

INVESTIGATING THE RELATIONSHIP BETWEEN THE BANK RATE,
UNEMPLOYMENT AND INFLATION: THE PHILLIPS CURVE IN NAMIBIA

A THESIS SUBMITTED IN PARTIAL FULFILMENT

OF

THE REQUIREMENTS FOR THE DEGREE

OF

MASTER OF SCIENCE IN ECONOMICS

OF

THE UNIVERSITY OF NAMIBIA

BY

HILENI SHIFOTOKA

STUDENT NUMBER: 200732048

October 2015

Main Supervisor: Dr. Omu Kakujaha - Matundu

Co-supervisor: Dr. Jacob M. Nyambe

ABSTRACT

This study investigates the relationship between the bank rate, unemployment and inflation rates in Namibia, and it also interrogates the policy implications of using the bank rate as a policy instrument not only to maintain price stability, but also to influence the unemployment rate in Namibia. In the same vein, the study aims to find out whether the Phillips curve is applicable to the Namibian economy, by using times series data of inflation, unemployment and bank rate from 1961 to 2012 and employing the Vector Auto Regression (VAR) model to estimate the data. The ADF and PP unit root tests are used to test for stationarity in the data and both these tests find all variables to be stationary at first difference. To test whether a long-run relationship exists between the variables, the Johansen cointegration test is used which rejects the null hypothesis of no cointegration at 5 percent level of significance. This implies that the variables are associated and move together in the long-run. As a result of the cointegration which is detected among the series, the vector error correction (VEC) model is then employed to investigate for short-run properties between the variables. Through the VEC model, the Granger causality test, impulse response functions as well as the variance decomposition test are estimated. The Granger causality test identifies a single unidirectional causality in the series in the case whereby bank rate Granger causes inflation, and this implies that monetary authorities in Namibia do not make decisions about inflation in isolation from the bank rate. The main results reveal that the rates of inflation and unemployment in Namibia are significantly explained by the changes in the bank rate. This means that the bank rate can be used as a suitable policy instrument to address the two evils of inflation and unemployment in the country. The results also indicate that the inflation and unemployment rates are inversely related, which confirms the existence of the Phillips curve in Namibia.

ACKNOWLEDGEMENTS

Firstly, I would like to thank God Almighty for the strength and guidance He has provided me with throughout the course of my studies. Without Him this would not have been possible. Secondly, I would like to extend my sincere gratitude to my supervisors, Dr. O. Kakujaha-Matundu and Dr. J. M. Nyambe, for their dedicated supervision throughout my thesis, as well as the support from Prof. E. Ziramba and Dr. R. Chifamba. I would also like to thank other staff members of the Economics Department at the University of Namibia for their valuable contributions that led to my completion of this programme, especially Ms. T. Kaulihowa for her support and assistance in obtaining data for my thesis. Finally, I thank my parents – my backbone –for their prayers and encouragement, as well as my entire family and friends who have been very supportive and who have endured this important journey with me.

DEDICATION

I dedicate this thesis to my beloved parents for their love, unwavering support and for making me understand the importance of education.

DECLARATION

I, Hileni Shifotoka, declare hereby that this study is a true reflection of my own research, and that this work, or part thereof has not been submitted for a degree in any other institution of higher education.

No part of this thesis/dissertation may be reproduced, stored in any retrieval system, or transmitted in any form, or by means (e.g. electronic, mechanical, photocopying, recording or otherwise) without the prior permission of the author, or The University of Namibia in that behalf.

I, Hileni Shifotoka, grant the University of Namibia the right to reproduce this thesis in whole or in part, in any manner or format, which The University of Namibia may deem fit, for any person or institution requiring it for study and research; providing that The University of Namibia shall waive this right if the whole thesis has been or is being published in a manner satisfactory to the University.

.....

Date.....

Hileni Shifotoka

LIST OF TABLES

Table 5.1: Unit root test results for inflation.....	48
Table 5.2: Unit root test results for unemployment	49
Table 5.3: Unit root test results for bank rate	51
Table 5.4: Results for lag length selection criteria	53
Table 5.5: Modulus results for Inverse Roots of AR Characteristic Polynomial	54
Table 5.6: Results from Johansen Cointegration Test	55
Table 5.7: Results from VEC Granger Causality test	57
Table 5.8: Variance decomposition results for the inflation rate.....	62
Table 5.9: Variance decomposition results for the unemployment rate	62
Table 5.10: Variance decomposition results for the bank rate.....	63

LIST OF FIGURES

Figure 1: Trends for Inflation, Unemployment and Bank Rate for Namibia 1961 - 2013	3
Figure 2: Inflation Trends for Namibia 1961 - 2013	11
Figure 3: Unemployment Trends for Namibia 1960 - 2013	17
Figure 4: Bank Rate Trend for Namibia 1960 - 2013	24
Figure 5: Short-run Phillips Curve.....	26
Figure 6: Long-run Phillips Curve.....	27
Figure 7: Unit root circle for Inverse Roots of AR Characteristic Polynomial	54
Figure 8: Impulse response functions results.....	59

LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller
BON	Bank of Namibia
CMA	Common Monetary Area
CPI	Consumer Price Index
MTI	Ministry of Trade and Industry
NLFS	Namibia Labour Force Survey
NPC	National Planning Commission
NSA	Namibia Statistics Agency
PP	Phillips-Perron
SME	Small and Medium Enterprises
TIPEEG	Targeted Intervention Programme for Employment and Economic Growth
VAR	Vector Auto Regression
VEC	Vector Error Correction

Table Of Contents

ABSTRACT.....	ii
ACKNOWLEDGEMENTS.....	iii
DEDICATION.....	iv
DECLARATION.....	v
LIST OF TABLES.....	vi
LIST OF FIGURES.....	vii
LIST OF ACRONYMS.....	viii
CHAPTER 1: INTRODUCTION.....	1
1.1. Orientation of study.....	1
1.2. Statement of the problem.....	4
1.3. Research Objectives.....	7
1.4. Research Questions.....	7
1.5. Significance of the study.....	7
1.6. Limitations of the Study.....	8
1.7. Organisation of Study.....	9
CHAPTER 2: OVERVIEW OF INFLATION, UNEMPLOYMENT AND BANK RATE IN NAMIBIA.....	10
2.1. Introduction.....	10
2.2. Inflation.....	10

2.2.1. Inflation causes in Namibia	12
2.3. Unemployment in Namibia.....	14
2.3.1. Unemployment Trends in Namibia.....	16
2.3.2. Types and Causes of Unemployment	21
2.4. Bank Rate.....	22
2.4.1. Monetary policy in Namibia	22
CHAPTER 3: LITERATURE REVIEW	25
3.1. Introduction.....	25
3.2. Theoretical Literature Review	25
3.2.1. The Phillips Curve theory	25
3.2.2. Keynes' General theory of Employment, Interest, and Money	27
3.2.3. Hutt's theory of Idle Resources	28
3.2.4. Irving Fisher's theory of Interest	30
3.3. Empirical Literature Review.....	30
CHAPTER 4: RESEARCH METHODOLOGY	37
4.1. Introduction.....	37
4.2. Model Specification.....	37
4.3. Analytical Framework	40
4.3.1. Unit root testing	40
4.3.2. Cointegration.....	41
4.3.3. Granger causality test.....	44

4.3.4. Impulse response functions.....	46
4.3.5. Variance decomposition.....	46
CHAPTER 5: RESULTS AND DISCUSSION.....	47
5.1. Introduction.....	47
5.2. Data Analysis.....	47
5.2.1. Unit root test.....	47
5.2.2. Lag length.....	53
5.2.3. Stability test.....	53
5.2.4. Cointegration test.....	55
5.2.5. Granger causality.....	57
5.2.6. Impulse response functions.....	59
5.2.7. Variance decomposition.....	61
CHAPTER 6: CONCLUSIONS AND POLICY IMPLICATIONS.....	65
6.1. Summary of the Study and Conclusions.....	65
6.2. Policy Implications.....	67
Reference.....	69

CHAPTER 1: INTRODUCTION

1.1. Orientation of study

Inflation has been one of the major macroeconomic challenges facing most developing countries in recent years, and Namibia is not an exception. Inflation is the persistent rise in the general price level of a country over a given time period (Likukela, 2007). An important thing to note is that some prices may increase and others may decrease, but with inflation the increasing prices will outweigh the decreasing prices, and the rise in the price level must be significant and continue over a long period. High and unanticipated inflation leads to reduced returns on capital investment because inflation makes foreign and domestic investors uncertain about the future course of monetary policy (Cohen, Hassett & Hubbard, 1999).

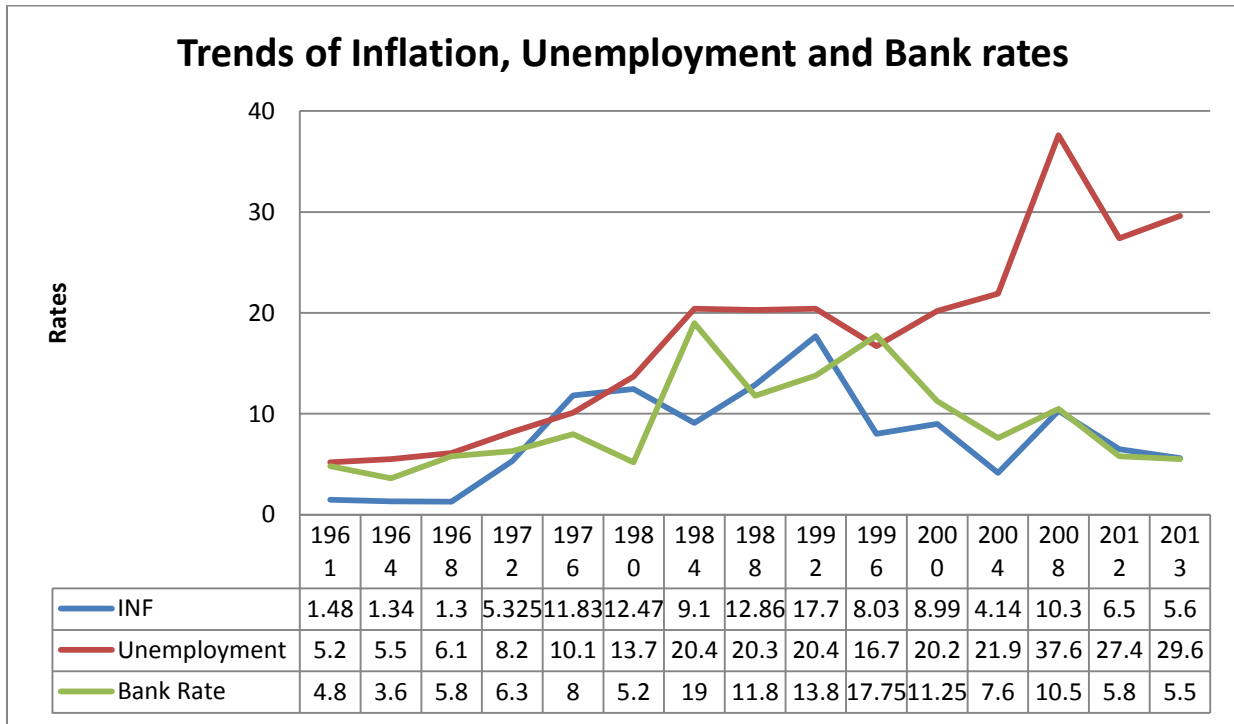
Although for the past 24 years Namibia remained politically stable, there are concerns regarding the continuous increase in inflation and unemployment. The increase in these two variables poses a threat to the macroeconomic stability of the country. The relationship between inflation and unemployment can be depicted by the Phillips curve which was first introduced by Williams Phillips in 1958. Since the Phillips curve shows an inverse relationship between inflation and unemployment, this offers policy makers scope to accommodate some increased levels of inflation.

Ogbokor (2005) examined this relationship for Namibia by estimating an Ordinary Least Squares (OLS) model and using data covering the period 1991 to 2005. In his study, he found that a direct relationship existed between inflation and unemployment which then counters the theory behind the Phillips curve. A possible reason which may have led to Ogbokor's contradicting

results is that he did not incorporate other variables that affect inflation in the model. In this study a more innovative approach was considered in that the bank rate, which is the rate at which commercial banks borrow from the Central Bank, is added to the model.

In line with the broad definition of unemployment, 29.6 percent are without paid employment in Namibia (Namibia Statistics Agency, 2013). Since the Bank of Namibia (BoN) is the custodian for monetary policy in Namibia, it uses the bank rate as its monetary policy instrument to control money growth within the economy and to achieve price stability. Inadequate empirical research work has denied many policy makers and the BoN the opportunity to understand the unemployment and inflation relation, and as a result there has been no active monetary policy instruments applied to effectively curb unemployment in Namibia. Instead, this task has only been left to the fiscal policy architectures.

Figure 1: Trends for Inflation, Unemployment and Bank Rate for Namibia 1961 - 2013



Data source: Various Bank of Namibia Annual Reports, Namibia Statistics Agency (2013), World Bank Development Indicators (2013,) and databases of Hartman (1988) and Ashipala (2010)

Figure 1 depicts the trend of inflation, unemployment and bank rate in Namibia from 1961 to 2013. As it can be seen from the graph, the trend of unemployment in the Namibian economy has always been above the trends of inflation and bank rate, with the exception of 1976 and 1996 when inflation and bank rate slightly exceeded unemployment respectively. Also, the chart shows that the trends of inflation and bank rate slightly follow a similar, although fluctuating, pattern. This can be explained by the fact that the central bank uses interest rates as a monetary policy instrument to control the amount of money in circulation and maintain price stability. When inflation is high, the central bank imposes restrictive monetary policy which increases the

bank rate. The aim is to influence the lending rate of commercial banks in a likely manner so that overall borrowing is discouraged and spending is reduced in the economy. Expansionary monetary policy is used to encourage the level of spending in the economy by central bank reducing its bank rate and the commercial banks following suit with their lending rates.

On the other hand, the chart shows an increasing trend of unemployment over the period under study. The increase has been constant from the early '60s to the late '70s; however, from the early '80s there was a drastic increase in unemployment from 13.6 percent in 1980 to 20.3 percent in 1984. From 1984 to 1992 unemployment remained in a stable range of between 20.2 percent and 20.4 percent. The highest level of unemployment ever recorded in Namibia since the 1960s is 37.6 percent in 2008. This increase in the level of unemployment can be attributed to the spill-over of the fragile global economic conditions which resulted from the global financial crisis of 2007/2008 and high level of retrenchment which took place during that time (Mwinga, 2012).

1.2. Statement of the problem

The current official unemployment rate figure for Namibia is 29.6 percent (Namibia Statistics Agency, 2013). Akintoye (2008) states that countries with relatively big informal sector tend to have lower unemployment compared to those with a small informal sector because most of the labour force is absorbed in the informal sector. In Namibia, the informal sector is relatively small and this may also be a contributing factor to high unemployment. In 2000, Namibia subscribed to the Inflation Targeting Framework that applies to the members of the Common Monetary Area (CMA), namely Namibia, Lesotho, Swaziland and South Africa, the responsibility which is

overseen by South Africa. It is in line with this view that a target band was conceived with the aim of maintaining inflation in Namibia between 3 percent and 6 percent (African Development Bank, 2008). The Monetary authorities strived to achieve this by using the bank rate as the monetary policy instrument. Regardless of these concerted efforts, inflation in the economy has exceeded this target by 0.85 per cent, using annual inflation figures of 2000 to 2012 accompanied by a high level of unemployment.

There are consequences to maintaining high inflation rate and some of which includes its effect of decreasing the real value of money which may translate into the aggravation of social and living standards, and it being a disincentive to attracting potential investors to invest in the economy. According to Likukela (2007) there may also be a possibility of a wage-spiral due to workers demanding increases in their nominal wages to maintain their real income. A country's terms of trade could also be affected by high inflation causing domestic products to become relatively less competitive on the international market.

The UNDP (2007) reported that during the mid-1990s and early 2000 annual inflation rates in Namibia increased slowly, although irregular, being in the range of around 9 percent, except for 1998 which recorded a decline in the rate of inflation. The UNDP (2007) attributed the 1998 decline in inflation to the reduction in the prices of energy and transport while the rise in 2002 was attributed to the rise in the prices of foodstuffs. Inflation rate experienced a rapid fall to below 5 percent in 2004 and 2005 still remaining below the target of 6 percent until 2006. The trend increased during 2007 to 2009 before it gradually started to fluctuate at decreasing rate from 2011 to 2013. Although the inflation pattern has been fluctuating over the years, the

negative impacts have been felt in the economy in the increased cost of living, especially by the low income earners.

As it has already been stated, research has shown that monetary authorities can use monetary policy and influence the level of inflation in the economy. From the existing literature, Ogbokor (2005) investigated the relevance of the Phillips curve in Namibia while Eita and Ashipala (2010) investigated the determinants of inflation in Namibia and tested whether or not the Phillips curve holds for Namibia. Kunst (2011) studied the nature of the relationship that exists amongst the Phillips curve variables and nominal interest rates in the US economy. Interesting to note is that all these three studies investigate the Phillips curve and found different results. Apart from Kunst (2011), Ogbokor (2005) and Eita and Ashipala (2010) did not incorporate the bank rate in their models. Although Kunst (2011) included nominal interest rate in his model, he did not consider how monetary authorities can use bank rate not only as a monetary policy instrument to ensure price stability, but also how it could be used to influence the level of unemployment. Chapter 3 elaborates more on the above mentioned studies.

All these studies suggest that if not controlled, inflation could have negative repercussions on economic growth. Despite the contribution these studies make to the existing literature, they fail to directly address how the bank rate can be used as a determining policy instrument not only to address inflation but also unemployment in Namibia.

Therefore, this current study attempts to fill this gap by introducing bank rate into the model not merely as an instrument for monetary authorities to better steer their monetary policy in order to maintain price stability, but also to influence the level of unemployment in Namibia.

1.3. Research Objectives

The main objective of this paper is to examine the impact of the bank rate on inflation and unemployment in Namibia. In so doing, the study also attempts to understand how the BoN could use the bank rate as a policy instrument to maintain not only price stability but also to influence unemployment in Namibia, and find out the applicability of the Phillips curve to Namibia.

1.4. Research Questions

The research questions for this study are:

- I. How do the rate of inflation and the unemployment rate respond to changes in the bank rate in Namibia?
- II. What is the nature and direction of the causal relationship between the inflation rate and the unemployment rate in Namibia?

1.5. Significance of the study

While this study seeks to investigate the impact of the bank rate on unemployment and inflation in Namibia, it goes further to analyse the inflation-unemployment relation in the context of the Phillips curve. The study of the Philips curve in Namibia is of great importance as it sheds light on the current inflation and unemployment situation in the country. This study is significant as it

not only helps to broaden the knowledge and understanding with regards to the actual inflation-unemployment relationship in Namibia, but it also makes a distinction between what is already known from established theoretical foundation and the real situation as supported by empirical work.

From the results that will be obtained in this paper the monetary authority of Namibia (BoN), who relies on economic analyses for informed policy decisions, will also be able to better steer its bank rate for better and more realistic monetary policy decisions, which unravels the twin evils of inflation and unemployment. These decisions are vital in the development of policies to achieve Namibia's Vision 2030.

1.6. Limitations of the Study

This study will use time-series data for Namibia covering the period 1961 to 2012. Labour Force Surveys in Namibia, which provide data on unemployment and the labour market in general, are conducted only once every four years, making data on unemployment scarce in Namibia. Nonetheless, the unknown data of unemployment for years the Labour Force Surveys were not conducted is retrieved from the database of Hartman (1988) and Eita and Ashipala (2010), whereby mathematically and statistically accepted methods of interpolation and extrapolation were used to generate the unknown data. The same statistical methods were employed to generate unemployment data for 2009-2011. This study, however, acknowledges that the use of data derived from these methods, although statistically accepted, may not be completely accurate.

1.7. Organisation of Study

This study is structured as follows: Chapter One introduces the statement of the problem, the study objectives, the research questions, the significance of the study, and the limitations of the study. The remainder of the paper is divided in five chapters. Chapter Two provides an overview of the three variables used in the study, namely inflation, unemployment and bank rate. Chapter Three gives an overview of the relevant theoretical and empirical literature on the area under study. Chapter Four presents the research methodology which this study is adopting, whereas, Chapter Five deals with the quantitative component of this study as well as the discussion of the results. Conclusions drawn from this study and the policy implications are covered in Chapter Six.

CHAPTER 2: OVERVIEW OF INFLATION, UNEMPLOYMENT AND BANK RATE IN NAMIBIA

2.1. Introduction

This chapter provides a historical overview of the trends and behavior of inflation, unemployment and bank rate in Namibia from 1961 to 2013. It also provides the general description of the three variables, and some causes and types of inflation and unemployment in Namibia.

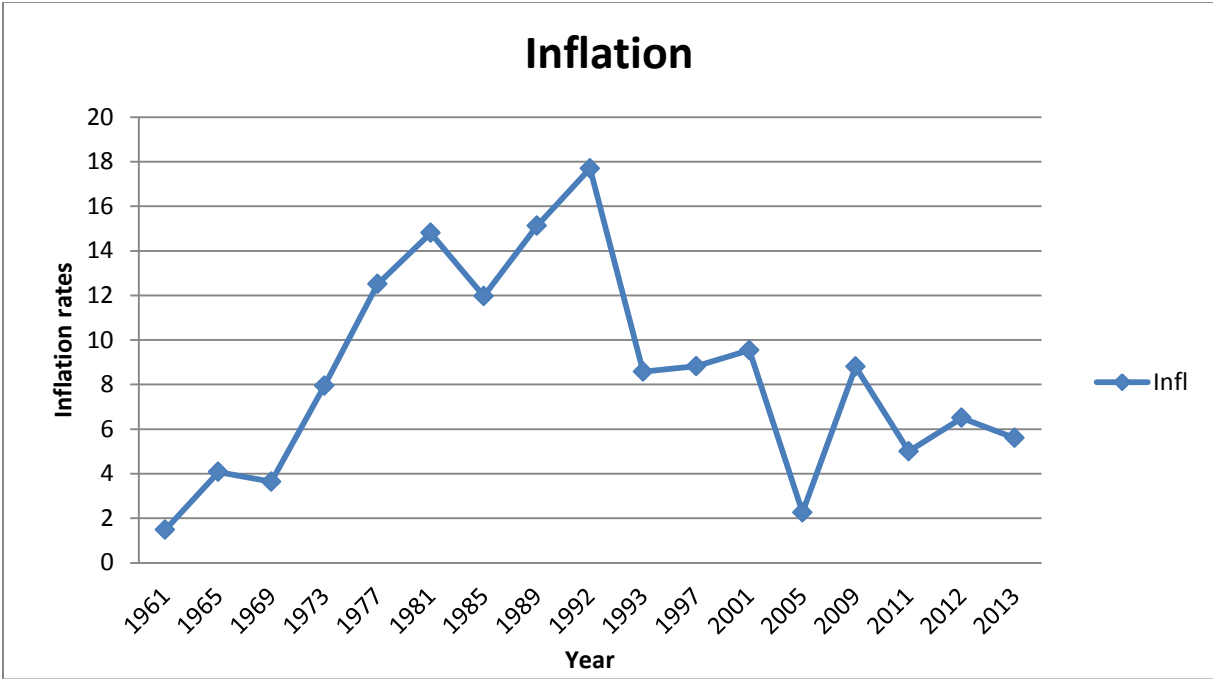
2.2. Inflation

Inflation is one of the economic indicators being closely monitored by policy makers. Inflation is a persistent rise in the overall (or average) level of prices of all goods and services over a given time period (Lim & Sek, 2015). This definition must be distinguished from an increase in relative prices of individual goods, for example an increase in the price of bread or milk, as this is not inflation. Moreover, it is important to note that individual (relative) prices do affect the measurement of inflation but cannot necessarily inform the cause of inflation.

Due to the close trade and monetary relations that exist between Namibia and South Africa, Namibia's inflation rate trend follows closely that of South Africa. Inflation in Namibia is measured by the Consumer Price index (CPI). The CPI is the indicator used as the basis to calculate the rate of inflation as experienced by households in their role as consumers. These consumers are also referred to as CPI target population and include all private households living in urban or rural areas in Namibia (Namibia Statistics Agency, 2013; Likukela, 2007). The inflation rate measures the change in the CPI of the month under review from the previous month

or to the same month in the previous year. According to the Namibia Statistics Agency (2013) the CPI and the inflation rate have become key figures for purposes of economic policy-making, especially the conduct of monetary policy.

Figure 2: Inflation Trends for Namibia 1961 - 2013



Data source: Namibia Statistics Agency (2013)

Figure 2 indicates the trend of inflation from 1961 to 2013. The graph indicates that the inflation trend in Namibia has been fluctuating over the past 50 years. From 1969 to 1981, there was a drastic increase in inflation rate from a low 3.6% in 1969 to a high 14.8% in 1981. After 1981, the trend slightly fell to 11.9 in 1985 before it drastically increased again to reach its highest record of 17.6% in 1992. Likukela (2007) attributed this increase to a cyclical drought which was experienced during this period which led to a severe shortage of cereal crops in Namibia and South Africa. This can be viewed as a classical demand-supply scenario whereby a shortage in the supply of agricultural produce leads to an increase in prices. After 1992 up until 2013 the

trend started to decrease and Namibia started to experience single digit rates, and in 2005 Namibia recorded its lowest inflation rate since independence of 2.3% before it started picking up to 8.8% in 2009.

It is generally argued that high inflation is not good for the economy. High and fluctuating inflation rate is bad for the economy because it increases uncertainty which makes economic decisions more difficult and makes the price signal role less efficient. This may result in lower levels of investment and growth. Furthermore, in countries with high poverty rates, high inflation affects the poor disproportionately more than the non-poor given their food consumption levels and their wealth status. Moreover, it is equally true that very low inflation, also referred to as deflation, is not good for the economy since it indicates economic stagnation.

2.2.1. Inflation causes in Namibia

Although inflation temporarily stimulates the economy by increasing the level of production, it also poses some serious economic problems. It causes instability and thus reduces efficiency and slows down the growth of an economy in the long-run. Inflation can be attributed to many different factors and policies. Moreover, inflation, depending on the actual cause, can be classified into two categories, namely demand-pull and cost-push inflation.

Demand-pull inflation occurs when aggregate demand rises faster than aggregate supply as a result of an increase in the level of national income in the economy. This can also be understood as a case where too much money is chasing too few goods, which then results in increased prices. Demand-pull inflation can also be associated with a government deficit (Haberler, 1960).

Government deficits do not directly cause money growth, however, as a practical matter, government deficits can have an important indirect effect on money supply growth. When the government spends more than it collects from revenue, the treasury must finance the deficit by borrowing in the private marketplace, by for example selling government securities. The increased demand for credit in financial markets, if not offset by a reduction in credit demand from elsewhere or an increase in credit supply, naturally puts upward pressure on all market interest rates. In such a case, monetary authorities may then attempt to prevent the rise in interest rates from taking place.

Another cause under demand-pull inflation is imported inflation. Imported inflation refers to rise in prices, as a result of exchange rate changes, which raises the price of goods brought into a country. With Namibia being a net importer of most of its products, it can be understood why the country is prone to experience imported inflation. A lack of sufficient foreign exchange reserves and the high demand for imported goods, can inevitably lead to exchange rate depreciations and a resulting rise in the price of imported goods. Using data from 1991 to 2001, Ogbokor (2004) analysed the impacts of inflation on the growth of the Namibian economy. The findings were that because of Namibia's openness and high dependence on imports from countries such as South Africa and Germany, growth impact of inflation in the Namibian economy can be counterproductive, especially if inflation is not monitored.

On the other hand cost-push inflation, within the monetary framework, is based on the notion that prices are set by the costs of production and that prices rise only when costs rise, regardless of demand. Inflation, in this framework, is the result of the sellers of productive inputs (including

labour) persistently and unilaterally raising their selling prices, causing producers' costs, and subsequently prices, to rise. As much as Namibia imports most of its consumer products, local producers also import most of their productive inputs. The high prices of these imports (imported inflation) further causes producers to increase the prices they charge locally.

Some of the major causes of inflation in Namibia accounting for about two thirds of the inflation weights are foods, utilities (e.g. energy and water) and transport. This means that any major changes in these items determine the direction of the inflation rate in the country.

2.3. Unemployment in Namibia

In the economics discourse, there are two definitions for unemployment, and depending on the definition used in analysis result may differ. Unemployment can either be defined in the strict (narrow) sense or in the broad (expanded) sense.

Unemployment in the strict sense refers to all persons within the economically active population or working age group who are without work, but are available for work and are actively seeking work. This is the definition used in the publications of the International Labour Organisation (ILO) (Byrne & Strobl, 2001). Unemployment in broad sense, which is also the definition used by the Namibia Statistics Agency (2013), refers to all persons within the economically active population or working age group of between 15 and 65 years, who are available for work and, irrespective of whether or not they are actively seeking work, are without work during the reference period which is usually seven consecutive days before the survey. The two definitions differ on whether an unemployed person is actively looking for work or not.

Unemployment rate is calculated by expressing all unemployed persons (either in the strict or broad sense) as a percentage of the total number of persons in the labour force, and is widely regarded as one of the key labour market indicators and a good measure of current economic activity. The labour force is comprised of the overall economically active population which includes both the employed and unemployed persons. The economically in-active population refers to those that are not in the labour force such as students, senior citizens, and the retired.

For economic and social planning purposes, it is important to have a clear knowledge and understanding of the size, composition and other characteristics of the labour force to enable proper national, as well as regional planning. To enable this, the Namibian government committed itself by conducting labour force surveys. Namibia Labour Force Surveys (NLFS) are an important component of the National Household Survey Programme which is put on the priority list by the Government of the Republic of Namibia because of the needed data on labour force characteristics, and are conducted on a sample basis covering the whole country (Ministry of Labour and Social Welfare, 2008). After Namibia gained independence in 1990, the country's first full scale Labour Force Survey was conducted in 1997. Subsequent Labour Force Surveys that followed were conducted roughly every four years by the Ministry of Labour and Social Welfare in close collaboration with the Central Bureau of Statistics (CBS) of the National Planning Commission (NPC), up until 2008. In 2012 and 2013, the 5th and 6th Labour Force Surveys respectively were conducted, however, this time by the Namibia Statistics Agency (NSA).

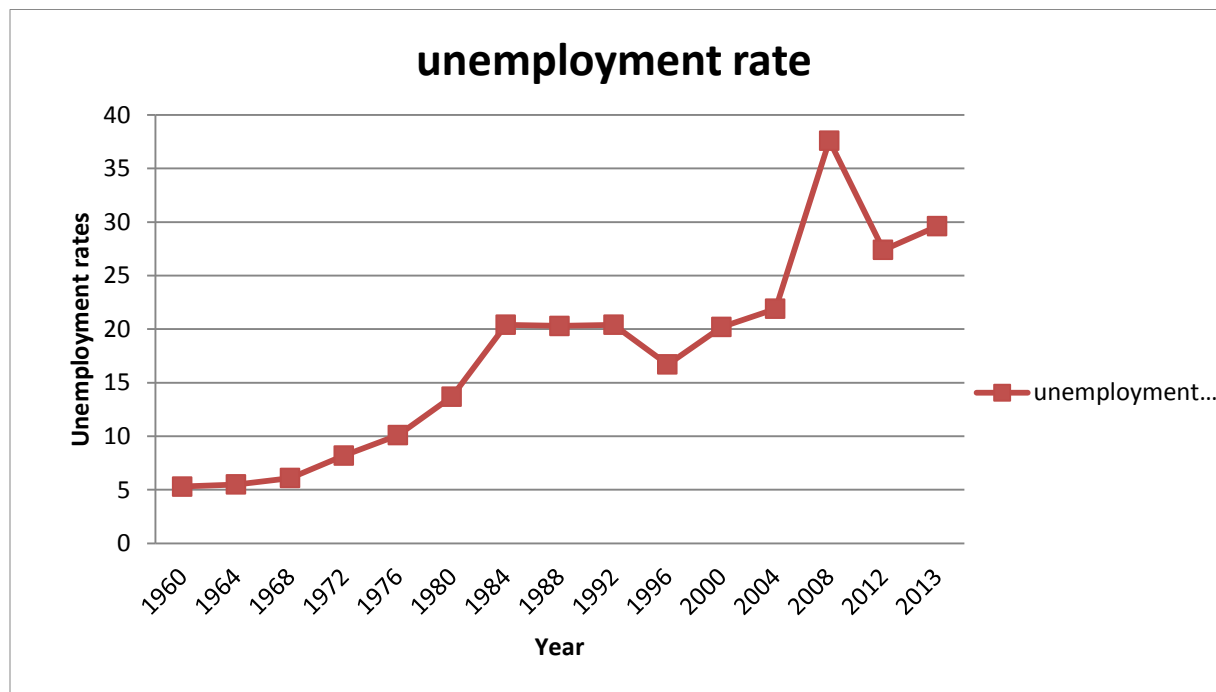
The Namibia Labour Force Surveys, therefore, provide an essential basis for the design and evaluation of overall government programmes geared towards employment creation and promotion as well as the assessment of the social effects of government employment policies.

2.3.1. Unemployment Trends in Namibia

According to the Labour Force Survey conducted by the Namibia Statistics Agency (2012), Namibia's unemployment rate was at 27.4 percent in 2012. This is a reduction from the 37.6 percent official figure recorded in 2008 by the World Bank, as per the broad definition of unemployment. In 2013, unemployment slightly increased by a mere 2.2 percent, from 27.4 percent in 2012 to 29.6 percent (Namibia Statistics Agency, 2013). This increase in unemployment is attributed mainly to the draught which the country experienced in 2013 which had direct and indirect effects. Since most people are employed in the agricultural sector, the draught lead to a reduction in the harvest of crops and size of livestock. Another contributing factor to the increase in unemployment is the still fragile global economy (Namibia Statistics Agency, 2013).

A seen in Figure 3, the 37.6 percent unemployment in 2008 was the highest recorded since the 1960s. Although the Namibian economy, especially banking system, was relatively insulated from the direct effects financial crisis which took place during that period, the economy remained vulnerable to the effects of the crisis through the exchange rate and commodity prices, which as a result reduced economic growth and unemployment (Bank of Namibia, 2008)

Figure 3: Unemployment Trends for Namibia 1960 - 2013



Data source: Namibia Statistics Agency (2013), database of Hartman (1988) and database of Eita and Ashipala (2010)

Another spillover from the global economic crisis which led to an increase in unemployment was the reduction in the number of employed people due to either the closure of companies, downsizing and retrenchments of workers (especially in the mining and fishing industries), due to a decrease in international demand for the respective commodities (Mwinga, 2012).

Moreover, the Ministry of Labour and Social Welfare (2008) further attributes this increase in unemployment to the country's economic and employment policies which it claims have not been sufficiently employment friendly to make a dent in the rate of unemployment.

According to various Labour Force Surveys of the Namibia Statistics Agency, unemployment can be analysed mainly by four distribution categories, namely age, gender, rural and urban distribution, and sectoral distribution. The incidences of unemployment affect those job seekers within the ages of 15 - 40 years according to the Namibia Statistics Agency (2013). In 2012 the overall unemployment rate among ages 15 -19 years was 56.3 percent; 48.5 percent among ages 20 - 24 years, 33.6 percent among those aged 25 - 29 and 20.1 percent among those aged 35 - 39 years. The high unemployment rates for the youth (of whom most are school leavers) can be attributed to the challenges they face to enter the labour market which is mostly due to a lack of the required working experience (Namibia Statistics Agency, 2013).

Moreover, the Namibia Statistics Agency (2013) reported that more females within the ages of 15 - 60 were unemployed compared to males in 2012 in the gender category, with an overall female rate of 31.8 percent as compared to 22.9 percent for males. Unemployment rate in urban areas was recorded to be higher with 28.3 percent than in rural areas with 26.2 percent for both males and females. This can be attributed to the fact that a lot of agricultural activities take place in the rural areas.

With reference to the 23.8 percent fall in unemployment rate between 2008 and 2012; this suggests that there has been an increase in efforts to increase employment activities in the country during that period. One such effort is the introduction of the Targeted Intervention Programme for Employment and Economic Growth (TIPEEG) programme in 2011, an initiative by the government through the National Planning Commission to address unemployment in the

short to medium-term, especially amongst the youth in the country. The target of TIPEEG is to create 104 000 direct and indirect jobs between 2011 and 2014 by focusing on economic sectors with high potential for growth and job creation such as agriculture, tourism, transport, housing and sanitation and public works, with a total budget of 5.5 billion (National Planning Commission, 2011). According to the Ministry of Trade and Industry Annual Report (2013), 27 235 new jobs have been created thus far since TIPEEG's implementation in 2011.

Another initiative by the Namibian government is the Business and Entrepreneurial Development and Promotion programme headed by the Ministry of Trade and Industry (MTI). Under this initiative, MTI provides assistance in the form of equipment and other technology as per requirement to Small and Medium Enterprises (SMEs) in order for them to effectively run their business and subsequently create employment. The scheme is rolled out in all 14 regions of the country and the Ministry's aim is to support businesses that are mainly focusing on manufacturing and adding value to natural resources. Thus far, 433 businesses have benefited from this initiative, which received a budget allocation of N\$ 33.4 Million during the 2012/2013 financial year (Ministry of Trade and Industry Annual Report, 2012).

In addition to other initiatives by the private sector, the above mentioned programmes, although not exclusive, are just a few ongoing initiatives of government aimed at reducing unemployment, increasing productivity and thus improving the livelihood of the population in the country. This is visible in the reduction of unemployment from 37.6 percent in 2008 to 27.4 percent in 2012, as earlier stated.

It is, however, important to note that, according to economic theory, an increase in productivity implies that there is an increase in employment and hence an increase in disposable income. The increase in disposable income in turn increases the aggregate demand and spending in the economy, leading to the elevation of prices and money supply which then fuels inflation in the economy. Hence, any efforts aimed at impacting productivity and the labour market in the country need to be well planned to ensure a balance between the two economic fundamentals, and in order to monitor and assess the impact on the labour market of policies which Government has implemented or plans to implement, it is important to ensure the timely collection and release of labour force data.

Important to note is that in 2008, the Ministry of Labour and Social Welfare (2008) through a national labour force survey recorded an unemployment figure of 51.2 percent for Namibia, as opposed to the World Bank (2008) which recorded an unemployment figure of 36.7 percent for Namibia. Mwinga (2012) concurred with the World Bank results and challenged the results of the national labour force survey in his study “Unemployment in Namibia: Measurement Problems, Causes & Policies”. In his study, Mwinga (2012) attributes the high unemployment figure of 51.2 percent in 2008 recorded by the Ministry of Labour and Social Welfare (2008) mainly to methodological issues such as data gaps, high fluctuations and inconsistencies in labour data due to under-recording. For the sake of this study, the 36.7 percent figure of unemployment is adopted.

2.3.2. Types and Causes of Unemployment

The study of economics identifies three primary categories of unemployment, namely structural unemployment, frictional unemployment and cyclical unemployment. In practice, most countries do not experience one type of unemployment but can experience a combination of two or all of these categories resulting from various causes, although one category could be dominant.

There is a structural type of unemployment which occurs when there is a mismatch of jobs and workers due to the lack of skills (out dated school curricula). Structural unemployment depends on the social needs of the economy and dynamic changes in the economy. This can, for instance, result from advances in technology and changes in market conditions which often turn many skills obsolete and hence increase the unemployment rate.

Frictional unemployment is always present in the economy. It results from temporary transitions made by workers and employers or from workers and employers having inconsistent or incomplete information. This type of unemployment is closely related to structural unemployment due to its dependence on the dynamics of the economy. It occurs because unemployed people may not always take the first job offer they receive because of the wages and necessary skills. This type of unemployment is also caused by failing firms, poor job performance, or obsolete skills. This may also be caused by workers who will quit their jobs in order to move to different parts of the country. Frictional unemployment can be seen as a cost of trying to find a new job and a result of imperfect information on available jobs.

Unemployment that is attributed to economic contraction is called cyclical unemployment. The economy has the capacity to create jobs which increases economic growth. Therefore, an expanding economy typically has lower levels of unemployment. On the other hand, according to cyclical unemployment, an economy that is in a recession faces higher levels of unemployment. When this happens there are more unemployed persons than job openings due to the breakdown of the economy.

Mwinga (2012) pointed out that the nature of unemployment experienced in Namibia is largely structural because even during periods of high economic growth, employment opportunities do not increase faster, implying that economic growth and employment growth in Namibia are negatively related.

2.4. Bank Rate

2.4.1. Monetary policy in Namibia

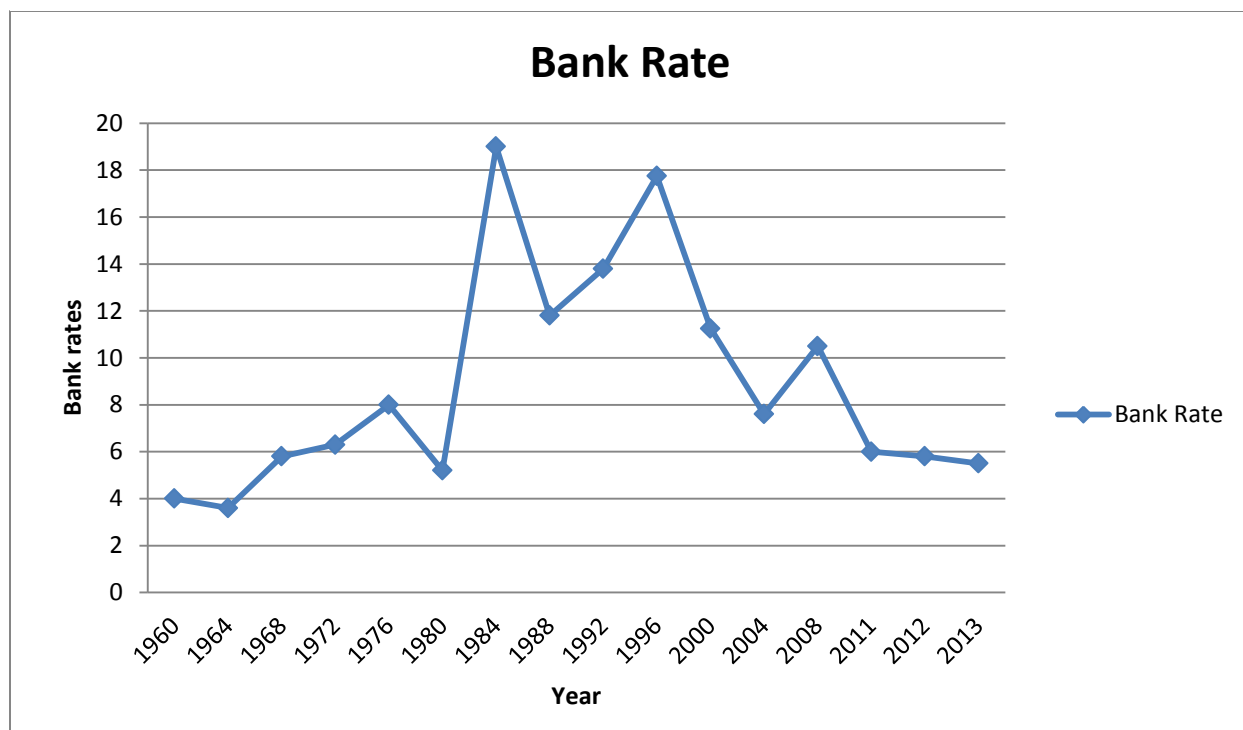
Monetary policy is one of the main components of macroeconomic management that is available to governments and central banks. Over time, however, the conduct of monetary policy has continued to evolve, with the most recent focus on inflation targeting in a range of developed and developing economies. In Namibia, the main objective of monetary policy is to ensure price stability in the interest of sustainable economic growth and the bank rate is the most common tool to influence the monetary conditions in the country. Namibia's monetary policy framework is underpinned by the exchange rate system linked to the South African Rand, and the country's bank rate is kept close to that of South Africa's. Therefore, in addition to domestic and international economic conditions, any changes that the Bank of Namibia wishes to impose on

the bank rate should also consider the repo rate decisions taken by the South African Reserve Bank (Bank of Namibia, 2008).

Shortly after independence, Namibia became a member of the Common Monetary Area (CMA), joining South Africa, Lesotho and Swaziland. Under the CMA, member states have agreed to peg their domestic currencies at par to the South African rand on a one-to-one basis. While the South African rand is legal tender in all member countries of the CMA as per bilateral agreements, the three other currencies are only legal tender in their own country (International Monetary Fund, 2007).

As a member of the Common Monetary Area, Namibia has opted to surrender its right of having a completely independent monetary system. Nevertheless, the country has some level of monetary policy discretion because of capital controls and other prudential requirements. These discretionary powers grant the central Bank of Namibia (BoN) the right to maintain its bank rate at a different level from the bank rate of the South African Reserve Bank, when required (Bank of Namibia, 1993).

Figure 4: Bank Rate Trend for Namibia 1960 - 2013



Data source: Various Bank of Namibia Annual Reports and World Bank Development Indicators (2013)

Figure 4 shows the trend of bank rate in Namibia from 1960 to 2013. As the graph depicts, bank rate has been fluctuating over the past 50 years. From the early 1960s to early 1980s, there has been a steady increase in the bank rate, with the lowest figure recorded in 1964. The trend increased drastically over a four year period from 5.2 percent in 1980 to 19 percent in 1984, this being the highest figure recorded. In the mid-1990s the bank rate trend started to decrease at an increasing rate until 2004 when bank rate stood at 7.6 percent; it increased to 10.5 percent in 2008 and started falling again from 2011 to 2013, recording an average of 5.8 percent over these three years.

CHAPTER 3: LITERATURE REVIEW

3.1. Introduction

In this section, theoretical literature and related empirical literature regarding the Phillips curve and regarding the inflation, unemployment and bank rate relation will be reviewed. This sets the foundation for research methods and basis for supporting the results which will emanate from this research.

3.2. Theoretical Literature Review

3.2.1. The Phillips Curve theory

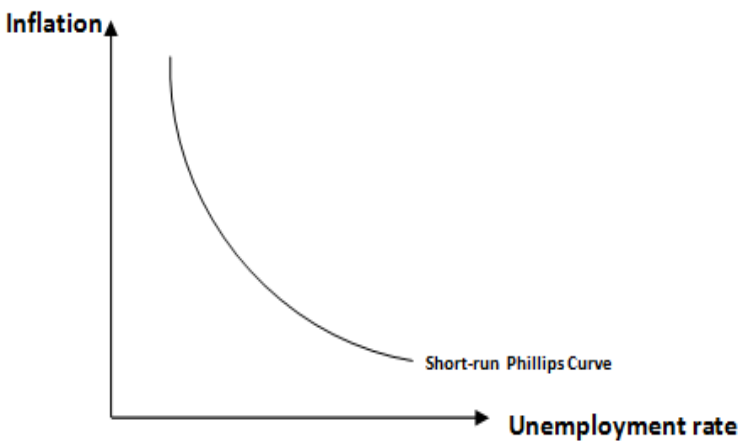
In 1958, New Zealand economist Alban William Phillips (Phillips, 1958) documented a negative relationship between unemployment and money wage rates in the United Kingdom (UK) using nearly 100 observations, from 1861 to 1957, in his published paper titled “The Relationship between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom”. Phillips set out to investigate whether statistical evidence support the hypothesis that the rate of change of money wage rates in the UK can be explained by the level of unemployment and the rate of change of unemployment.

Phillip’s findings were that, as money wage rate increases, unemployment in the economy falls during the period of study, and vice-versa. The original Phillips curve, therefore, describes the relationship between unemployment and money wage. The idea of the Phillips curve as a policy tool was only introduced by Paul Samuelson and Robert Solow in 1960, by estimating the relationship between the rate of inflation and the unemployment rate for the period from 1934 to 1958 (Hall & Hart, 2010). Samuelson and Solow found an inverse relationship between inflation

and unemployment but, however, warned that the Phillips curve had the potential to shift, that is, the trade-off may not be sustainable (Hall & Hart, 2010).

Phillips (1958) shares a common sentiment with the Classical economists that the Phillips curve only exists in the short-run and not in the long-run. With the short-run Phillips curve, the expected inflation rate and the natural unemployment rate are held constant. If inflation rises above the expected rate, unemployment will fall below the natural rate, while if inflation falls below its expected rate unemployment will rise above the natural rate. Hence, the short-run Phillips curve has a negative slope, as illustrated in figure 5:

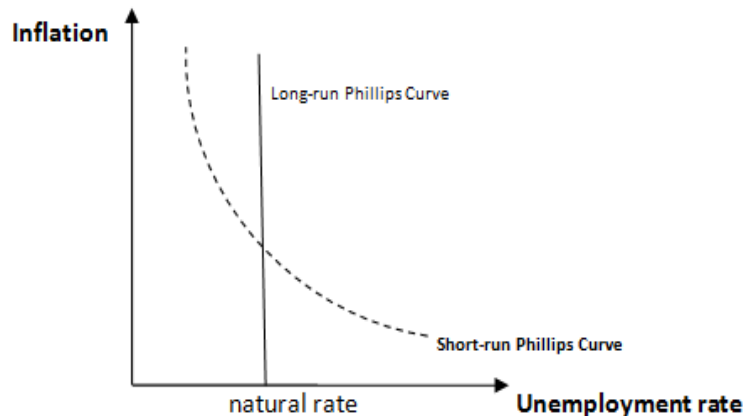
Figure 5: Short-run Phillips Curve



In the long-run, the Phillips curve has a vertical slope which implies that there is no trade-off between unemployment and inflation in the long-run. The long-run Phillips curve differs from the short-run curve in that it does not hold the expected inflation rate constant, although it holds the natural unemployment rate constant. More specifically, the long-run Phillips curve shows the relationship between inflation and unemployment when the actual inflation rate equals the

expected inflation rate. The curve is thus vertical at the natural rate of unemployment, and any level of inflation rate is possible at the natural rate of unemployment, as figure 6 illustrates:

Figure 6: Long-run Phillips Curve



3.2.2. Keynes' General theory of Employment, Interest, and Money

The analysis of Keynes (1936) treats the economy as a whole and focuses on government's use of fiscal policy (spending, deficits, and tax) to manage aggregate demand and thus ensure full employment. Keynes (1936) is an advocate for government intervention in the economy because he deems government's knowledge to be superior to that of the marketplace. According to Keynes (1936) the economy is chronically unstable and subject to fluctuations, and it should, therefore, not be left to the market forces of demand and supply as they alone cannot attain the objective of full employment. The reasons for this are inadequate investment and over saving, both rooted in the psychology of uncertainty. To remedy these problems, the government has to reduce interest rates ultimately to zero to encourage investment, and where necessary, missing private investment should be replaced with public investment. The government should also deliberately continually print money, and borrow and spend as needed so that the deficit spending would in turn create jobs and increase purchasing power.

Keynes further stated that any attempts aimed at balancing the government's budget during a slump would only make things worse, not better. In order to make his argument, Keynes introduced a range of new tools, namely standardised national income accounting (which led to the basic concept of gross national product), the concept of aggregate demand, and the multiplier (people receiving government money for public-works jobs will spend money, which will create new jobs). In summary, this theory strongly believes that the economy should be at full employment all the time hence unemployment is unacceptable, government should borrow to stimulate the economy, booms are good, economic bubbles too are acceptable, however, recession and should be avoided at all cost.

3.2.3. Hutt's theory of Idle Resources

The theory by Hutt (1939) contradicts the theory by Keynes (1936). Hutt strongly believes that full employment as advocated by Keynes (1936) is not definable and it is also not desirable in any economy. He views employment as a means, not an end.

Hutt argues that there is nothing uneconomic or wasteful about idle resources because the holder of a resource can hold back on using the resource for various reasons; and what may look like non-productive idle resources may actually be very productive and essential to the smooth working of a system. Hutt gave an example of a highly trained engineer: Is it more productive for a highly trained but unemployed engineer to bag groceries for payment or is it more productive to invest time without pay in looking for an engineering job? If the engineer takes the grocery bagging job, the economy would be closer to full employment. But on the downside, the

economy would actually not be more productive, which is a prerequisite for the creation of new jobs. Therefore, Hutt's argument is that for an economy to grow, it must change, which means that assets and workers must be shifted from where they are less needed (less productive) to where they are more needed (more productive) to realise the change. These shifts will inevitably produce temporary unemployment. If there had never been unemployment, and thus no economic change.

Another aspect of this theory is that unemployment will always exist in the economy because of two reasons. Firstly, some people may prefer to be unemployed than being employed at low wages. Thus Hutt argues that it makes no sense to develop policies aimed at achieving full-employment as this would entail overriding human choices. The second reason for the prevalence of unemployment is that workers are sometimes compelled to withhold labour due to legal restrictions imposed by capitalists who want to control production. This theory, therefore, strongly believes that unemployment in an economy is a result of mainly labour pricing alongside legal restrictions.

Hutt, who classifies himself as a classical economist, is against government's intervention in the market. He believes that government intervention to stimulate the economy and increase employment not only reduces employment over the long run, but it also creates an enormous amount of sub-optimal employment, which means that it leaves people unable to find the work for which they are best suited like in the example of the highly qualified engineer.

Hutt's theory is also against Keynes' sentiments that governments should continuously print money and reduce interest rates in order to increase spending and investments. Hutt argues that

one cannot create wealth simply by printing more money, and interest rates are a price which affects the entire economy. The main purpose of prices in a market system is to send signals about what consumers want and about the relative availability or scarcity of resources. When government intervenes to reduce interest rates, it therefore disables the price signaling system, which in turn leads investors to make decisions which, in the long run, turn out to be bad decisions. These bad decisions eventually lead, not to employment, but to massive unemployment.

3.2.4. Irving Fisher's theory of Interest

Fisher (1930) investigated the relationship between price changes and nominal interest rate in Great Britain and the United States for the periods 1820 to 1924 and 1890 to 1927 respectively. Fisher's findings were that, in the short-run, there existed no evident relationship between price changes and interest rates in the two countries without lagging the data. The results were, however, different when the data for inflation was lagged and used as a proxy of expected inflation. From the lagged data, Fisher (1930) found that price changes do affect interest rates directly. That is, an increase in prices (i.e. inflation) will lead to an increase in interest rates. Fisher (1930) concluded that though nominal interest rates and expected inflation are directly related, they did so less than his initial hypothesis suggested and only over the long-run.

3.3. Empirical Literature Review

By means of the Ordinary Least Squares model, Ogbokor (2005) investigated the relevance of the Short-run Phillips curve for the Namibian economy, using a short series of annual time series data of inflation and unemployment from 1991 to 2005. Ogbokor used the techniques of

interpolation and extrapolation in order to generate missing data for the years that were not readily available in the various publications that were used for data collation. Contrary to the Phillips curve notion, Ogbokor's results indicated a direct relationship between the two macroeconomic variables. This, in economic literature, is referred to as stagflation. Ogbokor (2005) further advised that authorities could not reduce inflation by raising the unemployment level in the economy or vice-versa. Hence it is important for the authorities to utilise the monetary policy instruments, e.g. the bank rate effectively in order to reach their set objective of price stability. Ogbokor (2005) further emphasised on the need for a favourable macroeconomic environment supported by strong structural reforms, including an export-driven industrialization strategy to aid in enhancing domestic production, boosting employment activities, thus controlling prices of goods and services.

Kunst (2011) did a study to investigate whether a determining relation exists between nominal interest rate and the Phillips curve variables, especially unemployment. This analysis was done by means of a Vector Auto Regression (VAR) model, whereas the Augmented Dickey-Fuller test was used to test for stationarity. Apart from the difference in the countries, Kunst's approach differed from that of Ogbokor (2005) because he added an additional variable – interest rate - to his model and used longer series of quarterly time-series data from 1949 to 2011 of the US economy. This differentiated his approach from that of Ogbokor (2005) who only used inflation and unemployment in his analysis. Kunst (2011) found an inverse relationship between unemployment and inflation, meaning that the Phillips curve holds in the economy of the United States of America (USA), and that there is no significant influence of interest rate on unemployment. This implies that for the US economy, monetary authorities cannot influence

unemployment by adjusting their interest rate. One of the objectives of this study is to also investigate whether bank rate has a significant influence on the rate of unemployment in Namibia.

In light of the Phillips curve notion, contradicting results are obtained by Chicheke (2009) in which he first examined the relationship between monetary policy, inflation and unemployment growth over the period 1980 to 2008, using the Johansen cointegration approach; and then investigated the relationship between inflation and unemployment as explained by the Phillips curve over the same period, in South Africa. The results suggest that there is a long run relationship between inflation and unemployment, and monetary policy reacts more to variations in inflation compared to variations in unemployment. With regard to the relationship between inflation and unemployment in the Phillips curve framework, results indicate that there is a positive relationship between inflation and unemployment, a situation referred to as stagflation.

Eita and Ashipala (2010) found contradicting results compared to Ogbokor (2005) with regard to the Phillips curve in Namibia. By means of an Engle-Granger two-step econometric procedure, Eita and Ashipala (2010) used data for the period 1971 to 2007 to investigate the causes of unemployment in Namibia, and employed the ADF to test for stationarity. The endogenous variables used in the model are inflation, output gap (difference between actual and potential output), and investment. The results revealed a negative relationship between unemployment and inflation, implying that the Phillips curve holds for Namibia. Results also indicated that unemployment responds positively to output gap, provided that actual output is below potential output. This means that if unemployment is to be reduced, output is to be increased to the

country's potential. Investment was found to be negatively related to unemployment, which means that to reduce unemployment, investment in the country should be increased. This conforms to economic theory.

Doğan (2012) investigated the response of Turkey's unemployment rate to shocks in six (6) macroeconomic policy variables, namely GDP growth, export growth, inflation, exchange rate, interbank interest rate and money growth. The study employed the VAR model and considered quarterly data for the period of 2000:Q1 to 2010:Q1. The study found that positive shocks to GDP growth, growth in export and inflation reduce unemployment. Whereas, positive shocks to exchange rate, interbank interest rate and money supply increase unemployment. The findings suggested the existence of the Phillips curve relationship that foresees negative a relationship between unemployment and inflation in Turkey. The findings were also consistent with Okun's Law relationship that expresses a negative relationship between output and unemployment.

Also by means of an unrestricted VAR model, Mahmood, Bokhari, and Aslam (2013) found that there is a significant tradeoff between inflation, interest and unemployment rate of in the Pakistan economy, in the long run. They investigated the relationship among the three variables using quarterly time series data from 1992:Q1 to 2011:Q3. The Johansen Cointegration test and Vector Error Correction Model were employed to find out the long run relationship between the variables. Moreover, the study found that interest and unemployment rates were both negatively related to the rate of inflation, confirming the Phillips curve in the Pakistan economy. But the rate of unemployment did not depend on inflation rate and interest rate, i.e. interest rate and inflation rate do not significantly influence the unemployment rate in Pakistan.

By means of the Ordinary Least Squares (OLS) technique in conjunction with the cointegration and error correction models, Nghifwenwa (2009) investigated the factors influencing investment in the Namibian economy and found that in the long run investment is negatively related to the prime lending rates and the inflation rate in Namibia. Meaning, if inflation is low, central bank will reduce its bank rate and as a result commercial banks will follow suit and reduce their interest rates. Investment in the economy will then increase because investors are attracted to countries with low interest rates as they can borrow more money to finance their investments at low interest rates; and investors are also attracted to economies with price stability. Though, in economic theory investment and inflation are positively related. That is inflation tends to increase when the economy is stimulated, and economic activities such as investment have increased. An increase in economic activities implies that more people are being employed and thus unemployment decrease. Such a situation would conform to Eita and Ashipala (2010).

Likukela (2007) set out to do an analysis on the determinants of inflation in Namibia using Namibian price as the dependant variable, and the real Gross Domestic Product (GDP), broad money supply, interest rate as proxied by lending rate, and South African Price index as well as the United States price index, being the explanatory variables. The study found that foreign prices, as proxied by South African and American Consumer Price Indices, have a significant long-run influence on the level of prices of Namibia. In the short run, inflation in Namibia is only significantly influenced by the inflation coming from South Africa and real GDP. He further went on to state that Namibia remains vulnerable to foreign prices, especially from South Africa, because of its openness and import dependence. These findings were in line with the

findings of Ogbokor (2004) who did an analysis on the impacts of inflation in Namibia. Furthermore, the study failed to establish any significant relationship between the broad money supply, interest rate and price level. This means that broad money supply and interest rate cannot be used to control inflation in the short run. In the long run, however, the study found that interest rate did seem to have a significant effect but it was found to be too small. This could suggest that Namibian consumers are less sensitive to changes in interest rate, which makes the domestic monetary policy less effective in controlling money supply in the economy. Likukela (2007) emphasised on the need to reduce Namibia's dependency on imports through the promotion and enhancement of the manufacturing sector as a major policy implication. He claims that this will not only help to reduce its dependency on import but it will also serve as protection against price volatility.

Robinson (1998) who used monthly observations of the exchange rate, gross domestic product, imported price index to capture imported inflation, interest rate on Jamaican treasury bills and the money base, to forecast inflation in Jamaica by means of a VAR model. Results found that a decline in the rate of depreciation of the exchange rate has an immediate dampening effect on prices. The response to exchange rate shocks suggests that exchange rate stabilisation maybe the most effective way of achieving price stability in the short run in Jamaica. With regards to prices, the results show that the prices do not return to their original level as there is a tendency for inflationary shocks to be long lived. These shocks maybe brought about by the nature of the stabilisation process, the structure of the economy, the production function, and other institutional factors. With regard to interest rate, the analysis showed that a positive shock to expansionary monetary policy (reduction in interest rate) has an unambiguous expansionary

effect on prices. That is interest rate and inflation rate are positively related. This is in contradiction with Eita and Ashipala (2010) and with the theory of Fisher (1930) who found inverse relations between these two variables.

Despite the above, these studies fail to directly address how the monetary authorities can use the bank rate as a determining policy instrument to not only influence inflation but also unemployment levels in an economy, with the exception of Kunst (2011) who did a similar study on the USA economy. This study thus follows the methodology used by Kunst (2011).

CHAPTER 4: RESEARCH METHODOLOGY

4.1. Introduction

The study adopts a desk research. It applies two approaches, namely the qualitative and quantitative methodologies. The qualitative approach covers the description and overview of inflation, unemployment and bank rate in Namibia. The quantitative technique stretches beyond theory and estimates the coefficients of the three variables. It uses econometric techniques to analyse the relationship between monetary policy as represented by the bank rate and two economic fundamentals, inflation and unemployment, in light of the short-run Phillips curve using time series annual data covering the period 1961 to 2012. This chapter, therefore, explains the procedures of data analysis ordered from the unit root test to test for stationarity, cointegration test, causality test, impulse response functions and the variance decomposition.

4.2. Model Specification

The study adopts an approach similar to that of Kunst (2011) where he used the quantitative Vector Auto Regressive (VAR) model to estimate the Phillips curve in the economy of the USA during the period 1949 to 2011 using the same variables identified in this study, namely inflation, unemployment and interest rate. According to Kunst (2011) the VAR approach avoids the need for structural modeling by modeling every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. The VAR model is a natural extension of the univariate autoregressive model to dynamic multivariate time series. Multivariate time series analysis is used when one wants to model and explain the interactions and co-movements among a group of time series variables.

Apart from Kunst (2011), the VAR model has also been employed by other scholars such as Robinson (1998) who used monthly observations of the exchange rate, gross domestic product, imported price index to capture imported inflation, interest rate on Jamaican treasury bills and the money base, to forecast inflation in Jamaica. Another scholar who employed the VAR model is Ratnasiri (2009), who set out to examine the main determinants of inflation in Sri Lanka over the period 1980-2005, using quarterly data of Colombo Consumers Price Index, GDP, money supply, exchange rate, rice price, and interest rate as variables.

The VAR model has proven to be especially useful for describing the dynamic behavior of economic time series and for forecasting. In addition, the VAR model is also used for structural inference and policy analysis. Stock and Watson (2001) pointed out that in structural analysis, certain assumptions about the causal structure of the data under investigation are imposed, and the resulting causal impacts of unexpected shocks on the variables in the model are summarised with impulse response functions and forecast error variance decompositions.

In this study, the general model used represents inflation as a function of unemployment and bank rate, as shown below: $Infl_t = f(Ue_t, Ir_t)$ (1)

The estimated equation is linear. A General Least Model predicts the dependent variable, which in this case is inflation ($Infl_t$), as a function of one or more explanatory variables, which in this case are unemployment (Ue_t) and bank rate (Ir_t). Usually, a linear model in a mathematical form is made up of three components, namely the intercept, the sum of the weighted independent variable and the error term, as shown in the following model:

$$Infl_t = \beta_0 + \beta_1 Ue_t + \beta_2 Ir_t + \varepsilon_t \dots\dots\dots (2)$$

Where ε_t is the error term.

Natural logarithms of the model are then taken in order to do an analysis of elasticities. The log linear form of the model can be stated as follows in equation 3:

$$\log Infl_t = \beta_0 + \beta_1 \log Ue_t + \beta_2 \log Ir_t + \varepsilon_t \dots\dots\dots (3)$$

The expectation is that, the coefficients of both of unemployment and bank rates will be negative. That is, inflation is inversely related to both unemployment and bank rate. Inflation is treated as the depended variable in the model. In this study, inflation is regressed against unemployment and the nominal bank rates. According to economic theory, especially the Phillips curve theory, inflation is inversely related to unemployment in the short-run, and the case is the same in the relationship between inflation and bank rates. This implies that when monetary authorities increase their bank rate, inflation tends to falls. This is because when the Central Bank adjusts its bank rate by increasing it in a quest to reduce inflation, commercial banks in turn respond by increasing their lending rates which reduces the level of borrowing in the economy. A reduction in the level of borrowing results in a decrease in the overall level of income which leads to low aggregate demand/spending, and thus reduces inflation.

Unemployment as a variable is important in the model because it is one of the two critical variables required in the analysis of the Phillips curve. When unemployment is high, according to the short-run Phillips Curve notion, inflation is expected to fall because with less people being employed and receiving an income, and hence the aggregate disposable income in the economy

is also low. This reduces the level of spending in the economy which leads to a fall in the amount of money in circulation and a reduction in inflation.

Bank rate is not a Phillips curve variable, but it enters the model as an additional variable with the aim of determining the possibility of the monetary authority to use it as an instrument not only to influence inflation but also unemployment in the economy. The coefficient of bank rate in the model is expected to be negative. This implies that bank rate and inflation are inversely related. That is, in times of high inflation monetary authorities will increase the bank rate to lower inflation in the country, and in reverse lower the bank rate to increase money circulation in the economy.

4.3. Analytical Framework

4.3.1. Unit root testing

Testing for unit root is the first step in the analysis of data. This test is carried out to avoid the issue of spurious correlation (regressions). Spurious Correlation (regressions) implies that the existence of statistically significant relationships between the variables being modeled, whereas in actual fact there exists no relationship between the variables. When the variables in a regression model are not stationary, then hypothesis testing cannot be carried out on the model parameters. Also regressing and analysing non-stationary data can result to false conclusions and hence misleading policy implications and recommendations. It is therefore important to ensure that the series being used are stationary for the model to be feasible. A time series is only stationary if its mean, variance and covariance are constant through time (Humavindu, 2007).

In order to avoid spurious regression problem, with its related non-stationary pattern of the variables, one can difference the series in order to make the non-stationary series stationary. A time series is integrated if it can be brought to stationarity through differencing. The number of differences required to achieve stationarity is called the order of integration. Time series of order “ x ” are denoted as $I(x)$. For instance, a variable can be stationary after being differenced once. In such a case, the variable is said to be intergraded of order one, in other words $I(1)$. If a variable is not stationary after being differenced once and is only stationary after the second differencing, then the variable is said to be integrated of order two, in other words $I(2)$. If the variable is stationary without differencing, then it is integrated of order zero, in other words $I(0)$ (Likukela, 2007).

For this study, the augmented Dickey Fuller (ADF) test and the Phillips-Perron (PP) tests are applied to test for stationarity. The ADF test takes into account and corrects any auto correlation present by entering lagged values of the dependent variable in the regression. This removes distortions to the level of statistical significance. The PP test adjusts the test statistics to account for serial correlation and it usually gives the same conclusions as the ADF test.

4.3.2. Cointegration

Cointegration is an econometric tool used for empirical analysis in numerous areas, where long-run relationships affect currently observed values. It is modeled using long periods of time series data measured monthly, quarterly or annually to test the linear combination of two or more time series (Ssekuma, 2011). Cointegration is important because it can be used to improve the accuracy of long-run forecast, and to separate short and long-run relationships among variables. Cointegration also implies that restrictions on the parameters and proper accounting of these

restrictions could improve estimation efficiency. Important to note is that cointegration analysis is inherently multivariate, meaning a single variable time series cannot be cointegrated. Assuming that there are two time series A_t and B_t , the following cointegration equation is used to check for cointegration:

$$A_t = \beta_0 + \beta_1 X_t + \mu_t \dots\dots\dots (4)$$

Some popular tests for cointegration are the Engle-Granger (EG) two-step test and the Johansen Maximum Likelihood (ML) test. The former is the most well-known test and was introduced by Engle and Granger in 1987. The EG test investigates the possibility of cointegration in bi-variate models (Humavindu, 2007). It is important to ensure that the series being used are integrated of order one (I(1)) before starting with estimation. Then one proceeds by estimating the two-step procedure for cointegration analysis, namely to estimate the long-run (equilibrium) equation and to estimate the vector error correction model (VECM). The VECM illustrates a clear distinction between long-run and short-run parameters. That is, the ECM describes how parameters behave in the short-run consistent with a long-run cointegrating relationship. This gives a great framework to assess the validity of the long-run implications of theory as well as estimating the dynamic process involved (Halicioglu & Ugur, 2005).

The Engle-Granger method has some limitations. Firstly, it identifies only a single cointegrating relation, among what might be many such relations. A second limitation of the Engle-Granger method is that it is a two-step procedure, with one regression to estimate the residual series, and another regression to test for a unit root. Errors in the first estimation are necessarily carried into the second estimation. The estimated, rather than observed, residual series requires entirely new tables of critical values for standard unit root tests (Ssekuma, 2011). Finally, the Engle-Granger

method estimates cointegrating relations independently of the VEC model in which they play a role. As a result, model estimation also becomes a two-step procedure.

The second test, which is the Johansen Maximum Likelihood test, is viewed as the best way of testing for cointegration restrictions in a VAR model, and was introduced by Johansen in 1988. This process suggests a method for both determining how many cointegrating vectors there are and also estimating all the distinct relationships, and is used in multivariate systems. There are two test statistics produced by the Johansen Cointegration procedure, namely the Trace test and the Maximum Eigen value test, and both tests can be used to determine the number of cointegrating vectors present. The Trace test is a joint test that tests the null hypothesis which states that there are no cointegrating vectors ($H_0 : r = 0$ or $H_0 : r \leq 1$) present against the alternative hypothesis that there is cointegration ($H_1 : r \geq 1$ or $H_1 : r = 2$). Where r = number of cointegrating vectors under the null. The Maximum Eigenvalue test conducts tests on each eigenvalue separately. It tests the null hypothesis that the number of cointegrating vectors is equal to r ($H_0 : r = 0$ or $H_0 : r = 1$) against the alternative of $r + 1$ cointegrating vectors ($H_1 : r = 1$ or $H_1 : r = 2$).

This study makes use of the Johansen ML test because, unlike the EG test which is only suitable for bi-variate testing, it is suitable for multivariate testing (more than two variables). In addition, it also avoids two-step estimators and provides comprehensive testing in the presence of multiple cointegrating relations. Moreover, the Johansen ML approach incorporates the testing procedure into the process of model estimation, avoiding conditional estimates.

The Johansen ML test also has some drawbacks. It is sensitive to lag selection, portrays ambiguity in the presence of conflicting t-values, and it has a tendency to signal cointegration where none exists (Della-Maggiora & Skerman, 2009)

4.3.3. Granger causality test

After conducting the cointegration test, the next step is to examine the causal relationships amongst the variables. Causal relationships are studied because policy makers need to know the consequences of the various actions which they take or plan to take.

In economics as a social science, all different variables affect the same variable simultaneously and repeated experiments under control are infeasible. The case, however, differs in natural sciences where researchers can perform experiments wherein all other possible causes are kept fixed except for the sole factor or variable under investigation; and by repeating the process for each possible cause, one can identify the causal structures among variables (Lin, 2008).

This study employs the Granger causality test to examine whether lagged values of one variable can be used to predict the value of another variable. Using the series used in section 4.3.2 (A_t and B_t) Granger causality implies that series B_t Granger causes series A_t if series B_t can be better predicted using the past values of both A_t and B_t , than it can be predicted using the past values of A_t alone. This is evident in the expectation of A_t given the past values of B_t is different from

the unconditional expectation of B_A . It can also be said that B_t does not Granger cause A_t if all the lagged coefficients of B_t equal to zero. This can be demonstrated as follows:

$$A_t = \beta_0 + \beta_1 A_{t-1} + \dots + \beta_n A_{t-n} + \alpha_1 B_{t-1} + \dots + \alpha_n B_{t-n} + \mu_t \dots \dots \dots (5)$$

Hence, when $\alpha_1 = \alpha_2 = \dots = \alpha_n = 0$, then this implies that the lagged coefficients of B_t do not affect A_t .

Lin (2008), Jacobs, Leamer and Wald (1978) and Granger (1969) highlighted some notable assumptions of Granger-causality. Firstly, the Granger-causality test should only be considered if the series is stationary. It is also important to specify the model correctly in order to avoid spurious relationships. Secondly, when using the variables defined in section 4.3.2 (A_t and B_t), only past values of B_t can Granger cause A_t , because the future cannot cause the past or the present. If B_t occurs after A_t , then it is evident that B_t cannot cause A_t . Moreover, it does not necessarily imply that B_t causes A_t just because B_t occurred before A_t . Thirdly, the variables should be exogenous. That is, for variable B_t to be considered exogenous of variable A_t , then variable B_t must fail to Granger cause variable A_t . The fourth assumption requires the variables to be independent. This means that variable A_t and B_t can only be considered as being independent of each other if they each fail to Granger cause the other. The fifth assumption states that the asymmetry condition should be met. This implies that if B_t Granger causes A_t , then changes in A_t have no effect on the future values of A_t . Lastly, it should be noted that correlation does not imply causality. Correlation or covariance is asymmetric, bi-variate relationship.

Therefore, one cannot infer anything about the existence or direction of causality between A_t and B_t by observing non-zero covariance.

The Pair-wise Granger causality test as proposed by Granger (1969) is thus used in this study to test the selected economic variables. But first, due to its sensitive nature, it is necessary to determine the optimal number of lags.

4.3.4. Impulse response functions

Impulse response functions are essential tools in empirical causal analysis and policy effectiveness analysis. According to Lütkepohl (2008) impulse response functions are useful for studying the interactions between variables in a VAR model, and are more specifically used to determine the effect of shocks in one variable on the other variables in a system.

4.3.5. Variance decomposition

Variance decomposition is an alternative to the impulse response functions, and is used to aid in the interpretation of a VAR model once it has been fitted. It is useful in assessing the pass-through of external shocks to each economic variable and it indicates which variables have short-term and long-term impacts on another variable of interest.

In the next chapter, the data is analysed, and an in depth more practical analysis of the different tests and techniques outlined in this chapter is given.

CHAPTER 5: RESULTS AND DISCUSSION

5.1. Introduction

In this chapter, data for the period 1961 to 2012 is analysed using E-views 6.0. The techniques applied are the unit root test, the lag length criteria, the VAR stability test, the cointegration test, the causality test, the impulse response functions and the variance decomposition technique.

5.2. Data Analysis

5.2.1. Unit root test

The Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test are used to test for stationarity in all the series. In both these tests, the series are tested at level and at first difference, using the intercept and trend models. The null hypothesis being tested states that at 1 percent, 5 percent and 10 percent level of significance there is unit root in the series, against the alternative hypothesis that there is no unit root in the series. The decision rule is that if the absolute value of the t-statistic is greater than the absolute t-critical value, the null hypothesis of unit root existence is rejected. This implies that the series is stationary. If the absolute value of the t-statistic is smaller than the absolute t-critical value, then the null hypothesis is not rejected, which implies that the series is non-stationary (i.e. there exists a unit root). Using non-stationary series can lead to spurious results.

The unit root test results for inflation, unemployment and bank rate are presented in tables 5.1, 5.2 and 5.3 respectively.

Table 5.1: Unit root test results for inflation

ADF Unit root test results for inflation (LNINF)					
Model Specification	t-statistic values	t-critical values			P-values
		1%	5%	10%	
Trend and intercept – levels	-2.271670	-4.144584	-3.498692	-3.178578	0.4413
Trend and Intercept - first difference	-6.999788	-4.161144	-3.506374	-3.183002	0.0000
PP Unit root test results for inflation (LNINF)					
Model specification	t-statistic values	t-critical values			P-value
		1%	5%	10%	
Trend and intercept – Levels	-1.416033	-4.144584	-3.498692	-3.178578	0.8446
Trend and intercept – first difference	-11.07230	-4.148465	-3.500495	-3.179617	0.0000

Source: Author's compilation and values obtained from E-views.

Table 5.1 shows the unit root results from the ADF and PP tests for inflation. The results from the table indicate that at all levels of significance used, the inflation series is not stationary at levels. This is because the absolute t-statistic value of 2.2716 is smaller than the absolute t-critical values of 4.1445 (at 1 percent), 3.4986 (at 5 percent) and 3.1785 (at 10 percent). This is also confirmed by the p-value of 0.4413 being greater than the significant levels of 0.01 (1%),

0.05 (5%) and 0.1 (10%). Therefore, the null hypothesis of unit root is not rejected and it can be concluded that inflation is not stationary at levels.

Nonetheless, when the inflation series is differenced once (first difference), the results differ and the inflation series is found to be stationary at all levels of significance. This is because the absolute t-statistic value of 6.9997 is greater than the absolute t-critical values of 4.1611 (at 1 percent), 3.5063 (at 5 percent) and 3.1830 (at 10 percent). Also, the probability value of 0.000 is less than the significant levels of 0.01, 0.05 and 0.1. The PP-test also shows that the inflation series is stationary at first difference, using the trend and intercept model. Results from the PP-test show that the absolute t-statistic value of 11.0723 is greater than the absolute t-critical values of 4.1484 (at 1 percent), 3.5004 (at 5 percent) and 3.1796 (at 10 percent). The probability value of 0.0000 for the PP-test is also less than the significant levels of 0.01, 0.05 and 0.1.

Therefore, the ADF and PP-tests offer grounds for rejecting the null hypothesis of unit root at first difference for the models with trend and intercept, and conclude that inflation is stationary.

Table 5.2: Unit root test results for unemployment

ADF Unit root test results for unemployment (LNUE)					
Model Specification	t-statistic values	t-critical values			P-values
		1%	5%	10%	
Trend and intercept – Levels	-0.728119	-4.175640	-3.513075	-3.186854	0.9646
Trend and intercept - First	-5.772525	-4.186481	-3.518090	-3.189732	0.0001

difference					
PP Unit root test results for unemployment (LNUE)					
Model specification	t-statistic values	t-critical values			P-value
		1%	5%	10%	
Trend and intercept – Levels	-0.874172	-4.175640	-3.513075	-3.186854	0.9501
Trend and intercept - First difference	-5.765689	-4.186481	-3.518090	-3.189732	0.0001

Source: Author's compilation and values obtained from E-views.

Table 5.2 shows the unit root test results for unemployment from the ADF and PP tests. Using the trend and intercept model at levels, results from the ADF test indicate that the t-statistic absolute value of 0.7281 is smaller than the absolute t-critical values of 4.1756 (at 1 percent), 3.5130 (at 5 percent) and 3.1868 (at 10 percent). The probability value of 0.9646 is greater than the significant levels of 0.01, 0.05 and 0.1. Hence, based on these outcomes the null hypothesis of unit root is not rejected and it can be concluded that unemployment is non-stationary at levels.

Nonetheless, when the ADF and PP-tests are employed respectively, using the trend and intercept models at first difference, the results differ. The results from the ADF test indicate that the absolute t-statistic value of 5.7725 is greater than the absolute t-critical values of 4.1864 (at 1 percent), 3.5180 (at 5 percent) and 3.1897 (at 10 percent), and the probability value of 0.0001 is less than the significant levels of 0.01, 0.05 and 0.1. The results from the PP-test also show that

the absolute t-critical values of 4.1864 (at 1 percent), 3.5180 (at 5 percent), and 3.1897 (at 10 percent) are all smaller than the absolute t-statistic value of 5.7656, with the probability value of 0.0001 being less than the significant levels of 0.01, 0.05 and 0.1. Therefore, both outcomes lead to the rejection of the null hypothesis of unit root, and it can be concluded that the unemployment series is stationary at first difference using the trend and intercept models.

Table 5.3: Unit root test results for bank rate

ADF Unit root test results for the bank rate (LNIR) – Trend and Intercept					
Model Specification	t-statistic values	t-critical values			P-values
		1%	5%	10%	
Trend and intercept – Levels	-0.127401	-4.205004	-3.526609	-3.194611	0.9926
Trend and intercept - First difference	-5.161567	-4.192337	-3.520787	-3.191277	0.0007
PP Unit root test results for the bank rate (LNIR) – Trend and Intercept					
Model specification	t-statistic values	t-critical values			P-value
		1%	5%	10%	
Trend and intercept- Levels	-1.265491	-4.152511	-3.502373	-3.180699	0.8850
Trend and intercept - First difference	-13.08016	-4.161144	-3.506374	-3.183002	0.0000

Source: Author’s compilation and values obtained from E-views.

Table 5.3 depicts the unit root test results for bank rate for both the ADF and PP tests. From the ADF test, results offers scope for not rejecting the null hypothesis of unit root in the bank rate series, at levels using the trend and intercept models. This is because the absolute t-statistic value of 0.1274 is smaller than the absolute t-critical values of 4.2050 at 1 percent level of significance, 3.5266 at 5 percent level of significance and 3.1946 at 10 percent level of significance. This is also supported by the probability value of 0.9926 being greater than the significant levels of 0.01, 0.05 and 0.1. It can, therefore, be concluded that the bank rate is non-stationary at levels using the trend and intercept models.

At first difference, however, the null hypothesis of unit root is rejected in the bank rate series for the trend and intercept model, for both the ADF and PP-test. The ADF test illustrates that the absolute t-statistic value of 5.1615 is greater than the absolute t-critical values of 4.1923, 3.5207, and 3.9112 at 1 percent, 5 percent and 10 percent levels of significance respectively, with the probability value of 0.0007 being less than the significant levels of 0.01, 0.05 and 0.1. The PP-test also shows that the absolute t-statistic value of 13.0801 is greater than the absolute critical values of 4.1611 at 1 percent significance level, 3.5063 at 5 percent significance level and 3.1830 at 10 percent significance level, and a probability value of 0.0000 being less than the significance levels of 0.01, 0.05 and 0.1. Therefore, it can be concluded that the bank rate is integrated of order 1 in both tests.

5.2.2. Lag length

The lag length test was carried out to ensure that the vector auto regression results are not spurious. To select the optimal lag length, the lag length criteria is used in order to select the lag chosen by most criteria and the results are presented in Table 5.4.

Table 5.4: Results for lag length selection criteria

Lag	LR	FPE	AIC	SC	HQ
0	NA	0.005524	3.314902	3.444186	3.360900
1	189.6011*	3.37e-05*	-1.787917*	-1.270785*	-1.603926*
2	5.791190	4.53e-05	-1.501046	-0.596064	-1.179060
3	12.64773	4.75e-05	-1.479066	-0.186235	-1.019087

Source: Author's compilation and values obtained from E-views.

* indicates lag order selected by the criterion.

LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

The optimal lag length is one because it has been chosen by majority of the criteria. It is chosen by the sequential modified LR test statistic LR, Final prediction error FPE, Akaike information criterion AIK, Schwarz information criterion SC, and Hannan-Quinn information criterion HQ all chose (determined) the optimal length at one.

5.2.3. Stability test

To test for stability in the model, the Inverse Roots of AR Characteristic Polynomial graph and table have been generated and the results are presented below in Figure 7 and Table 5.5

respectively. For the VAR model to satisfy the stability condition, all roots should lie inside the circle and the modulus should be less than one.

Figure 7: Unit root circle for Inverse Roots of AR Characteristic Polynomial

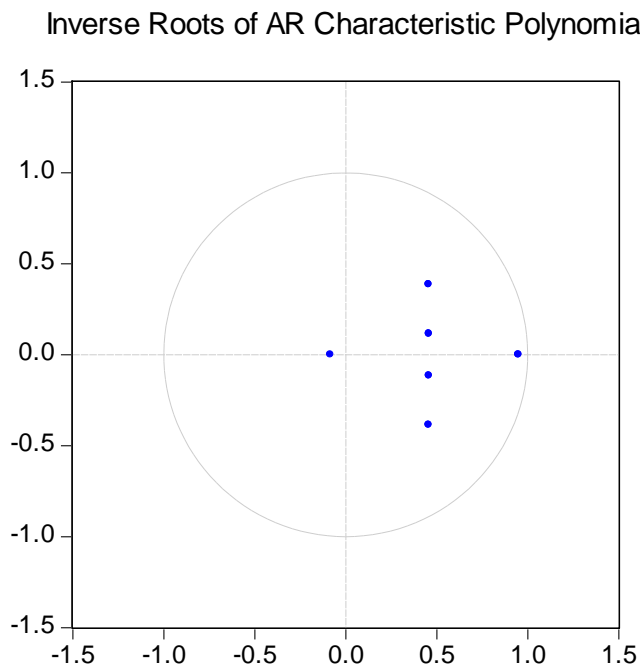


Table 5.5: Modulus results for Inverse Roots of AR Characteristic Polynomial

Root	Modulus
0.949557	0.949557
0.456506 - 0.385494i	0.597498
0.456506 + 0.385494i	0.597498
0.458568 - 0.116086i	0.473033
0.458568 + 0.116086i	0.473033
-0.084601	0.084601

Source: Author's compilation and values obtained from E-views.

Notes: No roots lie outside the unit circle. VAR satisfies the stability condition

From the results illustrated in Figure 7 and Table 5.5 respectively, it can be concluded that the VAR model satisfies the stability condition because all the roots of the polynomial lie inside the circle in Figure 7, and all modulus are less than one at the chosen lag length of one in Table 5.5.

5.2.4. Cointegration test

The Johansen Cointegration Test is used for series that are integrated of the same order and to determine the number of cointegration relations for forecasting and hypothesis testing.

As a basis for rejecting or not rejecting the null hypothesis, the probability values (p-values) will be compared to the 5 percent (0.05) level of significance. The decision rule states that the null hypothesis is rejected when the p-value is less than 0.05; and not rejected when the p-value is greater than 0.05. The results from both tests are presented in Table 5.6.

Table 5.6: Results from Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)			
Hypothesized no. of CE(s)	Trace Statistic	Critical Value 0.05	P-value
None *	36.07337	29.79707	0.0083
At most 1 *	21.68790	15.49471	0.0051
At most 2 *	9.977065	3.841466	0.0016
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)			
Hypothesized no. of CE(s)	Max-Eigen Statistic	Critical Value 0.05	P-value
None	14.38546	21.13162	0.3342
At most 1	11.71084	14.26460	0.1220

At most 2 *	0.230915	3.841466	0.0016
-------------	----------	----------	--------

Source: Author's compilation and values obtained from E-views.

Table 5.6 shows the results from the Cointegration Trace test and the Cointegration Maximum Eigenvalue test. The results from the Trace test indicate that at 5 percent (0.05) significance level, the p-values are 0.0083, 0.0051 and 0.0016 respectively and they are all less than the 0.05 level of significance. Hence, the null hypothesis of no cointegration is rejected. This analysis indicates that there exist 3 cointegrating equations. These cointegrating equations mean that three linear combinations exist between the variables, which imply that the inflation, unemployment and bank rate are associated and move together in the long-run.

The results from the Maximum Eigenvalue test in Table 5.6 indicate that at 5 percent level of significance, the p-values of 0.3342 and 0.1220 are greater than the 0.05 level of significance. This provides the basis for not rejecting the null hypothesis of no cointegration, meaning that no cointegrating equations exist in the series. The null hypothesis of no cointegration is, however, rejected in the case where the p-value of 0.0016 is less than the 0.05 level of significance, which implies that at 5 percent level of significance at most 2 cointegrating equations exist in the series.

Since three cointegrating equations were found to exist from the Trace test, which amongst the two tests provides a more pragmatic estimation, the next step will be to examine the short run relationship amongst the variables by means of the vector error correction model (VECM). The VECM makes it possible to estimate the Granger causality test, the impulse response functions and the variance decomposition tests.

5.2.5. Granger causality

This study employs the Granger causality test to examine whether lagged values of one variable Granger cause those of the other variable, and the results from the VEC Granger Causality test are presented in Table 5.7 For the interpretation of the results, the probability values will be used as a criterion for accepting or rejecting the null hypothesis at 5 percent level of significance.

Table 5.7: Results from VEC Granger Causality test

	Dependant Variable		
Regressor	D(LNINF)	D(LNUE)	D(LNIR)
D(LNINF)	0.0000	0.6580	0.6673
D(LNUE)	0.9041	0.0000	0.2515
D(LNIR)	0.0224	0.5195	0.0000

Source: Author's compilation and values obtained from E-views

Table 5.7 depicts three cases. The first case in which inflation is the dependent variable, the respective null hypotheses being tested state that unemployment does not Granger cause inflation and bank rate does not Granger cause inflation. The probability value for unemployment is 0.9041, which is greater than the 0.05 (5%) level of significance. This implies that the null hypothesis is not rejected and concludes that unemployment does Granger cause inflation at 5 percent level of significance, meaning that past values of unemployment rate do not predict the rate of inflation. In the case of bank rate, the probability value of 0.0224 is smaller than the 0.05 (5%) significance level. This provides the basis for the rejection of the null hypothesis, with the conclusion that the bank rate Granger causes inflation. This indicates that past lagged values of bank rate significantly influence the rate of inflation.

The second case is where unemployment is the dependent variable, and the two null hypotheses being tested state that inflation does not Granger cause unemployment and bank rate does not Granger cause unemployment. The probability values for inflation and bank rate are 0.6580 and 0.5195 respectively, and they are all greater than the 0.05 (5%) level of significance. This implies that at 5 percent significance level, the respective null hypotheses are not rejected, and therefore conclude that inflation and bank rate do not Granger cause unemployment. Hence, the level of unemployment cannot be predicted by the past lagged values of inflation and bank rate.

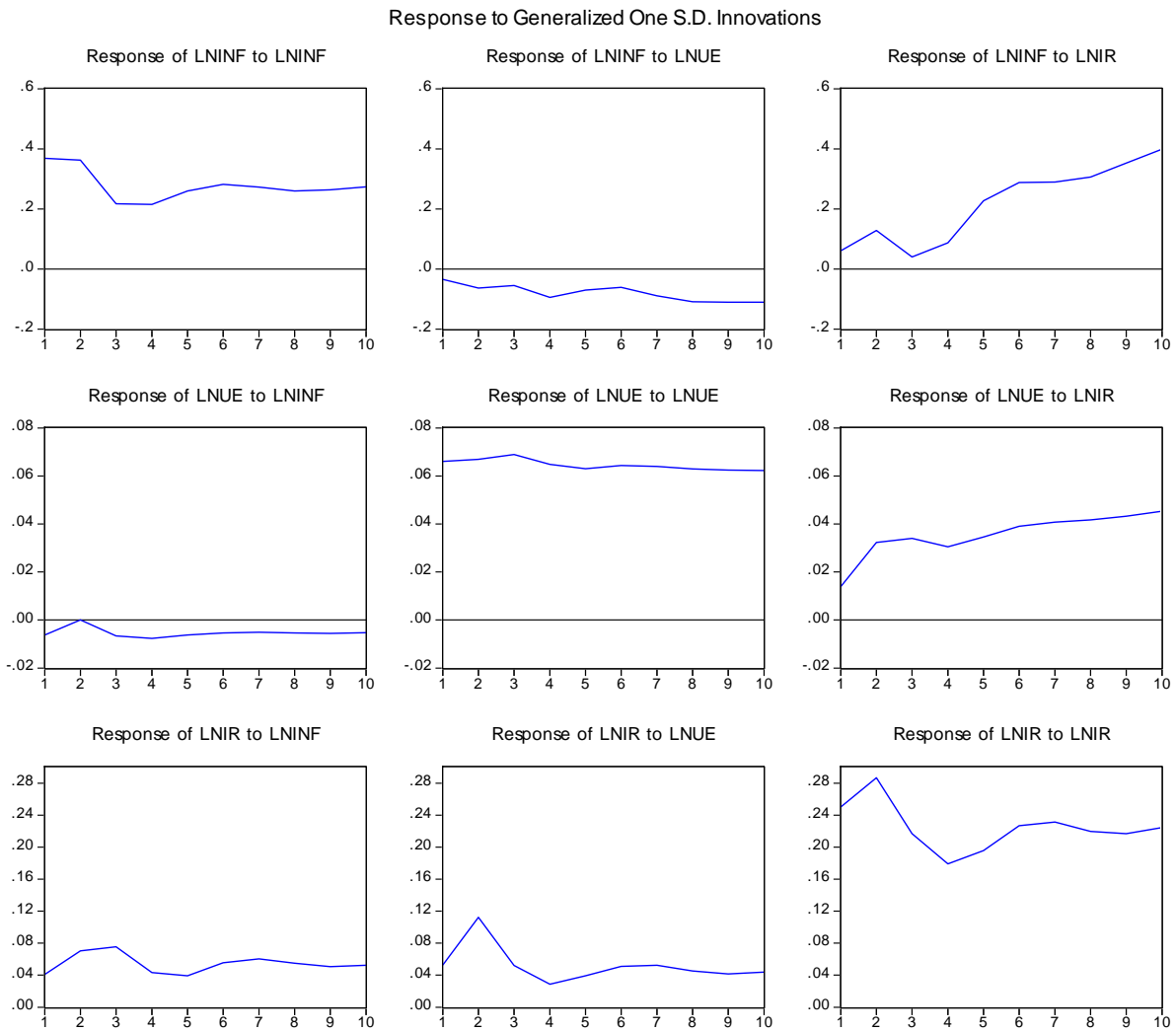
The third case is where bank rate is the dependent variable. The null hypothesis being tested states that inflation and unemployment do not Granger cause bank rate. The probability values for inflation and unemployment are 0.6673 and 0.2515 respectively, and they are both greater than the 0.05 (5%) significance level. This implies that the null hypotheses is not rejected, and conclude that inflation and unemployment do not Granger cause bank rate at 5 percent level of significance. This means that past lagged values of inflation and unemployment rate cannot predict the bank rate.

From table 5.7, it can thus be concluded that there is only a single unidirectional causality in the series. This is evident in the single case where the null hypothesis is rejected. This is the case whereby bank rate Granger causes inflation, however, inflation does not Granger cause bank rate, meaning there is no feedback-effect.

5.2.6. Impulse response functions

Impulse response functions are useful in that they are used to determine the effects of a one standard deviation in one variable on the other variables in a system. These impulse response functions are illustrated below in Figure 8.

Figure 8: Impulse response functions results



From the results in Figure 8, the response of inflation rate to an increase in itself is depicted. An increase in the inflation rate, which could have stemmed from the efforts of the monetary authorities, has an effect on itself which is evident for the consecutive 10 years period. There is a

slight decrease in the rate of inflation from year 1 to year 3 - whilst still in the positive. Though, from year 4 to year 10 the trend starts to increase steadily. The response of inflation rate to a one standard deviation in unemployment is negative. The rate of inflation rate decreases steadily over the 10 years period when there is an increase in the rate of unemployment. This conforms to the Phillips curve theory which depicts an inverse relationship between inflation and unemployment. There are fluctuations in the response of inflation to a one standard deviation in the bank rate from year 1 to year 3, however, from year 4 onwards inflation records a sharp increase and reaches its maximum in year 10. This contradicts economic theory which states that an increase in the bank rate will reduce the inflation rate in the economy. This contradiction can be attributed to other policy shocks which are beyond the scope of this study.

Unemployment rate responds negatively to innovations in the rate of inflation for all 10 years. There is a slight increase in the unemployment rate from year 1 to year 2, however, unemployment rate starts to decrease at a steady rate after year 2 and onwards. This conforms to the Phillips curve notion which implies an inverse relationship between the two variables. This can also be confirmed in the prior case when an increase in the rate of unemployment led to a fall in the rate of inflation. The response of unemployment to a unit variation in itself is positive throughout all the 10 years under consideration. The response of unemployment rate to a monetary policy shock in the bank rate is also positive. When the monetary authorities increase the bank rate, the unemployment rate increases progressively over the 10 years period and this can be attributed to a reduction in borrowings and investment.

There are fluctuations in the trend when the bank rate responds to a standard deviation in inflation. In the first three years (short-run) after an increase in inflation, the monetary authorities will slightly increase the bank rate in an effort to reduce the level of inflation. Once the threat of inflation has been averted, the monetary authorities start to reduce the bank rate steadily after year 3 onwards. When a standard deviation is imposed on unemployment, the bank rate responds with a sharp increase from year one and reaches its maximum in year 2. After the second year, the bank rate falls sharply until year 4 and then the decrease continues in a steadily manner over the remaining years. The results show that fluctuations in the bank rate over most of the period are mostly attributed to itself. The bank rate is at its maximum in the second year, and then it begins to fall drastically reaching its lowest recording in the fourth year. Over the remaining years, bank rate starts picking up but at a steady pace.

5.2.7. Variance decomposition

The variance decomposition technique determines how much of the forecast error variance for any variable in the system is explained by innovations or shocks to each explanatory variable over a series of time horizons (Stock & Watson, 2001). Noteworthy is that, in most cases, own series shocks explain most of the error variance in the short-run, even though shocks will also affect other variable in the system. The results from the variance decomposition technique, also referred to as the alternative method to the impulse response functions, are presented in the following three tables. Table 5.8, Table 5.9 and Table 5.10 depict the variance decomposition forecast for 10 years ahead for inflation, unemployment and bank rates, respectively. For the purpose of interpreting the tables, the results are presented over a two year forecast horizon, whereby year 2 represents the short-run and year 10 represents the long-run.

Table 5.8: Variance decomposition results for the inflation rate

Variance decomposition of LNINF			
Period	LNINF	LNUE	LNIR
2	97.43914	0.314509	2.246350
4	97.96880	2.007125	3.024073
6	79.41806	1.716924	18.86502
8	68.19322	2.349949	29.45683
10	57.50350	2.684771	39.81173

Source: Author's compilation and values obtained from E-views

Table 5.8 shows the variance decomposition results for inflation in Namibia. The influence of inflation shocks on itself dominates throughout the entire time horizon, with 97.43 percent in the short-run and 57.50 in the long-run. The trend is, however, decreasing as the years advance. Whereas, a shock imposed on the unemployment rate leads to minimal yet significant variations in the rate of inflation, with the trend slightly increasing over the time horizon. This can be seen when inflation fluctuations due to a shock in unemployment are 0.31 percent in year two, 1.71 in year six and 2.68 percent in year ten. Table 5.8 also shows that the bank rate becomes significantly stronger in the long-run in explaining fluctuations in Namibia's inflation level.

Table 5.9: Variance decomposition results for the unemployment rate

Variance decomposition of LNUE			
Period	LNINF	LNUE	LNIR
2	0.425010	96.17645	3.398544

4	0.750933	93.74405	5.505013
6	0.745085	91.34115	7.913768
8	0.699599	89.02355	10.27685
10	0.679010	86.77766	12.54333

Source: Author's compilation and values obtained from E-views

Table 5.9 shows the variance decomposition results for unemployment in Namibia. Variations in unemployment that resulted from own shock are dominant in the entire time period, however, the trend in the variations decreases as the time period advances. This can be seen when own shocks in unemployment lead to 96.17 percent variation in year one, 91.34 percent in year six, and 86.77 percent in year ten. It is evident in Table 5.9 that apart from the variations mainly resulting from own shocks, the bank rate is also slightly significant in explaining the variations in unemployment as the years advance. Nonetheless, the inflation rate is not so significant in explaining the variations in unemployment because all the variations in unemployment as a result of a shock in inflation are less than 0.1 percent throughout the entire time duration.

Table 5.10: Variance decomposition results for the bank rate

Variance decomposition of LNIR			
Period	LNINF	LNUE	LNIR
2	4.467022	11.79049	83.74248
4	6.180611	9.639235	84.18015
6	5.883888	8.493870	85.62224
8	6.032053	7.844024	86.12392
10	5.921567	7.248371	86.83006

Source: Author's compilation and values obtained from E-views

Table 5.10 shows the variance decomposition results for the bank rate in the Namibian economy. Variation in the bank rate resulting from a shock in the rate of inflation is significant but fluctuating throughout the time horizon. This is evident for example when the variation in the bank rate resulting from a shock in inflation increases from 4.46 percent to 6.18 percent, from year two to year four, and then it decreases to 5.88 percent in year six. Unemployment rate is slightly stronger in explaining the bank rate fluctuations in Namibia in the short-run, but the trend decreases as the years advance. Whereas, the variations in the bank rate resulting from own shocks are the most dominant throughout the entire time horizon. This can be seen in the 83.74 percent variation in the short-run and the 86.83 percent variation in the long-run of the bank rate resulting from own shocks.

The following chapter provides an overall summary of the study. The answers to the research questions which were asked in Chapter one will also be provided followed by the conclusions and policy implications.

CHAPTER 6: CONCLUSIONS AND POLICY IMPLICATIONS

6.1. Summary of the Study and Conclusions

This study set out to investigate the relationship between the bank rate, unemployment and inflation in Namibia. In so doing, the study also interrogated the policy implications of using the bank rate as a policy instrument not only to maintain price stability but also to influence the unemployment rate in Namibia, and to find out the applicability of the Phillips curve. The study started off by clearly defining the three variables used in the study and reviewing their historic trends. This was followed by an overview of the empirical and theoretical literature on related subject matters. Thereafter, the methodological section followed which entails the analysis and interpretation of the data.

The study used times series data of inflation, unemployment and bank rate from 1961 to 2012 and used the VAR model to estimate the data. By mean of the ADF and PP unit root tests, all variables were found to be stationary at first difference. This outcome provided the basis to test for cointegration in order to investigate the long-run properties of the model. At 5 percent level of significance, the test for cointegration found the existence of 3 cointegrating equations, which implies that the variables are associated and move together in the long-run. As a result of the cointegration which was detected in the series, the vector error correction (VEC) model was then employed to investigate for short-run properties between the variables. Through the VEC model, the Granger causality test, impulse response functions as well as the variance decomposition test were estimated.

The Granger causality test only discovered a single unidirectional causality in the series in the case whereby bank rate Granger causes inflation. This unidirectional causality means that passed lagged values of the bank rate can be used to predict future values or levels of inflation. This confirms that the bank rate can indeed be used by monetary authorities to influence inflation in the Namibia economy.

The results from the impulse response functions show that the rate of inflation responds positively to a one standard deviation in the bank rate, meaning that, in Namibia, when the rate of inflation increases the bank rate also increases, and vice versa. This does not conform to the initial expectation of this study nor with economic theory which states that implementing a restrictive monetary policy (i.e. increasing bank rate) causes a reduction in inflation. This, however, means that if the monetary authorities want to reduce the level of inflation in the Namibian economy, they should reduce the bank rate.

The results from the impulse response functions further indicate that one standard deviation in the bank rate has a positive effect on unemployment in Namibia. This means that when monetary authorities increase the bank rate, unemployment responds by also increasing, and when monetary authorities reduce the bank rate, unemployment will decrease because the commercial banks will also follow suit and reduce their interest (lending) rates. The latter case will encourage borrowing and investment in the economy which will result in an increase in the output level and hence an increase in level of employment. In this context, it can be concluded that the bank rate can be used to influence unemployment. This does, however, not conform to the findings of

Kunst (2011) who discovered that there is no significant influence of interest rate on unemployment in the US economy.

To answer the question whether the Phillips curve exists in Namibia, results from the impulse response function indicated that a one standard deviation in the level of unemployment has a negative effect on inflation. This is also confirmed by the negative response of unemployment as a result of innovations in the rate of inflation. This is consistent with our expectation and therefore confirms the existence of the Phillips curve in Namibia. This also conforms to the findings of Kunst (2011).

6.2. Policy Implications

The results from the study show that the bank rate as a policy instrument can be used to significantly influence the rate of inflation and unemployment rate in Namibia. Therefore, in addition to the fiscal policy instruments that are already used to influence the unemployment level in the country such as government expenditure and taxation, the monetary authorities should align their efforts with the efforts of the fiscal authorities such that they complement each other in order to curb the rate of unemployment in the country. The fiscal and monetary authorities should jointly recognize the use of the bank rate as being detrimental in addressing the two economic evils of unemployment and inflation.

Nevertheless, since the results also found an inverse relationship to exist between the rate of inflation and unemployment rate, confirming the Phillips curve in Namibia, this means that the use of the bank rate as a policy instrument to influence the rate of inflation and unemployment

should be executed with discretion in order to avoid cases whereby the efforts to reduce inflation lead to increases in unemployment above the natural rate, and vice-versa.

Future researchers can investigate the long-run impact of these variables on the gross domestic product (GDP) and the level of foreign direct investments (FDI) in Namibia.

References

- African Development Bank. (2008). African Economic Outlook: Namibia. (*African Development Bank Working Papers*. Author.
- Akintoye, I. R. (2008). Reducing unemployment through the informal sector: A case study of Nigeria. *European Journal of Economics, Finance and Administrative Sciences*, 1(11), 97-106.
- Bank of Namibia. (1993). *Annual report*. Windhoek, Namibia: Author.
- Bank of Namibia. (2008). *Annual report*. Windhoek, Namibia: Author.
- Bank of Namibia. (2008). *Namibia's monetary policy framework*. Windhoek, Namibia: Author
- Byrne, D., & Strobl, E. (2001). Defining unemployment in developing countries: The case of Trinidad and Tobago. *Centre for Research in Economic Development and International Trade*, 1(09), 1-29.
- Cohen, D., Hassett, K., & Hubbard, R. G. (1999). Inflation and the user cost of capital: does inflation still matter?. *The Costs and Benefits of Price Stability*, 1, 199-233.
- Della-Maggiora, D., & Skerman, R. (2009). *Johansen cointegration analysis of American and European stock market indices: An Empirical Study*. Master in Finance Thesis, Lund University, Lund, Sweden.
- Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, 49(4), 1057-1072.
- Doğan, T. T. (2012). Macroeconomic variables and unemployment: the Case of Turkey. *International Journal of Economics and Financial Issues*, 2(1), 71-78.
- Du Plesiss, S., & Burger, R. (2006). A new Keynesian Phillips curve for South Africa. *Journal of Economic Literature*, 37(4), 1661-1707.

- Lütkepohl, H. (2008). *Impulse response function*. (S. N. Durlauf & L. E. Blume, Ed.). London: Palgrave Macmillan.
- Eita, J. H., & Ashipala, J. M. (2010). Determinants of unemployment. *International Journal of Business and Management*, 5(10), 92-104.
- Fisher, I. (1930). *The theory of interest: As determined by impatience to spend income and opportunity to invest it*. Clifton: Augustus M. Kelley Publishers.
- Gloag, A., Gloag, A., & Kramer, M. (2002). *Linear interpolation and linear extrapolation*. US: CK-12 Foundation.
- Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, 37(3), 424-438.
- Halicioglu, F., & Ugur, M. (2005). On stability of the demand for money in a developing OECD country: The case of Turkey. *Global Business and Economics Review*, 7 (2/3), 203-213.
- Hall, T. E., & Hart, W. R. (2010). The Samuelson-Solow Phillips Curve and the great inflation. *Journal of political economy*, 85(3), 451-72.
- Hartman, W. P. (1988). *The role of mining in the economy of South West Africa/Namibia 1950-1985*. Unpublished Master of Economic Sciences Thesis, University of Stellenbosch, South Africa.
- Humavindu, R. R. K. (2007). *Estimating the demand for money in a developing country: The case of South Africa*. Master of Economics Thesis, University of Namibia, Windhoek, Namibia.
- Humphrey, T. M. (1985). The early history of the Phillips curve. *Economic Review, Federal Reserve Bank of Richmond*, 63, 14-22.
- Hutt, W. H. (1939). *The theory of idle resources*. London: Jonathan Cape.

- International Monetary Fund. (2007). *The common monetary area in Southern Africa: Shocks, adjustment, and policy challenges*. (IMF Working Paper African Department No. 07/158). Benedicte Vibe Christensen: IMF.
- Jacob, R. L., Leamer, E. E., & Wald, M. P. (1978). *Difficulties with testing for causality*. (Discussion Papers No. 117). Los Angeles, California: University of California, Departments of Economics.
- Keynes, J. M. (1936). *The general theory of employment, interest, and money*. London: Macmillan.
- Kumar, M. (2012). *An empirical study of Phillips curve in India*. Haryana, India: Central University of Haryana Press.
- Kunst, R. (2011). Estimating the US Phillips curve. *Applied time series analysis*. New York: Universitatwein Press.
- Likukela, M. (2007). *An econometrics analysis of the determinants of inflation in Namibia*. Thesis (M.S.) - University of Namibia, Windhoek, Namibia.
- Lim, Y. C., & Sek, S. K. (2015). An examination of the determinants of inflation. *Journal of Economics, Business and Management*, 3(7), 678-682.
- Lin, J. (2008). *Notes on testing causality*. National Chengchi University, Institute for Economics, Academia Sinica Department of Economics.
- Mahmood, Y., Bokhari, R., & Aslam, M. (2013). Trade-off between inflation, interest and unemployment rate of Pakistan: A cointegration analysis. *Pakistan Journal of Commerce and Social Sciences*, 7(3), 482-492.
- Ministry of Labour and Social Welfare. (2008). *Namibia Labour Force Survey*. Windhoek: Author.

- Ministry of Trade and Industry. (2013). *Ministry of Trade and Industry Annual Report 2012/2013*. Windhoek, Namibia: Author.
- Mitchell-Innes, H. A. (2006). The relationship between interest rates and inflation in South Africa: Revisiting Fisher's hypothesis. *South African Journal of Economics*, 73(4), 657-673.
- Mwinga, M. S. (2012). *Unemployment in Namibia: Measurement problems, causes and policies*. (First Capital Research Working Paper Series). Windhoek: Author.
- Namibia Statistics Agency.(2012). *Namibia Labour Force Survey 2012 Report*. Windhoek: Author.
- Namibia Statistics Agency.(2013). *Namibia Labour Force Survey 2013 Report*. Windhoek: Author.
- National Planning Commission. (2011). *Targeted Intervention Program for Employment and Economic Growth (TIPEEG)*. Windhoek: Author.
- Nghifenwa, N. F. (2009). *Factors influencing investment: A case study of the Namibian economy*. Thesis (M.S.) – The University of Namibia, Windhoek, Namibia.
- Ogbokor, C. A. (2004). Impact of inflation on Namibia: An empirical study. *Journal of Applied Sciences*, 4(4), 644-648.
- Ogbokor, C. A. (2005). The applicability of the short-run Phillips curve to Namibia. *Journal of Social Sciences*, 1(4), 243-245.
- Phillips, A.W. (1958). The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1861-1957. *Economica*, 25(100), 283-299.
- Ratnasiri, H. P. G. S. (2009). *The main determinants of inflation in Sri Lanka: A VAR based analysis*. Sri Lanka: Central Bank of Sri Lanka.

- Robinson, W. (1998). *Forecasting inflation using VAR analysis*. Jamaica: Bank of Jamaica.
- Ssekuma, R. (2011). *A study of cointegration models with applications*. Thesis (M.S.) – University of South Africa, Pretoria, South Africa.
- Stock, J. H., & Watson, M. W. (2001) Vector Autoregressions (VARs): Operational Perspectives. *Journal of Economic Perspectives*, 15(4), 101-115.
- Sumner, S. (2011). The real problem with the Phillips curve. *Journal of Political Economy*, 97(3), 706-720.
- United Nations Development Programme. (2007). Namibia economic review. (*UNDP working paper No. 3*). Windhoek: Author.
- World Bank. (2013). *World Bank Development Indicators*. New York: Author.