws governing banks. Thereafter, amendments to the Banking Act of 1965 was made. The amendments included that near-money and new-money should be considered in the economy, and that other financial institutions should be accepted besides commercial banks. As a result, policy was mainly directed at banks and financial institutions. Most importantly, liquid assets were revised to include all financial institutions and the liquidity of assets to liabilities had to be monitored by all.

Different schools of thought had different opinions on money. Van De Merwe and Mollentze (2010) state that according to the Keynesian view, money was important when determining interest rates and expenditure. On the other hand, monetarists viewed money as insignificant and having no effect on economic activity and inflation. Monetary targets were therefore not adopted. Fiscal policy was mostly applied, however, monetary policy still had a role to play in the economy. Credit ceilings were implemented, SA's financial markets were underdeveloped, deposit rates were controlled, and foreign exchange controls were implemented. Thereafter, the Bretton Woods System collapsed due to financial crises in other countries and other exchange rate linkage options were tried. Despite these efforts, high unemployment still prevailed, and the De Kock Commission made an entry in 1979. Consequently, SA implemented a controlled exchange rate floating system.

Figure 2.4: Annual inflation during the liquid asset system



Source: Author, data from StatsSA (2023)

In Figure 2.4 above, inflation rates sharply increases year on year. This is due to the polices mentioned above such as credit ceilings, using fiscal policy to control inflation, and the failure of the Bretton Woods System. These policies still resulted in low employment levels as mentioned above. In addition, the graph shows that inflation reached double digits in 1973. This occurred irrespective of direct control measures implemented (Rossouw and Padayachee, 2011). Moreover, the increasing inflation trend worsened as a result of the oil price shock, leading to cost-push inflation, and SA experienced trouble in controlling inflation towards the end of the period. Lastly, stable prices during this period were not achieved, leading to a change of system.

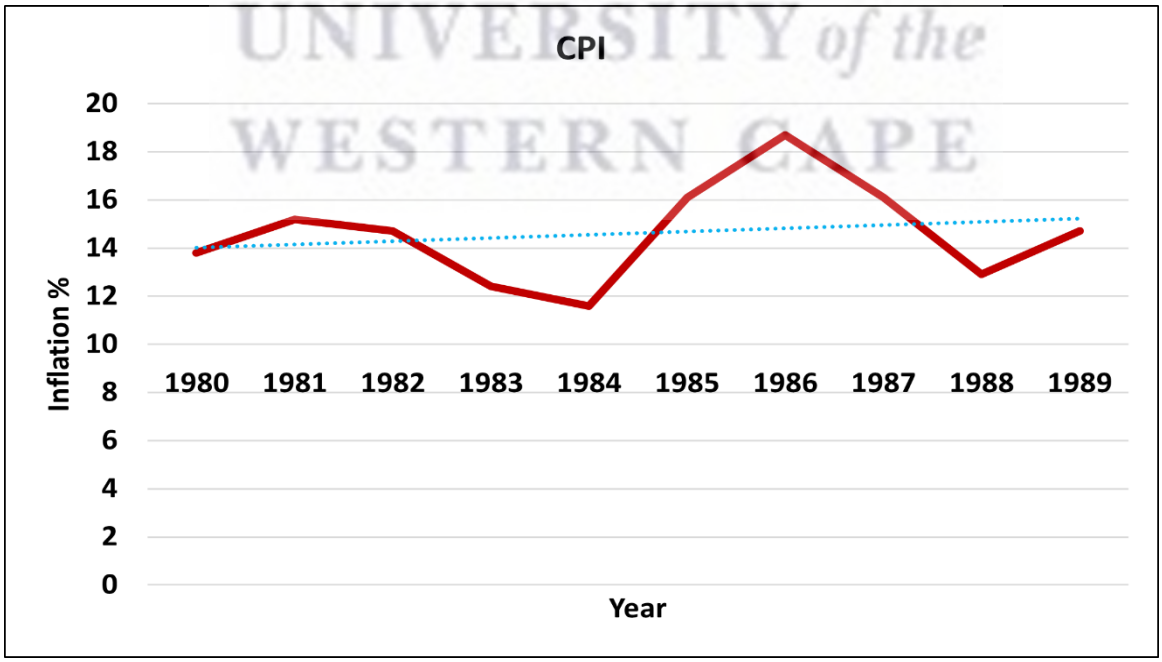
2.2.5. Cash reserve system

Mollentze (2000) states that the main purpose of this system was to control money supply by using the bank rate. Therefore, by influencing interest rates, it would affect credit, money in circulation, and cash reserves. In addition, open market operations could also be used to affect discount policy. This period was characterised by a market-related and demand-management approach due to the fact that countercyclical monetary policy resulted in unstable financial

markets and decreased economic growth. In addition, although inflation was the main objective, the SARB temporarily deviated from this in 1985-1987 to pursue economic growth objectives. Thereafter, inflation became the primary goal again.

The cash reserve system was based on the recommendations of the De Kock Commission during the 1980s and was fully operational by 1985 (Smal and de Jager, 2001; Akinboade, Niedermeier and Siebrits, 2002; Aron and Muellbauer, 2006; Govera, 2017). The commission believed in policies that aimed at a stable financial environment and considered various national objectives. These were economic growth, employment, and improving people's living conditions. In addition, a stable financial environment was necessary for low inflation to be possible. Therefore, the SARB followed a monetary targeting strategy where money supply target ranges were annually announced. Later, these targets were referred to as guidelines for monetary policy. Open market operations were also conducted to manipulate liquidity. In addition, market interest rate and lending rates were influenced using the bank rate. As trade openness increased in SA during the 1990s, the relationship of money supply with the demand for goods and services, interest rates and inflation, changed. As a result, the impact of monetary policy had longer time lags on economic activity and price stability. Therefore, money supply was no longer effective for monetary policy. This led to the SARB using an eclectic approach.

Figure 2.5: Annual inflation during the cash reserve system



Source: Author, data from StatsSA (2023)

Figure 2.5 shows a stable but slightly increasing trend of inflation over the years 1980 to 1989. This period is also where CPI reaches its highest level of 18.7% over the period under study. In addition, the use of monetary policy proved ineffective in containing inflation rates as it ranged between 10% and 20% in the cash reserve regime. Rossouw and Padayachee (2011) support the idea that monetary policy failed during 1980-1989. According to the authors, the SARB's inflation target was between 10-15%. In addition, inconsistent policies were applied to control inflation, even though they had the correct tools to do so. Therefore, due to double-digit price levels, a different approach was needed to contain inflation.

2.2.6. Eclectic approach

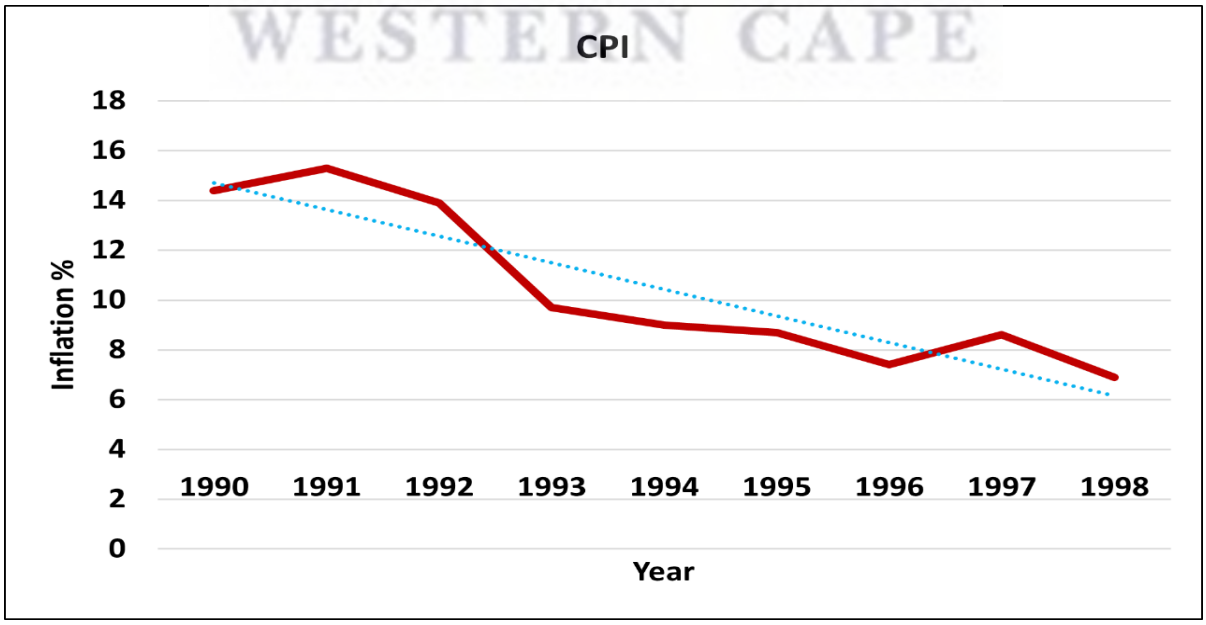
The eclectic approach started with a change of the SARB's governor from De Kock to Dr Stals towards the end of 1989 (Mollentze, 2000). At first, there were no major changes to monetary policy. However, during this period, achieving monetary stability was the only target along with restoring the SARB's independence. Money supply targets were still applied intermediately as there could be a relationship between the growth rate of money supply and inflation. Therefore, the success of this model would result in low inflation and a stable exchange rate, and sustainable economic growth would be achieved. Furthermore, inflation expectations played a role and was important to eliminate. However, attempts to reduce it could result in more pressures due to high interest rates. In addition, elasticity of expectations are important, leading to John Hick's theory of adaptive expectations in 1946. Consequently, this approach had negative policy implications such as the disappearance of the PC. According to the author, inflation stops economic growth and increases unemployment in the long run. Therefore, fighting inflation inefficiently gives rise to other sacrifices. Lastly, the author stated that inflation has many interconnected parts, and that SA needs to pursue monetary and fiscal policy to combat it.

Aron and Muellbauer (2006) state that a set of indicators were later used in monetary policy due to liberalisation and capital flows. According to the author, Stals (1997) stated that these were "exchange rates, asset prices, output gap, balance of payments, wage settlements, credit extension and fiscal stance". Moreover, these indicators were only significant in the beginning of the period and were weighted differently. In addition, policy during this period can be characterised as opaque and diminished the SARB's accountability.

In contrast, Van de Merwe and Mollentze (2010) viewed this period as informally targeting inflation. In view of that a reduction in the price level was emphasised instead of a specific target. In addition, the reserve bank adopted a long-term approach to monetary policy where the primary goal was to protect price stability. However, informal inflation targeting did not improve the SARB's transparency but improved the accountability of monetary policy. Furthermore, the dual exchange rate system ended in 1993 and the exchange rate was determined by demand and supply.

Liberalising and reintegrating the SA economy resulted in a rapid increase in money supply (Van de Merwe and Mollentze, 2010). However, this was not related to spending on goods and services, and the income velocity of money in circulation continuously declined. As a result, more money became available than production in the country. When the money supply increased, it however had no effect on inflation as it started to decline. Therefore, the initial relationship between the growth rate of money supply and inflation had less influence on monetary policy. As a result, an eclectic approach was implemented and money supply played a minor role in policy. According to the authors, other financial indicators were used. For instance, exchange rates, foreign reserves, the borrowing requirement, extension of credit, GDP, and output were used in monetary policy to combat inflation. Other indicators included the yield curve, BOP and money market conditions. Lastly, the SARB was successful in combating inflation during this period.

Figure 2.6: Annual inflation during the eclectic approach



Source: Author, data from StatsSA (2023)

In figure 2.6 above, the trendline shows CPI declining over the time period. However, in the years 1990 to 1992, inflation rates were still at double digits and only fell below 10% from 1993 onwards. On the other hand, inflation was still high for the rest of the period and never fell below 6%. Rossouw and Padayachee (2011) agree that monetary policy only started combating inflation in 1993, as seen in the graph above. As a result, inflation became the primary objective as SA started to align inflation with its major trading partners. Exchange rate stability was also pursued as it could result in domestic inflation. Lastly, the authors state that although inflation rates were still high during this period, the trend in inflation indicated the success of monetary policy.

2.2.7. Repurchase transactions system

Smal and de Jager (2001) and Aron and Muellbauer (2006) state that a repurchase system came into effect in 1998. The purpose of this system was to ensure that financial instruments were more flexible and that interest rates reacted faster to market conditions. Moreover, this system was more transparent as the SARB's policy intentions were continuously communicated. Liquidity was the main indicator of changes in the repurchase system. For example, an illiquid market signalled that the repurchase rate needed to be adjusted. However, adjusting repurchase rates were ineffective for monetary policy during this period, and the system underwent various changes from 2001 - 2005 due to a poorly functioning money market. The repurchase system thus forms part of the inflation targeting regime, whether formally or informally. Moreover, the repurchase rate was adjusted and fixed, weekly auctions were implemented and a seven-day maturity period was allowed. In addition, the price of tenders were announced after auctions. Announcements of daily liquidity requirements were made before an auction occurred, and the SARB could hold auctions at its own discretion to manipulate liquidity and stabilise interbank rates.

2.2.8. Inflation targeting regime

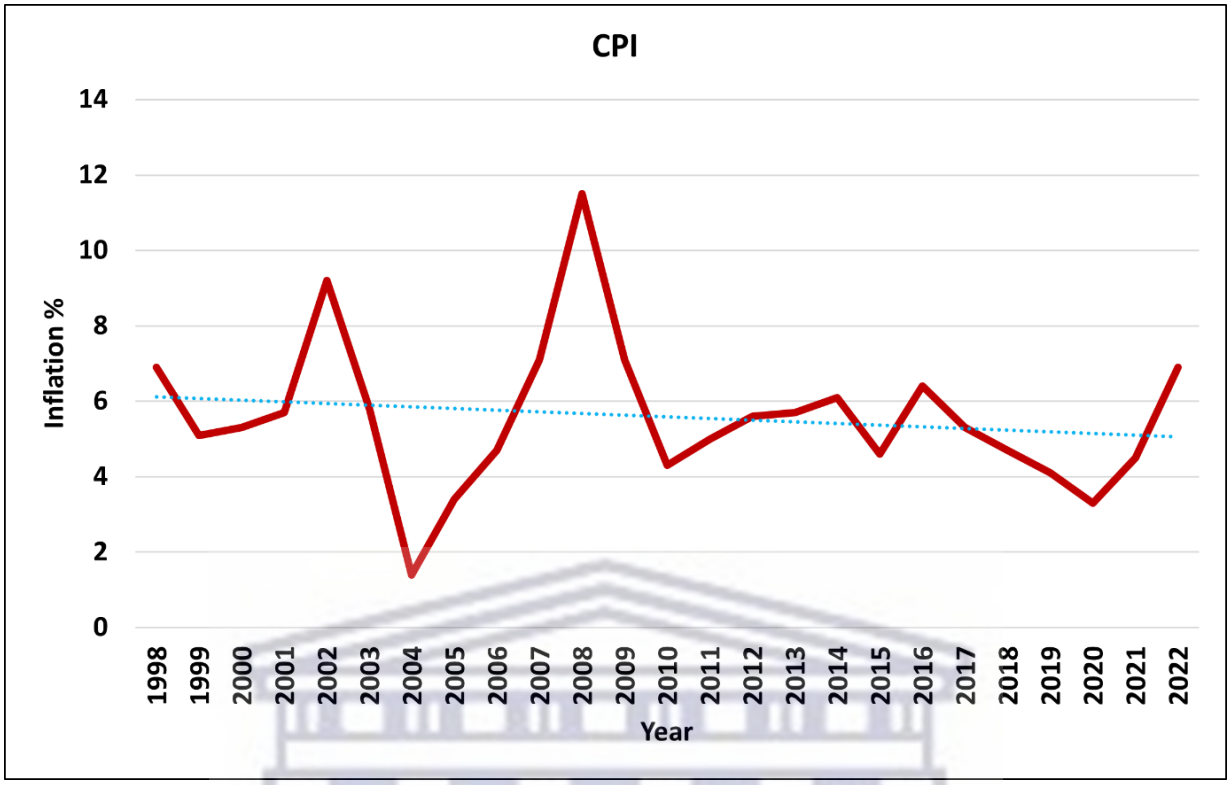
Rossouw and Padayachee (2011) state that formal inflation targeting was adopted in 2000. In addition, this regime followed a rules-based monetary policy framework, which is still in existence today. An advantage of this system is that it limits the time inconsistency problem of implementing monetary policy. For example, the target of 3-6% was initially set to be achieved by 2002 as policy adjustments takes 18 to 24 months to affect inflation. In addition, the SARB

abandoned other objectives in favour of inflation targeting such as an exchange rate target. The SARB also no longer intervened in foreign exchange markets and only made purchases to supplement reserves. Therefore, due to inflation targeting being the only objective, the central bank followed an operational independence approach by using any available instruments to achieve its inflation target.

Moleka (2015) affirms that inflation targeting was adopted in 2000 and that the SARB used CPI to target an inflation range between 3% and 6%. In addition, reducing inflation and identifying the channels that monetary policy goes through to affect the economy was the main reasons for adopting inflation targeting. In doing so, relevant policies could be identified to effectively influence interest rates, aggregate demand and inflation.

Honohan and Athanasios (2022) state that this regime has been fairly successful in keeping inflation within its target band. The SARB also needs to have a good understanding of macroeconomic conditions to achieve its objectives, and because of this a Quarterly Projection Model (QPM) was implemented in 2017 and is still used by the SARB today (Botha, Kuhn and Steenkamp, 2020; Honohan and Athanasios, 2022). After all, the PC is inherent in the QPM (Botha, et al, 2020). Honohan and Athanasios (2022) stated that SA's QPM is similar to the ones used by developed nations and can also be called a gap model. This model represents a merger of how of different economic conditions are interrelated and how they fluctuate or evolve around steady states in the economy. The model has four main variables or gaps, namely inflation, the real exchange rate, GDP, and the neutral real interest rate. The QPM thus takes the form of a generalised Taylor rule to include a degree of inertia in setting policy.

Figure 2.7: Annual inflation during inflation targeting



Source: Author, data from StatsSA (2023)

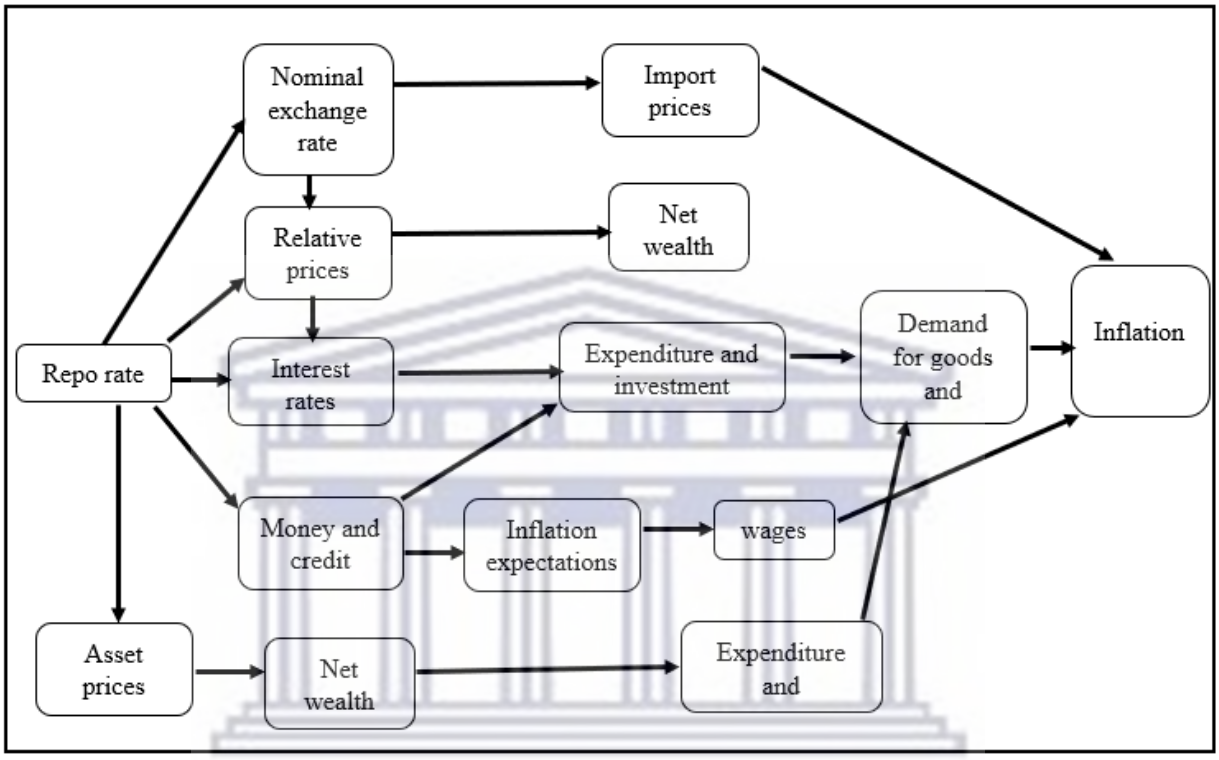
Figure 2.7 shows inflation rates during the repurchase transactions system and inflation targeting regimes. The repurchase system was short-lived as it was effective in 1998 and marks the start of inflation targeting which was formally adopted in 2000. Inflation rates during this period shows a declining trend while generally being between 3% and 6%. However, inflation peaked during the global financial crisis in 2007 and 2008, and the lowest rates were seen in 2004 at 1.4% and 2020 at 3.3% which was the start of COVID-19. Afterwards, annual inflation started to increase until 2022. According to Honohan and Athanasios (2022) SA took more than a decade after inflation targeting was adopted to reach the target of 3-6% as seen the figure above. Overall, inflation has been lower and more contained than previous periods.

2.3. Monetary policy transmission mechanism

Monetary policy goes through a series of events in the economy to affect real GDP, inflation, employment, exchange rates and other variables (Mollentze, n.d; Mishkin, 1995; Smal and de Jager, 2001; Mohr et al., 2018). This is called the transmission mechanism and there are various channels involved, namely interest rate, exchange rate, asset price, and credit channels. In addition, the mechanism can briefly be described as follows: changes in the repurchase rate affects interest rates, exchange rates, asset prices and consumption and investment decisions.

In turn, the demand and supply of goods and services are impacted which causes inflationary pressures. The figure below shows the monetary transmission mechanism, adapted from Smal and de Jager's well- known 2001 article:

Figure 2.8: Monetary transmission mechanism



Source: adapted from Smal and de Jager (2001)

The above figure shows how the repurchase rate affects inflation. In addition, inflation can be seen as a result of pressure on the demand for goods and services, import prices and wages due to changes in exchange rates, asset prices and money and credit. This is then further broken down into the various transmission channels which are discussed below.

2.3.1. Interest rate channel

According to Mollentze (n.d) the interest rate channel is important to an inflation targeting regime. When the repurchase rate changes, it affects other money market interest rates such as lending rates or interest rates charged to customers. The repurchase rate thus works in two ways. Firstly, the bank's marginal cost of funding is affected and secondly, the bank's monetary policy stance is seen. As the repurchase rate is adjusted, it causes changes in interest rates and

the cost of capital. Eventually, consumption, investment, aggregate demand and income changes. As a result, these demand pressures cause inflation rates and output gap changes.

Mishkin (1995) argued that the interest rate channel is also important in Keynesian macroeconomics. According to the author, Keynes's original idea was that this channel was only influenced by investment spending by firms. However, later, consumer spending decisions related to households were also seen as investments. As a result, the interest rate channel includes investments via consumer spending for housing and durable goods. In addition, the investment decisions of firms are included.

Loayza and Hebbel (2002) argued that this is the most important transmission mechanism. They believed that expansionary monetary policy causes interest rates to fall. Thereafter, business and consumer investment decisions are affected, and this shifts the AD curve. Output and prices are affected, and the interest rate channel is affected by various economic theories such as price and wage rigidities, the expectational hypothesis and the PC. Finally, this channel is seen as important form a new Keynesian perspective.

Ireland (2006) agreed with Loayza and Hebbel (2002) that the interest rate channel is significant in new Keynesian economics and the IS-LM curves. Ireland (2006) also explained how the expectational hypothesis plays a role in the transmission mechanism. For instance, long-term nominal interest rates rise due to short-term nominal interest rates increasing. As a result, investors buy or sell assets to account for the risks of expected returns based on their bonds or equities. This is known as the expectational hypothesis of term structure. As nominal prices adjust slowly, real interest rates are affected as well. Thereafter, the cost of borrowing for firms increase, leading to a decline in investments. At the same time, household borrowing costs are higher, resulting in a fall in their investment decisions on housing, cars and other goods. This results in a decrease in output and employment..

2.3.2. Exchange rate channel

This channel operates via interest rate effects and the uncovered interest rate parity condition in the following manner: due to the contractionary monetary policy, domestic interest rates increase, causing the domestic currency to appreciate. This occurs as prices adjust slowly due to uncovered interest rate parity. For instance, if domestic interest rates exceed foreign interest rates, depreciation occurs which equalises the return on assets domestically and abroad. Thus,

carry trade profitability is increased, causing an increase in exchange rates. As a result, local goods and services are more expensive than foreign goods. This results in net exports, aggregate output, employment and inflation declining (Mishkin, 1995, 1996; Kuttner and Mosser, 2002; Chmielewski, Kapuściński, Kocięcki, Łyziak, Przystupa, Stanisławska, Wróbel, 2018).

Similarly, the exchange rate channel works via AD and AS effects (Loayza and Hebbel, 2002). On the demand side, as interest rates decrease due to expansionary monetary policy, the exchange rate depreciates. As a result, net exports and demand increase. On the supply side, expansionary monetary policy causes exchange rate depreciation and increases the prices of imported goods. As the price of imported goods rise, AS and output decline, causing inflation to increase.

2.3.3. Asset price channel

The asset price channel operates via equity or stock prices and is split into two, namely the wealth effect and Tobin's Q theory of investment (Mishkin, 1995; Kuttner and Mosser, 2002; Loayza and Hebbel, 2002; Ireland, 2006; Chmielewski et al., 2018). As a result, Tobin's Q is a ratio and can be defined as the firm's market value over its replacement cost of capital. In addition, the basic assumption is that the ratio of investment and investment spending are related. For example, if the ratio is high, it means that the firm's market price is greater than its cost of capital, which means that new equipment and machinery costs are cheaper. As a result, more stock can be issued at a higher price, leading to investment spending and output increasing. On the other hand, the wealth effect on consumption is based on Modigliani's life-cycle model. In the life-cycle model, consumer wealth and income are important in their lifetime resources in terms of financial wealth (equity prices). When stock prices decline, consumer financial wealth, lifetime resources and consumption fall due to contractionary monetary policies. Aggregate output, inflation and employment also decline.

2.3.4. Credit channel

The credit channel occurs as a result of asymmetric information and agency costs in monetary policy. As a result, this leads to the bank lending and balance sheet channel (Mishkin, 1995; Loayza and Hebbel, 2002; Kuttner and Mosser, 2002; Ireland, 2006; Chmielewski et al., 2018). According to the bank lending channel, asymmetric information exists in the market and banks play a minor role. Therefore, firms access credit via stocks and bonds, bypassing bank loans.

As a result, contractionary monetary policy leads to a decline in bank deposits and bank loans, and investment, output, employment and aggregate spending decrease.

On the other hand, Mishkin (1995, 1996) stated that the balance sheet channel operates via a business's net worth. A lower net worth means that firms have less collateral available for loans, thereby increasing the adverse selection problem. In addition, moral hazard problems rise due to lower equity prices, resulting in risky investments. Therefore, lending from banks, investments and output decline. Furthermore, contractionary monetary policy increases interest rates. As a result, cash flow problems increase, and the firm's balance sheet deteriorates. Liquidity effects are also experienced on the consumer side with regard to household expenditure decisions and durable goods. Liquidity effects therefore operate as follows: if consumers are under financial distress, they prefer to hold more liquid assets such as durable goods and housing and less illiquid assets. This is due to the fact that they can sell these assets quickly to raise money, even if the full value is not realised in a distress sale. On the other hand, financial assets such as bonds or stocks can be sold at full value to raise cash. Therefore, as monetary policy contracts, the price of equities and financial assets are reduced. In turn, consumers are under financial distress, leading to a decline in consumption and income.

Furthermore, Mishkin (1996) described a balance sheet channel that operates via a change in inflation due to monetary policy. In this case a rise in prices will decrease the debt burden on firms as the value of their liabilities has declined. This occurs since the firm's debt repayments are fixed in nominal terms. Hence, a rise in inflation decreases the real value of their repayments. As a result, when expansionary monetary policy is implemented, it causes the price level to rise. Thereafter, net wealth increases, and moral hazard and adverse selection problems decline. Finally, investment and AD rise.

Similarly, Ireland (2006) argued that financial market imperfections causes a firm's cost of credit to increase as the balance sheet deteriorates. In addition, the balance sheet deteriorates as a result of direct and indirect effects of monetary policy. The direct effect occurs when monetary policy causes interest rates to increase. As a result, a firm's debt payments increase. Indirectly, the increase in interest rates reduces the value of assets that firms have. Thereafter, spending via the interest rate channel is decreased and the cost of capital is increased. In addition, the increase in the firm's cost of capital can occur with a time lag, and the fall in output and inflation is deepened.

2.4. Conclusion

This chapter provided an overview of monetary policy in SA from the 1920s until today. Monetary policy when through various phases where the main objective evolved from maintaining the exchange rate to keeping inflation as low as possible. Techniques such as manipulating interest rates, credit ceilings, exchange control and targeting inflation, were employed. However, the most successful regime to date has been inflation targeting. This regime is significant as it uses the PC in making decisions about policy. Moreover, monetary policy goes through various channels to affect inflation, output and employment which is based on Keynesian theory. The next chapter provides an overview of the theoretical and empirical literature on the PC.

CHAPTER THREE: LITERATURE REVIEW

3.1. Introduction

This chapter provides a theoretical and empirical review of the literature related to inflation dynamics and the Phillips Curve (PC). Section 3.2 discusses the theoretical evolution of the PC since its inception in 1958; various forms of the PC are discussed. Inflation theory is also covered in the theoretical literature as it forms a major part of the thesis. Section 3.3 reviews the empirical literature relating to inflation dynamics, and section 3.6 concludes the chapter.

3.2. Theoretical literature

The theoretical literature looks at the various PCs found in the literature. The Phillips curve is an empirical notion or proposition that describes the ability of monetary policy to repel inflation and unemployment in opposite directions (Mankiw, 2001). However, Van De Merwe and Mollentze (2010) state that over time, various economists developed different concepts as the curve lacked theory. As a result, this section is divided into the PC before and after 1975. The traditional PC and New Classical Phillips Curve (NCPC) are covered before 1975. Then, after 1975, Gordan's triangle model, the New Keynesian Phillips Curve (NKPC) and Hybrid New Keynesian Phillips Curve (HNKPC) are covered.

3.2.1. The Phillips curve before 1975

Before 1975, the PC is discussed according to different views. These are Keynesian, monetarist and neoclassical views. Different authors give different descriptions of the curve based on different assumptions and concepts. These include adaptive and rational expectations, and the natural rate or Non-Accelerating Inflation Rate of Unemployment (NAIRU). According to Samuelson (2009) the natural rate refers to how fast or slow the unemployment rate converges to equilibrium, irrespective of the inflation level. In addition, adaptive expectations means that inflation rates depend on its past values, which includes inertia into the inflation process. On the other hand, with rational expectations, price changes occur immediately after demand shocks and excess demand. Therefore, this section covers the traditional PC and NCPC.

3.2.1.1. Traditional Phillips curve

The traditional PC originated in 1958 from A.W. Phillips. He studied the relationship between the rate of change of money wages and the unemployment rate in the United Kingdom (UK). Phillips (1958) hypothesises was that there is a relationship between the rate of change in

money wages, the unemployment level and its rate of change. He adds that this relationship is non-linear, and cites three factors that affect the price of labour. They are: the demand and supply of labour, the rate of change that labour and unemployment demanded at and the rate at which retail prices change. The latter occurs when wages are adjusted to cover the increased cost of living (i.e., inflation). Using statistical analysis and covering three time periods from 1861 to 1957, the graphs show a negative relationship between wages and unemployment, thereby proving the hypothesis correct. On the other hand, the graphs also indicate a decreased dependence on wages and unemployment. This is due to time lags and sliding scale adjustments. Most importantly, the traditional Phillips curve emphasises the rate of change of the variables involved, namely wages and unemployment.

Similarly, Samuelson and Solow (1960) studied the PC for the United States (US) and compared it to the UK. They also found the PC relationship to be non-linear. In addition, the PC became more popular after their study. Thereafter, Phelps (1968) discussed and provided challenges to the traditional PC. According to him, the slope and stability of the curve might have policy implications. Phelps (1968) also mentions how the augmented version of the PC was derived, which makes use of generalised excess demand theory, and the unemployment rate. That is, general excess demand equals the unemployment rate and employments rate of change. As a result, the augmented PC relationship is given. In addition, the author captures the role of expectations in the PC.

On the contrary, Gordon (2008, 2011) made several interesting points regarding Phillips (1958) and Samuelson and Solow (1960). According to Gordon, Phillips' (1958) analysis included demand and supply shocks. In this case, demand shocks refers to the unemployment level and change of unemployment. On the other hand, supply shocks are measured by the change in prices of imports compared to final goods. However, the 1970s marked the full integration of supply shocks into the PC. In addition, no policy implications of the curve was mentioned, and no reasons were provided as to why the PC might shift in the long run. This provided the setting for Samuelson and Solow's 1960 article that made the PC more popular. As a result, they proposed that the long-run PC is able to shift and therefore exploitable for policy.

Next, Gordon (2008, 2011) states that the natural rate evolution came about via Friedman (1968) and Phelps (1968). According to Friedman, a natural employment rate can only be chosen for the long term by policymakers; in other words, a rate that is compatible with

inflation expectations. As a result, a stable inflation rate is reached. However, the natural rate hypothesis was based on two assumptions, namely that information is imperfect and markets clear continually. This was extended and rational expectations were introduced in 1972 to 1973 by Lucas. With rational expectations, agents predict or forecast price level changes using past experience. Consequently, rational expectations were criticised due to the policy ineffectiveness proposition. This occurs when real Gross Domestic Product (RGDP) cannot be changed regularly or predictably by monetary policy. Further criticisms included the fact that rational expectations were also based on assumptions of the natural rate hypothesis.

According to Alisa (2015), Samuelson and Solow (1960) and Lipsey (1960) give Keynesian interpretations of the PC. Additionally, Alisa (2015) states that the PC is based on static expectations and is interpreted as law. For instance, as aggregate demand increases, the factors of production demanded by employers will also increase. Moreover, assuming all agents have static expectations, the unemployment rate will drop below its natural rate, leading to a decline in inflation. As a result, the rate at which wages and unemployment change, exhibits a negative relationship. In addition, the PC contributes to Keynesianism in two ways. Firstly, it filled the theoretical gap which paid no attention to the relationship between the labour market and the goods market. Secondly, the PC was a tool for policies in macroeconomics. On the other hand, Alisa (2015) states that Friedman (1968) and Phelps (1968) provided a monetarist interpretation of the curve. According to them, expected inflation depends on past inflation, i.e., adaptive expectations. In addition, economic agents do not have reliable information available to them immediately, which means there will be a delay in their responses.

Phiri (2015) described a negative relationship between the two main variables of the curve, namely, inflation and unemployment. However, the author states that the empirical success of the traditional PC was short-lived. The curve presented policymakers with a combination of choices between inflation and unemployment, and during periods of stagflation, the usefulness of the PC was questioned and the NCPC was created.

Stirati and Meloni (2018) pointed out that Phillips' (1958) analysis does not comply with the neoclassical view of the labour market. According to them, nominal wages are stable when there is full employment in the labour market and no inflation inertia. As a result, Phillips should approximately interpret a 6% unemployment rate as a full employment situation. In addition, any other points on the curve should correct any excess demand and supply in the

labour market, resulting in equilibrium again. Lipsey (1960) addressed these issues of the traditional PC and also takes a neoclassical view of the AD and AS analysis. By extension, there is excess demand in the labour market when a change in nominal wage is positive. Thereafter, equilibrium is restored as wages adjust, prices remain the same, and the demand for labour falls. On the other hand, equilibrium is not reached as prices continuously rise. Therefore, constant prices are linked with lower unemployment rates in an equilibrium situation, leading to a decline in frictional unemployment. Lipsey's version of the PC was incorporated into the IS-LM models in macroeconomics.

According to Lawler, Moscardini, Pavlenko, and Vlasova (2020) the expectations-augmented PC was established by Phelps in 1967. According to these authors, the wage and pricing behaviour of a firm was modelled, and inflation expectations were considered. This means that inflation expectations cause changes in the PC relationship due to wage and price adjustments being based on forecasts of inflation.

3.2.1.2. New Classical Phillips curve

According to Alisa (2015), the NCPC was based on neoclassical views and a shifting short- and long-run PC. In addition, short-run shifts occur due to expectations, and when equilibrium is restored the long-run PC becomes vertical again. Moreover, neoclassicists such as Lucas (1973) criticised the monetarist approach to inflation dynamics. He rather believed that inflation follows the rational expectations hypothesis. As a result, agents are able to analyse the economy's performance, leading to changes in factors of production and expected inflation. Therefore, as AD and AS change, output and employment remain the same.

According to Phiri (2015) the major contributors to the NCPC were Phelps (1967), Friedman (1968) and Lucas and Rapping (1969). Phiri (2015) also agrees that the NCPC was grounded in rational expectations and considered no trade-off between the two main variables, inflation and unemployment. Additionally, monetary authorities had to choose between pegging unemployment or stabilising inflation as both were not possible simultaneously. Consequently, inflation dynamics could not be identified when external shocks occurred. As a result, Gordon's triangle model was introduced into the literature in 1984. Lastly, the NCPC was not based on microeconomic principles, leading to the NKPC. Phiri (2016) also stated that the NCPC is a function of inertia and a demand pressure variable such as output gap.

According to Szentmihályi and Világi (2015) the NCPC was criticised by Friedman (1968) and Phelps (1968) because the PC was unstable as the unobserved variable, and inflation expectations were missing. In addition, Friedman and Phelps presented the long-run PC as vertical. This occurs as monetary policy cannot influence inflation in the long run by stimulating economic activity. On top of that, the natural rate of the economy is determined by technology and the environment. Moreover, inflation can divert the economy from its natural rate. However, when inflation expectations are adjusted, in the long run, the natural rate is restored. This results in a vertical long run PC when output gap and inflation is used. Szentmihályi and Világi (2015) submit that Lucas (1973) inspired the NCPC. According to them, the curve is based on rational expectations and there are no deviations in the long- and short-run from the natural rate. As a result, the PC is vertical, resulting in the ineffectiveness of monetary policy. Therefore, monetary policy only affects inflation and not the economy or output gap.

In contrast, Stirati and Meloni (2018) state that Friedman provided an accelerationist view to the PC. However, his argument was based on neoclassical foundations which corresponds to Alisa (2015). Therefore, in Friedman's view, the use of nominal and real wages was confusing and required additional assumptions with regard to money illusion. In other words, the assumption is that nominal wages affect labour supply better than real wages. Additionally, adaptive expectations were used in his interpretation with nominal wages as the independent variable. Mostly importantly, the correlation between inflation and unemployment is opposite to the idea proposed by Phillips in 1958 (i.e., positive). Stirati and Meloni (2018) argue that pro-cyclical real wages were an empirical failure of the PC.

According to Lawler et al (2020) the NCPC is also called the vertical Phillips curve (VPC). This occurred due to inflation expectations not being different from actual inflation rates as a result of rational agents in the market. The author argued that the Lucas critique discredits the original negative relationship of the PC, that is to say, the negative correlation between the inflation and unemployment rates in the short run. In essence, when output or employment is higher than the natural rate, it causes inflation to increase. As a result, new wage rates are negotiated by firms and workers. Thereafter, at a certain inflation rate, employers and employees are no longer willing to hire and work respectively at the new wages rates. As a result, unemployment increases and the correlation between PC variables are destroyed due to government intervention.

3.2.2. The Phillips curve after 1975

The PC after 1975 was split into two roads. The left fork gave rise to the triangle model of inflation while the right fork produced the NKPC and HNKPC (Gordon, 2011). However, the period is still characterised by Keynesian economics. In addition, this period fully incorporates demand and supply shocks, which was already recognised by Phillips in 1958. Furthermore, inflation persistence and inertia, monopolistic competition and sticky prices enter the PC theoretically. This section discusses these terms under the various PCs after 1975.

3.2.2.1. Gordan's triangle model

The triangle model represents the left fork of the PC after 1975 and Gordan and Phelps are independently accredited with its development (Gordon, 2008, 2011). In addition, it is also called the mainstream approach and is Keynesian in nature. This is due to the fact that inflation is influenced by persistence and inertia, meaning that lags of inflation are included in the model. As a result, the model depends on three factors, namely, inertia, demand and supply. Supply shock variables include prices of oil and non-oil imports. Most importantly, the unemployment or output gap can be used as a proxy for demand shocks in the model. As a result, the correlation between inflation and unemployment or output gap can be negative or positive. However, this result depends on the source of the demand shock, how policies respond, and the amount of time lagged inflation takes to respond. In addition, the model also explains the extremely high inflation and unemployment rates in the 1970s and 1980s. The triangle approach was used in the 1990s to analyse the low rates of unemployment and inflation, and the model can also be regarded as resurrecting the PC notion. On the other hand, the model excludes sticky wages and is based on a reduced-form single equation.

Similarly, Samuelson (2009) points out that the triangle model of inflation included long-run neutrality and explicit supply shocks. In addition, past inflation is interpreted as considering inflation expectations and inertia. This approach is backward looking and can incorporate rational expectations. According to Phiri (2015) the Gordon triangle model was developed in 1984, and Gordon (1984) added supply shocks to the PC. As a result, the new classical curve was less vulnerable to a positive relationship between the variables. Moreover, if supply shocks are excluded, the estimated coefficients will be biased. Phiri (2015) agreed with Gordon (1990, 2008, 2011) that the triangle model depended on three factors, namely, inertia, demand and supply shocks.

3.2.2.2. New Keynesian Phillips curve

Mankiw (2001) states that the NKPC is a dynamic price adjustment model used to determine the nature of the inflation-unemployment relationship. As a result, there are advantages to using the curve, for example it is derived from microeconomic principles which state that inflation responds slowly to economic conditions. In addition, the new Keynesian approach gives rise to the expectations-augmented PC. This is useful for policy analysis due to its simplicity and has become vital for monetary policy. However, there are also disadvantages to using the new-Keynesian curve. Firstly, it can cause disinflations. Secondly, it ignores inflation persistence, and lastly, impulse response functions cannot be generated when policy shocks occur.

According to Dupuis (2004) the NKPC is advantageous due to its forward-looking element of inflation and the inclusion of rational expectations. The model displays low levels of inflation persistence, and this is inconsistent with inflation dynamics behaviour. In addition, the NKPC excludes sticky prices, and includes the Taylor rule and Calvo model.

According to Gordon (2008, 2011) the NKPC is based on monopolistic competition, which means that firms can control their prices to a certain degree due to their product differentiation. In addition, the unemployment gap and general price level are factors that affect how firms set their prices. Moreover, future expected inflation and the unemployment or output gap are regressed on inflation in the NKPC specification. In this specification, either the unemployment or output gap is used as proxies for expected future inflation. Real marginal cost (MC) can also be used in the NKPC equation in place of either gap. Additionally, supply shocks and inertia are excluded in the curve and expectations are only forward-looking. Consequently, the model does not capture the PC relationship as positive or negative when using output gap. It can either be positive only or negative only. Inflation and output gap are thus positively related when output gap is used in the specification. Gordon (2008, 2011) argued that the new Keynesian approach represents the right fork after 1975. In addition, the approach also ignores the procyclicality of labour.

Expanding on the same logic, Phiri (2015) stated that the NKPC improves inflation dynamics in various ways. Firstly, a specific variable for inflation dynamics is modelled and the forward-looking behaviour of inflation is emphasised. Secondly, within monopolistic competition, price optimisation and wage problems are introduced, which results in staggered prices and wage settings occur. In addition, the basic assumption of this curve is that prices are set based on

expectations of the future around demand and cost variables. The author's view is that in the short run, unemployment and inflation cannot be influenced by monetary policy because agents are rational; they predict and act on anticipated policy outcomes. Lastly, the NKPC links the MC of firms to the output gap under certain assumptions concerning technology, preferences and labour market processes. In addition, MCs are assumed to be procyclical, and the MC or output gap can be used when specifying the NKPC.

Szentmihályi and Világi (2015) identified three main features of the new Keynesian approach to the PC. Firstly, in the short run, monetary policy can influence economic activity via inflation. This is due to the rational expectations hypothesis. Therefore, the output-gap and inflation trade-off occurs in the short run. Secondly, inflation has no effect on the economy even with rational expectations. Therefore, any shocks will have no effect on inflation and future expectations as prices will return to the same rates. As a result, the output gap is not affected, and monetary policy decisions are ineffective. Thirdly, the gradient of the curve is dependent on the amount of price stickiness present. That is to say, a flat PC occurs due to stickier prices. Moreover, the impact on inflation is low. On the other hand, if prices are flexible, the PC is vertical both in the long-run and short-run. Therefore, monetary policy cannot influence the economy and we have the NCPC. Most importantly, the NKPC has been successful in integrating inflation expectations and includes a supply function. In addition, the PC, AD and a monetary policy rule helps to explain inflation and the economy. Consequently, past inflation is not included in the NKPC.

To sum up, the NKPC is based on microeconomic foundations, namely, the Cobb-Douglas production function. Delayed prices and monopolistic competition are key in its derivation. Therefore, the NKPC specification states that current inflation depends on the expectations of forward-looking inflation and can include MC. By extension, sticky prices allow a positive PC relation between the inflation rate and aggregate demand or output. On the other hand, the inverse relationship between inflation and unemployment still holds. Lastly, this relationship is only temporary, not permanent (Lawler et al: 2020).

3.2.2.3. Hybrid New Keynesian Phillips curve

Gali and Gertler (1999) are the original authors who motivated the HNKPC, which is largely an empirical approach, and extended the NKPC. Their implementation of the curve includes MC as opposed to the output gap. This is due to the fact that productivity gains are directly

accounted for, whereas the output gap has measurement errors. However, the authors stated that MC and output gap share a log-linear relationship, and inflation is negatively related with lagged output. In addition, the pricing behaviour of backward-looking firms is included in the specification. Therefore, firms that look to the past to predict inflation follow certain assumptions based on the rule of thumb. The first assumption states that firms do not deviate from the rule and behave optimally. Secondly, current inflation depends on the previous period's inflation rate. In addition, firms are unable to distinguish the inflation behaviour of competitors. Moreover, inflation is dependent on expected and lagged inflation and the lagged term captures inflation persistence. Lastly, the hybrid curve also includes the NKPC (i.e., the forward-looking behaviour of firms).

Expanding on the same logic, Dupuis (2004) states that the hybrid curve was extended to include sticky prices, whereas the NKPC did not. Therefore, the Calvo model was adapted to include the price setting behaviour of forward-looking and backward-looking firms. Similarly, Gordan (2011) argues that the NKPC excluded the backward-looking behaviour of inflation. Hence the hybrid curve was developed by Gali and Gertler in 1999. Therefore, the HNKPC includes both future expected and past inflation (i.e., backward-looking and forward-looking). However, the author stated that the differences between the NKPC and its hybrid version are minimal due to some form of past inflation being a proxy for inflation.

Phiri (2015) agreed with Dupuis (2004) that the hybrid curve includes the backward-looking component of inflation. The hybrid curve also relates current inflation to expected future inflation, lagged inflation and MC. Moreover, the hybrid version of the curve creates price stickiness, includes inflation inertia and various forms of the PC, namely the NCPC and NKPC. Lastly, output gap or labour share variables can be used in the specification to provide satisfactory results. More to the point, Phiri (2016) stated that the hybrid curve fits South African data well when the output gap is used.

3.2.3. Inflation

Most authors, including Mohr (2008), Mohr et al (2018) and Malikova and Ziyadullayeva (2023) defined inflation as follows: inflation is generally when the prices of all goods and services increase in an economy. In addition, Mohr (2008) and Mohr et al (2018) stated that this increase must occur continuously and considerably. Inflation is generally measured using a Consumer Price Index (CPI) or a Producer Price Index (PPI). It provides a signal that

unemployment, economic activity and poverty should be analysed (Atikah, Syafi'i , Rohimi, Rani, 2023).

Fourie and Mohr (2022) argued that inflation is a dynamic process. The mechanisms involved in creating increases in prices via the economy need to be investigated over time, and these mechanisms give rise to the conditions of inflation. This means increases in prices continually occur over time and are significant. Most authors (Mishkin, 2007; Upper, 2016; Arslan, Jašová and Takáts, 2016) discussed inflation dynamics in terms of inflation persistence, the slope of the PC, the effect of other variables on inflation, inflation expectations, and the exchange rate pass-through effect. Thus, most of these factors have been surveyed under the different types of PCs above (i.e., inflation persistence and expectations, PC slope). Due to the importance of inflation, it is necessary to dive deeper and discuss inflation in terms of its theories, effects and types. Further details are provided below.

3.2.3.1. Inflation breakdown

Inflation occurs when the general prices of goods and services increase continuously over time. This leads to various effects, which can be distributional, economic, and social and political (Mohr et al, 2018; Fourie and Mohr, 2022). Distributional effects occur when income or wealth is transferred from one participant to another. An example of this is debtors and creditors. Generally, inflation will benefit the debtor or borrower more in terms of purchasing power. This is due to the value for money decreasing when prices increase, which means that the creditor receives less value for money when it is paid back. Another example occurs between the private sector and government, who is the debtor. In this case, the government always benefits. On the other hand, economic effects could reduce economic growth and increase unemployment rates. Economic effects could result due to businesses anticipating inflation and becoming risk averse, taking part in speculative practices, discouraging savings, and balance of payment problems. Likewise, social and political effects can influence the economy's performance. As prices of goods and services increase, people become frustrated and start blaming one another. This could result in political uncertainty.

Fahlevi, Ernayani, Lestari, Hubur, and Wahyudi (2020) discussed various theories of inflation and described how the process of inflation occurs, resulting in price changes. The theories include the quantity theory of money, and Keynesian and structuralism theories. The quantity theory of money relates to money supply and inflation expectations; it states that money

supplied causes inflation in the economy. This could be the result of increases in deposits or currency. Inflation can also be determined by the expectation that future price levels will increase.

Keynesians believe that prices rise due to different groups of society wanting to live beyond its means (Fahlevi et al, 2020). This results in an inflation gap where demand for goods and services exceeds the amount available. Consequently, to stop the inflation process, demand should not be greater than output. Lastly, structuralism highlights developing countries due to their inflexible economic structures; inflation is associated with structural factors where change is only possible in the long run and happens gradually. According to this theory, inflation occurs as a result of rigidities in developing countries. These include in-elasticities of exports and supply of goods produced in the economy. Lastly, structuralism theory explains the long-term inflation process in developing countries. The quantity theory of money is relevant to structuralism as well. In addition, structural factors are not entirely structural in nature. For example, monetary policy may influence and change structural factors.

3.2.3.2. Types of inflation

The various types of inflation are discussed below. These include demand-pull and cost-push inflation, stagflation, and hyperinflation. Domestic and imported, creeping, and galloping inflation are also included in this section. These types of inflation describe the factors or causes of the changes in inflation rates. Mohr et al (2018) argued that demand pull, and cost push factors are intertwined in the inflation process, and are useful when analysing inflation.

Demand-pull inflation

According to Mohr et al (2018) and Fourie and Mohr (2022), demand pull inflation affects the AD curve only. As the demand for goods and services increases, it creates excess demand in the market. As a result, prices increase. Excess demand is caused by the factors that affect the AD curve. These include increases in consumption, investment, and government spending, and an increase in export earnings. An increase in consumption can occur when interest rates decline or when consumer credit increases. On the other hand, governments can increase spending when they want the unemployment rate to drop or improve services offered. In addition, firms increase their investment spending when interest rates are low or when improvements in confidence and profits of businesses are seen. Moreover, an increase in export revenue can occur as the prices of exported goods increase or global economic conditions

improve. All of these scenarios lead to an increase in the circulation of money and inflation. This type of inflation affects production, income and employment positively.

Cost-push inflation

Totonchi (2011) argued that the wage spiral leads to cost-push inflation or wage-push inflation; if the increase in wages is greater than labour productivity, labour unions put more pressure on employers to further increase wages. As a result, production costs are increased for various commodities. In return, the prices of these commodities are raised. However, workers are still able to purchase goods and services despite the higher prices due to their considerable wage increases. Consequently, the commodity price increases allow unions to fight for even higher wage increases. Under these circumstances, the wage-cost spiral results in cost-push inflation. In addition, if cost-push inflation is only experienced in certain economic sectors, it can result in the entire economy experiencing inflation. Another source of cost-push inflation is when the price of imported materials increases, leading to an increase in production costs.

To summarise, this type of inflation is a result of the cost of production increasing (Mohr et al, 2018; Fourie and Mohr, 2022). According to the authors, production costs can increase due to increases in the following sources: wages and salaries, cost of imported capital and intermediate goods and profit margins. In addition, decreased productivity and natural disasters affect the cost of production. Moreover, cost-push inflation and income, employment and production share a negative relationship. Lastly, in order to avoid this type of inflation, increases or decreases in the sources or factors that increase cost-push inflation need to be controlled.

Stagflation

Stagflation is related to the factors that affect cost-push inflation. That is, the AS curve. According to Mohr et al (2018) if the price of imported oil increases, the AS curve will shift upward. This occurs due to the cost of production increasing. Next, the quantity demanded of goods and services will decrease, leading to an upward movement in the demand curve. Consequently, the new price level will be higher and production in the economy will fall. Therefore, an increase in the cost of production leads to higher inflation rates and a decline in economic activity, production and employment. In turn, the economy experiences higher unemployment. This situation is referred to as stagflation.

Liu (2023) affirms that stagflation occurs when a country experiences high unemployment and inflation rates together with low growth rates. Two key events resulting in stagflation are the oil price shock in the 1970s and the reign of Robert Mugabe which resulted in a supply shortage. Firstly, stagflation in the 1970s was the result of oil prices increasing to extremely high levels. Inflation and unemployment increased while economic growth and interest rates declined. In addition, most countries experienced financial crises. This led to the breakdown of the PC which states that there is a negative relationship between inflation and unemployment. Secondly, Zimbabwe experienced stagflation due to Robert Mugabe's actions. He created a food shortage by preventing skilled labour from producing food items. The shortage of food created a negative supply shock, leading to stagflation. The recent Russian-Ukraine war has created a global stagflation-like situation as a result of global supply chain shocks and substantial increases in commodity prices. These effects are difficult to control for developed and developing countries.

Hyperinflation

According to Hanke and Kwok (2009), hyperinflation occurs when money supply cannot be constrained. An example of hyperinflation occurred in Zimbabwe during 2007 and 2008. During this time, Zimbabwe's central bank did not want to provide any economic data. As a result, the PPP was used to measure the inflation rate. According to the authors, when the ratio of inflation rates between two economies equals their respective exchange rates, PPP is obtained. In addition, PPP is maintained by price arbitrage even during hyperinflation periods. During hyperinflation, prices of goods and services increased in Zimbabwe and the Zimbabwean dollar depreciated against other currencies, including the US. Eventually the reserve bank of Zimbabwe intervened to stabilise inflation rates. They used the Old Mutual implied rate and the US dollar as a base to calculate the inflation rate for the country. Regulations were enforced, and the country's stock exchange closed down. As a result, dollarisation occurred, and prices stabilised.

Hyperinflation is very dangerous to economic development and is associated with price levels increasing over 50% per month. Since hyperinflation cannot be managed, extraordinary measures have to be taken to combat it (Malikova and Ziyadullayeva, 2023).

Domestic and imported inflation

Domestic inflation occurs within the borders of a country as a result of a budget deficit. Due to such deficit, new money is printed which causes inflation to rise in the domestic economy. Moreover, when the country experiences an increase in the price of exported goods, it also has inflation effects. As a result, there will be an increase in the cost of living and production index, and an increase of income for producers and exporters (Fahlevi et al., 2020; Atikah et al., 2023).

In contrast, imported inflation occurs when the inflation rates of trading countries increase. In addition, when prices of imported goods increase, it has direct and indirect effects. Firstly, the cost-of-living index rises as some goods are bought from a country's trading partners. Secondly, an increase in production costs leads to the price index following the same trend. That is, cost inflation rises. This occurs as a result of raw materials being imported. Lastly, demand inflation is affected due to higher domestic prices, which can result in government spending increasing (Fahlevi et al., 2020; Atikah et al., 2023).

Fourie and Mohr (2022) believe that the inflation process cannot be imported or exported. Imported or exported inflation thus refers to the prices of imported or exported goods and services increasing. These prices increases could result in a process of inflation, whereby prices rise continuously. This occurs for all participants in the market trying to pass on the cost by rising wages or prices.

Galloping and creeping inflation

The distinction between creeping and galloping inflation has been reviewed as early as 1981. According to Qadir and Qadir (1981) the difference lies in intrinsic inflation. The authors defined intrinsic inflation when prices rise due to technological progress. Productivity increases also result in intrinsic inflation, leading to more commodities being produced. As a result, the authors view intrinsic inflation as creeping inflation; all the factors causing intrinsic inflation also cause creeping inflation. Other factors that lead to an increase in prices such as strikes are therefore referred to as galloping inflation.

Similarly, galloping inflation occurs when there is an increase of annual inflation rates between 20-200%. When prices rise abruptly over a short time period, economic structures are at risk. Economic equilibrium is under threat and galloping inflation becomes difficult to manage. As a result, a crisis may arise (Yunusovna, Azizbek, Sanjar, Lazizbek, and Faizullo, 2022; Atikah et al., 2023; Malikova and Ziyadullayeva, 2023).

Creeping or moderate inflation happens over time when prices gradually rise, normally between 5% and 10%. Money depreciates slowly, and the economy does not experience significant shocks (Yunusovna et al., 2022; Atikah et al., 2023; Malikova and Ziyadullayeva, 2023).

3.3. Empirical literature

Section 3.2 covered the theoretical literature relating to the PC and inflation. This section covers empirical studies on inflation dynamics using the NKPC. The aim of the section is to view and understand the nature of the PC for various countries. In doing so, the dynamics of the inflation process will be uncovered. Studies from developed nations such as the US and Europe are reviewed under global studies. Next, the literature covering African countries are reviewed, and lastly, the literature is viewed from a South African perspective.

3.3.1. Global studies

Chowdhury and Sarker (2017) studied the NKPC relation for Russia, Brazil and India. The study used monthly data from 1994 to 2011 to test the stability of the NKPC using Generalised Moment of Methods (GMM) and unit root testing. Firstly, all countries used in the study contained no unit root in terms of inflation. The output gap was found to be non-stationary and had a deterministic trend break. In addition, the results for India when using the Wholesale Price Index (WPI) instead of CPI, showed no structural break. Therefore, Augmented Dickey-Fuller (ADF) testing was used. The results indicated that the variables were stationary only at the 1% significance level. Furthermore, in order to account for regime switching, the Hamilton model was introduced. This was done for output gap estimations. The findings showed that inflation is very persistent for India and Russia. In addition, there are no volatile business cycles present in the output gap variables for all countries involved. Most importantly, the hybrid PC was found to be structurally unstable for all countries under study.

Kim (2018) studied inflation dynamics in the US and European areas; the study was based on various forms of the PC. These were the forward-looking and backward-looking NKPC and the HNKPC. A Dynamic Stochastic General Equilibrium (DSGE) model was used in the empirical study to test if forward-looking behaviour is more important in the relationship between output and inflation. The empirical findings showed that only the hybrid curve performed well when studying inflation dynamics for both countries. Overall, the results indicated three main findings. Firstly, the forward-looking and backward-looking NKPC does

not fit both countries. Secondly, monetary policy changes have a limited impact on inflation behaviour. Lastly, inflation expectations were found to be important. In conclusion, the author stated that more research on the theoretical foundations of the hybrid PC needs to be done.

Likewise, Salunkhe and Patnaik (2019) investigated inflation dynamics for the period 1996Q2 – 2017Q2 in India. They used various forms of the PC such as the traditional PC, purely forward-looking NKPC, HNKPC, extended backward-looking PC and extended HNKPC. In addition, CPI and WPI were compared as inflation measures in the PC specifications. India follows a Flexible Inflation Targeting (FIT) approach to monetary policy decisions and believe that by keeping inflation low, an environment for sustainable economic activity is created in the medium- to long-term. The empirical findings showed that when using CPI in the PC specifications, the extended backward-looking PC has more persistence than the traditional PC. In addition, the output gap variable best explains inflation. In the pure forward-looking model, output gap positively affects inflation. The HNKPC and extended HNPKC produced the same results. In other words, output gap, lagged and expected inflation significantly impact inflation. When compared to WPI, the PC specifications provided similar results. The authors concluded that the extended backward-looking PC and HNKPC best fits India. In addition, anchoring inflation is important and using the output gap best explains inflation dynamics in India. Therefore, monetary policy plays an important role in this regard.

Zobl and Ertl (2021) investigated both the NKPC and HNPKC when studying inflation dynamics. They used small, open or emerging economies in Central and Eastern Europe (CEE) who use inflation targeting regimes in monetary policy, namely, Poland, the Czech Republic, Hungary and Romania. In addition, the study explored the possibility of the NKPC flattening. GMM and Bayesian estimation methods were used on various variables for the period 2003 to 2019. According to the pure NKPC results, inflation expectations and external shocks are statistically significant and a determinate of inflation for CEE. Therefore, the NKPC exists for all countries under review. In addition, various economic slack variables such as output gap, capacity utilisation, labour share and short-term unemployment rates were tested in the PC specifications. The results showed that labour market variables were the most suitable proxies. When the pure-NKPC was compared to the HNKPC results, the hybrid model was rejected due to the fact that lagged inflation was already included in inflation expectations. Furthermore, when faced with using core or headline inflation, empirical testing of the NKPC showed that core inflation is the most preferred choice. The evidence suggested that the NKPC has not

flattened, and non-linearity only exists for Hungary. However, the non-linearity results were vague, and the authors suggested that inflation expectations should be anchored despite the fact that there is weak evidence of the flat NKPC.

On the other hand, Wardhono et al. (2021) used panel data for five ASEAN countries to estimate the NKPC. Their study also determined what effect the output gap had for each country and the corresponding monetary response. Using quarterly data from 2005 to 2018 and GMM methods, all variables were integrated of order zero. In addition, the backward-looking behaviour of inflation was dominant and there was no vertical long-run PC. The coefficients of output gap and future and past inflation expectations were positive, and the authors concluded that the output gap and demand and supply variables are determinants of inflation. According to the authors, this view is in contrast to Gali and Gertler (1999) and Gali et al. (2005) that output cannot be used when estimating the PC. Furthermore, the study found that monetary variables affect the inflation process. In addition, ASEAN countries are characterised by low inflation persistence, and equilibrium is restored within a week. Due to the above results, the authors suggest that a money supply strategy should be used to maintain desired inflation levels.

Abbas (2022) studied inflation dynamics using Monacelli's (2005) approach to the NKPC and GMM estimations. This was due to the fact that in the local environment, import prices were sticky. As a result, imperfect exchange rate pass-through occurred. In addition, inflation dynamics were studied using different business cycles and threshold effects of various inflation targeting countries. These were Australia, Canada, New Zealand (NZ), the United Kingdom (UK) and the US. The study was able to capture the asymmetry of inflation due to its specifications. It tested both the NKPC, and its hybrid version and the findings indicate three main things. Firstly, the NKPC is flatter when inflation is low. This is due to price stickiness and wage rigidity increasing. Therefore, inflation responds asymmetrically in different regimes and business cycles for all countries involved. Secondly, the forward-looking behaviour of inflation dominates in expansionary periods. Thirdly, inflation is unresponsive to business cycles and price stability changes when nominal price rigidities exist in domestic and imported markets. Most importantly, US business cycles are the main determinant of the inflation process for all the other countries under study. In conclusion, the NKPC and HNKPC exists for these counties. However, it depends on the business cycle stage (i.e., expansion or contraction) and the current inflation regime (i.e., low or high inflation).

Similarly, Demir (2022) estimated the HNKPC for the US only. According to the author, inflation rates have remained low since the great depression until 2020, and economists are debating whether or not inflation can be explained by marginal cost or output gap. As a result, the author aimed to identify if the PC still exists for the US. However, potential problems exist in estimating the curve, which includes the fact that the output gap is unobservable due to the natural output rate and expected future inflation is also unobservable. Despite this, the author used GMM estimations and followed Gali and Gertler's (2000) approach to the HNKPC using quarterly data for two samples. These were 1960 to 2000 to compare results with Gali and Gertler and 1960 to 2019. Inflation dynamics for the US are explained using calculations of the natural unemployment and output gap, and the natural output rate is estimated using logs, Okun's Law, various statistical procedures and Hodrick-Prescott (HP) filters. The empirical results indicated that in all cases, the forward-looking behaviour of inflation dominant, which is the same as in Gali and Gertler (2000). In addition, the second sample showed that output gap had a positive sign and was significant. This was contrary to Gali and Gertler's result of an insignificant output gap. Therefore, based on the empirical results, it can be inferred that the NKPC was found for the US and can be used to explain inflation.

Likewise, Gabriel et al. (2022) investigated the NKPC for the US and Euro Area from a slightly different perspective. Their focus was on labour market frictions and more importantly, on the elasticity of inflation and unemployment. The authors believed that inflation and unemployment are important variables in policymaking and are interested in how monetary policy on these two variables are transferred to the economy. As a result, this relationship should be reassessed. The study used GMM, a model averaging procedure and two stage least squares to confirm the NKPC existence. This result was proven by a negative coefficient on labour productivity with inflation. However, labour market frictions are more significant in the Euro Area. Extensions to the NKPC were also made. These included a time-varying NAIRU, and measures of market tightness and separation rates. Results for these extensions were similar to the original estimations. In addition, productivity measures for only the US were added. These results showed that technological shocks barely influence inflation. The author concluded that due to the smaller elasticity of the US, employment rates are lower when compared to the Euro Area. In addition, the period that US workers are unemployed is shorter than the Euro Area. Therefore, the author suggested finding more information on labour market variables to better understand inflation dynamics.

3.3.2. African studies

Kobbi and Gabsi (2017) studied the NKPC in Tunisia; more specially, the non-linearity of the PC was investigated for the period 1993 to 2012. In addition, quarterly data and a Smooth Transition Regression (STR) model was used. According to the authors, a linear PC means that the inflation and economic growth relationship is stable. On the other hand, a non-linear PC implies that in the short term, this relationship is dependent on whether inflation is low or high, or the business cycle phase. The PC relationship is important to Tunisian monetary authorities as it is used to guide decision-making processes. The empirical study tested linearity using two versions of the NKPC, namely, the forward-looking NKPC and HNKPC. Based on the results, the linear specification of the PC does not describe the inflation process in Tunisia. Asymmetry or non-linearity was consequently tested. In addition, the STR results indicate that the PC relation is dependent on whether the economy is in expansion or recession, that is, regime-switching. Therefore, the PC was non-linear in Tunisia and depended on past inflation. There was also a threshold of 3.55% where price rigidity was eroded and the trade-off between inflation and output was restored. In conclusion, monetary authorities in Tunisia must account for asymmetry in the PC when deciding on policy to affect inflation.

In the same way, Belinga and Doukali (2019) studied the NKPC for Morocco. This was done since their monetary policy regimes were in the process of changing from an exchange rate to an inflation targeting framework. The country also started using Quarterly Projection Models (QPM) in 2016 to improve forecasting, policy analysis and monetary policy decisions to align with central banks around the world. The authors used two methods to estimate the PC, namely, GMM and TJIVE (Tikhonov Jackknife Instrumental Variable Estimator). The results showed that a new Keynesian approach to inflation dynamics is encouraged. Moreover, inflation is more forward-looking in nature and using the output gap produces significant and accurate results. Therefore, the HNKPC is dominant for Morocco.

In contrast, few studies exist for Zimbabwe following a new Keynesian approach to inflation dynamics. However, Mukoka (2019) studied the PC for the country using yearly data and Ordinary Least Squares (OLS) methods. The Zimbabwe economy considers inflation and unemployment important indicators of their economy and has experienced high rates of inflation and unemployment. However, policies implemented to combat these high rates were unsuccessful. As a result, the PC becomes important to assist authorities in making informed decisions. The hypothesis of this study is aimed at finding a negative relation between

unemployment and inflation, and it was found that the coefficients of inflation and unemployment share the correct sign. That is to say, there is a negative relationship between the two variables, indicating the existence of the curve for Zimbabwe. In other words, when unemployment increases by one unit, inflation will decrease by 9.6 units. Therefore, monetary policy in this country needs to be specific and constructive in order to control inflation and unemployment.

Likewise, Ayinde, Akanegbu, and Jelilov (2021) estimated a HNKPC for Nigeria. The study used quarterly data ranging from 2000 to 2018. Studies using a new Keynesian approach to inflation dynamics are few to non-existent in Nigeria. Hence, a hybrid curve was employed to describe inflation. Moreover, inflation in Nigeria is volatile despite efforts to control it. GMM and maximum likelihood methods were used in the empirical analysis, and the study found that inflation expectations play an important role in the process of inflation. In addition, the output gap is not a factor that determines inflation in Nigeria. Thereafter, a labour share of income variable was proxied for marginal cost to test for robustness. The results were similar, concluding that forward-looking behaviour of inflation is dominant in Nigeria. However, marginal cost is not a significant driver of inflation.

On the other hand, Adjei (2023) studied variations of the NKPC in Ghana and concluded that it does not exist. The variations included the expectations-augmented PC, accelerationist PC, the Lucas supply curve, HNKPC and the NKPC. These specifications disable policymakers to exploit the trade-off and allow central banks to make use of conventional and unconventional tools to manage inflation and expectations. The hypothesis of the study was to prove that the curve existed in Ghana, in other words that unemployment was negatively related to inflation. Alternatively, inflation and real activity or output gap had a positive relation, illustrating the existence of the curve. Using OLS regressions, the hypothesis was rejected as there was no evidence of the curve in the economy. Afterward, a structural break was confirmed and the period under study was broken into two subsets, namely, 1971-1992 and 1993-2020. Thereafter, estimations revealed that the PC had flattened in Ghana, implying that output had a smaller effect on inflation. Consequently, the author stated that a flatter curve creates challenges as it would become difficult to control inflation once it has flared up again. Anchoring of inflation expectations and globalisation were provided as reasons for a flatter PC. Most importantly, in the short term, policies that create employment and economic growth in Ghana will likely be successful and not cause inflation.

3.3.3. South African studies

Phiri (2015) studied asymmetry in the PC for SA using an STR model. The use of this model was to capture non-linearity. In addition, asymmetry in the curve was studied since the dynamics of the relationship have recently changed. More specifically, an asymmetric PC can be used to revitalise the relevance of policy. Besides, studying non-linearity in the curve produces robust estimations of inflation expectations and demand pressure measurements. The author stated that the PC can be either convex or concave at various stages over the business cycle and are important in monetary policy. Convexity in the PC thus means that inflation is more sensitive to output in a weakening economy. Concavity implies the opposite. In other words, inflation becomes sensitive to output when the economy strengthens. In addition, the cost of fighting inflation is different at convexity and concavity. The study used the NCPC, NKPC and HNKPC as well as extensions to each curve in the linear testing. Extensions to these curves included adding supply sock variables, using an output-based and marginal cost NKPC, and adding inflation inertia in the hybrid version. The empirical findings showed at least one non-linear relationship for each PC specification. Thereafter, the STR model was employed, and interesting results were provided. In particular, the NCPC and NKPC were not applicable to SA. However, the marginal cost and output-based extensions of the HNKPC produced the best result for SA data. The authors concluded that monetary policy only has the ability to affect the economy on the demand side asymmetrically. In addition, this effect occurs via inflation expectations and inertia.

Leshoro and Kollamparabil (2016) studied the existence of the PC in SA as previous studies disagreed that the PC exists. As a result, the authors hypothesised that the PC existed in SA. Therefore, their main objective was to find the PC in SA and whether inflation is determined by forward-looking or backward-looking components. In addition, the HNKPC was used, together with OLS and GMM methods. More to the point, the sign for the output gap was expected to be negative in the hybrid model. On the other hand, output growth was expected to have a positive sign. The empirical findings showed that a long-run relationship existed using annual data. The OLS and GMM methods found no PC in SA, which means there was no trade-off between inflation and demand-side variables. In addition, OLS showed that inflation is more forward-looking in SA. This means that the agent's behaviour is rational and adaptive when predicting inflation. By comparison, GMM methods found mixed results about whether inflation is forward-looking or backward-looking. In conclusion, the authors stated that growth should be targeted in SA instead of inflation.

Chowdhury and Sarker (2017) empirically tested the HNKPC for SA since it is regarded as important developing country. In addition, SA performs well in macroeconomic indicators. Their study used monthly data for a period of 17 years for the following variables: CPI, money supply, Real Effective Exchange Rate (REER) and Index of Industrial Production (IIP). The empirical estimator used in the study was GMM after unit root and structural breaking testing was done. The study found that inflation is stationary whereas output is non-stationary, and both of these variables have a deterministic trend. Furthermore, output gap estimations revealed that inflation is very persistent in SA and forward-looking. Finally, the study revealed that the NKPC is unstable for the country.

Similarly, Fedderke and Liu (2018) studied inflation dynamics in SA using a range of PC models. These include the Gordon model, Gali model, NKPC, and HNKPC. In addition, quarterly data from 1970 to 2015 was obtained from the SARB and a wide range of variables were used. These include inflation, output gap, nominal wage changes, real wage and labour productivity, unit labour cost, exchange rates, surplus or deficit of government, and money balances. Different PC models were tested against a benchmark model, and the empirical findings of the benchmark model were that inertia is present in SA and is significant. In addition, the Gordon model produced weak results of an output gap and inflation relationship. This was due to the output gap being the only statistically significant variable from demand shocks which included the Gross Domestic Product (GDP) deflator. On the supply side, only the GDP deflator was a significant variable in inflation determination. On the other hand, the Gali model used a Vector Error Correction Model (VECM) approach and found that the price level is a significant determinant of cost of production. In addition, results from the NKPC approach using OLS methods showed that wage costs had the strongest influence on inflation. Therefore, the output gap played no role. The GMM estimations provided poor results for various reasons. Firstly, capital accumulation was not included when the NKPC was derived. Secondly, variables were omitted which led to bias and inconsistent results. In contrast, two HNKPC models were tested. According to the first model, unit labour costs were used. In the second model, unit labour costs were split into two categories. The first category was changes in real labour productivity and the second category was changes in nominal wage. In both these models, output gap, money balances and government expenditure positively affected inflation. Lastly, in all these PC type models, the MC measure (unit labour cost) provided the most robust results of inflation dynamics.

Likewise, Leshoro (2020) studied inflation dynamics in SA using quarterly data for two separate time periods, namely, 1995-2014 and 2002-2014. In contrast to the other SA studies above, Leshoro (2020) incorporated fiscal policy in the inflation process. In addition, an augmented Gordon's model was used as a basis for the PC while a Vector Autoregression (VAR) model or VECM estimation approach was used. The model assumed to find a negative relationship for output gap and a positive relationship for output growth with inflation for the PC to exist in SA. The empirical findings suggested that all variables have mixed orders of integration, and cointegration was found between the variables. More to the point, inflation was positively related to output growth, suggesting no PC in SA. Likewise, the coefficient on output gap was found to be statistically insignificant. The author concluded that the country's deficit, exchange rate and price of electricity are economically important. In addition, these variables significantly determine inflation rates in SA. Therefore, Fiscal Theory of the Price Level (FTPL) applies in SA, which means that fiscal and monetary policies have an effect on inflation.

3.4. Research Gap

From the literature reviewed, it can be concluded that the existence of the PC for each country depends on economic conditions. The results relating to SA are mixed and the latest study was reviewed in 2020. This study included an updated time period and sought to update the results of the PC for SA. Moreover, a vast majority of the literature has been done in other countries, specifically in the US and European countries. Most of the studies included in the literature review has made use of GMM methods. However, according to Nason and Smith (2008) using GMM to test for the hybrid PC does not produce reliable results due to weak identification or non-identification of the variables. In addition, GMM is not able to identify the HNKPC. As a result, this thesis made use of an ARDL approach, and therefore fills a research gap of using a different estimation approach to studying inflation dynamics in SA. In doing so, the literature for SA is updated as well.

3.5. Conclusion

This chapter provided an overview of the theory relating to the PC and inflation dynamics. For this reason, various forms of the PC were discussed in section 3.2. These included the original PC in 1958 to the HNKPC in 1999. In addition, due to the importance of inflation, the economic, social, political and distributional effects of inflation were covered. The theories describing how price levels can change and different types of inflation such as demand and

cost push, hyperinflation and stagflation were also analysed. Thereafter, the empirical literature was examined in three sub-sections. Firstly, the studies were reviewed in a global context. Secondly, African literature was discussed. Thirdly, the chapter zoomed in on the literature relating to SA on inflation dynamics using a new Keynesian approach. Lastly, the research gap was identified, which was to use a different estimation approach based on the studies reviewed. The next chapter discusses the steps involved in the research methodology in order to archive the objectives of the study.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1. Introduction

This chapter discusses the methods used in the study. Section 4.1 specifies the theoretical framework and the model specification, which includes the theory underpinning the study and the expected signs of the variables. Section 4.3 reviews the estimation approach to aid the investigation of the objectives of the study. Thereafter, section 4.4 specifies the sources of the data. Section 4.5 discusses the limitations to the study, and section 4.6 provides a conclusion to the chapter.

4.2. Theoretical framework and model specification

The study followed the theory of the PC developed in 1958, namely the PC reflects a negative relationship between inflation and unemployment. A new Keynesian approach was used together with the HNKPC originally developed by Gali and Gertler (1999), which also includes inflation inertia. The hybrid curve accounts for monetary policy effects in the process of inflation for a longer time period, and as a result, current inflation is correlated with expected and past inflation. In addition, the NCPC and NKPC were included in the hybrid specification of the PC. Gali and Gertler (1999) represented the HNKPC as follows:

$$\pi_t = \lambda mc_t + y_f \, E_t\{\pi_{t+1}\} + y_b \pi_{t-1} \quad (4.1)$$

From equation 4.1 above:

$$\lambda \equiv (1 - \omega)(1 - \theta)(1 - \beta\theta)\emptyset^{-1} \quad (4.2)$$

$$y_f \equiv \beta\theta\emptyset^{-1} \quad (4.3)$$

$$y_b \equiv \omega\emptyset^{-1} \quad (4.4)$$

$$\text{And } \emptyset \equiv \theta + \omega[1 - \theta(1 - \beta) \quad (4.5)$$

In equations 4.1 to 4.5, MC instead of output gap is used. The coefficients of θ, ω and β represent price stickiness, backward-looking price setting behaviour and the discount factor irrespectively. When the coefficient of ω is zero, firms are forward-looking, and the model becomes the NKPC. Alternatively, when β equals one, the model represents the HNKPC and the sum of $y_f + y_b = 1$.

One of the hypotheses of the study was to determine if monetary or fiscal variables has a more significant impact on inflation. Therefore, inflation (CPI), the repurchase rate, money supply (M3), and the Real Effective Exchange Rate (REER) were included as proxies for monetary variables. Final consumption expenditure by government (i.e., government spending) and taxes were included as fiscal variables. In addition, unemployment rate, real GDP (RGDP) and unit labour cost (MC) were included. These variables are represented in the function below:

$$inflation = f(unemplomentrate, REER, RGDP, M3, government\ spending, taxes, repurchase\ rate, unit\ labour\ cost) \quad (4.6)$$

As a result, equation 4.6 above can be transformed into equation 4.7 below to include the expected sign of the variables:

$$CPI = c - unemployment\ rate + RGDP + M3 - REER + taxes - repurchase\ rate + government\ spending + unit\ labour\ cost \quad (4.7)$$

In equation 4.7, CPI is the dependent variable while unemployment rate, RGDP, M3, REER, government spending, repurchase rate and unit labour cost are the independent variables. In addition, a proxy for MC, the forcing variable is included, which is unit labour cost. The HNKPC equation thus shows that MC should have a positive sign with inflation (Equation 4.1). On the other hand, RGDP is added as a measure of output gap to determine if it has a stronger effect on inflation than MC. The expected sign indicates a positive relationship (Gordon, 2011). In addition, inflation and unemployment are expected to have a negative sign in the short run as indicated by the PC (Phillips, 1958). According to the quantity theory of money, money supply positively affects inflation (Mohr et al., 2018), and according to the authors, money supply causes inflation and therefore has a positive sign in the above equation.

Moreover, under the interest rate channel of monetary policy, when the repurchase rate is adjusted, it has ripple effects for other interest rates. AD, income and inflation are also affected when expansionary or contractionary policy is used (Mohr et al, 2018). Therefore, expansionary policy entails reducing the repurchase rate whereas contractionary policy indicates when the repurchase rate is increased. Van De Merwe and Mollentze (2010) stated that as the repurchase rate is increased due to contractionary monetary policy, inflation will

decline. The opposite is true for expansionary monetary policy. As a result, a negative relationship between inflation and the repurchase rate is expected. In the same way, under the exchange rate channel of monetary policy, exchange rates and inflation have a negative relationship. If the exchange rate appreciates, it results in lower inflation. On the other hand, a depreciating currency leads to a high inflation rate (Van De Merwe and Mollentze, 2010).

According to the FTPL, inflation can be determined by government debt, spending, and taxes (Bassetto, 2008), but these variables have no direct relation to monetary policy. The study thus included government spending and taxes in the above equation. Mohr et al (2018) stated that fiscal policy uses government spending or taxes. Expansionary fiscal policy is when government spending is increased or when taxes are decreased. If such policies are implemented, the price level will increase. On the other hand, a decrease in government spending or an increase in taxes occurs under contractionary fiscal policy. As a result, inflation will decline. Therefore, government spending has a positive relationship and taxes have a negative relationship with inflation.

4.3. Empirical model

An Autoregressive Distributed Lags (ARDL) model and an Error Correction Model (ECM) were used in the study. This approach was developed by Pesaran, Shin and Smith (2001) and includes a bounds test to cointegration to ascertain if long-run relationships exist in the model. In addition, the main attraction of the method is that the variables can have mixed integration orders, ranging from zero to one. However, variables should not be integrated for order two or higher. Most importantly, the authors mentioned that this model can be used in econometric analysis of the PC and is a linear equation.

When a regression includes the past values of the dependent variable, it can also be called a distributed lag model (Shittu, Yemitan and Yaya, 2012). As a result, if the independent variable leads to the dependent variable, a distributed lag model or regression can be used. An ARDL model is thus useful to determine how variables affect each other when policy changes occur. In addition, the authors stated that when variables are integrated of different orders, the ARDL model alone cannot analyse the data. Hence the bounds test to cointegration was needed to determine if long-run relationships exist. In addition, the ARDL is converted into an ECM when variables have different orders of integration to analyse both long- and short-run

relationships. Moreover, the ECM measures the amount of time taken for the variables to return to equilibrium after a shock.

Phillips (2018) stated that the bounds test to cointegration gives insight into the order of integration. For example, if variables are cointegrated, they are stationary in first difference. If no cointegration is found, the variables are stationary in levels. The author stated that using an ARDL has advantages, which include that unit root testing is not a necessary condition and provides a detailed approach for policymakers to use. In contrast the author stated that the use of an ARDL for small samples provides poor results. However, Nkoro and Uko (2016) argued that the model performs well when sample sizes are small. Another disadvantage provided by Phillips (2018) is that the bounds test is used as a replacement for stationarity testing. However, despite this, the author views the ARDL approach as a powerful tool to tackle problems in time-series analysis.

Expanding on the same logic, an ARDL can be converted into an ECM without difficulty (Kripfganz and Schneider, 2022). This allows the separation of short- and long-run relationships. Additionally, the authors argued that the main feature of using this model is testing for long-run relationships which accommodate multiple processes of adjustment. For example, variables can be integrated of different orders and a single step equation can distinguish the long-run from the short-run. More specifically, the authors agree with Pesaran et al (2001) that an ARDL can be used when analysing the PC. Next, a detailed description of the steps followed in the model are provided.

4.3.1. Unit root testing

Unit root testing involves knowing how many times a variable needs to be differenced in order to become stationary and therefore integrated of a particular order (Engle and Granger, 1987). A variable containing a unit root is said to be non-stationary (Nkoro and Uko, 2016). Alternatively, a variable that has no unit root is stationary. In addition, a variable that is non-stationary could be a trend or difference stationary process. Moreover, non-stationary data containing a unit root follows a random walk process. The equation below indicates a random walk model which all data follows:

$$Y_t = \rho Y_{t-1} - 1 + U_t \tag{4.8}$$

In equation 4.8, ρ should range between a negative one and positive one. When ρ is smaller than one in absolute terms, the series is stationary [i.e., I(0)]. The error term U_t is normally distributed and has a mean and unit variance of zero. That is, U_t is a white noise process. However, when ρ=1, the variable Y_t is not stationary and contains a unit root. It therefore has to be differenced to become stationary [i.e., I(d)].

Various tests can be conducted to ascertain if a series contains a unit root. These are the Philip-Perron (PP), Dickey-Fuller (DF), Durbin-Watson (DW), Augmented Dickey-Fuller (ADF), and Kwiatkowski-Philips-Schmidt-Shin (KPSS) tests. This study made use of PP and KPSS. According to Nkoro and Uko (2016) the PP and KPSS unit root tests share different hypotheses. On the one hand, the null hypothesis of PP reads that the variable is non-stationary, and on the other hand, the null hypothesis of KPSS states that the variable is stationary. Afriyie et al (2022) state that PP and KPSS unit root tests are mostly used in empirical studies. Moreover, using a PP test will overcome problems of heteroscedasticity. In addition, the KPSS test is generally used together with another test, in this case, the PP test. Seasonal dummies do not affect KPSS. Lastly, Del Barrio Castro, Rodrigues and Taylor (2015) stated that the PP test also accounts for autocorrelation.

4.3.2. Lag length

Time series data is autoregressive in nature (Liew, 2004). This means that the process entails determining the lag length where the current values of the data depends on its first lagged values. The most important exercise in this regard is determining the lag length. As a result, various criteria are used, which include the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SIC), the Hannan-Quinn Criterion (HQC), the Final Prediction Error (FPE), and the Bayesian Information Criterion (BIC). These criteria are successful in selecting the correct lag length; however, AIC and FPE provide the most correct results, with AIC being the more popular choice, especially in small samples of less the 120. Moreover, using AIC or FPE avoids the possibility of selecting a lower lag length.

What is more, using the correct number of lags is important as the model should be free of autocorrelation and heteroskedasticity (Nkoro and Uko, 2016). In addition, there should be normal error terms and the data should be normally distributed (that is, Gaussian error terms). Therefore, the lag length suggested by AIC criterion was used in the study.

4.3.3. Cointegration

According to Shittu et al (2012) and Nkoro and Uko (2016), cointegration is important when we want to know if long-run relationships exist between variables. That is, it shows the long-run equilibrium in the regression. As a result, the ECM is stronger statistically and economically. In addition, the bounds test to cointegration is based on the F-statistic. This test is split into the upper bound I(1), and the lower bound I(0). All variables are stationary in levels under the lower bound. On the other hand, all variables are integrated of order one under the upper bound. Thus, when the f-statistic is greater than all critical values, variables are cointegrated. Alternatively, if the f-statistic is lower than the upper and lower bounds, the variables are not cointegrated.

More to the point, testing for cointegration implies that unit root testing does not have to be performed (Phillips, 2018). Therefore, the null hypothesis of the bounds test states that there is no cointegration. If the f-statistic is lower than the critical values of the lower and upper bounds, the null hypothesis is not rejected, and all variables are stationary in levels. In addition, no further unit root testing is required. Alternatively, when the f-statistic is greater than all critical values, the null hypothesis is rejected. This is to say that the variables are cointegrated, share a long run relationship and integrated of order one. Most importantly, this suggests that that the model was correctly specified.

4.3.4. ARDL equation

The ARDL equation provides the long-run dynamics of the equation specified. In addition, Shrestha and Bhatta (2018) state that the ARDL is based on OLS methods due it its single equation approach. It also accommodates non-stationary data and mixed orders of integration. Moreover, as the data generating process occurs, an adequate number of lags are included in the process. In addition, Phillips (2018) represented the ARDL general equation in p,q form below:

$$y_t = \propto_0 + \sum_{i=1}^{p} \propto_0 y_{t-i} + \sum_{j=1}^{q} B_j x_{t-j} + \epsilon_t \quad (4.9)$$

In equation 4.9 above, y is the dependent variable. In addition, $\propto$ represents a constant term. Past values of y and the constant are included for p amount of time periods. In addition, x is

the independent variable and its lagged values are included up to a lag of q. Lastly, ϵ represents the error term and is independent and identically distributed.

4.3.5. Error Correction Model

Verbeek (2004) states that the ECM can be estimated using OLS methods, and the model shows how the explanatory variables causes the explained variable to change. As a result, the model gives an indication of when long-run equilibrium will be restored.

Shittu et al (2012) stated that the ECM is the solution to distinguishing between the short- and long-run in an ARDL model. Therefore, the change in the dependent variable comprises two components in an ECM. Firstly, the current changes in the variables are proportional to each other. Secondly, changes in the dependent variable is partially corrected by its lagged values from equilibrium deviations. As a result, the ECM makes all the data stationary. Furthermore, the re-parameterisation from the ARDL into an ECM provides the short run dynamics of the model. Nkoro and Uko (2016) argued that the error correction term indicates the amount of time taken for equilibrium to be restored in the dependent variable. Therefore, if the value is positive, it indicates divergence. On the hand, convergence occurs if the value is negative.

Shrestha and Bhatta (2018) argued that an ECM is the linear transformation of an ARDL. They also agreed with Verbeek (2004) that the model integrates both short- and long-run relationships. In addition to this, Shrestha and Bhatta (2018) added that the model maintains long-run information and spurious regressions are avoided. The ECM can be represented as follows:

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{p} \beta i \Delta y_{t-i} + \sum_{i=1}^{p} \delta i \Delta x_{t-i} + \sum_{i=1}^{p} \varepsilon i \Delta z_{t-i} + \lambda_1 y_{t-1} + \lambda_2 x_{t-1} + \lambda_2 z_{t-1} + u_t \quad (4.10)$$

In equation 4.10, x,y, and z are the independent variables. In addition, λ shows the long run relationships of x,y, and z. Therefore, the short-run relationships are shown by β, δ and ε. Moreover, y is included as an independent variable. More specifically, the lagged values of y. In addition, if the sum of lambda's equal zero (i.e., $\lambda_1 + \lambda_2 + \lambda_3 = 0$), there is no long run relationship between the variables of interest.

4.3.6. Diagnostic Testing

Diagnostic testing has been done to ensure that the coefficients estimated are robust. In addition, various tests have been conducted, which include coefficient and residual diagnostic tests. Residual testing involves making sure that the error terms are independently and identically distributed. As a result, serial correlation and heteroskedasticity have been tested for. On the other hand, coefficient testing ensured that the coefficients of the model specified were stable. Thus, Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) tests have been carried out (Shrestha and Bhatta, 2018).

4.3.6.1. Heteroskedasticity

Verbeek (2004) argued that heteroskedasticity happens when error terms variances are not identical. This means that they are uncorrelated and can vary over the sample size. There are various tests used to determine heteroskedasticity, namely the white test, the Breusch-Pagan test and testing for multiplicative heteroskedasticity. This study used the Breusch-Pagan test developed in 1980, and the main reason for using this test was that it is a Lagrange multiplier test. Therefore, it can be estimated using the R^2 value of a regression.

Wooldridge (2009) argued that heteroskedasticity occurs when the variance of the error terms influences the regression. Thus, the regression should be homoscedastic. As a result, the null hypothesis is that there is no heteroskedasticity while the alternative hypothesis is that there is heteroskedasticity. If the probability value is greater than 5%, we do not reject the null hypothesis. That means that the model is homoscedastic.

4.3.6.2. Serial correlation

Verbeek (2004) defined serial correlation or autocorrelation as an instance when two or more error terms are related to each other. The consequences of serial correlation are that the OLS regression is unbiased and inefficient. In addition, standard errors are incorrectly estimated. The author also states that the use of time-series data normally leads to serial correction, which makes it important to check for. The factors that lead to autocorrelation are omitting important variables, using the incorrect functional form, and specifying a poor dynamic regression.

Expanding on the same logic, serial correlation implies that the explanatory variables are related to each other (Gujarati, 2015). Therefore, according to the null hypothesis the model is not serially correlated. Alternatively, the model is serially correlated. For the model to be free

of serial correlation, the probability values should be more than the 5% significance level. As a result, the null hypothesis should be accepted.

4.3.6.3. CUSUM and CUSUM of squares

Brown, Durbin and Evans (1975) argued that a regression is constant over a particular time period. However, this is not always the case. It is therefore critical to test this, especially if the model is used for forecasting purposes. As a result, the authors developed the CUSUM and CUSUMSQ. Ploberger and Kramer (1992) stated that these tests are built using recursive residuals, and that the residuals are independent over time. Therefore, CUSUM and CUSUMSQ tests have been carried out to ensure that the model specified, and coefficients are stable (Batool et al., 2022). We wanted the coefficients to be stable over the sample period.

4.3.7. Causality testing

In 1969 Granger developed causality testing to determine the explanatory power of variables (Green, 2003). According to Shrestha and Bhatta (2018), causality can be bidirectional and unidirectional. When causality is unidirectional, the independent variable causes the dependent variable. On the other hand, a bidirectional relationship exists when both the dependent and independent variables affect each other.

4.4. Data

The data used in the study was secondary time-series data. Additionally, quarterly data for the period 2000 – 2022 was collected. Quantitative methods were used to analyse the variables of interest. The variables were CPI, RGDP, M3, repurchase rate, REER, government spending, unit labour cost, taxes and unemployment rate. CPI, RGDP, repurchase rate and M3 were sourced from the Federal Reserve Bank of St. Louis (FRED). Government spending, taxes, unit labour cost and unemployment rate data came from the SARB. REER data was sourced from the IMF, while RGDP and government spending were logged to allow for uniformity of data.

4.5. Limitations

The study only considered PC linearity in SA; non-linearity was not considered in the methodology.

4.6. Conclusion

This chapter provided an overview of the methodology used to achieve the objectives of the study, which were to determine the HNKPC in SA and whether fiscal or monetary variables have a significant impact on inflation. The chapter specified the variables used in the study, which include CPI, unemployment, RGDP, REER, unit labour cost, M3, government spending, repurchase rates, and taxes. The empirical model used to achieve the objectives and hypotheses was the ARDL, which comprises the following main steps: unit root testing, lag length, cointegration, estimating long- and short-run equations and diagnostic testing. The next chapter provides the results using the above-mentioned variables and estimation methods.

CHAPTER FIVE: RESULTS

5.1. Introduction

Chapter five provides the empirical results based on the methodology described in chapter four. Section 5.2 describes the sample of data using statistics and graphical analysis. Statistics include measures such as the mean, median, skewness and normality of the data. A graphical analysis of the data is also provided. Section 5.3 presents the results of unit root testing using PP and KPSS methods. The lag length, ARDL equation and ECM findings are also presented. In addition, diagnostic testing such as serial correlation and heteroskedasticity are provided. Granger causality is determined amongst the variables, and section 5.4 concludes the chapter.

5.2. Descriptive statistics analysis

Descriptive statistics were used to describe the data. Table 5.1 provides a summary of the statistics as well as mean and median measures of central tendency, indicating the variable distribution. Pearson (2012) referred to the mean as the average value and median as the middle observation. On the other hand, measures of dispersion such as standard deviation indicate how the data is spread across the sample from its mean. The shape and normality of the data are given by kurtosis, skewness, the Jarque-Bera test statistic, and probability value. The data can be positively or negatively skewed, which means that most of the data observations can lie either to the left or the right. Most importantly, when the mean and median are close to each other, the data has a normal distribution. In addition, the observations are symmetrically shaped and peak around the mean. The peakedness or flatness of the data is measured by the kurtosis value, which is centred around the distribution measures of the data.

Table 5.1: Descriptive statistics

STATISTIC	VARIABLES			
	CPI	***GOVERNMENT SPENDING***	***M3***	***REER***
Mean	1,3072	162190,9000	2,5445	86,5402
Median	1,2675	150327,5000	2,2281	83,3890
Maximum	3,4182	328645,0000	8,9922	108,9898
Minimum	-1,9275	41438,0000	-0,7999	64,6833

Standard Deviation	0,8824	88284,0300	1,8821	11,6750
Skewness	-0,0598	0,2591	0,8766	0,2375
Kurtosis	4,4325	1,7139	3,9160	1,8422
Jarque-Bera	7,9212	7,3705	14,9990	6,0033
Probability	0,0191	0,0251	0,0006	0,0497

STATISTIC	**VARIABLES**				
	RGDP	***TAXES***	***UNEMPL-OYMENT***	***UNIT LABOUR COST***	***REPURCHASE RATE***
Mean	984245,8000	10,1489	26,2076	81,8337	7,4657
Median	1019635,0000	9,6000	25,4000	80,6500	6,9519
Maximum	1160700,0000	77,9000	35,3000	148,9000	13,5000
Minimum	696879,9000	-35,4000	21,0000	40,1000	3,5000
Standard Deviation	146654,5000	12,2118	3,2351	30,2985	2,6207
Skewness	-0,5870	1,4526	1,0795	0,2393	0,6809
Kurtosis	1,9714	14,7660	3,8111	1,8116	2,5435
Jarque-Bera	9,3399	563,0331	20,3889	6,2916	7,9075
Probability	0,0094	0,0000	0,0000	0,0430	0,0192

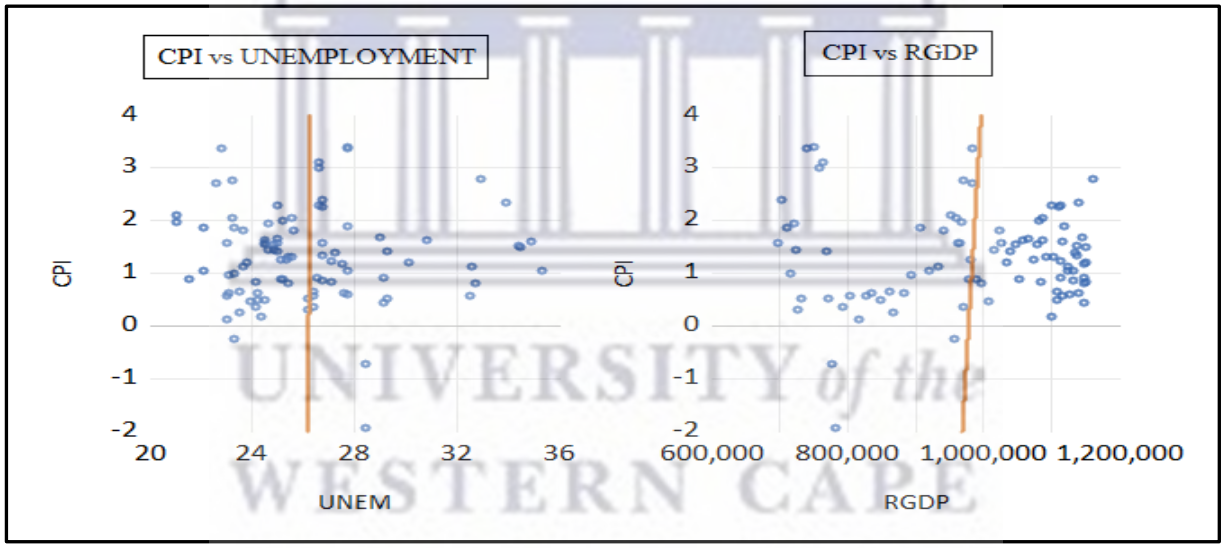
Source: authors own compilation

In Table 5.1, only CPI, money supply (M3), taxes and the repurchase rate are relatively close to their average values as indicated by their respective standard deviations. On the other hand, the standard deviations of REER, real GDP (RGDP), unemployment, government spending and unit labour cost are far from their mean values. This indicates that the data for these variables is widely dispersed. Only CPI and RGDP are negatively skewed, meaning that most of the data for these variables lies on the right. The rest of the data is positively skewed. The kurtosis values for CPI, M3, taxes and unemployment are over three, which reveals that the distribution of the data for these variables are peaked compared to normal. Alternatively, the data distributions of government spending, REER, RGDP, repurchase rate and unit labour cost is relatively flat to the normal since the kurtosis values are less than three. All variables under

study were not normally distributed due to the probability values being less than the significance level of 5%.

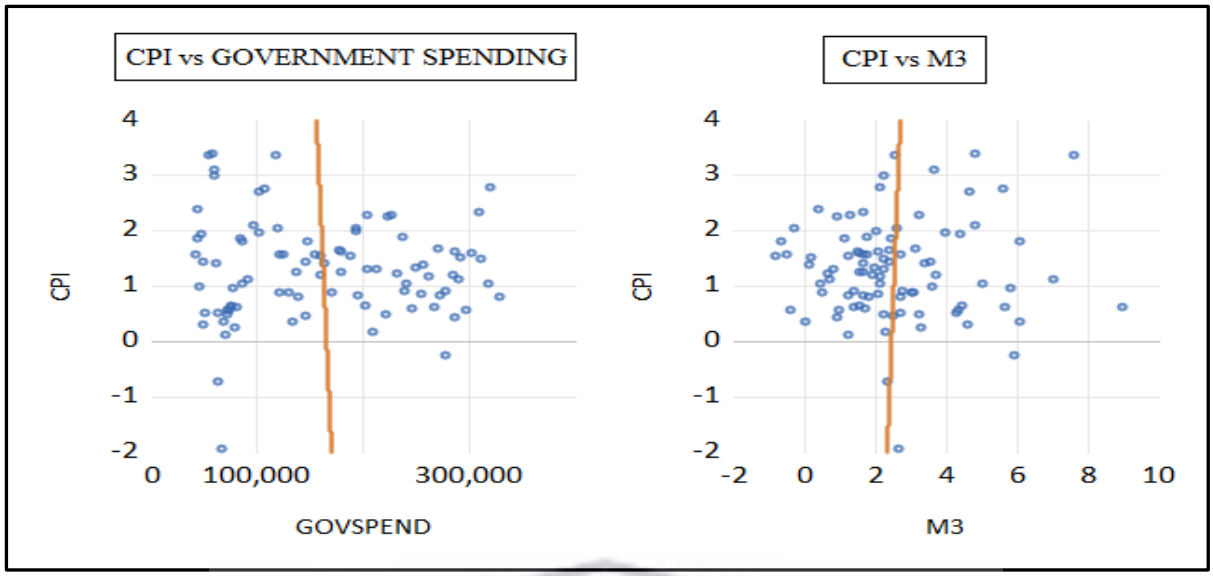
The variables can also be analysed and graphically described. Scatter plots were therefore used to determine the relationship between inflation, RDGP, unemployment, taxes, government spending, M3, repurchase rate, unit labour cost and REER. This is shown in Figures 5.1 to 5.4 below. The graphs indicate that CPI's relationship with unemployment, RDGP, M3, government spending, taxes and unit labour cost is basically vertical. Regarding CPI and unemployment, it can graphically be interpreted that there is no PC (i.e., no negative relationship) in SA for the period under study. Only figure 5.4 provides meaningful insights. Therefore, CPI and REER share a negative relationship while CPI and the repurchase rate have a positive graphic relationship.

Figure 5.9: CPI vs unemployment rate and RGDP



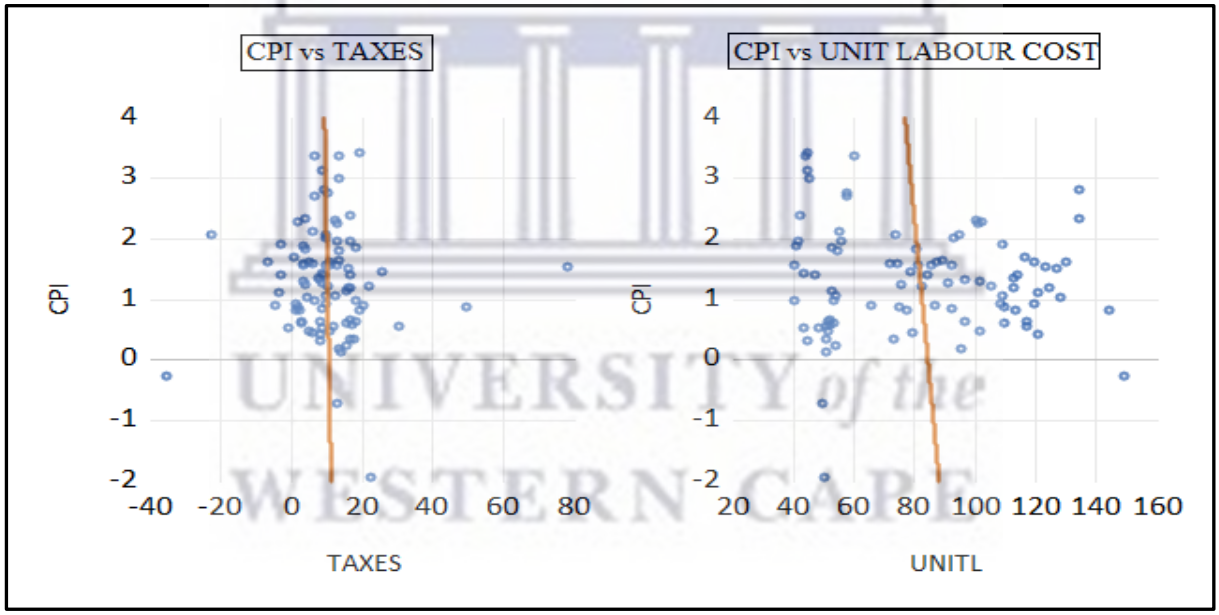
Source: authors computations

Figure 5.10: CPI vs government spending and M3



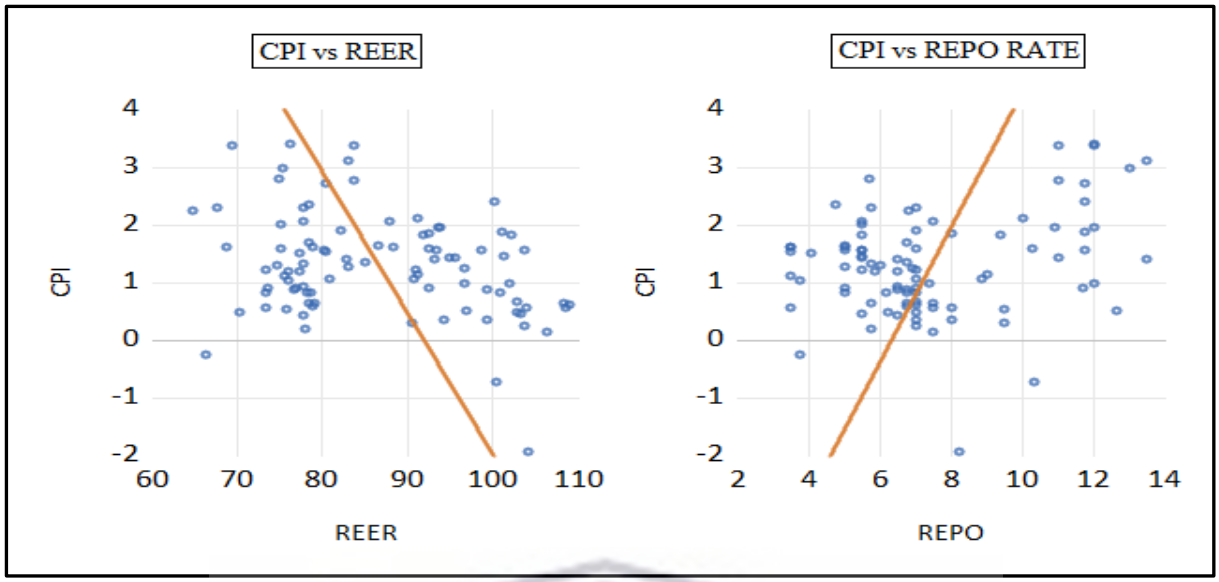
Source: authors computations

Figure 5.11: CPI vs taxes and unit labour cost



Source: authors computations

Figure 5.12: CPI vs REER and repurchase rate



Source: authors computations

5.3. Results from empirical model

5.3.1. Unit root testing

Unit root testing was done to ensure that the data was not integrated of order two or higher. The results of the PP and KPSS unit root tests are shown in Tables 5.2 and 5.3 below. The null hypothesis of the PP test states that the variable has a unit root and is non- stationary while the alternative is that the variable is stationary. KPSS works in the opposite direction of PP; therefore, the null hypothesis of KPSS is that the variable is stationary. Alternatively, the variable is non-stationary.

Table 5.2: PP unit root test results

PP				
Variable	**Intercept**		**Trend and Intercept**	
	Level I(0)	**1st difference I(1)**	**Level I(0)**	**1st difference I(1)**
CPI	-5,4907***	-15,5971	-5,4637***	-15,6011
UNEMPLOYMENT	-1,5225	-13,1323***	-2,5814	-13,7470***
REER	-2,2816	-7,6575***	-2,8953	-7,6125***
M3	-5,5025***	-22,7987	-6,3788***	-22,5781
LNRGDP	-2,5884***	-14,3883	-1,6047	-18,7993***
REPURCHASE RATE	-2,1296	-4,3846***	-2,4813	-4,4108***
UNIT LABOUR COST	1,6823	-17,1905***	-4,3911***	-23,2805

LNGOVERNMENT SPENDING	-3,5976***	-11,6648	-1,2623	-17,1291***
TAXES	-9,1537***	-17,8889	-9,3059***	-17,7819

*Source: authors compilation. Note: *** rejected at 10%, ** rejected at 5%, *rejected at 1%.*

Tables 5.2 and 5.3 show that CPI, M3, and taxes are all stationary in levels according to PP and KPSS. The rest of the variables provided mixed results when comparing the unit root test results. For instance, unemployment is integrated of order one under PP. However, when compared with KPSS, it shows mixed orders of integration. That is, the variable is stationary in levels under the intercept method and in the first difference according to trend and intercept. However, the REER and repurchase rate share the same results. Both variables are stationary in the first difference under PP. Under KPSS, the intercept method shows the order of integration as one and trend and intercept shows that the variables are integrated of order zero. Moreover, RGDP shows mixed orders of integration under PP. It is stationary in levels and first difference under intercept, and trend and intercept methods respectively. When compared with KPSS, RGDP was found to be stationary in first difference. Lastly, unit labour cost and government spending shows mixed orders of integration under both PP and KPSS. As a result of these variables having mixed orders of integration, an ARDL model can be estimated.

Table 5.3: KPSS unit root test results

KPSS				
Variable	**Intercept**		**Trend and Intercept**	
	Level I(0)	**1st difference I(1)**	**Level I(0)**	**1st difference I(1)**
CPI	0,0490***	0,0904	0,0476***	0,0889
UNEMPLOYMENT	0,6275*	0,2274	0,2713	0,0477***
REER	0,8078	0,0378***	0,0754***	0,0378
M3	0,6265*	0,1423	0,1017***	0,1399
LNRGDP	1,1503	0,4548**	0,2967	0,0726***
REPURCHASE RATE	0,8684	0,0820***	0,0939***	0,0371
UNIT LABOUR COST	1,2503	0,3531**	0,2118*	0,1049
LNGOVERNMENT SPENDING	1,2433	0,3815**	0,2977	0,0891***
TAXES	0,2651***	0,0372	0,0419***	0,0334

*Source: author's own compilation. Note: *** do not reject at 10%, ** do not reject at 5%, * do not reject at 1%*

5.3.2. Lag length

The lag length criteria results are shown below in Table 5.4. The table shows the various lag lengths selected according to FPE, AIC, SC and HQ. According to FPE, AIC and HQ, eight lags should be used in the model. However, SC shows that one lag should be used.

Table 5.4: Lag length criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1328,5860	NA	548,0695	31,8473	32,1077	31,9520
1	-671,9744	1156,8870	0,0006	18,1423	**20,7467***	19,1892
2	-564,1340	166,8959	0,0003	17,5032	22,4516	19,4924
3	-448,9317	153,6031	0,0002	16,6889	23,9813	19,6204
4	-286,3989	181,8819	0,0000	14,7476	24,3841	18,6214
5	-193,8657	83,7205	0,0001	14,4730	26,4535	19,2890
6	-57,3973	94,2282	0,0000	13,1523	27,4768	18,9106
7	159,5282	**103,2979***	0,0000	9,9160	26,5845	16,6166
8	543,0050	100,4344	**0,0000***	**2,7142***	21,7266	**10,3570***

Source: author's own compilation

Based on these results, the model made use of AIC test results in estimating the relationships of inflation dynamics. This is due to the fact that AIC provides accurate results (Liew, 2004). In addition, the model will not be serially correlated and homoscedastic when the correct number of lags are used (Nkoro and Uko, 2016).

5.3.3. Bounds test to cointegration results

Cointegration testing was done to determine if the variables share a long-run relationship. Therefore, the cointegration test results originally developed by Pesaran et al (2001) are shown below in Table 5.5. It can be interpreted that all variables are stationary in first difference [i.e.,

I(1)] as the f-statistic is greater than the lower and upper bounds. However, testing for unit root was still done in Table 5.2 to ensure that no variable was integrated of order two to meet the conditions of an ARDL model. In addition, the null hypothesis of the bound test states that there is no cointegration. Therefore, due to the f-statistic falling outside both lower and upper bounds, the null hypothesis was rejected. This means that there was cointegration in the model and at least one variable shared a long-run relationship with inflation.

Table 5.5: Cointegration results

Sample Size	F-static			6,5634		
	10%		5%		1%	
80	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Asymptotic case	-1,0000	-1,0000	-1,0000	-1,0000	-1,0000	-1,0000
	1,8500	2,8500	2,1100	3,1500	2,6200	3,7700

Source: author's own compilation

5.3.4. ARDL equation

The long-run dynamics of inflation in SA is represented in Table 5.6 below. As can be seen, unemployment has a positive relationship with inflation. This contradicts theory since in the long run, there is no relationship between inflation and unemployment (Szentmihályi and Világi, 2015). On the other hand, the coefficient of lagged unemployment becomes negative. Both unemployment and lagged unemployment are statistically significant as the probabilities are less than 5%. Furthermore, inflation and RGDP share a positive but insignificant relationship. This positive relationship is supported by Gordon (2011).

Moreover, government spending bears a positive coefficient. This is correct as theory dictates that spending should increase due to expansionary fiscal policy, leading to a rise in inflation rates (Mohr et al., 2018). Furthermore, the probability value indicates that the variable is statistically significant, especially when lagged by two and four quarters. In addition, the relationship between inflation and M3 is found to be positive but insignificant. Moreover, according to Mohr et al (2018), the quantity theory of money implies that as money supply increases, price levels will increase. This means that a positive relationship exists. Furthermore, the findings that government expenditure and M3 share positive correlations with CPI, corroborates the findings of Fedderke and Lui (2018). Taxes are negatively related to inflation

since it is generally known that a decrease in taxes due to expansionary fiscal policy leads to a rise in inflation (Mohr et al, 2018). However, the probability value is more than 5%, making it insignificant.

Similarly, exchanges rates (REER) have a negative relationship with inflation. This has been theoretically proven by the exchange rate channel (Van De Merwe and Mollentze, 2010). According to the authors, exchange rates and inflation move in opposite directions. If the currency appreciates, the result would be lower price levels and vice versa. However, the probability value of 0,1075 indicates that it is insignificant. When compared with unemployment, repurchase rates shares a positive relationship with inflation which is opposite to theory. According to the interest rate channel, if the repurchase rate is increased, prices will decline. Alternatively, a drop in the repurchase rate results in an increase in inflation (Van De Merwe and Mollentze, 2010). However, when the repurchase rate is lagged by one quarter, the coefficient becomes negative. In addition, irrespective of the coefficient of the repurchase rate, the variable is statistically significant according to Table 5.6.

On the other hand, inflation and unit labour cost are positively related, but the probability indicates that unit labour cost is an insignificant variable. Most importantly, lagged inflation is significant in the short run. This indicates that inflation is persistent. However, the coefficients vary from positive to negative. Looking at the summary statistics, no autocorrelation is present in the model as the Durbin Watson (DW) value is over two. In addition, approximately 64% of the explanatory variables explain the dynamics of inflation in SA as indicated by the adjusted R^2 value. Lastly, the model is significant as the f-statistic's probability value is less than 5%.

Table 5.6: Long- run dynamics of ARDL

Variable	Coefficient	Standard Error	t-Statistic	Probability
CPI(-1)	0,2613	0,0941	2,7774	0,0070
CPI(-2)	-0,1694	0,0933	-1,8157	0,0737
CPI(-3)	0,1152	0,0896	1,2862	0,2026
LNGOVERNMENT SPENDING	6,3756	2,6617	2,3953	0,0193
LNGOVERNMENT SPENDING(-1)	-2,1539	2,2117	-0,9738	0,3335
LNGOVERNMENT SPENDING(-2)	8,9075	2,2396	3,9773	0,0002

LNGOVERNMENT SPENDING(-3)	-1,9188	2,3170	-0,8282	0,4104
LNGOVERNMENT SPENDING(-4)	-11,6402	2,7241	-4,2731	0,0001
LNRGDP	0,9340	3,8684	0,2414	0,8099
M3	0,0301	0,0432	0,6958	0,4889
REER	-0,0142	0,0087	-1,6302	0,1075
REPURCHASE RATE	0,5587	0,1314	4,2521	0,0001
REPURCHASE RATE(-1)	-0,5919	0,1212	-4,8838	0,0000
TAXES	-0,0084	0,0058	-1,4399	0,1544
UNEMPLOYMENT	0,1195	0,0453	2,6390	0,0102
UNEMPLOYMENT(-1)	-0,1183	0,0475	-2,4902	0,0151
UNIT LABOUR COST	0,0048	0,0224	0,2126	0,8322
C	-6,5307	34,1799	-0,1911	0,8490
SUMMARY STATISTICS				
R-squared			0,7178	
Adjusted R-squared			0,6493	
F-statistic			10,4735	
Prob(F-statistic)			0,0000	
Akaike info criterion			1,7403	
Durbin-Watson stat			2,2397	

Source: author's own compilation

5.3.5. Error Correction Model

The error correction results are shown in Table 5.7 below. The table also shows the short-run relationships of the model; government spending shares a positive sign with inflation in the short run. In addition, government spending and inflation are positively correlated in the long run as shown above in Table 5.6. This positive sign is correctly predicted since an increase in spending increases inflation (Mohr et al, 2018). In addition, the variable is statistically significant, especially when lagged up to three quarters. Furthermore, the relationship between the repurchase rate and inflation remains positive and significant in the long and short run. In conclusion, monetary and fiscal policies affect inflation (Leshoro, 2020) due to their significance.

Similarly, the coefficient of unemployment is positive and statistically significant. However, this is opposite to theory which states that a negative relationship exists (Phillips, 1958). Therefore, it can be concluded that the PC does not exist in SA, agreeing with Leshoro and Kollamparabil (2016). A positive relationship suggests that the triangle model of inflation exists. Furthermore, lagged inflation becomes insignificant. Most importantly, the error correction term reveals that it will take approximately 79% every quarter for variables to converge to long-run equilibrium. In addition, the DW statistic shows no problem of autocorrelation, and the ECM is significant as indicated probability of the F-statistic. Finally, the adjusted R^2 reveals the model has an explanatory power of about 69%.

Table 5.7: ECM

Variable	Coefficient	Standard Error	t-Statistic	Probability
COINTEQ*	-0,7929	0,0921	-8,6065	0,0000
D(CPI(-1))	0,0542	0,0891	0,6083	0,5447
D(CPI(-2))	-0,1152	0,0782	-1,4737	0,1445
D(LNGOVERNMENT SPENDING)	6,3756	1,6222	3,9303	0,0002
D(LNGOVERNMENT SPENDING(-1))	4,6516	1,7319	2,6858	0,0088
D(LNGOVERNMENT SPENDING(-2))	13,5591	1,6656	8,1406	0,0000
D(LNGOVERNMENT SPENDINGC(-3))	11,6402	1,7666	6,5889	0,0000
D(REPURCHASE RATE)	0,5587	0,0886	6,3074	0,0000
D(UNEMPLOYMENT)	0,1195	0,0376	3,1762	0,0021
SUMMARY STATISTICS				
R-squared			0,7187	
Adjusted R-squared			0,6902	
F-statistic			25,2294	
Prob(F-statistic)			0,0000	
Akaike info criterion			1,5357	
Durbin-Watson stat			2,2397	

Source: authors own compilation

5.3.6. Diagnostic tests

5.3.6.1. Heteroskedasticity

The Breusch-Pagan-Godfrey test was used to test for heteroskedasticity. The results are shown in Table 5.8 below The null hypothesis is that the model is homoscedastic. On the other hand, the alternative hypothesis states that heteroskedasticity is present. As a result, the null hypothesis is not rejected since the probability values of 0.8324, 0.7929 and 0.9908 are greater than the 5% significance levels. Therefore, the model is homoscedastic.

Table 5.8: Heteroskedasticity

F-statistic		0,6576
Obs*R-squared		12,1193
Scaled explained SS		6,3170
Prob. F(17,70)	Prob. Chi-Square(17)	Prob. Chi-Square(17)
0,8324	0,7929	0,9908

Source: authors own compilation

5.3.6.2. Serial correlation

Table 5.9 shows the serial correlation results according to the Breusch-Godfrey LM test of up to eight lags. According to the null hypothesis, the model is free of serial correlation. The opposite is true for the alternative hypothesis; that is, serial correlation is present. Table 5.9 shows that the probability values are greater than 5%. Therefore, the null hypothesis is not rejected, and the model is free of serial correlation. This means that the error terms and explanatory variables are not correlated to each other (Verbeek, 2004: Gujarati, 2015).

Table 5.9: Serial correlation

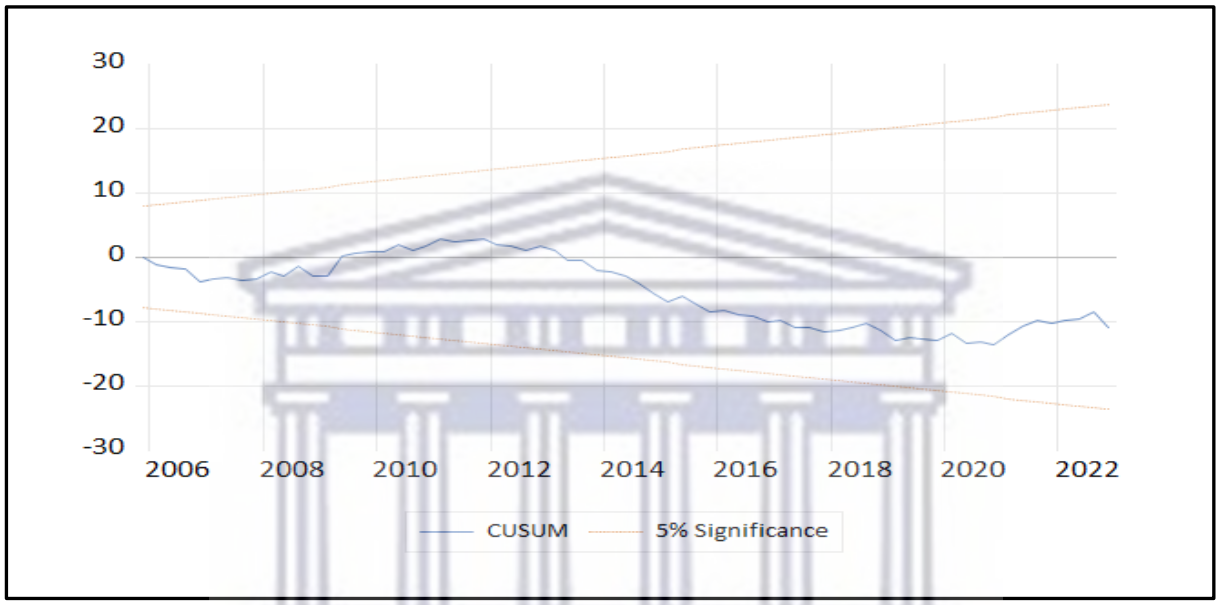
F-statistic	1,1971
Obs*R-squared	11,7740
Prob. F(8,62)	Prob. Chi-Square(8)
0,3156	0,1616

Source: authors own compilation

5.3.6.3. CUSUM and CUSUMSQ

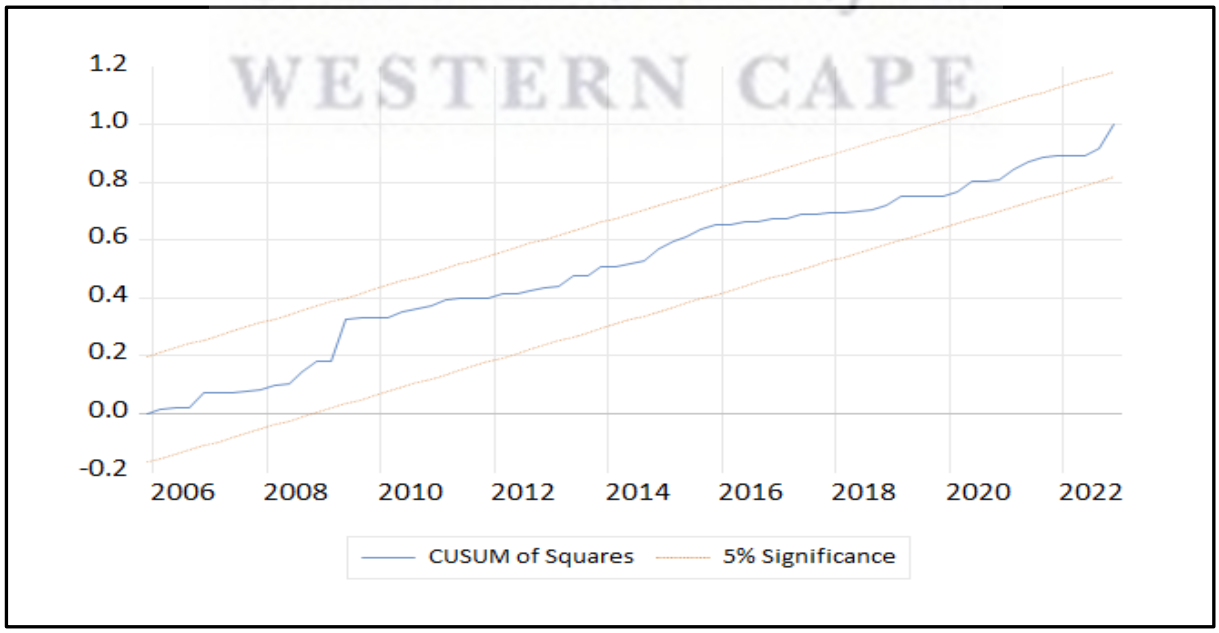
The CUSUM and CUSUMSQ graphs (Figures 5.5 and 5.6) show the stability of the model and coefficients in the long run. Figures 5.5 and 5.6 below show that the blue line falls within the bandwidth of the 5% significance level. Therefore, the regression and model is stable and constant over the sample period.

Figure 5.13: CUSUM test



Source: authors computations

Figure 5.14: CUSUMSQ test



Source: authors computations

5.3.7. Causality

Table 5.10 shows Granger causality when inflation is the dependent variable. As a result, the table indicates that government spending, REER and the repurchase rate has an effect on inflation. This is due to the fact that their probability values are less than 5%. Therefore, CPI and REER share a unidirectional relationship. Similarly, CPI and the repurchase rate have a unidirectional relationship as the direction of causality only comes one variable. Table 5.10 also shows the effect on government spending when it is used as the dependent variable. As can be seen, there is causality running from CPI, M3, repurchase rate, taxes and unemployment to government spending. Therefore, taxes, repurchase rate, M3 and unemployment all have a unidirectional relationship with government spending. Most importantly, Table 5.10 indicates that CPI and government spending share a bidirectional relationship. This means that there is causality running in both directions.

Table 5.11 shows the causality results when REER and repo rate is the explained variable independently. As a result, none of the variables under study affect exchange rates (REER). On the other hand, when repo rate is the explained variable, only unit labour costs has an effect on repo rate. Therefore, repo rate and unit labour cost share a unidirectional relationship. Table 5.12 shows that unit labour cost granger causes RGDP when used as the dependent variable. In addition, when the dependent variable is unit labour cost, only RGDP has an effect. Therefore, there is a bidirectional relationship between RGDP and unit labour cost.

Likewise, Table 5.13 shows the results of causality when taxes are the explained variable: CPI, RGDP, repo rate and unit labour cost all cause changes in taxes. These variables thus all share a unidirectional relationship with taxes. Table 5.13 indicates that when unemployment is used as the dependent variable, only RGDP has an effect. Hence, the relationship is unidirectional. Lastly, when M3 is used as the dependent variable, Table 5.14 shows that inflation, repo rate, government spending, REER, unit labour costs, taxes, RGDP and unemployment have no influence.

Table 5.10: Granger causality of CPI and government spending

Dependent variable: D(CPI)				**Dependent variable: D(LNGOVERNMENT SPENDING)**			
Excluded	Chi-sq	df	Probability	Excluded	Chi-sq	df	Probability

D(LNGOVERNMENT SPENDING)	7,4756	2	**0,0238**	D(CPI)	13,6402	2	**0,0011**
D(LNRGDP)	2,6029	2	0,2721	D(LNRGDP)	4,2185	2	0,1213
D(M3)	2,5550	2	0,2787	D(M3)	9,9282	2	**0,0070**
D(REER)	8,3083	2	**0,0157**	D(REER)	2,1907	2	0,3344
D(REPO RATE)	8,3255	2	**0,0156**	D(REPO RATE)	29,3545	2	**0,0000**
D(TAXES)	1,9018	2	0,3864	D(TAXES)	11,8735	2	**0,0026**
D(UNEMPLOYMENT)	0,8833	2	0,6430	D(UNEMPLOYMENT)	6,1146	2	**0,0470**
D(UNIT LABOUR COST)	0,6275	2	0,7307	D(UNIT LABOUR COST)	2,5564	2	0,2785
All	43,8991	16	0,0002	All	58,4296	16	0,0000

Source: authors own compilation

Table 5.11: Granger causality of REER and the repurchase rate

Dependent variable: D(REER)				**Dependent variable: D(REPO RATE)**			
Excluded	Chi-sq	df	Probability	Excluded	Chi-sq	df	Probability
D(CPI)	5,8722	2	0,0531	D(CPI)	3,6531	2	0,1610
D(LNGOVERNMENT SPENDING)	0,7868	2	0,6748	D(LNGOVERNMENT SPENDING)	1,5849	2	0,4527
D(LNRGDP)	1,4618	2	0,4815	D(LNRGDP)	4,4590	2	0,1076
D(M3)	0,0813	2	0,9602	D(M3)	0,1148	2	0,9442
D(REPO RATE)	3,7151	2	0,1561	D(REER)	0,6020	2	0,7401
D(TAXES)	1,7866	2	0,4093	D(TAXES)	3,3412	2	0,1881
D(UNEMPLOYMENT)	3,9575	2	0,1382	D(UNEMPLOYMENT)	1,6594	2	0,4362
D(UNIT LABOUR COST)	0,7911	2	0,6733	D(UNIT LABOUR COST)	7,0552	2	**0,0294**
All	14,0778	16	0,5929	All	26,1840	16	0,0515

Source: authors own compilation

Table 5.12: Granger causality of RGDP and unit labour cost

Dependent variable: D(LNRGDP)				Dependent variable: D(UNIT LABOUR COST)			
Excluded	Chi-sq	df	Probability	Excluded	Chi-sq	df	Probability
D(CPI)	1,2950	2	0,5233	D(CPI)	3,0154	2	0,2214
D(LNGOVERNMENT SPENDING)	0,3902	2	0,8227	D(LNGOVERNMENT SPENDING)	0,0661	2	0,9675
D(M3)	1,1085	2	0,5745	D(LNRGDP)	22,9556	2	**0,0000**
D(REER)	0,4695	2	0,7908	D(M3)	0,9729	2	0,6148
D(REPO RATE)	2,6445	2	0,2665	D(REER)	0,3201	2	0,8521
D(TAXES)	0,4563	2	0,7960	D(REPO RATE)	2,1624	2	0,3392
D(UNEMPLOYMENT)	0,7300	2	0,6942	D(TAXES)	2,2824	2	0,3194
D(UNIT LABOUR COST)	7,7554	2	**0,0207**	D(UNEMPLOYMENT)	1,8929	2	0,3881
All	18,0367	16	0,3217	All	42,8539	16	0,0003

Source: authors own compilation

Table 5.13: Granger causality of taxes and unemployment

Dependent variable: D(TAXES)				Dependent variable: D(UNEMPLOYMENT)			
Excluded	Chi-sq	df	Probability	Excluded	Chi-sq	df	Probability
D(CPI)	12,8144	2	**0,0016**	D(CPI)	0,2657	2	0,8756
D(LNGOVERNMENT SPENDING)	2,3254	2	0,3126	D(LNGOVERNMENT SPENDING)	1,348	2	0,5097
D(LNRGDP)	6,7871	2	**0,0336**	D(LNRGDP)	13,7433	2	**0,0010**
D(M3)	1,7691	2	0,4129	D(M3)	1,6281	2	0,4430
D(REER)	1,2547	2	0,5340	D(REER)	1,0406	2	0,5943
D(REPO RATE)	10,0954	2	**0,0064**	D(REPO RATE)	1,5966	2	0,4501
D(UNEMPLOYMENT)	1,0876	2	0,5805	D(TAXES)	0,4569	2	0,7958
D(UNIT LABOUR COST)	6,3157	2	**0,0425**	D(UNIT LABOUR COST)	5,7172	2	0,0573
All	32,2678	16	0,0092	All	26,1199	16	0,0524

Source: authors own compilation

Table 5.14: Granger causality of M3

Dependent variable: D(M3)			
Excluded	Chi-sq	df	Probability
D(CPI)	2,3821	2	0,3039
D(LNGOVERNMENT SPENDING)	1,0338	2	0,5964
D(LNRGDP)	1,4704	2	0,4794
D(REER)	1,8473	2	0,3971
D(REPO RATE)	0,2862	2	0,8667
D(TAXES)	0,4703	2	0,7904
D(UNEMPLOYMENT)	1,4391	2	0,487
D(UNIT LABOUR COST)	0,938	2	0,6256
All	11,9703	16	0,746

Source: authors own compilation

5.4. Conclusion

In conclusion, unit root testing has provided mixed results, therefore ARDL and ECM was estimated. The results proved interesting, especially in the short run. It showed that the unemployment rate was positively correlated with inflation. Therefore, the hybrid curve was not found for SA and the null hypothesis of the study was not rejected. In addition, government spending and the repurchase rate are found to be significant in the short-run and long-run, which means that both monetary and fiscal variables influence inflation. As a result, the null hypothesis that monetary and fiscal variables do not influence inflation, was rejected. The following chapter provides a conclusion to the thesis.

CHAPTER SIX: CONCLUSION

6.1. Introduction

This chapter provides a conclusion to the thesis. It discusses and summarises the key findings of the study which aimed at finding the PC in SA and determining if monetary and fiscal variables affect inflation. Section 6.2 provides a review of the key findings, and section 6.3 discusses policy recommendations.

6.2. Summary and conclusion

Monetary policy plays a key role in inflation dynamics. It was therefore pivotal to look at the various monetary policy regimes in SA and to describe the different inflation trends during these periods. They include the reinstatement and demise of the gold standard, the revival of monetary policy, the cash reserve system, the liquid asset system, inflation targeting, the eclectic approach and the repurchase transactions system. Various instruments have been used to maintain price stability and achieve full employment and economic growth. These included reinstating and dropping the gold standard, and increasing or decreasing interest rates, money supply, exchange rates, credit and open market operations. Monetary policy goes through various mechanisms to affect economic activity and inflation. These include exchange rate, interest rate, asset price and credit channels. Fiscal policy is secondary to monetary policy, but it still has a role to play in analysing inflation in SA. However, it has not been given much attention in the South African literature with the exception of Leshoro (2020).

Ultimately, the PC has been used in monetary policy to help the SARB achieve its objectives. The PC has been in existence since 1958; explaining how inflation can change. As a result, inflation and unemployment trade-offs have become important as policy could be exploited to achieve low inflation with a slight rise in unemployment. Various types of PC have been covered in the literature review, which include the traditional PC conceptualised by Phillips in 1958. Thereafter, the NCPC, NKPC, Gordons triangle model of inflation and the HNKPC came about. Major contributing authors (Phillips, 1958; Phelps, 1967; Friedman, 1968; Lucas and Rapping, 1969; Gordon, 1990; and Gali and Gertler, 1999) have either described the PC as a success or failure; a topic that has been continuously debated in the literature.

This research study aimed to investigate inflation dynamics in SA using the new Keynesian approach. This approach is based on the assumption that inflation should be influenced by

inflation persistence (i.e., lagged inflation) and inertia. The HNKPC was utilised as it included more than one type of PC, and the empirical study applied an ARDL model together with an ECM to fulfill the objectives and prove or disprove its hypotheses. The basic hypothesis of the study was to determine if a HNKPC existed, and to identify the other factors that influence inflation. Consequently, a secondary hypothesis was included to investigate if both monetary and fiscal factors play a role in determining inflation in SA. For this purpose, quantitative research methods were employed using quarterly data for the period 2000 - 2022.

The study found that inflation and unemployment move in a positive direction both in the short and long run, and the relation becomes negative when unemployment is lagged. This could indicate that the triangle model exists in SA. RGDP and unit labour costs had the correct signs but were statistically insignificant in affecting inflation. Lagged inflation was significant in both the short and long run, proving that a new Keynesian approach was the correct route to take. In addition, government spending, the repurchase rate and unemployment were the only variables to affect inflation in both the short and long run. These variables all proved to be significant, and the results indicated that the HNKPC does not exist and that monetary and fiscal variables play a pivotal role in inflation dynamics.

6.3. Policy recommendations

Inflation and unemployment are two very important variables. Both affect people's livelihoods, buying power and economic growth. Unemployed people cannot fight the cost of inflation, and it is important to find the correct balance between the two. Policies aimed at keeping both inflation and unemployment as low as possible should be implemented since this affects economic growth. In addition, both monetary and fiscal policies should be considered when studying inflation dynamics and the PC. The scope of these variables should also be widened when studying inflation dynamics. Most importantly, inflation is a continuous process; policies should regularly be updated to achieve better results and alternative theories should be considered when analysing inflation.

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