THE ROLE OF UGANDA'S MONETARY POLICY IN CONTROLLING INFLATION: A CASE STUDY OF BANK OF UGANDA

BY

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A DISSERTATION SUBMITTED TO THE FACULTY OF SCIENCE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELORS OF SCIENCE IN FINANCIAL MATHEMATICS OF

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DEDICATION

I dedicate this study to my mum Hajat Kaweesa Khadija and brother Katongole Muhammed. Without you I would not have made it this far in my life.

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I humbly appreciate God for the blessings and the opportunities that He has always bestowed on me. Thank you for the faith you have installed in me throughout this entire dissertation and my academic life.

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LIST OF ABBREVIATIONS AND ACRONYMS

91 Day TBR	91 day Treasury bill rate
ADF	Augmented Dickey Fuller
ATC	Akaike Information Criterion
BOU	Bank of Uganda
BR	Bank Rate
CMB	Coffee Market board
CPI	Consumer Price Index
DSP	Differenced Stationary Process
DWT	Durbin Watson
EACB	East African currency board
ECM	Error Correction Model
ERP	Economic Recovery Programme
MPC	Monetary Policy Committee
PPI	Producer Price Index
RR	Rediscount Rate
TSP	Trend stationary process
UBOS	Uganda National Bureau of Statistics

ABSTRACT

The topic of this study is the role of Uganda's monetary policy in controlling inflation with the case study of Bank of Uganda. The main objective of this study was to examine the role of Uganda's monetary policy in controlling inflation and it tested the hypotheses that Bank rate, rediscount rate and the 91-day Treasury bill rate do not play a significant role in controlling inflation. Monthly secondary data from January 2011 to December 2014 that was collected from Bank of Uganda and Uganda Bureau of Statistics was used to analyze the role that Uganda's monetary policy plays in controlling inflation. This study focused on bank rate, 91-day Treasury bill rate and rediscount rate as the tools of Uganda's monetary policy. The study was carried out by adopting an empirical linear model with inflation as the dependent variable. Diagnostic tests such as test for normality, test for stationarity, test for multicollinearity and test for serial correlation were carried on the study variables. The findings of the study showed that the rediscount rate had a positive relationship with inflation while the bank rate and 91-day Treasury bill rate had a negative relationship with inflation. The study concluded that rediscount rate does not affect the level of interest rates therefore Bank of Uganda should increase the bank and the 91-day Treasury bill rates to control inflation in Uganda when the problem arises.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

Monetary policy refers to measures employed by the Central Bank on behalf of the government in the management of demand and supply of money together with the interest rates in order to achieve various economic goals such as high economic growth rate, financial sector stability among others in country (Colander, 2000). Thus, it is a set of objectives aimed towards the growth and stability of the economy. The duty of the conduct of the monetary policy exclusively rests with the central bank of the country, which regulates the money stock through its different tools in order to achieve macroeconomic stability such stabilization of output and prices (Atukwase, 2012). Monetary policy uses a variety of techniques to control one or all of these; economic growth, inflation, exchange rates with other currencies and unemployment to influence economic growth. Inflation is an issue of concern over the world and especially in developing countries (Berg, Laxton, & Karam, 2006). Therefore this study focuses on investigating the role Uganda's monetary policy plays in controlling inflation with a case study of Bank of Uganda.

This chapter presents the introduction to the study. It aims at highlighting and making the research problem clear. It specifically discusses under the background to the study, the problem statement, and the objectives of the study, the hypotheses of the study, and the purpose of the study, the scope of the study and justification of the study. It also includes the conceptual frame work of the study and the definitions of major terminologies used in the study.

1.1 Background of the Study

1.1.1 Historical background

The evolution of Uganda's monetary policy and its developments tracks back from the time Bank of Uganda (BOU) was established in July 1966. Until the establishment of BOU, the East African Currency Board (EACB) issued a common currency that circulated in Uganda, Kenya and Tanzania. BOU did not issue its own currency until January 1967 when its currency was allowed to co-circulate with the EACB currency. It continued to be a legal tender until April 1969 but was still accepted by BOU for conversion purposes only (BOU, 2015).

In 1967, the East African Co-operation treaty came into force. This treaty required the central banks of Uganda, Kenya and Tanzania to coordinate their monetary, balance of payments and interest policies in line with one another. They based their rates on the EACB rate for rediscounting which was at 5%. Treasury bills were availed to commercial banks at a rate of 5% with the hope that they would be repurchased at the same rate in order to encourage them to invest their surplus funds domestically rather than using them to purchase foreign exchange.

In 1968/69 a new banking act came into place and the credit measures were relaxed. This contributed to the lowering of the foreign reserves of BOU. The new banking law aimed at ensuring that commercial banks and other financial institutions operate on sound financial principles and in conformity with overall government economic policy. The law dictated liquidity requirements at 20% of the total deposits of commercial banks.

In 1972 a number of non-national who had for a long time dominated most of the economic sectors were told to give way for the Ugandan nationals. Nearly all the departing non-national

did not liquidate their financial obligations with banks and yet new credit had to be extended to the new Ugandan business men. These factors made the imposition of BOU's restrictive policy inventible. It was further dictated that all banking business be transferred to the Uganda commercial bank, the only state owned bank at that time. This resulted in a number of expatriate banks closing down making UCB the biggest and sole operating bank in the country. Over the period of 1972 -1980 a large part of the monetary sector virtually collapsed.

In 1981, the government embarked on a rehabilitation program to restore economic stability. In October in the field of monetary policy all interest rates were raised sharply. This was partly to mobilize resources for economic development and partly to encourage banking habits while also taking account of inflation. This triggered a shift in the structure of financial assets and treasury bills. Rate in treasury bills were raised again in 1982 and the bank rate and rediscount rate in conformity with the change in interest rate conditions were also adjusted by BOU.

The policy environment changed drastically when the authorities adopted the Economic Recovery Program (ERP) in 1987. The main objective of this policy was to restore macro-economic stability. One of its main objectives was to contain inflationary pressures by restricting the monetary growth. In May of the same year a new Uganda shilling equivalent to 100 old shilling was introduced, coupled with the conversion of 30% and all this intended to reduce the excessive liquidity and generate additional tax revenue. Monetary policy was therefore confronted with the problem of limited monetary growth while accommodating the private sector needs (Anguyo, 2008).

In 1988, a year after the launch of the ERP, emphasis was still put on limiting the financing of the government by BOU in order to control inflation. During the same year the

responsibility for the provision of crop finance was transferred from the government to BOU and this was to enable the Coffee Market Board (CMB) to pay off its liabilities. This contributed to inflationary pressures of about 86% as a result of doubled money supply. This program aimed at controlling credit expansion mainly for crop financing and repayment the debt of the CMB. As a result monetary growth declined, the real GDP growth rate shot higher than 7% and inflation fell to 29% (BOU, 2011).

In 1991/92 annual inflation shot up by 63% and this was because the repayment program that had been initiated the previous year was reversed leading to liquidity expansion. In 1992/93 the government made repayments to the banking system and the rate of inflation plunged to negative 1% on a yearend basis. The Treasury bill auction was initiated in 1992 allowing the participation of commercial banks for the first time and it has been used as a monetary policy tool since then. The new arrangement of allowing banks to hold Treasury bills improved BOU's liquidity management.

In summary, for the period 1971/72 to 1992/93, the conduct of monetary policy was largely subdued to fiscal considerations. Monetary control was exercised through direct means characterized by interest rate and credit controls. Reserve requirements remained unchanged at 10% of commercial banks deposits' liabilities. Interest rates were set and remained administratively unchanged for long periods despite inflation. When they were changed, the adjustments were not high enough to offset inflation. Monetary policy therefore remained virtually dormant even under the stabilization programs. The introduction of indirect monetary policy instruments in 1993 was part of the broader set of reforms in the financial sector which not only included financial sector but macroeconomic stability of the whole economy in general.

1.1.2 Conceptual background

Monetary policy refers to measures employed by the Central Bank in the management of demand and supply of money together with the interest rates in order to influence the level of economic activities (Colander, 2000). According to (Harry, 1993) a policy employing the central banks control of the supply of money as an instrument for achieving the objectives of general economic policy is a monetary policy. Monetary policy is also a policy by the central bank that influences the economy through changes in the money supply and available credit (Colander, 2000).In this study monetary policy was characterized by bank rate, rediscount rate and 91-day Treasury bill rate.

Inflation is the persistent increase in the general prices of goods and services in a given period of time (Colander, 2000). According to (Harry, 1993), inflation is a continual rise in the price level and subsequent fall in the purchasing power in a given period time. Central banks attempt to control severe inflation in an attempt to keep the excessive growth of prices to a minimum. Inflation is the dependent variable of this study.

1.1.3 Contextual background

Bank rate refers to the interest rate charged by the central bank on the loans to commercial banks. (Colander, 2000). Bank rate policy is an important tool of Uganda's monetary policy because its increase or decrease affects the interest rates charged by commercial banks which in turn affect the moneys supply in the economy. According to (Eshag, 1985) bank rate has an influence on inflation since it affects interest rates. If the bank rate is decreased then the interest rates charged by commercial banks are decreased which attracts customers to obtain loans from the bank. Bank rate affects the amount of money in circulation which can consequently lead to inflation. It is therefore necessary to determine the role that bank rate plays in controlling inflation.

Treasury bills are risk-free short term debt instruments regularly issued by Government through Bank of Uganda to the public (BOU). Treasury bills are short term high liquid government security issued at a discount from the face value and returning the face amount at maturity (Zvi, et al. 2009). Treasury bills are usually issued with maturities of 91days, 182 days and 364days (BOU). This study focused on the 91-day Treasury bills. The 91-day Treasury bill rate influences the money supply and can be used to regulate liquidity in the economy since it is regarded as the bench mark of all the rates charged by Bank of Uganda. Since the main objective of Bank of Uganda is to maintain macroeconomic stability it is necessary to determine the role that the 91-day Treasury bill rate plays in controlling inflation.

Rediscount rate is the interest rate at which BOU discounts government securities offered by the holder (Harry, 1993). The Central Bank under the BOU Act 2000 is mandated to issue securities on behalf of Government to the public. The public may rediscount their securities at BOU at an interest rate known as the Rediscount Rate. This rate is pegged to the monetary policy's signaling rate known as the Central Bank rate and the 91-day Treasury bill. It is derived from the average of three recent 91-day Treasury bill annualized yields to reflect market conditions and it also reflects the monetary policy stance at a particular time (BOU, 2015). This rate is increased to encourage the public or commercial banks to buy government securities and this reduces the money supply and can reduce the level of interests charged therefore affecting inflation rates. It is therefore necessary to determine the role that the rediscount rate plays in controlling inflation.

1.2 Statement of the Problem

Inflation is considered a critical factor that affects the economic performance of most countries in Africa. A look at the public opinion polls reveals that inflation at times can be viewed as the most important national problem (Shiller, 1996). The inflation rate of any country should be kept at single digit values for macroeconomic stability. Inflation rates in Uganda have been an unsteady trend. This study focused on the time frame from January 2011 to December 2014. January 2011 kicked off with a 5.0 percent which increased continuously to 18.8 percent in July. It soared to 21.4 percent in August and then to 28.3 percent in September and further increased to 30.5 percent in October and then stood at 27.0 percent in December. In January 2012 the inflation rate was at 25.6 and it decreased in the preceding months and was at 4.4 percent in October of that year (BOU). With that trend it is clear that Bank of Uganda needs to formulate strategies that can keep the inflation rates at one figure for a long time basis. In July 2011, the Bank of Uganda reformed its monetary policy which sought to fight inflation using the amount of liquidity in the market using the Central Bank Rate as the benchmark charged by banks and financial institutions. The CBR is set at a level which is consistent with achieving the policy objectives of the monetary policy (BOU, 2011). Despite the fact that inflation has been a vital macroeconomic problem in Uganda and there have been various monetary policy regimes set to control inflation over the years there is not much research about the role that Uganda's monetary policy plays in controlling inflation. Most researchers have bent their research on interest rate spreads in Uganda and how they affect inflation and on the effectiveness of the monetary policy rather than the role that the monetary policy plays in controlling inflation therefore, it is still not clear if Uganda's monetary policy plays a significant role in controlling inflation. It is further not certain whether the tools that the monetary policy employs play a significant role in

controlling inflation. Because of the above discrepancies; the researcher finds it imperative to undertake this study.

1.3 General objective

The major objective of this study is to analyze the role of Uganda's monetary policy in controlling inflation for the period January 2011 to December 2014.

1.3.1 Specific objectives of the Study

- To examine the role of the bank rate in controlling inflation.
- To assess the role of the 91-day Treasury bill rate in controlling inflation.
- To identify the role that the rediscount rate plays in controlling inflation.

1.4 Research Hypotheses

The study will test the hypothesis that:

- Bank rate has no significant role in controlling inflation.
- 91-day Treasury bill rate does not play any role in controlling inflation.
- Rediscount rate does not play any role in controlling inflation.

1.5 Justification of the study

The researcher carried out this study as a requirement for the award for the degree of Bachelors of Science in Financial Mathematics at Uganda Martyrs University and therefore it was important that it is carried out.

The primary objective of monetary policy to hold the rate of inflation at a single digit value was apparently not achieved as evidenced by the inflation rates over the past years. This

study attempts to closely examine the role of Uganda's monetary policy in controlling inflation with the case study of Bank of Uganda. This study if not carried out Bank of Uganda will not establish the actual role that its different tools play in curbing inflation and therefore appropriate techniques to ensure that inflation rates are kept below 5% over a long period of time may never be adopted.

1.6 Significance of the study

This study attempts to closely investigate the role that Uganda's monetary policy plays in controlling inflation with the case study of Bank of Uganda.

The study suggests significant policy statements through its recommendations. The study makes recommendations on bank rate, 91-day Treasury rate and legal reserve requirement as tools of Uganda's monetary policy. These recommendations enable Bank of Uganda to evaluate its policies in order to achieve better macroeconomic stability which improves economic growth and development.

The study can act as a foundation for further research about Uganda's monetary policy and its influence on inflation since it did not take into consideration all the tools of monetary policy. This leads to a more effective monetary policy since more knowledge will be acquired about it and its role investigated further which leads to price stability in the economy.

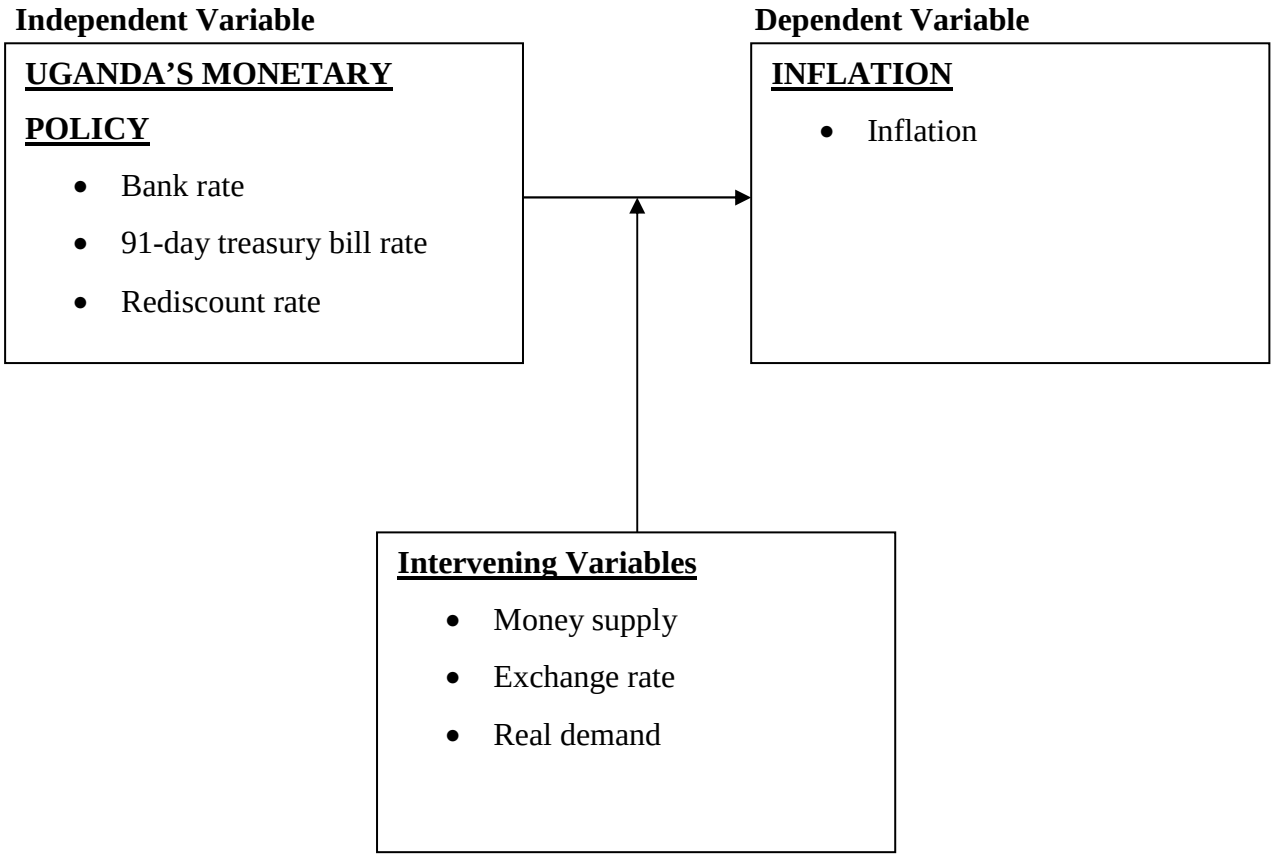
The study improved the research skills of the researcher and also widened their knowledge about Uganda's monetary policy, its tools and the role it plays in maintaining price stability in the economy. This was through analysis of the different documents from Bank of Uganda and Uganda Bureau of Statistics.

1.7 Scope of the Study

The study intended to examine the role of Uganda's monetary policy in controlling inflation in Uganda. . The study was purely based on secondary data and statistical data from Bank of Uganda and Uganda Bureau of Statistics was used. Monthly statistical data on the variables for the period between January 2011 and December 2014 was collected and the quantitative and case study research designs were used. The content of the study was further limited to the bank rate, 91-day Treasury bill rate and rediscount rate as tools of Uganda's monetary policy and their role in controlling inflation was investigated. Uganda's monetary policy was the independent variable and Inflation the dependent variable.

1.8 Conceptual Frame Work

Figure 1.1: Conceptual Framework



Source: Generated by the researcher

The main aim of this study was to analyze the role that Uganda's monetary policy plays in controlling inflation. The independent variable was Uganda's monetary policy and the dependent variable was Inflation. The underlying concept of this framework is that Uganda's monetary policy affects Inflation. Emphasis of the monetary policy is put mainly on three tools such as bank rate, 91-day Treasury bill and rediscount rate which variables affect Inflation. The framework also showed that there are other variables that affect Inflation other than the Uganda's monetary policy which were called the intervening variables. These were money supply, Exchange rate and Real demand.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter examined the theoretical and empirical literature related to the role that different tools of Uganda's monetary policy play in controlling inflation. The theoretical literature presented the different theories that are used to analyze inflation and monetary policy in an economy. The empirical literature presented the literature review from past studies related to the impact of monetary policy on inflation. The chapter was analyzed with the guidance of the objectives of the study. Finally, the chapter concludes with a summary of the theoretical and empirical literature that was reviewed.

2.1 Theoretical literature

2.1.1 Theories of inflation

Various theoretical literatures exist in the literature as to the forces shaping the inflation phenomenon. This study concentrated on the classical and Keynesian theories of inflation.

2.1.1.1 The Classical Theory of Inflation

This theory was developed by different classical economists, Jean Bodin, Richard Cantillon, John Locked, David Hume, Adam Smith and William Petty and is collectively called the "Classical Theory of Inflation". According to this theory, inflation occurs in direct proportion to increase in money supply, given the level of output. The theory goes on to attribute sustained price inflation to excessive growth in the quantity of money in circulation and for this reason it is sometimes referred to as the "quantity theory of money". The classical theory

of inflation is therefore derived directly from the classical quantity theory of money using Fisher's equation,

MV = PT, and P = MV/T or

m + v = p + y p = m + v – y

Where;

p = per cent rate of inflation

m = per cent rise in money supply

v = per cent increase in velocity of money

y = per cent increase in real output

This theory which is contained in the classical theory of inflation is employed to explain the most important and long run determinants of inflation rate and price level. Inflation is a phenomenon which takes the whole economy into its grasp. It spreads across the whole of the economy. It is such a phenomenon which impacts the whole of the economy and is concerned about the value of the mode of exchange in an economy that is, it concerns itself with money (Harry, 1993). With the rise in the supply of money the price rate rises and the value of money falls that causes devaluation of money. The supply of money is controlled by the central bank through a policy of open market. Open market is a powerful tool of controlling the supply of money. The demand of money actually depends on a lot of factors. These factors include interest rates, average level of prices in the economy. Every economy endeavors to reach equilibrium where the demand and supply of the money becomes equal.

2.1.1.2 The Keynesian Theories of Inflation

Keynesian economic theory states that money is transparent to real forces in the economy, and that visible inflation is the result of pressures in the economy expressing themselves in prices (Colander, 2000). This theory consists of mainly two classifications namely the demand- pull inflation and the cost push inflation.

2.1.1.3 Demand- Pull inflation theory

In economics, the demand-pull theory is the theory that inflation occurs when demand for goods and services exceeds existing supplies (Sheffrin, 2003). According to the demand pull theory, there is a range of effects on innovative activity driven by changes in expected demand, the competitive structure of markets, and factors which affect the valuation of new products or the ability of firms to realize economic benefits (Barth and Bennet, 1975).

In this theory, inflation is said to come about when there is a significant increase in aggregate demand in an economy and that increase outpaces aggregate supply. Demand may increase for a number of reasons for example an increase in the money supply. This makes the public have excess money to spend on goods and services and this drives up the prices which causes inflation. The demand pull theory can be conceptualized as a lot of money chasing very few products.

2.1.1.4 Cost-push inflation theory

In this theory, inflation is caused by an increase in prices of inputs like labour, raw material and other factors in the same line. As a result of the higher costs of these production factors, aggregate supply decreases in the economy and because there are fewer goods being produced supply weakens and demand for these goods remains consistent causing the prices of finished goods to increase which leads to inflation (Sheffrin, 2003).

In this theory, the overall price level increases due to higher costs of production which reflects in terms of increased prices of goods and commodities which majorly use these inputs. This is inflation triggered from supply side for example because of less supply. The opposite effect of this is called demand pull inflation where higher demand triggers inflation (Barth and Bennet, 1975).

Apart from rise in prices of inputs, there could be other factors leading to supply side inflation such as natural disasters or depletion of natural resources, monopoly, government regulation or taxation, change in exchange rates and other factors. Generally, cost push inflation may occur in case of an inelastic demand curve where the demand cannot be easily adjusted according to rising prices.

2.2 Empirical literature

There are few empirical studies that have investigated the determinants of inflation in Uganda for example (Mikkelsen, 2005); (Nachega, 2001); (De Grauwe P. and Polan, 2001) and others.

In Mikkelsen (2005), it is shown that broad monetary aggregates have the largest impact on prices, with a 1% increase in money causing prices to increase by 0.24%; changes in interest rates have no effect on prices; inflation is also driven by own innovations (inflation expectations) have a significant but low persistent effect on future prices. Their study also suggests that changes in exchange rate have an impact on price levels, although the feed through effect is less than unity. Although not mentioned in their study, the results on exchange rate suggest that devaluation theory might help to support external macroeconomic stability through competitiveness.

The study by Nachega (2001) on the dynamics of inflation in Uganda, revealed that inflation in Uganda is a monetary phenomenon and this was consistent with a cross-section study by De Grauwe and Poland, (2001).

Chris Ndatira and Mukiza (2011) investigated Current Inflation Trends and found out that inflation has been driven by both domestic and external factors. One main domestic factor is increasing food prices owing to supply constraints. The second domestic factor is exchange rate depreciation. The third one is strong growth in aggregate demand that responded to acceleration of economic activity in the first half of FY 2010/11. External factors included increasing crude oil prices on international market and global inflation in Uganda's major trading partners, implying imported inflation. Finally, high demand for the country's food commodities in the region and rest of the world has put pressure on domestic food prices, owing to supply rigidities.

Kabundi (2012) identified main factors underlying inflation in Uganda, both in the long - and short-run, using monthly data from January 1999 to October 2011. He used a single-equation Error Correction Model (ECM) based on the quantity theory of money including both external and domestic variables. His main finding was that both external and domestic factors explain dynamics in inflation in Uganda. Over the long-run, monetary aggregate, world food prices, and domestic supply and demand effects in agricultural sector are main determinants of inflation in Uganda. While money growth, world food prices, and energy prices, combined with domestic food prices have short-term impact on inflation. Finally, the study finds evidence of inflation inertia which can be attributed to expectations of agents and/or inflation persistence.

The study by Dlamini, Armstrong, & Nxumalo (2001) on the determinants of inflation in Swaziland established that both the interest rates and money supply play no significant role in determining prices in Swaziland but found that changes in the lagged exchange rate, South African inflation, and the nominal wage as key determinants of changes in the consumer price index, the inflation function in Swaziland.

2.2.1 Bank rate and inflation

In this section of the literature review this study seeks to establish the effect of bank rate on the rates of inflation. Bank rate refers to the interest rate charged by the central bank on the loans advanced to commercial banks (Colander, 2000). In the BOU Act 2000, BOU is required to extend loans to commercial banks for a period not longer than three months at an interest rate at least one percentage point higher than the Rediscount Rate known as the Bank Rate. This rate is charged by BOU on loans and advances in order to control money supply in the economy and ensure macroeconomic stability. This rate has a direct influence on inflation because its increase or decrease affects the interest rates charged by commercial banks on the loan packages they provide to their customers.

When the BR is raised, commercial banks are compelled to pay higher interest to BOU which in turn prompts them to raise the interest rates on loans they offer to customers. The customers then are dissuaded in taking credit from banks, leading to a shortage of money in the economy and less liquidity. As a result, inflation is controlled as there is less money circulation and growth suffers as companies avoid taking loans at high rates, leading to a shortfall in production and expansion. For instance, if the availability of funds is scarce because of decreased borrowing and banks are not able to borrow at BR, they may have to increase the deposits rates upwards to attract depositors in order to increase their profitability.

Bernanke and Blinder (1992) argue that the changes to the bank rate lead to changes in the amount of money in circulation which in turn affects the rate of inflation. They show that when the BR is increased the economy is depressed by means of reduction of the loans supply by the commercial banks since they are forced to increase the interest rates which discourage the borrowers. Kashyap and Jeremy (1993) and Gertller and Gilchrist (1993) share the same view. When borrowers are discouraged because of the high interest rates charged, few loans are processed and the level of money supply reduces which in turn reduces inflation.

Nampewo (2010) shows that there is a positive correlation between BR and the rate of inflation using a linear regression econometric model. She argues in her research that the interest rate spreads in Uganda affect the rate of inflation with the BR being the bench mark of all the other interest rates charged by the central bank. She continues to say that the BR affects the commercial banks' cost of funds which affects the interest rates they charge which consequently affects the rate of inflation. (Mwega, 2000) shares the same view and adds that it is possible for the BR to affect inflation because it easily affects the level of interest rates in the economy. In his view, this is possible because the central bank lends large amounts of money to banks on short notice and therefore can easily influence their actions. Eshag (1985) also points out that BR is a monetary policy tool that should be given sufficient attention since it can easily affect the level of interest rates but however does not relate the BR to the rate of inflation.

In their studies, Saunders and Schumacher (2000), (Gelos, 2006), Hesse and Beck (2006) and (Nannyonjo, 2002) came up with empirical evidence to the fact that financial regulation by the central bank through charging different interest rates such as the BR is costly to banks which makes them pass on all of the resultant costs to the customer by hiking the lending

interest rates. However, their studies linked the BR to the lending rates and left out the fact that this rate could consequently have an impact on the rate of inflation.

2.2.2 Rediscount rate and inflation

The Central Bank under the BOU Act 2000 is mandated to issue securities on behalf of Government to the public. The public may rediscount their securities at BOU at an interest rate known as the Rediscount Rate. In the same Act, Bank of Uganda (BOU) is required to extend loans to commercial banks for a period not longer than three months at an interest rate at least one percentage point higher than the Rediscount Rate. This interest rate is known as the Bank Rate. The short term borrowing is collateralized by government securities, that is, Treasury bills and bonds. The BOU fully adheres to the law that requires the central bank to fix and make public at all times its standard Rediscount Rate. Effective July 2011, the derivation of the Rediscount and Bank Rate is pegged to the monetary policy's signaling rate-the Central Bank Rate (CBR). The Rediscount Rate and Bank rate are determined as a margin on the CBR, with the margin and CBR being set by the BOU's Monetary Policy Committee (MPC). For example, the Rediscount rate was 4 percentage points on the CBR and the Bank rate was 5 percentage points on the CBR in October 2012. Before the implementation of Inflation targeting-Lite policy framework in 2011, the Rediscount Rate was pegged to the 91-day Treasury bill annualized yield. It was derived from the average of the three recent 91-day Treasury bill annualized yields to reflect market conditions plus a margin to reflect the monetary policy stance at a time. The Rediscount Rate, therefore, changed as and when 91-day treasury bills had been issued and sold, and/or when there was a change to the margin (BOU, 2015).

Nampewo (2010) shows that there is a negative relationship between RR and the rate of inflation using a linear regression econometric model. She argues in her study that the rediscount rate does not play a big role in affecting the level of interests and therefore does not play a big role in controlling inflation. However Katatrikawe (2010) came up with empirical evidence to show that the RR has a positive relationship with inflation which does not agree with this study since she argues in her study that the rediscount rate is an important tool of monetary policy which plays a role in controlling inflation. She goes ahead to confirm that for the effectiveness of this rate it is mainly tied to the moving average of the 91 day Treasury bill.

2.2.3 91-day Treasury bill rate and inflation

Treasury bill is a short-term investment product offered by the Bank of Uganda on behalf of the government. An investor in Treasury bills lends his or her idle funds to the government at a fixed interest rate for either 91, 182 0r 364 days. When the bill matures, that is at the end of the specific period, the government will repay the principal (the amount it borrowed) plus the specific or agreed interest rate at the time of the purchase. The interest rate payable however depends on the length of the period. You may purchase treasury bills through a licensed Bank of Uganda Primary Distributor and the investor pays nothing as transaction cost. One may choose to take your interest/discount up front or may take it together with the entire principal at the maturity date. On the other hand, investment in treasury bills is risk free. The rate of return on treasury bills can be estimated quite precisely. That is, you are sure of exactly how much you will earn upon the maturity of the investment. Theory thus has it that no investment should be undertaken unless the expected return is high enough to compensate the investor for the perceived risk of investment. The 91 Treasury bill rate is used by BOU to reduce on the amount of money in circulation thereby controlling Inflation. Most studies conclude that this rate is a strong tool to fight inflation in the country.

In their studies, (Okyere & Nanga, 2014), Nampewo (2010), Aboagye (2008) and Nandwa (2006) argue that increase in the 91 day Treasury bill rate increases the rate of interest rates charged which consequently reduce the amount of money in circulation and therefore reduces on the rate of inflation in the country.

Conclusion

Most of the empirical studies reviewed above indicate that inflation can be controlled by the central bank using monetary policy tools used in the study. However there is scarce empirical literature on the role of the central bank rates charged play in effectively controlling inflation in Uganda thus necessitating the present study.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents a detailed description of the research procedure used by the researcher to collect and analyze data used in the study. It involves the description of the research design, data sources and types, data processing and analysis, econometric model specification, variable description, diagnostic tests, final model for analysis, limitations of the study and finally the ethical considerations.

3.1 Research Design

According to Oso and Onen (2005), a research design is a way in which the requisite data can be gathered and analyzed to arrive at a solution. This study conducted a quantitative research design and the case study design. According to Sarantakos (2003), the quantitative methodology involves the use of structured techniques of data collection that allow quantification, measurement and operationalization using quantitative methods of analysis like statistics. Case study is a research design that studies a single entity in detail in order to gain insight into the larger cases (Oso and Onen, 2005). Bank of Uganda was used as a case study and information obtained from there about Uganda's monetary policy was used to ascertain the role it plays in controlling inflation.

3.2 Data sources and types

The study employed secondary time series monthly data in its analysis. The monthly data on all study variables was obtained from Bank of Uganda and Uganda Bureau of Statistics websites. Data on bank rate, rediscount rate, the 91-day Treasury bill rate and inflation was obtained from BOU. Information about inflation was mainly obtained from UBOS.

3.3 Data processing and analysis

3.3.1 Univariate analysis

Univariate analysis explores each variable to describe a phenomenon under study. This data analysis majorly describes and provides facts or data about the variable under study. It does not involve causes or relationships when analyzing the situation or variable in question (Oso and Onen, 2005). Statistics of Bank Rate, 91-day Treasury bill rate rediscount rate and legal reserve requirement were analyzed and frequency tables were obtained showing the retrieved data. Measures of central tendency such as the mean, mode, median and standard deviation were calculated.

3.3.2 Bivariate analysis

Bivariate analysis involves analyzing two variables simultaneously. It deals with causes, relationships, explanations and correlations between two variables (Oso and Onen, 2005).

Bivariate analysis was used in the model where inflation as the dependent variable acted as a function of all the independent variables (Bank rate, 91-day Treasury bill rate and Rediscount Rate). Correlation analysis was done for all the variables under study to determine the strength of the relationship between the independent variables and the dependent variable and this was done using the correlation matrix.

3.3.3 Multivariate analysis

Multivariate analysis involves two or more variables to measure the variables under study. The variables may or may not be dependent on each other (Oso and Onen, 2005).

At this stage, the analysis looked at estimation of the unknown coefficients and the effect of each independent variable (BR, RR and 91-day TB) on the dependent variable (Inflation).

The researcher identified variables which had significant relationship with inflation (with P-value less than 0.05). A linear regression model was used to measure the estimates of coefficients of each independent variable on the Inflation. The Least Squares regression method was used to carry out the analysis since continuous data was generated for inflation and regressed on the Bank Rate, Rediscount Rate and 91- day Treasury bill rate.

3.4 Empirical Model

In this study a linear regression model was used to determine role that Uganda's monetary policy plays in controlling inflation. The study adopted the Kabudi (2012) model which identified main factors underlying inflation in Uganda, both in the long - and short-run, using monthly data from January 1999 to October 2011. He used a single-equation Error Correction Model (ECM) based on the quantity theory of money including both external and domestic variables. His main finding was that both external and domestic factors explain dynamics in inflation in Uganda.

The specification of the model was as follows;

$$INF_t + \alpha_0 + \alpha_1 BR_t + \alpha_2 RR_t + \alpha_3 TB_t + \in_t$$

Where;INF is the monthly inflation rate which is the dependent variable of the study, BR is the monthly Bank rate, RR is the monthly rediscount rate, TB and is the monthly 91-day Treasury bill rate.

3.5 Variable Description

3.5.1 Inflation

Inflation is the sustained increase in the general level of prices for goods and services (BOU). According to Colander (1997), inflation is a continual rise in the price level in a given period

time. It is referred to as an annual percentage and as inflation increases, the purchasing power is eroded (every shilling buys a smaller percentage of a good or service). To measure inflation, a number of goods that are a representative of the economy are put together into what is referred to as the "market basket." The cost of this basket is then compared over time. This results in a price index, which is the cost of the market basket today as a percentage of the cost of that identical basket in the starting year. There are two main price indices that measure inflation such as Consumer Price Index (CPI) and Producer Price Index (PPI). CPI is a measure of price changes in consumer goods and services and PPI is a family of indices that measure the average change over time in selling prices by domestic producers of goods and services. Data about these indices was gotten from UBOS.

3.5.2 Bank Rate (BR)

Bank rate refers to the interest rate charged by the central bank on the loans to commercial banks. (Colander, 2000). Bank rate can also be defined as a rate set independently by BOU depending on its forecast of future inflation and other economic variables (BOU). Bank rate policy is a preferred method by which the central bank can regulate the level of economic activity. Changes in bank rate are reflected in the prime lending rates offered by commercial banks to their customers.

In this study, it is predicted that the BOU uses the bank rate to reduce on the inflation rate in Uganda. The bank rate policy is engaged to reduce the amount of money spent in the economy by increasing the level of interest rates charged by commercial bank since it increases their cost of funds. Conversely, higher bank rates help to reign in the economy when inflation is higher than desired.

Bank rate is expected to have a negative impact on inflation rates. This implies that an increase in the bank rate charged by the central bank on the commercial banks reduces

inflation rate since it increases the commercial banks' cost of funds which they pass on to the public inform of high interest rates which reduces spending and hence the economy is slowed and inflation decreases.

3.5.2 Rediscount Rate (RR)

Rediscount rate is the rate at which BOU discounts government securities offered by the holder (Harry, 1993). According to the BOU Act 2000 the rediscount rate is the rate at which the public may rediscount their securities at BOU. The Rediscount rate is determined on the basis of the four week moving average of the annualized yield of the 91-day Treasury bill plus a policy margin that reflects the monetary policy stance (Katarikawe, 2010).

In this study, it is presumed that BOU increases the RR to encourage the public or commercial banks to buy government securities and this reduces the money supply the level of interests charged therefore reducing inflation rates. When the RR is increased the inflation rates decrease since the money in supply is regulated and so are the general prices of goods and services in the economy. Therefore, the Rediscount Rate is expected to have a negative impact on inflation rates.

3.5.3 91-day Treasury bill rate

The 91- day Treasury bill rate is the interest rate at which a short term debt instrument issued by or on behalf of the Central Bank to generate quick funds needed to finance outstanding obligations and also affect economic activities in the country (Luis, 2010). This bill is issued on behalf of the central bank at either a discount or face value at a competitive weekly basis auction. When the 91-day Treasury bill rate is increased the public is discouraged from purchasing the 91-day Treasury bill since its yield at maturity (after 3 months) is reduced.

In this study, the 91-day Treasury bill rate is generally regarded as an indicator of the interest rate policy being pursued and a benchmark for the rates charged by the commercial banks. Lower Treasury bill rates lead to lower interest rates which mean the public has less money to spend leading to decrease or lower inflation rates. The 91-day Treasury bill rate is expected to have a negative impact on inflation.

3.6 Diagnostic tests

3.6.1 Test for normality

Normality is a condition in which the variables used follow the standard normal distribution. In this test, the null hypothesis is tested against the alternative hypothesis. The null hypothesis states that the sample has a normal distribution, against the alternative hypothesis that is non-normal. A normally distributed data set has a probability density function of the form;

$$f(x,\mu,\sigma) = \frac{1}{\sigma\sqrt{2\Pi}} e^{-(x-\mu)^2/2\sigma^2}$$

If μ = 0 and σ = 1, the distribution is called the standard normal distribution or the unit normal distribution (Wooldridge, 2012).

The Jarque and Bera (1980) statistic was used to test for normality. This statistic measures whether the data under study follows a normal distribution by measuring the difference of the skewness and kurtosis of the series with those from the normal distribution.

It follows the form of;

Jarque-Bera $= \frac{N-k}{6}\left[S^2 + \frac{1}{4}(k-3)^3\right]$

Where;

N is the number of observations under study

k is Kurtosiss

S is Skewness

The null hypothesis (H_0) states that the data has a normal distribution against the alternative hypothesis (H_1) which states that the data that the data has a non-normal distribution.

The null hypothesis was rejected for the cases when probability of the JB statistic was less than 0.05 (significant) and then concluded that the data under study is not normally distributed. For the case where the Jarque-Bera statistic was more than 0.05 (insignificant), it was concluded that the data under study was normally distributed and the histogram formed as a result was bell shaped.

The normality test is useful in identifying periods that indicate deficiencies in the model of the study. It is also useful because hypothesis testing requires specification of the distribution of a test statistic under the null hypothesis. In regression analysis the test statistic often depends upon the disturbances which are usually assumed to be normally distributed.

3.6.2 Test for stationarity

Stationarity or non-stationarity of variables depends on the variation of its moments (mean, variance and auto covariance) over a period of time. If the joint statistical distribution of any collection of the time series variables and never depends on time (the mean, variance and any moment of a variable is the same for whichever variable you choose) then it's called **strict stationarity**. However for day to day purposes strict stationarity is too strict and therefore we assume a constant mean, a constant variance and an auto covariance that does not depend on the actual time it was computed. This is called **stationarity of second order** which is what was referred to in this study.

A variable is said to be stationary (of second order) if its mean and variance are constant over time and the value of the covariance between the two time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed (Gujarati, 2004). A stationary time series tends to return to its mean (called mean reversion) and volatility around this mean (measured by its variance) have broadly constant amplitude.

The Augmented Dickey Fuller (ADF) unit root test was used to test the variables under study for stationarity. The ADF statistic is a negative number and the more negative it is, the stronger the rejection of the hypothesis that there is a unit root test at some level of confidence (Fuller, 1976).

The ADF test is applied to the following model;

$$\Delta y_t = \alpha + \beta_t + \mu y_{t-1} + \delta_1 \Delta y_{t-1} + \ldots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t$$

Where;

α is a constant

β is the coefficient on a time trend

p is the lag order of the auto regressive process

ε_t is the error term

Imposing the constraints $\alpha = 0$ and $\beta = 0$ on the model above corresponds to modeling a random walk and using the constraint $\beta = 0$ corresponds to modeling a random walk without a drift.

By including lags of order p the ADF model allows for higher order auto regressive processes and the lag length p has to be determined when applying the test. The lag length was

determined by the use of Akaike's Information Criterion (AIC). This was considered because it is considered superior to other criterions (Liew, 2004). It is considered superior because it minimizes the chance of under estimation while maximizing the chance of recovering the true lag length.

The unit root test was then carried out the null hypothesis $\mu=0$ against the alternative hypothesis $\mu<0$. The ADF test statistic was computed and compared to the relevant critical value. The null hypothesis was rejected when the ADF test statistic value was less than (more negative) the critical value.

The weakness in the ADF test is that the power of the test may be adversely affected by not specifying the lag length accurately (Rao, 1994).

3.6.3 Correcting for non-stationarity

A non-stationary variable can be transformed into stationary one by differencing or by removing its trend. If a non-stationary variable turns into a stationary one by differencing (once or more), it is called Differenced Stationary Process (DSP). If a non-stationary variable turns into a stationary one by removing its trend, it is called Trend Stationary Process (TSP). In general, if a non-stationary time series has to be differenced *d* times to make it stationary, that time series is said to be integrated of order *d*. Most economic time series are generally I(1); that is, they generally become stationary after taking their first differences (Gujarati, 2004).

In this study all the variables were tested for stationarity and the times series data became stationary after it was differenced one time so there was no need to continue to the second time. The hypothesis that the series were not stationary was therefore rejected.

3.6.4 Test for multicollinearity

Multicollinearity is a situation in which two or more explanatory variables in a multiple regression model are highly linearly related (Kumar,Krishna, 1975). It is a phenomenon in which two or more predictor variables in a multiple regression model are highly correlated meaning that one can linearly predicted from the others with a non-trivial degree of accuracy. In this situation the coefficient estimates of the multiple regressions may change erratically in response to small changes in the model or the data.

Multicollinearity can be detected if there are large changes in the estimated regression coefficients when a predictor variable is added or deleted. It can also be detected if a multivariable regression finds an insignificant coefficient of a particular explanatory variable and yet a simple linear regression of the explained variable on this explanatory variable shows its coefficient to be significantly different from zero.

Various methods can be used to measure and test the degree of multicollinearity; among these are using the magnitude of the tolerance value, checking stability of the coefficients when different samples are used, checking significance of the t-ratios and the F statistic, and examining the bivariate correlations between the independent variables. In this study, a correlation matrix was constructed to test for multicollinearity.

Muliticollinearity was corrected by standardizing the independent variables. This helped to reduce on false flagging of a condition index above 30. The model was left as it was despite multicollinearity since according to Gujarati (2004) the presence of multicollinearity doesn't affect the efficacy of extrapolating the fitted model to new data provided that the predictor variables follow the same pattern of multicollinearity in the new data as in the data on which the regression model is based.

It was very crucial to conduct this measurement because multicollinearity may lead to overstated regression coefficients, incorrect signs, and highly unstable predictive equations (Kumari, 2008**)**.

3.6.5 Testing for serial correlation

According to Pindyck and Rubinfeld (1991), serial correlation occurs in a time series when the errors associated with a given time period carry over into future time periods. According to investorwords.com the correlation of a variable with itself over successive time intervals is serial correlation. There are different types of serial correlation such as first order serial correlation and positive serial correlation. For first order serial correlation, errors in one time period are correlated directly with errors in the next period. With positive serial correlation errors in one time period are positively correlated with errors in the next time period.

Different statistical techniques are used to detect the undesirable problem of serial correlation. This study used the Durbin-Watson (DW) statistic to test for serial correlation. Durbin and Watson (1950, 1951) applied this statistic to the residuals from least square regressions.

The hypothesis tested was as follows

H_0: μ=0 (null hypothesis)

The DW test is of the form of;

$$d = \frac{\sum_{t=2}^{T}(e_t - e_{t-1})^2}{\sum_{t=1}^{T} e_t^2}$$

Where;

T is the number of observations (time periods)

e_t= β - α such that β and α are respectively the observed and predicted values of the response variable for individual t.

d becomes smaller as the serial correlations increase.

When successive values of e_t are close to each other, the DW statistic will be low indicating the presence of positive serial correlation.

Upper and lower critical values were tabulated for different values of k (the number of explanatory variables) and t. The null hypothesis was rejected if the test value (d) was less than the lower critical value and when the test value was greater than the upper critical value the null hypothesis was not rejected. The test was considered inconclusive if the test value (d) was less than the upper critical value and greater than the lower critical value.

The Durbin-Watson statistic is always between 0 and 4. If the statistic has a value of 2 then there is no serial correlation in the sample. Values approaching 0 indicate positive auto correction and values approaching 4 indicate negative auto correction.

Serial correlation does not affect the consistency of OLS estimators but it does affect their efficiency. In the case of positive serial correlation, the OLS estimates of the standard errors are less than the true standard errors. This leads to the conclusion that the parameter estimates are more precise than they really are. This may lead to situation where the null hypothesis is rejected when it is not supposed to be rejected.

Serial correlation in many economic time series when the variables are omitted (omitted variables end up in the error term). If the omitted variable is correlation over time, then the residuals will appear on track. In order to correct these problems reformulate the model and include the omitted variable.

3.7 Limitations of the study

The major limitation of this study was the use of mainly the quantitative method of research. This method in most cases does not provide information that is specific to the researchers needs. The data provided may be of poor quality, insufficient and sometimes incomplete or outdated. But this was the most suitable research method for this study because secondary sources of data from Bank of Uganda, Uganda Bureau of Statistics and other online sources provided sufficient information. This information fulfilled the objectives of the study which eliminated the need and expense of the researcher having to carry out their own primary research.

The study also failed to use legal reserve requirement as a tool of monetary policy since the data on this variable was not available and besides, it is fixed hence it will affect the regression results. This led to reduction in study objectives from four to three.

3.8 Ethical considerations

This study mainly used secondary sources of data and the researcher ensured that all this data was appropriately referenced and cited. All the authors whose work was used were acknowledged and credit was given wherever it was due.

The researcher sought for permission from the University in form of an introductory letter which was presented to Bank of Uganda before they were allowed to access some information that the central bank provides to researchers.

The sources of the data collected in this study were authentic and allowed by the University to be used by their students while carrying out their research.

CHAPTER FOUR

PRESENTATION, INTERPRETATION AND DATA ANALYSIS

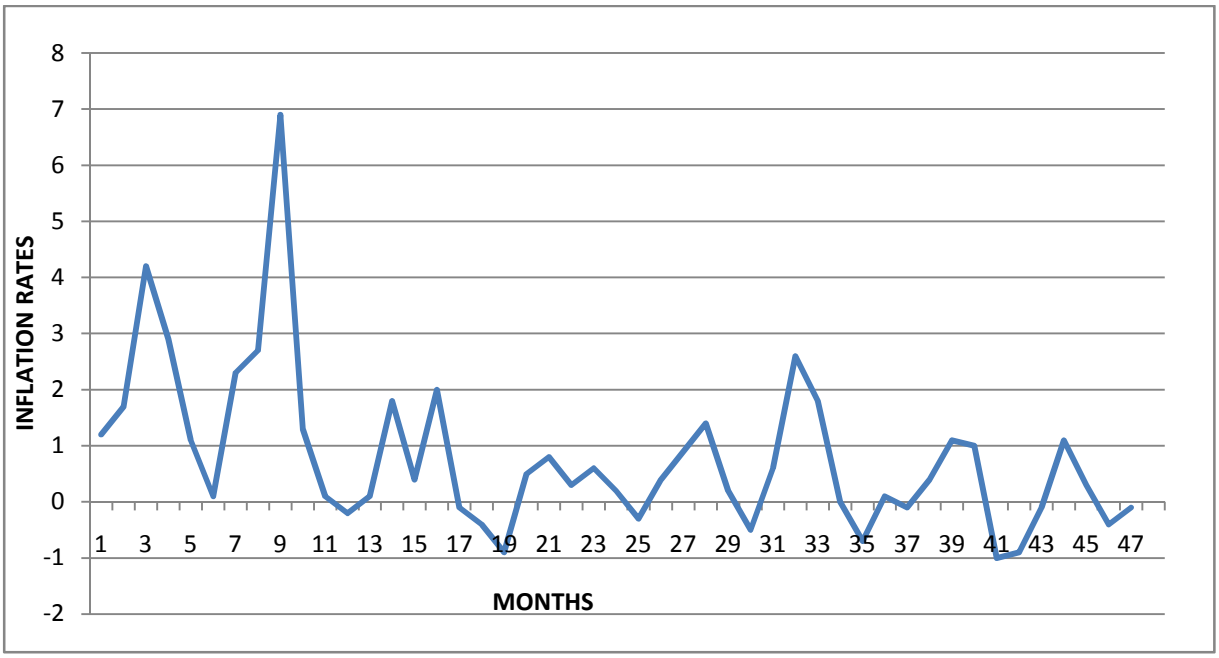
4.0 Introduction

The data collected from Bank of Uganda (2015) and UBOS (2015) was subjected to diagnostic tests as shown below and thereafter regressions are run in order to assess the role of Uganda's monetary policy in controlling inflation using a case study of Bank of Uganda.

4.1 Descriptive Statistics

The descriptive statistics were established to get the means, medians, standard deviations and explain the trend for each of the variable in the study. The descriptive statistics carried out therefore included trend analysis and summary statistics for all the study variables.

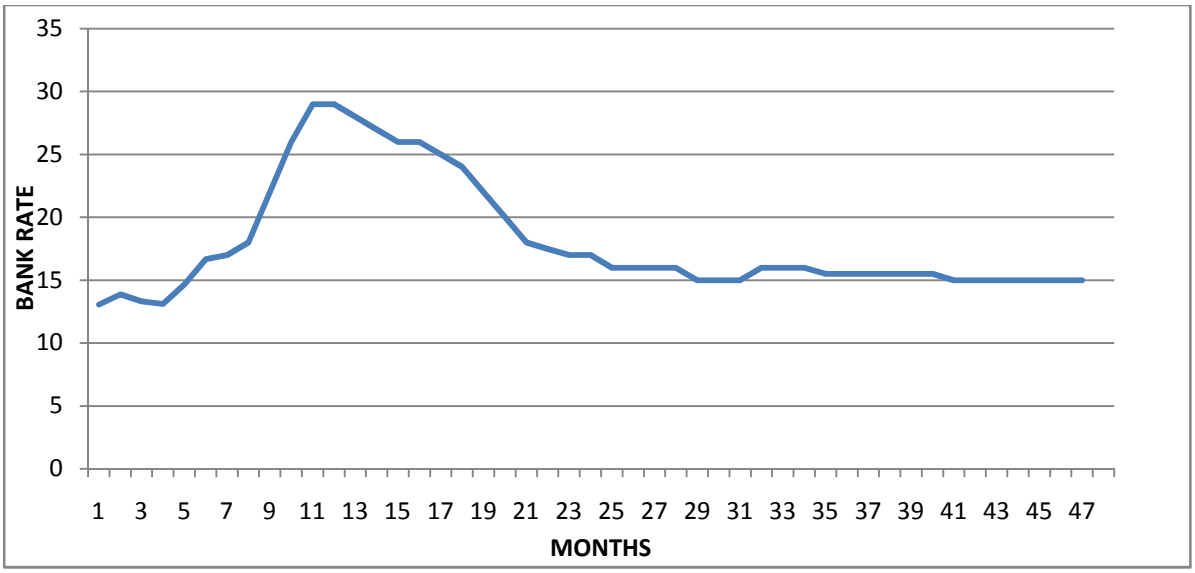
Figure 4.1: Trend of Inflation in Uganda from August 2011 to December 2014



Source: research data

In figure 4.1, months are arranged from 1 to 48 where 1 is the first month of the study which is January 2011 and 48 is the last month of the study which is December 2014. Generally the trend of monthly inflation rates in Uganda is not stable as shown above. The rates increase and decrease with no steady increase or decrease. The trend shows a sharp increase in the Uganda's monthly inflation rate in September 2011 to about 6.9 percent. This was also the highest inflation rate recorded between January 2011 and December 2014. The sharp increase could be attributed to the immerse government expenditure preceded by the February's presidential elections and also the global financial turmoil and the drought in East Africa during those periods. The sharp increase was followed by a decrease to 1.3 percent in October of the same year. The trend was then relatively stable throughout 2012 with the highest being 1.8 percent witnessed in February and the lowest being -0.1 percent. The monthly inflation rates were relatively low throughout the 2013 and 2014 with highest rate during that period recorded in August 2013 at 2.6 percent and the lowest being -0.1 which was recorded in January and December of 2014.

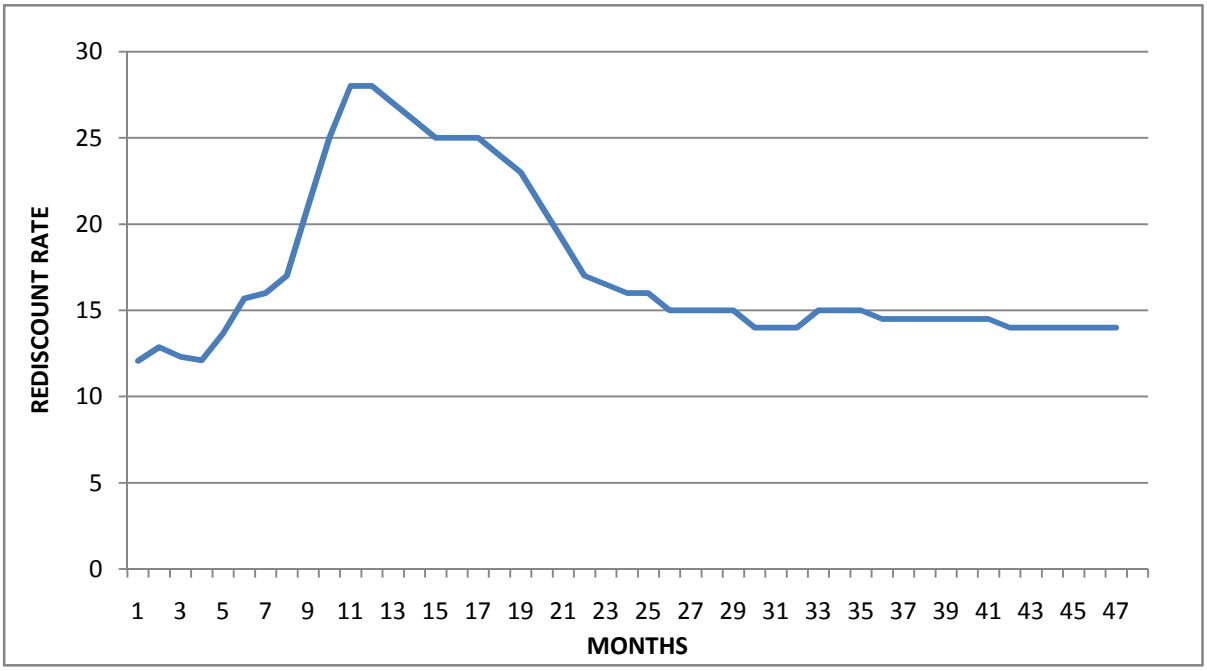
Figure 4.2: Trend Analysis of Bank Rate in Uganda from January 2011 to December 2014



Source: research data

The trend shows that the country had the highest bank rate in November and December 2011 which was recorded as 29 percent. Bank of Uganda increased the bank rate during this time since there was a high inflation rate in the country. This high bank rate was very instrumental in controlling inflation in the country. The trend also shows relatively stable rates between January 2013 and December 2014. The rates recorded between these periods are between 16 percent and 15 percent where most of them are constant at 15 percent.

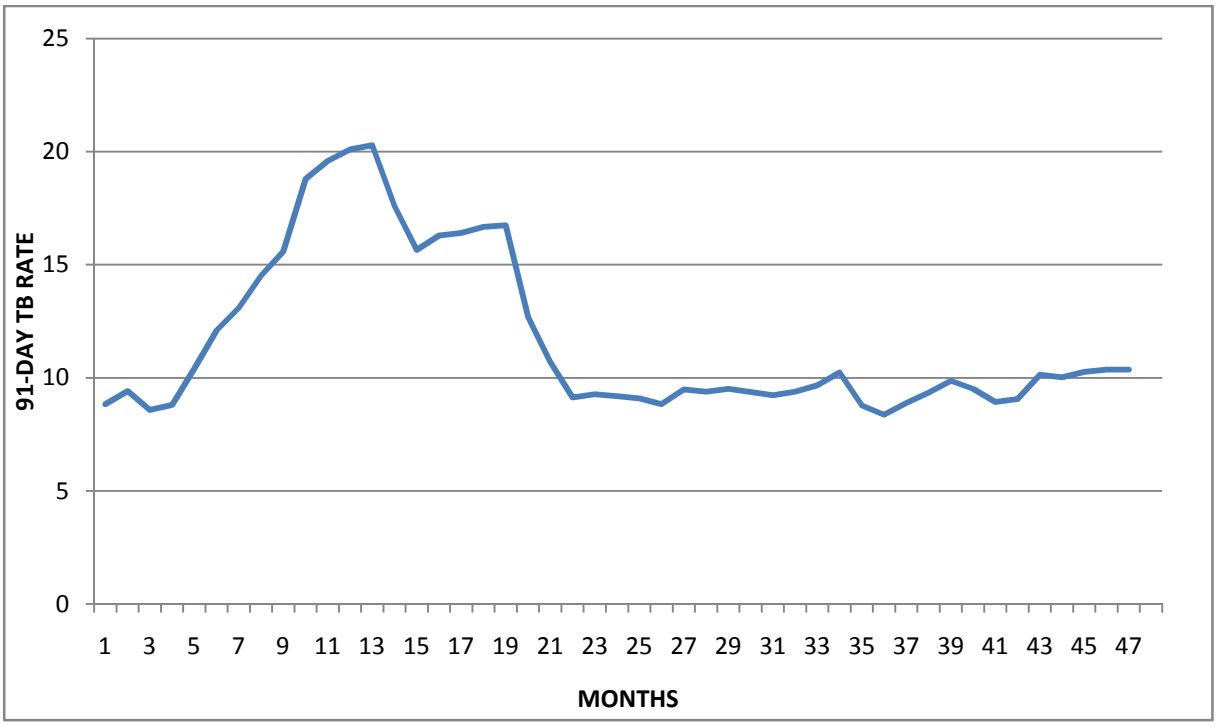
Figure 4.3: Trend of Rediscount rate in Uganda from January 2011 to December 2014



Source: research data

The trend above shows that the highest rediscount rate was recorded in November and December 2011 but it averaged at 14 percent for the rest of the months under study. The high trend in the rediscount rate in November and December 2011 was attributed to the central bank trying to avert the high inflation rate which was being experienced in the country at that time. The rate at which government securities are discounted was increased to encourage the public to invest in these securities and consequently decreasing the money stock and therefore curb the high rates of inflation that were evident during that period.

Figure 4.4: Trend of 91 day Treasury bill rates from January 2011 to December 2014



Source: research data

The trend shows that a highest 91-dayTreasury bill rate was recorded in January 2012 of 23.1 percent while the lowest was recorded in January 2014 of 8.8 percent. The highest percentage in the 91-day Treasury bill rate was as a result of the central bank reacting to the high inflation in the country during that period. The increase was an attempt to discourage the public from investing into treasury bills since increase in their rate decreases the yield of the Treasury bill. The trend also shows a maintained rate of between 9 percent and 10 percent for the periods between September 2012 and December 2014.

Table 4.1: Summary of the descriptive statistics of the study variables

	INF	BNKRATE	RDRATE	91DTBR
Mean	1.337967	18.21244	17.21247	11.62916
Median	3.573281	16.00000	15.00000	9.768227
Maximum	6.900000	29.00000	28.00000	20.28000
Minimum	-1.00000	13.06000	12.06000	8.360000
Std.Dev.	0.564286	4.741841	4.741815	1.193436

Source: author's computations

The summary table 4.1 indicates that there are 48 monthly observations obtained over the time periods from January 2011 to December 2014. The choice of this time period was majorly due to the availability and completeness of the data. The highest monthly inflation rate of the study was 6.9 percent and the lowest was -1.0 percent with the mean and standard deviation being 1.337967 and 0.564286 respectively. The statistical means for the independent variables such as bank rate, rediscount rate and 91-day Treasury bill rate are 18.21244, 17.21247 and 11.62916 respectively. It further shows that the variables are worth including in the model since their standard deviations are greater than zero.

4.2 Diagnostic Tests

The diagnostic tests carried out on the data series included the normality test, stationarity test, multicollinearity test and serial correlation.

4.2.1 Normality Test

The Jarque and Bera statistic was used to measure whether the variables under study follow a standard normal distribution. The table 4.2 shows the results of the analysis arrived at using the E-views 8.

Table 4.2: Normality Test results on the study variables

	INF	**BNKRATE**	**RDRATE**	**91DTBR**
JB	3.74934	0.28231	0.42731	1.24921
P-value	0.15343	0.86841	0.80755	0.53565
Skewness	0.74211	-0.14271	-0.05540	-0.31116
Kurtosis	3.21561	3.29642	2.505821	3.60150

Source: author's computations

The JB test statistic whose probability (P-value) is greater than 5 percent level of significance implies that the null hypothesis that the variables are normally distributed is accepted. However, if the JB statistic is less than the 5 percent level the null hypothesis is rejected and logarithms are considered in order to induce the normality of the variables under study.

From the table 4.2 it was observed that all variables under study were normally distributed since the probability (P-value) of the JB statistic was above 0.05 for all the study variables which acts as the rejection point. The null hypothesis that the sample has a normal distribution was not rejected.

Skewness is the measure of the asymmetry of the probability distribution of a variable around its mean. The data is perfectly symmetric if the skewness value is equal to zero. The study variables bank rate, rediscount rate and 91-day Treasury bill rate are highly skewed since

their skewness values are less than -1 and the distribution of inflation is moderately skewed since its skewness value is between 0.5 and 1.

Kurtosis measures peakedness of the probability distribution of the study variables. Negative kurtosis shows too much peak (sharp) and positive kurtosis shows that the peak is not sharp. The kurtoses for all the variables are between positive therefore the peak of their probability distribution is not sharp and the variables are normally distributed

4.2.2 Test for stationarity and correcting for non stationarity

Stationarity of a variable occurs when its mean and variance are constant over time. Stationarity is essential econometric models because since when data is considered stationary it means that it still retains its memory in mean reverting and therefore it's considered predictable.

Graphical representation of stationary tests as shown in appendix I an appendix II show the plots of the variables before and after differencing respectively. It is observed that the series are linearly trended and each variable apart from inflation appears to have a non-constant mean and therefore do not appear to be stationary at different significant values.

The variables all appear to be stationary in appendix II after differencing. Although graphical evidence is useful as a first approximation to decide whether the variables are non-stationary, most econometricians agree that this is clearly unreliable method to use to make inferences about unit roots (Harris, 1995). The researcher therefore proceeded by using the formal testing procedures to test the stationarity of variables further.

The study variables were tested at significant levels of 1 percent, 5 percent and 10 percent to establish whether they are stationary or not using the ADF test. Using this test, the variables under study are considered stationary when the ADF test statistic is greater than the absolute

values of the critical values at a given significant level. The table 4.3 below shows the unit root test results of the variables under study before differencing (in their original form).

Table 4.3: Unit root test results for the study variables before differencing

			Critical values at different significant levels		
Variables	**Specification**	**ADF test statistic**	**1%***	**5%**	**10%**
INF	Trend and Specification	-6.182723	-4.219126	-3.533083	-3.195312
BR	Trend and specification	-2.447810**~	-2.118680	-3.352976	-3.196411
RR	Trend and Specification	-3.447790**	-4.211868	-3.529758	-3.196411
91DTB	Trend and Specification	-2.383361***	-4.170583	-3.510740	-3.185512
	*MacKinnon critical values for rejection of hypothesis of a unit root ** Not stationary at 1% and 5% **~Not stationary at 5% and 10% ***Not stationary at 1%,5% and 10%				

Source: author's computations

A non-stationary variable can be transformed into stationary one by differencing. From table 4.3, it was observed that apart from the inflation rate all the other variables were not stationary at the levels of significance since the absolute values of their ADF test statistic was less than their critical values at all the significant levels. All the variables under study were differenced once to correct non-stationarity. After testing for stationarity at first difference the study also tested the variables at the first difference in order to establish the order of integration of the study variables and if the variables are stationary at the first difference, it means that the variables are integrated of order one.

Table 4.4: Unit root test results for the variables under study after differencing

			Critical values at different significant values		
Variables	**Specification**	**ADF test statistic**	**1%**	**5%**	**10%**
DINF	Trend and specification	-9.236021	-4.170583	-3.510740	-3.185512
DBR	Trend and specification	-4.512813	-4.170583	-3.510740	-3.185512
DRR	Trend and specification	-6.363141	-4.170583	-3.510740	-3.185512
D91DTB	Trend and specification	-4.261402	-4.170583	-3.510740	-3.185512
		*MacKinnon critical values for rejection of hypothesis of a unit root			

Source: author's computations

All the variables appeared stationary at 1%, 5% and 10% after the first order differencing.

Inflation is or order I(0) since it was stationary before differencing and all the independent variables are of order I(1) because they became stationary after the first differencing. The graphical presentation as shown in appendix II of all the variables under study showed a zero means which confirms stationarity and this presentation agrees with the ADF test statistics as shown in table 4.4.

4.2.3 Multicollinearity test

Multicollinearity in regression occurs when independent variables in the regression model are perfectly correlated with each other than with the dependent variable of the study. In the presence of multicollinearity, there will be large standard errors of the estimated coefficients and the parameter coefficients will be vague thus it is very imperative to test for multicollinearity. In this study a correlation matrix was constructed to test for muliticollinearity as shown in Table 4.5.

Table 4.5: Correlation Matrix

	Inflation	91 days TB	Rediscount Rate	Bank Rate
Inflation	1.0000	0.1554	0.1177	0.0013
91 days TB	0.1554	1.0000	0.9496	0.8739
Rediscount Rate	0.1177	0.9496	1.0000	0.9580
Bank Rate	0.0013	0.8739	0.9580	1.0000

Source: author's computations

From table 4.5 showing the correlation matrix, it is observed that Uganda's monthly inflation rate is positively correlated with 91 days Treasury bill rate, rediscount rate and bank rate. Correlation test is important in time series analysis because, according to Gujarati (1995), when the independent variables are highly correlated, they should not be used in the same regression model. This is because of the multicollinearity problem that might result due to use of highly correlated variables in the same model.

The correlation matrix results show that bank rate, rediscount rate and the 91-day Treasury bill rate are not correlated with each other therefore no problem of multcollinearity is suspected.

4.2.4 Serial Correlation test

Serial correlation occurs in a time series when the errors associated with a given time period carry over into future time periods (Pindyck and Rubinfeld, 1991). Serial correlation does not affect the consistency of OLS estimators but it does affect their efficiency. In the case of positive serial correlation, the OLS estimates of the standard errors are less than the true standard errors. This leads to the conclusion that the parameter estimates are more precise than they really are. This may lead to situation where the null hypothesis is rejected when it is not supposed to be rejected therefore it is important to test for serial correlation.

The DW statistic was used to test for serial correlation but because it is always difficult to interpret and thus making a conclusion whether the data series had a problem of the presence of either positive or negative serial correlation is hard. This challenge necessitated the performing of the Correlogram Q-satistics test in which case if there is no serial correlation in the residuals the auto correction and partial auto correlations at all lags will be nearly zero and all the Q-statistics will be insignificant with large p values.

Table 4.6: Correlogram-Q-statistics testing for serial correlation

Date: 05/05/15 Time: 22:14
Sample: 1 48
Included observations: 48

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*******	. |*******	1	0.941	0.941	45.236	0.000
. |******|	***| . |	2	0.839	-0.411	81.957	0.000
. |***** |	.*| . |	3	0.715	-0.129	109.23	0.000
. |**** |	. | . |	4	0.588	-0.009	128.10	0.000
. |*** |	. | . |	5	0.476	0.072	140.74	0.000
. |*** |	**| . |	6	0.356	-0.266	147.99	0.000
. |** |	**| . |	7	0.217	-0.269	150.75	0.000
. |*. |	. |*. |	8	0.083	0.102	151.16	0.000
. | . |	. |*. |	9	-0.035	0.087	151.24	0.000
.*| . |	. | . |	10	-0.123	0.026	152.18	0.000
.*| . |	. | . |	11	-0.180	-0.053	154.28	0.000
**| . |	. | . |	12	-0.224	-0.055	157.64	0.000
**| . |	. |*. |	13	-0.249	0.172	161.90	0.000
**| . |	.*| . |	14	-0.263	-0.069	166.77	0.000
**| . |	.*| . |	15	-0.266	-0.114	171.93	0.000
**| . |	. | . |	16	-0.250	0.045	176.62	0.000
**| . |	.*| . |	17	-0.233	-0.077	180.84	0.000
**| . |	. | . |	18	-0.216	-0.017	184.58	0.000
.*| . |	. | . |	19	-0.193	0.014	187.66	0.000
.*| . |	.*| . |	20	-0.183	-0.160	190.54	0.000

Source: author's computations

Table 4.6 shows the results of Correlogram Q-statistics test. The test displays the autocorrelation and partial autocorrelation functions of the residuals for high-order serial correlation. In this test here was no serial correlation in the residuals since the

autocorrelations and partial autocorrelations at all lags were zero, and all Q-statistics were insignificant with large p-values.

4.3 Model estimation

The model was estimated and the results are presented in table 4.6. The equation was estimated using Ordinary Least Squares (OLS) method. A multiple regression analysis was used to establish how the establish how the independent variables that is 91 days Treasury bill, Rediscount rate and bank rate control inflation in Uganda. But since most of the variables were not stationary at levels, the regression analysis considers their first difference in order to correct for the non stationarity.

Table 4.7: Regression Results using OLS

Variables	Coefficient	Std. Err.	T-Statistic	P-Value
D 91DTB	-0.3884212	0.1596755	-2.43	0.0201
DRR	1.147585	0.2097419	5.47	0.0000
DBR	-0.5389784	0.1951435	-2.76	0.0090
Constant	0.5300836	0.1575111	3.37	0.0020
Dependent variable: DINF Number of observations = 48 Included observations 37 after adjustment				
F-statistic = 10.32 Prob(F-statistic = 0.0000)				
R-squared = 0.6876				
Adjusted R-squared = 0.6654				
Root MSE = 1.0057				
Durbin-Watson d-statistic = 1.916697				

Source: author's computations

The regression results show that there is a relationship between inflation and the independent variables since DW statistic is greater than R^2 a rule of thumb for testing spurious regression.

As a rule thumb for the DW test, the statistic has to be 2 or close to 2 for there to be no serial correlation between the residuals. The DW test statistic between the residuals was 1.91667

which is close to 2 therefore there was no evidence of serial correlation between the residuals in the monthly data series used.

All the coefficients of the independent variables in the model; 91 days treasury bill rate, Rediscount rate and Central Bank rate are statistically significant at 5 percent level of significance since their P-Values are less than 5% implying that their calculated t-values are greater than their critical values which means that we reject the null hypothesis that the coefficients of these variables are statistically not different from zero as shown in table 5. The coefficient of rediscount rate is positive while that of 91 days Treasury bill rate and the bank rate are negative just as expected by the economic theory and previous studies of Katarikawe (2010)

The adjusted R^2 from the results of the regression is 0.6654 which implies that 66% of variation in Uganda's inflation rate is explained by the variables included the model. The F-statistics strongly rejects the null hypothesis that the regression coefficients are jointly equal to zero. This means that all the independent variables included in the model are jointly statistically significant at a 5% level of significance and therefore they play a very big role in controlling Uganda's inflation rate.

From table 4.7, the fitted regression model that can be used for controlling inflation in Uganda is as follows;

$$Inflation = 0.5300836 - 0.3884212\Delta \text{TBRate} + 1.147585\Delta RediscountRate - 0.5389784\Delta BankRate + \epsilon_t \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (4.1)$$

The dependent variable of the study which is monthly inflation rate is at its levels while all the independent variables are at their first difference. All the independent variables included in the study are statistically significant at 5 percent level of significance.

4.5 Discussion of results

4.5.1 91-day Treasury bill rate

The coefficient of 91 day is negative and statistically significant at 5 percent level of significance just as expected by the study and the previous studies implying that increase in the issue of 91 day treasury bills reduces on the rate of inflation in the country hence the use of treasury bills as a tool of monetary policy by Bank of Uganda reduces inflation in the country. Specifically a unit increase in the rate of 91 days Treasury bill reduces inflation in the country by 0.3884212 percentage points.

4.5.2 Rediscount rate

The coefficient of rediscount rate is positive and statistically significant at 5 percent level of significance. A unit increase in RR does not decrease inflation. This result is different from the expectation of the study because the study expected it to be negative. This therefore implies that rediscount rate does not reduce inflation in Uganda. This could be true since most of the government securities in Uganda are usually purchased by the outsiders who come in with their money.

4.5.3 Bank rate

The coefficient of bank rate is negative and statistically significant at 5 percent level of significance. This finding is in line with the economic theory and the findings of the previous studies. This means that an increase in the bank rate reduces inflation in the country specifically a unit increase in the bank rate reduces Uganda’s inflation rate by 0.5389784 percentage points other factors held constant.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

In this chapter a summary related to the study problem and objectives is given. The summary basically presents the analysis of the role of monetary policy in controlling inflation in Uganda from January 2011 to January 2015. Suggestions in terms of possible policy options and further research areas are also provided in this chapter.

5.1 Summary of findings

The main objective of this study was to assess the role of monetary policy in controlling inflation in Uganda from January 2011 to December 2014 using Bank of Uganda as the case study.

The adjusted R^2 from the results of the regression is 0.6654 which implies that 66% of variation in Uganda's inflation rate is explained by the variables in the model. The F-statistics strongly rejects the null hypothesis that the regression coefficients are jointly equal to zero. This means that all the explanatory variables included in the model are jointly statistically significant at a 5% level of significance and therefore they play a very big role in controlling Uganda's inflation rate. The Durban Watson (DW) statistic of 1.916697 indicates that the regression does not suffer from problems of autocorrelation since it is very close to 2.

It was found that specifically a unit increase in the rate of 91 days Treasury bill reduces inflation in the country by 0.3884212 percentage points. The impact of 91 day Treasury bill on Uganda's inflation rate was found to be negative and significant suggesting that the use of treasury bills by the Bank of Uganda to control Inflation is very significant and indeed it can help to reduce the problem in the country.

It was found that the coefficient of bank rate is negative and that every increase in the bank rate reduces Uganda's inflation by 0.5389784 percentage points if other factors are kept constant. The bank rate was also found out to be another significant monetary tool to control inflation in Uganda since it was statistically significant at 5 percent level of significance.

The rediscount rate was found with a positive relationship which implies that its use may not help to control inflation in the country. It was found to be significant at 5 percent level of significance.

Finally, structural and predictive tests by the study reveal 91 day Treasury bill and bank rate as key monetary policy tools to control inflation in Uganda thus Uganda's inflation function (Equation 4.1) can reliably be used for forecasting purposes using these variables.

5.3 Conclusions

The study concludes that bank rate has a negative effect on Uganda's inflation rates which is in line with Bernanke and Blinder (1992), Kashyap and Jeremy (1993) and Gertler and Gilchrist (1993) findings which argued that the changes in bank rate leads to changes in the amount of money in circulation which in turn negatively affects inflation. The increase in the bank rate by BOU therefore controls the levels of inflation.

The study also concluded that the 91-day Treasury bill rate has a negative relationship with inflation and it is statistically significant at 5 percent level of significance just as expected by the study. These findings are in line with past studies of Nampewo (2010), Aboagye (2008) and Nandwa (2006) who argue in their studies that increase in the 91 day Treasury bill rate increases the rate of interest rates charged which consequently reduce the amount of money in circulation and therefore reduces on the rate of inflation in the country. Therefore, the use

of Treasury bill rate as a tool of monetary policy by Bank of Uganda reduces inflation in the country.

The further study concluded that the rediscount rate is positive and statistically significant at 5 percent level of significance. This result is different from the expectation of the study because the study expected it to be negative. This is in line with the study of Nampewo (2010) who argues that the rediscount rate does not have an impact on the level of interests charged and therefore doesn't play a big role in controlling inflation. This therefore implies that rediscount rate does not reduce inflation in Uganda. However Katatrikawe (2010) does not agree with this study since she argues in her study that the rediscount rate is an important tool of monetary policy which plays a role in controlling inflation. She goes ahead to confirm that for the effectiveness of this rate it is mainly tied to the moving average of the 91 day Treasury bill.

5.4 Policy recommendations

Basing on the findings of the study, Bank of Uganda should always issue many 91 days Treasury bills whenever there is inflation in order to reduce inflation in case there is a high inflation rate in the country.

Bank of Uganda should also increase its bank rate whenever there is a high inflation rate in the country in order to reduce it. This is because increase in the bank rate discourages borrowing of the commercial banks from the central bank thereby reducing the amount of money available for lending. Also when the bank rate is increased, it forces the commercial banks to increase their lending rate (interest rate) thus discouraging the public from borrowing hence reducing on the amount of money in circulation and thereby reducing inflation rate.

The central bank should make it mandatory for all commercial banks to use the bank rate as the bench mark for all the interest rates they charge so that the monetary policy and control by the central bank is more effective in controlling macroeconomic stability in the economy. This can be achieved through strict supervision and monitoring of the activities of the commercial banks.

5.3 Suggestions for further research

The areas for further research that are proposed by this study involve covering the gap that has been left by this study of measuring the extent to which monetary policy tools play in controlling inflation.

This study has investigated the role of monetary policy in controlling inflation in Uganda from January 2011 to December 2014 using an error correction but it has not been all exhaustive since it only looked at only three monetary tools yet there are more than three monetary tools. Therefore other studies can be carried out on role of other monetary policy tools that have not been included in this study such as moral suasion, currency reforms, cash ratio and selective credit control.

Research about other determinants of Uganda's inflation rate such the structural rigidities, world food prices, variations in world Oil prices and many others. Research can also be carried out on the relationship between Inflation and government deficit, inflation and government revenue, effects of inflation on Uganda's tax revenue and many other areas.

This study used the quantitative research design and mainly used secondary data obtained from BOU and UBOS. Further research can be carried out to investigate the role of Uganda's monetary policy in controlling inflation using other research designs such as descriptive research design and primary data should be collected to close the gaps that the secondary data obtained could not cover.

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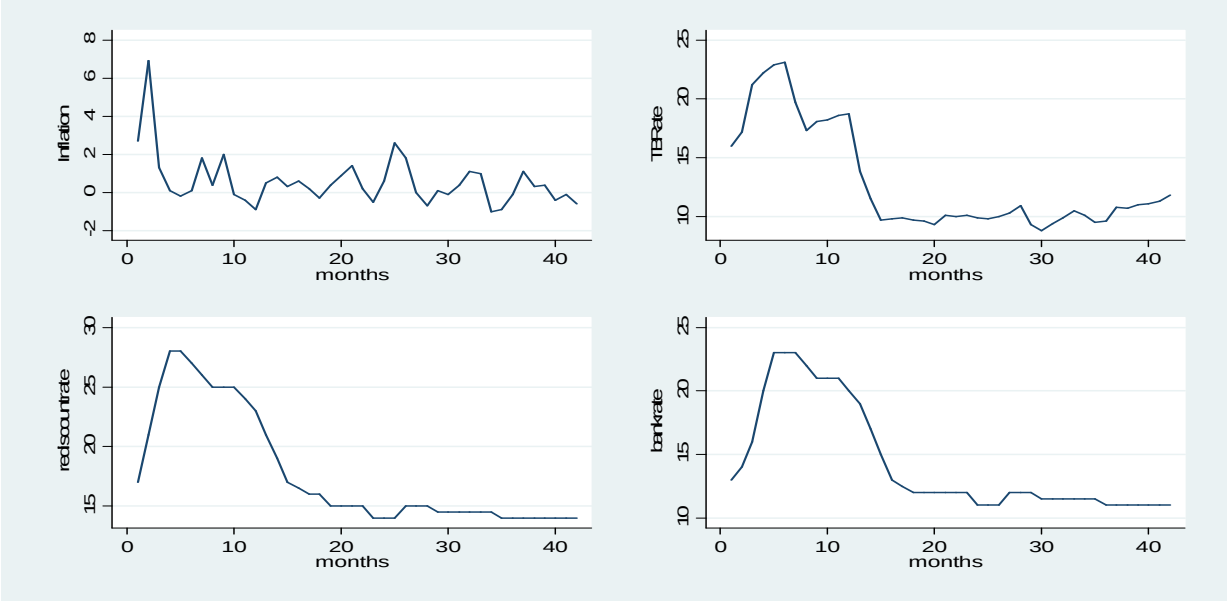
APPENDICES

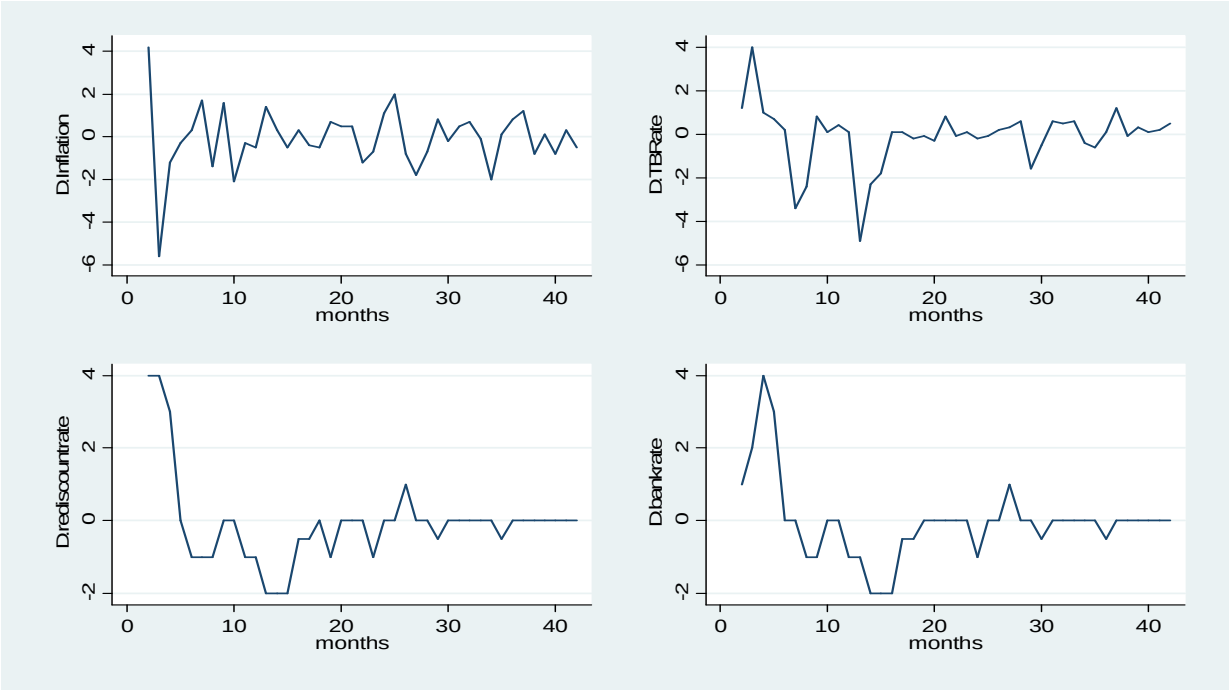
Appendix I: Stationary Test

Graphical representation of stationarity test results on variables before differencing



Appendix II

Graphical representation of stationarity test results on variables after differencing once



Appendix III: Data series that was used in the model

Inf	Rdrate	Bnkrate	91dTBr
1.2	12.06	13.06	8.83
1.7	12.87	13.87	9.41
4.2	12.32	13.32	8.58
2.9	12.11	13.11	8.81
1.1	13.66	14.66	10.40
0.1	15.68	16.68	12.10
2.3	16.00	17.00	13.09
2.7	17.00	18.00	14.53
6.9	21.00	22.00	15.59
1.3	25.00	26.00	18.80
0.1	28.00	29.00	19.58
-0.2	28.00	29.00	20.09
0.1	27.00	28.00	20.28
1.8	26.00	27.00	17.58
0.4	25.00	26.00	15.66
2.0	25.00	26.00	16.29
-0.1	25.00	26.00	16.40
-0.4	24.00	25.00	16.68
-0.9	23.00	24.00	16.74
0.5	21.00	22.00	12.68
0.8	19.00	20.00	10.71
0.3	17.00	18.00	9.14
0.6	16.50	17.50	9.28
0.2	16.00	17.00	9.36
-0.3	16.00	17.00	9.19
0.4	15.00	16.00	9.09
0.9	15.00	16.00	8.84
1.4	15.00	16.00	9.49
0.2	15.00	16.00	9.39
-0.5	14.00	15.00	9.52
0.6	14.00	15.00	9.37
2.6	14.00	15.00	9.23
1.8	15.00	16.00	9.39
0.0	15.00	16.00	9.67
-0.7	15.00	16.00	10.24
0.1	14.50	15.50	8.78
-0.1	14.50	15.50	8.37
0.4	14.50	15.50	8.89
1.1	14.50	15.50	9.35
1.0	14.50	15.50	9.87
-1.0	14.50	15.50	9.52
-0.9	14.00	15.00	8.94
-0.1	14.00	15.00	9.07
1.1	14.00	15.00	10.14
0.3	14.00	15.00	10.03
0.4	14.00	15.00	10.27
-0.4	14.00	15.00	10.36
-0.1	14.00	15.00	10.56