

**THE DYNAMIC DETERMINANTS OF INTEREST RATES IN
TANZANIA: A FOCUS ON INFLATION, MONEY SUPPLY AND
EXCHANGE RATES**

**THE DYNAMIC DETERMINANTS OF INTEREST RATES IN
TANZANIA: A FOCUS ON INFLATION, MONEY SUPPLY AND
EXCHANGE RATES**

**By
Boniface Kikoti**

**A Dissertation Submitted in Partial/Fulfilment of the Requirements for
Award of the Degree of Master of Science in Accounting and Finance
(MSc A&F) of Mzumbe University**

2015

CERTIFICATION

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation entitled “**The dynamic determinants of interest rates in Tanzania: A focus on inflation, money supply and exchange rates**”, in partial/fulfilment of the requirements for award of the Degree of Master of Science in Accounting and Finance (MSc A&F) of Mzumbe University

Signature

Major Supervisor

Signature

Internal Examiner

Signature

External Examiner

Accepted for the Board of

.....

Signature

DEAN/DIRECTOR, FACULTY/DIRECTORATE/SCHOOL/BOARD

DECLARATION AND COPYRIGHT

I, Boniface Kikoti, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature _____

Date_____

©

This dissertation is a copyright material protected under the Berne Convention, the Copyright Act 1999 and other international and national enactments, in that behalf, on intellectual property. It may not be reproduced by any means in full or in part, except for short extracts in fair dealings, for research or private study, critical scholarly review or discourse with an acknowledgement, without the written permission of Mzumbe University, on behalf of the author.

ACKNOWLEDGEMENT

The completion of this work cannot go without acknowledging the contributions made by some few special individuals who devoted their time, means and intellectual abilities to make my Master of Science in Accounting and Finance studies at the University of Mzumbe a success.

First and foremost, I would like to thank the almighty God for his grace and enabling me reach this far. I would also like to acknowledge my supervisor Dr. Benedicto Lukanima who has been rendering to me constant support and timely provision of constructive comments throughout the conception and development of this dissertation.

Second, I would like to thank my employer, the Rukwa Regional Administrative Secretariat (RAS Rukwa) as my Masters studies would have just remained a dream without her full sponsorship. To this effect, I would like to thank *Alhaj* Salum Mohammed Chima, the former Rukwa Regional Administrative Secretary for his kindness and moral support and the current Regional Administrative Secretary Mr. Smythesis E Pangisa for his continuous support. At Rukwa Regional Administrative Secretariat, I also wish to express my appreciation to Chief Accountant, Mr. Sosthenes T. Mutarubukwa and Principal Accountant, Ms. Chrisanta O. Shayo, for the their commitment and support. Collectively, they symbolize the contribution of the Department of Accounts and Finance.

I must also acknowledge the support and help of my very good friends and colleague, Jensen Mdoe and Edwin Michael. Brothers, we began this journey together and are finishing together. Life has a way of bringing the right people together, at the right time, for the right reasons. Brothers, you have been and will continue to be my true companion in the learning process.

I cannot end without thanking my family, on whose constant encouragement and love I have relied upon throughout my time at Mzumbe University. Most importantly, I wish to thank my parents: they bore me, raised, loved me and have in many ways inspired my desire to learn and grow professionally. I wish I could mention each individual, but will throw a large party instead. However, I thank everyone who contributed in one way or another to the success of this dissertation.

DEDICATION

This work is dedicated to my lovely family: wife Veronica, sons Fransisko, Rafael and Raymond.

ABBREVIATIONS AND ACRONYMS

AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
BOT	Bank of Tanzania
EACB	East African Currency Board
ECM	Error Correction Model
FPE	Final Prediction Error
FSAP	Financial Sector Assessment Programme
HQIC	Hannan Quinn Information Criterion
IMF	International Monetary Fund
Max	Maximum
Min	Minimum
OLS	Ordinary Least Square
SBIC	Schwarz-Bayesian Information Criterion
Std. Dev.	Standard Deviation
TSHS	Tanzanian Shillings
URT	United Republic of Tanzania
USD	United States Dollar
VECM	Vector Error Correction Model

ABSTRACT

High interest rates prevail in developing countries including Tanzania since full implementation of financial sector reforms where interest determined by the market force have restricted the access of potential borrowers to credit markets thus reducing investments and limiting growth potentials of the economy. This study was conducted to determine the dynamic determinants of interest rates in Tanzania with a focus on inflation, money supply and exchange rates. The study used time series secondary data covering the period 1970-2013, extracted from two main sources, namely; the National Bureau of Statistics (NBS) and Central Bank of Tanzania (BoT), where all variables employed on the analysis are extracted. The study applied OLS, Johansen Cointegration and VECM technique to examine the effect of Inflation Rates, Money Supply and Exchange Rates Dynamics to Interest Rates in Tanzania. Johansen co-integration test was employed to test for existence of long run relationships between variables interest rate, inflation rate, money supply and exchange rates and the results showed the existence of long run relationship among variables and they move together and suggested to use VECM instead of VAR. Stationarity test was enhanced by the use of Augmented Dickey Fuller and Philip Perron test. The results showed that all variables exhibit unit roots at level and they became stationary after performing first difference. VECM results revealed that money supply had significant effect on interest rate and the effect of inflation rate and exchange rate dynamics to interest rate were not significant for the period under study. Therefore, in order to correct short term disequilibrium of interest rate, the government should adjust money supply. The OLS results showed that explanatory variables significantly affect interest rates but the R-square was very low for the model. Even if, only money supply seemed to have statistically significant impact on interest rate, the government should not ignore other variables such inflation rate and exchange rate because they are important in monetary policy setting.

Keywords: Interest rate, Inflation rate, Money Supply, Exchange rates, Tanzania.

TABLE OF CONTENTS

CERTIFICATION	i
DECLARATION AND COPYRIGHT	ii
ACKNOWLEDGEMENT	iii
DEDICATION.....	iv
ABBREVIATIONS AND ACRONYMS.....	v
ABSTRACT	vi
TABLE OF CONTENTS.....	vii
LIST OF TABLES	x
LIST OF FIGURES	xi
CHAPTER ONE	1
STUDY BACKGROUND AND PROBLEM SETTING	1
1.0 Introduction.....	1
1.1 Background	1
Figure 1.1: Trends of Interest Rates, Inflation Rates and Money Supply in Tanzania 1970-1989	3
Figure 1.2: Trends of Interest Rates, Inflation Rates and Money growth in Tanzania (1990-2013).....	4
1.2 Statement of the problem	6
1.3 Research question(s)	7
1.4 Research objectives.....	8
1.5 Rationale of the study	8
1.6 Organization of the dissertation	10
CHAPTER TWO	11
LITERATURE REVIEW.....	11
2.0 Introduction.....	11
2.1 Theoretical review.....	11
2.1.1 Rate of inflation and Interest Rates.....	11
2.1.2 Money Supply and Interest Rates.....	12
2.1.3 Exchange Rate Dynamics and Interest Rates	13
2.2 Empirical literature review	14
2.2.1 Rate of inflation and Interest rates.....	14
2.2.2 Money Supply and Interest rates.....	17

2.2.3 Exchange Rate Dynamics and Interest Rates	18
2.3 Conceptual framework	20
2.3.1 Interest Rate	20
2.3.2 Inflation rate	21
2.3.3 Money supply	21
2.3.4 Exchange rates	22
CHAPTER THREE	25
RESEARCH METHODOLOGY	25
3.0 Introduction	25
3.2 Area of the study	25
3.3 Study population	26
The population for this study was series of data covering the whole period of January 1970 to December 2014.	26
3. 4 Sample size and sampling techniques	26
3.5 Types and sources of data	26
3.6 Data analysis methods	27
3.6.1 Econometrical Framework and Model Specification	27
3.6.2 Econometrical Model Specifications	29
3.6.3 Johansen and Juselius Cointegration Tests	30
3.6.4 Vector Error Correction Model	30
3.6.5 Granger Causality Test	31
3.6.6 Specification Tests	31
3.6.7 Time Series Properties of Data	32
CHAPTER FOUR	34
ANALYSIS AND PRESENTATION OF FINDINGS	34
4.0 Introduction	34
4.1 Description of Basic Statistics of Data	34
Table 4.1 (a): The Summary Statistics of the Data	35
Table 4.1 (b): Shapiro-Wilk test for normality of data	36
Figure 4.1: Interest rate	36
Figure 4.2: Inflation Rate	37
Figure 4.3: Money Supply	37
Figure 4.4: Exchange Rate	38

4.2 Unit Root Test	38
Table 4.2 (a): Results for ADF and PP Unit Root Test at Level	39
Table 4.2 (b): Results for ADF and PP Unit Root Test at First Difference	40
4.3 Ordinary Least Square Results	40
Table 4.3: Estimation results of OLS regression.....	41
4.4 Lag Selection.....	41
Table 4.4: Lag-order selection criterion.....	42
4.5 Testing for Cointegration	42
Table 4.5: Results of Johansen Cointegration Tests Based on Trace and Maximum Eigen Values of the Stochastic	42
4.6 Vector Error Correction Model.....	43
Table 4.6 : Vector Error Correction Model.....	44
Table 4.7(a): The error correction model results the interest rate (bank rate).....	45
Table 4.7 (b): The error correction model results for inflation rate (inflrate)	45
Table 4.7 (c): The error correction model results for money supply (mgrowthrate) ...	46
Table 4.7 (d): The error correction model results for exchange rate (exchrte).....	46
4.7 Diagnostic tests	47
Table 4.8 (a) Lagrange-multiplier test	47
Table 4.8 (b) Jarque-Bera test for normality.....	47
CHAPTER FIVE	48
DISCUSSION OF THE FINDINGS.....	48
CHAPTER SIX	51
SUMMARY, CONCLUSIONS, AND POLICY IMPLICATIONS.....	51
6.0 Introduction.....	51
6.1 Summary.....	51
6.2 Conclusion	53
6.3 Policy implications	54
6.4 Limitation of the Study.....	54
6.5 Suggestion of the area for further study	54
REFERENCES.....	56
APPENDICES	62
Appendix I: Research time frame.....	62
Appendix II: Budget.	63

Appendix III: Vector Error Correction Results	64
Source: Researcher's compilation using STATA.	64
Appendix IV: Research data	65

LIST OF TABLES

Table 4.1 (a): The Summary Statistics of the Data	35
Table 4.1 (b): Shapiro-Wilk test for normality of data.....	36
Table 4.2 (a): Results for ADF and PP Unit Root Test at Level.....	39
Table 4.2 (b): Results for ADF and PP Unit Root Test at First Difference	40
Table 4.3: Estimation results of OLS regression.....	41
Table 4.4: Lag-order selection criterion	42
Table 4.5: Results of Johansen Cointegration Tests Based on Trace and Maximum Eigen Values of the Stochastic.....	42
Table 4.6 : Vector Error Correction Model	44
Table 4.7(a): The error correction model results the interest rate (bank rate).....	45
Table 4.7 (b): The error correction model results for inflation rate (inflrate)	45
Table 4.7 (c): The error correction model results for money supply (mgrowthrate)	46
Table 4.7 (d): The error correction model results for exchange rate (exchrte).....	46
Table 4.8 (a) Lagrange-multiplier test.....	47
Table 4.8 (b) Jarque-Bera test for normality	47

LIST OF FIGURES

Figure 1.1: Trends of Interest Rates, Inflation Rates and Money Supply in Tanzania 1970-1989.....	3
Figure 1.2: Trends of Interest Rates, Inflation Rates and Money growth in Tanzania (1990-2013).....	4
Figure 4.1: Interest rate	36
Figure 4.2: Inflation Rate	37
Figure 4.3: Money Supply.....	37
Figure 4.4: Exchange Rate	38

CHAPTER ONE

STUDY BACKGROUND AND PROBLEM SETTING

1.0 Introduction

This chapter introduces the background information about the study. Sections 1.1 gives an overview of interest rate dynamics and highlight some specific interest rate issues in Tanzania prior and post financial sector reforms. Mostly, it discusses various interventions taken to manage interest rates in conjunction with literature review, from which the research problem and rationale of the study is highlighted and the study is justified.

1.1 Background

Interest rates are among closely watched variables in the economy. Their movements are reported almost daily by the news media, because they daily affect our everyday lives and have important consequences for the health of economy. They affect personal decisions such as whether to consume or save, whether to buy a house and whether to purchase bonds or put funds into saving account. Interest rates also affect the economic decisions of business and households, such as whether to use their funds to invest in new equipments for the factories or to save their money in a bank. Therefore, Interest rate should be monitored and adjusted accordingly because it is a contributing factor in macroeconomic policy making (Wilson& Sheefeni, 2014).

The interest rate behaviour in Tanzania exhibited mixed trend in different periods before and after financial liberalization. During the period 1961-1967, the Tanzanian interest rate policy was largely controlled by the East African Currency Board (EACB) – a board that was established in December, 1919. The EACB was mainly concerned with the interest rates on government securities.

There was no concern with interest rates charged by commercial banks. The emphasis at this time was on keeping the local Treasury bill rate at approximately 12.5% below the United Kingdom (UK) Treasury Bills. The so-called 'big three' commercial banks in Tanzania (the National and Grindlays Bank, the Standard Bank and the Barclays Bank D.C.O.) tied their interest rates to money market rates in London. However, during this period the interest rate on saving deposits did not show any significant change. For example, the deposit rate decreased from 3.5% per annum in 1961 to 3% per annum in 1962 and remained unchanged until 1964. The interest rate later increased to 3.5% in 1965, which prevailed until 1966. The small variations in the deposit rate could be attributed to the cartel nature of commercial banks that operated in the country during this period.

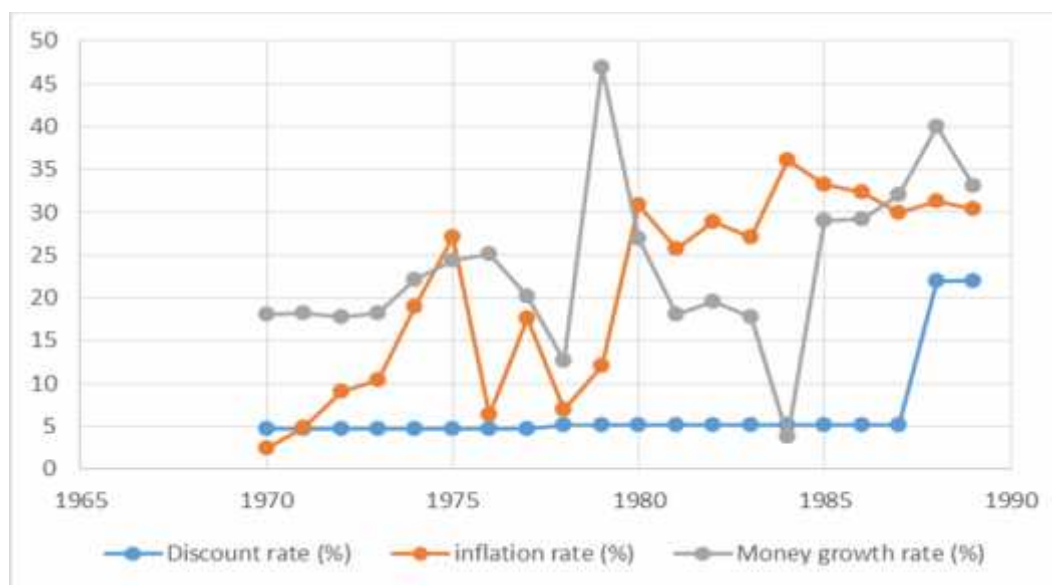
Following the Arusha Declaration in April 1967, the interest rate policy was changed substantially. This marked the beginning of an era of administratively-fixed interest rates in Tanzania. In 1969, for example, the government lowered the Treasury bill rate to 4.3% per annum from 4.6% in 1968, a rate that was maintained for 14 years. The rationale for this move was to lower the cost of government borrowing from the banking system.

However, the rate was later adjusted upward to 5.00% in 1983 and 5.70% in 1985. Although the nominal Treasury Bill rate remained more or less fixed during the period 1967-1985, the real rate remained virtually negative throughout this period, with the lowest rate (-26.95%) being recorded in 1981. The negative real interest rate is attributed to the high and persistent inflation that prevailed during this period. As in the case of Treasury Bills, the bank rate was administratively fixed throughout this period. The nominal bank rate remained fixed at 5.00% during 1967 to 1977. The rate was later adjusted to 6.00% in 1979, a rate that was maintained until 1986. Although the nominal rate remained fixed during this period, the real bank rate followed a different trend. The rate remained negative during 1973 to 1985, with the lowest rate (-28.88%) being recorded in 1985.

The deposit rate also remained fixed at 4% per annum over the period 1967 to 1984. It was then adjusted to 4.5% in 1985, reflecting an increase of only 50 basis points after a period of almost 20 years.

However, the real deposit rate remained largely negative throughout the pre-reform period. Likewise, the nominal lending rate followed a similar trend. The lending rate was lowered from 7% per annum in 1967 to 6.5% in 1968, and thereafter remained unchanged until 1977. It was then adjusted upwards to about 6.54% in 1978 and reached 13% in 1984. The real rate, on the other hand, remained negative throughout this period. Since 1986, there has been a reversal of interest rate policies. This is evidenced in the upward trend of interest rates recorded since 1986. Figure 1.1: shows the trends of selected variables, interest rates, inflation rates and money growth in Tanzania during 1970-1989.

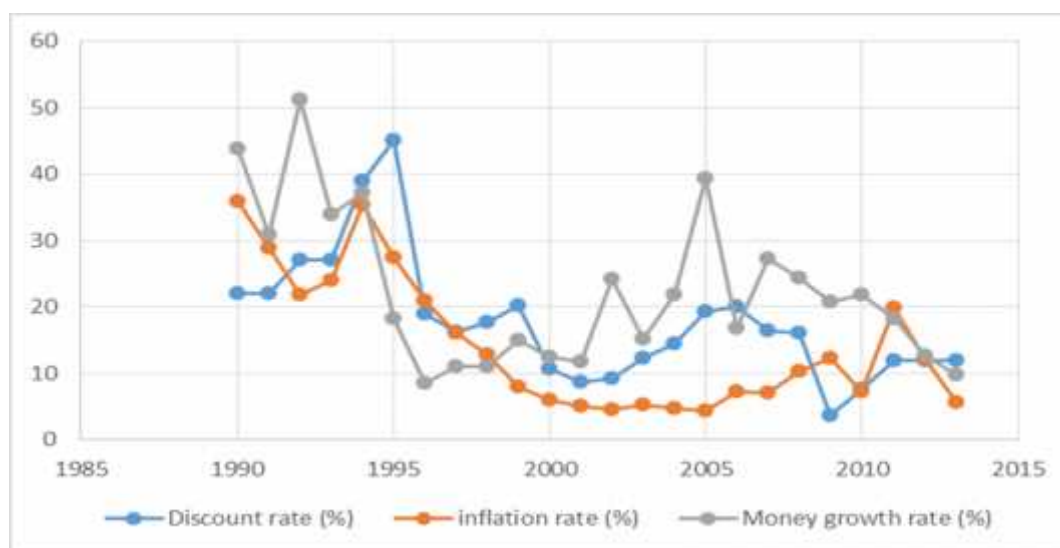
Figure 1.1: Trends of Interest Rates, Inflation Rates and Money Supply in Tanzania 1970-1989



Source: Compiled from BOT reports, 2013.

Following the full implementation of financial liberalization in 1990s, Tanzania suffered sharp increases in both nominal and real interest rates because rate was left to be determined by market force and by the time the financial institution was in infancy stage. For example, during 1993 to 2001, nominal discount and lending rates remained at a double-digit level, except in 2001. During the same period, the Treasury bill rate reached 40.33% in 1995 while the deposit rate reached 26% in 1994. The real lending rate, which was largely low and negative before interest rate liberalization, persistently remained positive and high throughout the period (Odhiambo, 2011). The figure 1.2: shows the trends of selected variables; interest rates, inflation rates and money growth in Tanzania during 1990-2013.

Figure 1.2: Trends of Interest Rates, Inflation Rates and Money growth in Tanzania (1990-2013)



Source: Compiled from BOT report, 2013

The implementation of financial liberalization which was the result of Nyirabu Commission was reviewed by the Government in 2001. The review results showed that more needed to be done to improve the efficiency of financial resources mobilization and allocation.

In particular, there was still a need to expand access to financial services by the majority of Tanzanians, most of whom operated outside the formal financial system. In order to boost economic development in the country, there was also a need to develop medium and long-term lending instruments and to bring financial services within the reach of the Small and Medium Enterprises (SMEs) Sector. In assessing the impact of the financial reforms the government invited International Monetary Fund/World Bank to form a joint mission to conduct a Financial Sector Assessment Programme (FSAP) in May 2003. The focus of the assessment was to identify the strength, vulnerabilities and general soundness of the country's financial system. The FSAP Mission report observed that access to financial services by the majority was still inadequate, as large segments of the economy were still working with little formal credit and interest rates on loans were very high.

The report recommended a number of legal, judicial and institutional reforms that would remove the main obstacles to lending, deepen financial intermediation and help develop the financial system.

As a follow-up to the FSAP report recommendations, the Government appointed a committee to review the recommendations of the joint IMF/World Bank FSAP report and propose actions for implementation. The committee chaired by the Governor of the Bank of Tanzania (BOT) developed a roadmap which outlined a plan of actions to undertake the activities in the identified areas. The roadmap covering the period from 2006 to 2011 came to be known as the Second Generation Financial Sector Reforms (SGFSRs) and was developed and approved by the Government in 2006. Development partners namely the International Development Association (IDA) and the UK Department for International Development (DFID) agreed to provide Technical Assistance in areas where they had competence through new or ongoing programs (BOT, 2011).

Despite all these efforts taken by the government to remove the obstacles in the financial sector, interest rate in financial institutions and banks is still high and restrict potential borrowers the access to financial services. Presenting to the national assembly, the estimates of government revenue and expenditure for fiscal year 2014/2015, Minister of Finance explained the awareness of the government of higher interest rate charged by banks and financial institutions and called upon stakeholders in collaboration with BOT to conduct a research on the issue with the view to address them (UNITED REPUBLIC OF TANZANIA [URT] BUDGET, 2014/15).

Interest rate behaviour has been the area of interest by many scholars; Obamuyi and Olorunfemi (2011) examined the implications of financial reform and interest rate behaviour on the economic growth in Nigeria. Study results revealed that financial reform and interest rates have significant impact on economic growth in Nigeria; also, results implied that the interest rate behaviour is important for economic growth.

1.2 Statement of the problem

The interest rate is perhaps the most controversial of all financial policies (Ebiringa, 2012; Berument, 1999 & Monnet et al., 2001), as central banks today states their policies in terms of interest rates thus interest rates policies have bearing on many economic variables such as investment decisions (that is financing of various development projects). Interest rates play a crucial role in the efficient allocation of resources aimed at facilitating growth and development of an economy and as a demand management technique for achieving both internal and external balance with specific attention for deposit mobilization and credit creation for enhanced economic development (De Angelis et al., 2005).

The higher interest rate characterized by developing countries including Tanzania since the full implementation of financial sector reforms in 1990s (Odhiambo, 2011) have restricted the access of potential borrowers to credit markets thus reducing investments and limiting growth potential of the economy.

Moreover, problems become more acute for small businesses, household enterprises and rural industries which are vital to promoting equitable growth and reducing poverty in low income countries. In addressing the challenges of high interest rates on loans which are charged by commercial banks and financial institutions which have major adverse effect on accessing financial services for majority of population, the government of Tanzania has taken several initiatives including: continuing with implementation of the Property and Business Formalization Programme (MKURABITA); establishment of the Tanzania Mortgage Refinancing Company (TMRC); continue with issuance of National Identification Cards and residential addresses; utilization of the Credit Reference Bureau; and strengthening of Credit Guarantee Schemes under supervision of the Bank of Tanzania. Despite the efforts taken to deal with higher interest rate the government have called in collaboration with the Bank of Tanzania and other stakeholders to conduct an analysis of the causes to high interest rates charged by the commercial banks and financial institution with a view to address them ([URT] BUDGET, 2014/15).

1.3 Research question(s)

The movements of interest are watched closely in the economy as they affect everyday life and have important consequences for the health of economy. They affect personal decisions such as whether to consume or save, whether to buy a house and whether to purchase bonds or put funds into saving account. Interest rates also affect the economic decisions of business and households, such as whether to use their funds to invest in new equipments for factories or to save to save their money in a bank. The most known economic factors affecting the interest rate are: inflation, economic growth, money supply and budget deficit (Madura, 2009). Despite the efforts made by the government of Tanzania during pre and post financial liberalization in 1990's to make interest rate low, the interest rate is still high. For example the inflation for December 2013 was 5.2%, over all Treasury bill rate was 15.2% and inflation rate for December 2014 was 4.8% and over all Treasury bill rate for the same period was 15.73% (BoT, 2014).

Therefore, interest rate should be monitored and adjusted accordingly because it is a contributing factor in macroeconomic policy making (Wilson, & Sheefeni, 2014). This study is set forward to find the answer for the following question. How do money supply, inflation rate and exchange rate instability in both short run and long run affect interest rates in Tanzania?

1.4 Research objectives

The main objective of this study was to determine the dynamic determinants of interest rates in Tanzania with a focus on inflation, money supply and exchange rates by using Tanzania data so as to ascertain its importance in monetary policy. In particular, the specific objectives of this study were:

- a) To investigate the relationship between nominal interest rates and the level of inflation (Fisher hypothesis) in Tanzania.
- b) To determine if money supply is another factor that have effect on interest rate hence to control it so as to maintain desired interest rate.
- c) To investigate if exchange rate dynamics also have effect on interest rate and controlling it so that the desired interest rate are attained.

1.5 Rationale of the study

Interest rate is a key financial variable that affects the decisions of governments, businessmen and customers who need funds for the purpose of investments, hoarding and consumptions respectively. Government borrows funds for the provision of public goods; the businessmen borrow for the purchase of capital goods and for starting of new projects. Therefore, interest rates are used to keep economic growth in line. Lower interest rates encourage borrowing and tend to enhance economic growth. Higher interest rates increase the cost of borrowing for both consumers and government, encourage saving, and tend to slow economic growth. Central banks routinely state monetary policies in terms of interest rates. For example, in December 2014, the Russian central bank increased interest rates by 6.5 percent-point of the key rate to 17%.

The decision was aimed at limiting substantially increased rouble depreciation risks and inflation risks”, according to BBC News, Moscow (Steve, 2014).

Central banks do not control interest rates directly. They can target interest rates, but they can only attempt to hit those targets by adjusting other instruments they control, such as supply of bank reserves, inflation rate and exchange rate dynamics. Changes in these instruments are what actually change the level of interest rates (Monnet et al., 2001).

Interest rates are important on a number of levels. On a personal level, high interest rates could deter you from buying a house or a car because the cost of financing it would be high. Conversely, high interest rates could encourage you to save because you can earn more interest income by putting aside some of your earnings as savings.

On a more general level, interest rates have an impact on the overall health of the economy because they affect not only consumers’ willingness to spend or save but also businesses’ investment decisions. High interest rates, for example, might cause a corporation to postpone building a new plant that would ensure more jobs to curb the increasing unemployment rate. Because changes in interest rates have important effects on individuals, financial institutions, businesses, and the overall economy, it is important to explain fluctuations in interest rates that have been substantial over years (Mishkin, 2004). For example, Tanzania suffered sharp increase in both nominal and real interest rate following financial liberalization in 1992 and 1993. During 1993 to 2001, nominal discount and lending rates remained at a double-digit level, except in 2001. During the same period, the Treasury bill rate reached 40.33% in 1995 while deposit rate reached 26% in 1994. The real lending rate, which was largely low and negative before liberation, persistently remained positive and high throughout the period (Odhiambo, 2011).

1.6 Organization of the dissertation

The study is in six chapters. Chapter one comprises the background of the study, Statement of a problem, research question (s), research objectives, rationale of a study and organization of the study. The second chapter which is the literature review entails theoretical and empirical reviews of the study. The theoretical review consists of the relationship between rate of inflation and interest rates, money supply and interest rates and finally exchange rate dynamics and interest rates. The empirical part is also separated as in theoretical review. The hypotheses used in this study formulated in this part based on the results previous empirical studies. Chapter three, research methodology, includes types of the study, area of a study, study population, sample size and sampling techniques, types and sources of data, data analysis methods, Econometrical Model Specifications includes statistical and econometrical tests that would be carried out such as stationarity, cointegration and causality tests and description of the model to be used (VECM). Chapter four is made up of empirical analysis and presentation of results. Chapter five is made up of discussion of findings. The final chapter is the conclusion, which includes the summary of findings, policy implication, recommendation and limitations of the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter is divided into two main sections. Section one comprises the theoretical review and section two comprises the empirical review of the study. The chapter identifies among other things the various methods used in the empirical examination of the theoretical literatures. This chapter therefore served as the basis upon which the appropriate model was chosen for empirical analysis.

2.1 Theoretical review

This section reviews theoretical literature on the relationship between inflation and interest rates, money supply and interest rates and lastly, exchange rate and interest rate.

2.1.1 Rate of inflation and Interest Rates

The relationship between nominal interest rates and the rate of inflation is often couched in terms of the *Fisher hypothesis*, which is named for the famous economist Irving Fisher, who formally proposed it in 1930 (reference-fundamentals of valuations). According to the Fisher effect, the nominal interest rates reflect all the available information regarding the future levels of the rate of inflation. Therefore, the nominal interest rate should have a direct one to one relationship with the expected rate of inflation, under the assumption that the real interest rates are independent of movements in inflation. The hypothesis, proposed by Fisher (1930) have been a subject of significant amount of the empirical research conducted in developed countries and emerging economies to prove and establish this hypothesis. This wealth of literature can be attributed to various factors including the pivotal role that the nominal rate of interest and, perhaps more importantly, the real rate of interest plays in the economy (Awomuse & Alimi, 2012).

The real interest rate reflects the real cost of borrowing, is likely to be a better indicator of the incentives to borrow and lend. It appears to be a better guide to how people will be affected by what is happening in credit markets (Mishkin, 2004:80). The validity of the Fisher effect also has important implications for monetary policy and needs to be considered by monetary authorities (Alimi, 2014).

Despite the significant amount of research conducted to prove and establish the validity of Fisher hypothesis in developed and developing countries, to the best of my knowledge there is limited study which has been conducted in Tanzania to validate this important hypothesis. The recently research papers including those by Tsong and Hachicha (2014); Alimi (2014); Berument, Ceylan and Olgun (2007); Ayub et al. (2014); Obi, Nurudeen and Wafure (2009); Umoru and Oseme (2013); Mahdi and Masood (2011); Mitra (2010); and Awomuse and Alimi (2012). Therefore, this study was conducted to prove the validity of Fisher effect in Tanzania.

2.1.2 Money Supply and Interest Rates

Economic theory offers two seemingly contradictory views of the relationship between money supply and interest rates. The liquidity preference theory for the interest rate determination suggest that changes in equilibrium rates results from changes in the demand for and supply of money. Increases in money supply by monetary authorities lead to a deduction in interest rates (i.e., the liquidity effect). On the other hand, changes in demand result from income and price effects that are positively related to interest rates.

The liquidity effect generally has an immediate influence on interest rates, while income and price effects can involve substantial time lags. This is because increases in money supply take time before they increase prices and income in the economy. It is important for monetary policy to identify the magnitude and speed of adjustment associated with each effect (Mishkin, 2004:112-118). This view is called *liquidity theory framework*.

Another view, which follows from the Fisher equation due to fact that expectations of inflation also have an important influence on the interest rates. According to Fisher (1896) effect; money and interest rates are positively related: increasing interest rates requires an increase in the rate of money growth. The Fisher equation states that the nominal interest rate equals the real interest rates plus expected inflation (Fisher, 1896). If monetary policy does not affect the real interest rate (and errors in inflation expectation are ignored), then the Fisher equation implies that higher nominal interest rates are associated with higher money growth rates. The fisher equation suggests that an increase in interest rates requires an increase in the money growth rates. This is called *Fisher equation view* (Monnet & Weber, 2001).

The central banks are conflicted by these two seemingly contradictory views in translating its interest rate target into actual changes in the money supply. One view implies that interest rates move in opposite direction as the money supply; the other that they move in same direction.

Most of the studies on the effect of money supply on interest rate have concentrated on the United States and little work has been done using data of other developing economies (Yunana, Chenbap, Yunana, & Akpan, 2014). The recently studies on these relationship between money supply and interest rates are as follows; Schabert (2005), Michis (2011), Monnet and Weber (2001), Yunana et al. (2014). This study intended to add to the existing literature the relationship between money supply and interest rate and its policy implications by using data from Tanzania.

2.1.3 Exchange Rate Dynamics and Interest Rates

The theoretical relationship between exchange rate and interest rate is portrayed by the Interest Rate Parity Theory. The interest rate parity characterizes the relationship between interest rate and exchange rate of two countries. It assumes that the exchange rate of two countries will be affected by their interest rate differentials. The interest rate parity tries to relate interest rate of one country to the exchange value of her trading partner (Fadli et al., 2011).

In other words, interest rate change in a country is a reflection of the exchange value of the currency of that country and her trading partners(s). Thus, when interest rates are low, exchange value of the domestic currency in relation to international currencies will be low (devaluation). The reverse is the case if interest rates are high. The exchange rate and the interest rates are typically considered to be negatively related in the short-run when product price are sticky and positively related in the long run when they are not. An increase in country's interest rate relative to the other countries will induce financial capital flows to this country, which creates pressure for that country's currency to appreciate (Hacker et al., 2010).

2.2 Empirical literature review

This section is made up of the empirical reviews of the relationship between inflation and interest rates, money supply and interest rates and finally exchange rate and interest rates.

2.2.1 Rate of inflation and Interest rates

There is voluminous empirical literature on the relationship between inflation rate and interest rate. Tsong and Hachicha (2014) reinvestigated the validity of Fisher hypothesis, for several selected developing countries: Indonesia, Malaysia, Russia and South Africa by using A Quantile Cointegration Approach, they found the long run relationship between inflation rates and interest rate. More specifically, in the upper quantiles there is one-to-one relationship between the two variables, supporting the Fisher effect, while in the lower quantiles, the nominal interest rate responds by a lower percentage than the change in inflation.

The study by Burument , Ceylan and Olgun (2007), testing the Fisher hypothesis for as many as 52 counties (G7 countries and 45 developing economies) within a common framework using monthly data revealed that Fisher hypothesis holds in all G7 countries both in its simple and augmented versions. And the hypothesis fails to hold in more than half of the developing economies included in the sample.

Obi et al. (2009) conducted an empirical investigation of the Fisher Effect in Nigeria by using a co-integrated and Error Correction Approach and using the data from 1970-2007. The study discovered that there is existence of a long run partial fisher effect in Nigeria. The same results was also confirmed by Awomuse and Alimi, (2012) when they conducted a study to investigate the relationship between expected inflation and nominal interest rates in Nigeria and the extent to which the Fisher effect hypothesis holds, for the period 1970-2009 using the Johansen Cointegration Approach and Error Correction Mechanism. In addition to the already mentioned results study by Awomuse and Alimi (2012) confirmed that causality run strictly from expected inflation to nominal interest as suggested by the Fisher hypothesis and there is no “reverse causation” and only about 16 percent of the disequilibrium between long term and short term interests is corrected within a year.

Ayub, Rehman, Iqbal, Zaman. and Atif (2014), on their study on the relationship between Inflation and Interest Rate: Evidence from Pakistan. The study focused on the study of the causal relation of inflation rate with that of nominal interest rate in Pakistan using time series data from 1973-2010. The study revealed that there exists a relationship for long run or co-integration relationship in nominal interest rates and inflation rate at 5 percent significant level for period of 1973-2010.

Mahdi and Masood (2011) used Johansen’s co-integration approach and then Vector Error Correction Model (VECM) approach in their analysis of the long run relationship between interest rates and inflation in Iran: Revisiting Fisher’s hypothesis. Their study was guided by two hypotheses, first, there is no long run relationship between inflation rate and interest rate in Iran and, second, there is just one way relationship between inflation rate and interest as suggested by Fisher hypothesis. The results of the study showed that there is co-integration between two variables, but this long run relationship is in two ways. It means inflation rate affects interest rate and vice versa, but this relation from interest rate to inflation is more powerful than inflation rate to interest rate in Iran.

Chowdhury (2012) studied the impact of Inflation on Bank Lending Rates in Bangladesh using Augmented Dickey Fuller Test and Co-integration test for the study period 2002-2011. The results show that there is no significant relationship between the interest rates and inflation rates.

The study by Mitra (2010), on developing cointegrating relationships between interest rates and other macroeconomic variables using the latest available data in Indian context, could not find a stable relationship between the variables on visual plots. The lack of long term relationship was confirmed by using methodology suggested by Johansen. This is contrary to the hypothesis postulated by Fisher (1930) of stable long run relations between interest rates and inflation rate.

Jaradat and Al-Hhosban (2014) conducted a study on the relationship and causality between interest rate and inflation rate within Jordan economy over the period of time (1990-2012) by using multiple regression, correlation, unit root tests, co-integration tests and causality tests, as well as the trends, graphs and charts of the variables to analyze the variables under study. The empirical results of the study showed that there is a positive relationship between inflation and interest rate in Jordanian economy over the period of time under study. Thus the policy makers should pay attention to this kind of relationship between these two such important economic variables.

Alimi (2014), conducted an investigation on the relationship between expected inflation and nominal interest rates in Nigeria and the extent to which the Fisher hypothesis holds, for the period 1970-2012. The study applied ARDL bound testing, Vector Error Correction Model (VECM) and the stability of the functions was also tested by CUSUM and CUSUMSQ. The results of the study suggested that the full Fisher hypothesis does not hold but there is a Fisher effect in the case of Nigeria over the period under study. More so, the paper revealed that in the closed-economy context, the causality run from expected inflation to nominal interest as suggested by the Fisher hypothesis and there is no “reverse causation”.

The empirical testing of the Fisher hypothesis has been renewed researchers interest despite the mixed empirical evidence on the long run Fisher effect due to inflation-targeting monetary policy in many countries of the world and advances in the time series techniques for studying non-stationery data with the help of various cointegration techniques and recently developed Auto-regressive Distributed Lag (ARDL). In developing countries, especially Tanzania, there are sparse literature on empirical testing of the Fisher effect and this study aims at providing more insightful literature. Moreover, the instability of interest rate and other macroeconomic variables such as inflation rate have continued to be of intense concern to both government and policy makers.

2.2.2 Money Supply and Interest rates

A study by Yunana et al. (2014) applying vector auto-regression approach and granger causality statistics in examining the effects of money supply and fiscal deficits on interest rates and the bilateral relationship between these economic variables in Nigeria revealed that in short-term liquidity theory framework hold for Nigeria. When money supply increases, interest rates decline in the first step. This evidence implicates that the income, price and price expectations effect are not robust in the short term.

Michis (2011) conducted a study to examine the existence of a liquidity effect in Mexico over different time scales. The analysis drew from the liquidity preference framework, an approach to interest rate determination, and used wavelet multiscale analysis in the context of a standardised regression model. The results suggest that, in short-term cycles, interest rates are influenced primarily by changes in the money supply (i.e., the liquidity effect). In medium-term and long-term cycles, the liquidity effect becomes less important and interest rates are found to be more sensitive to income and price effects.

Monnet and Weber (2001) described and reconciled two common, seemingly contradictory views about a key monetary policy relationship: that between money and interest rates for about 40 countries. One, the liquidity effect view, is that increasing interest rates requires a decrease in money supply. The other view, The Fisher Equation view, is that increasing interest rates requires an increase in the rate of growth of money supply. The empirical evidences examined found the consistence of both views. Also, they have present the model that reconciles the two views. In the model, surprise increases in current money growth that leave expected future money growth unchanged lead to lower interest rates. However, increases in expected future money growth, lead to higher interest rates.

Dabale and Jagero (2013) on their study of causes of Interest Rate Volatility and its Economic Implications in Nigeria for the year 2000-2005 periods; found a negative relationship between the broad money supply and interest rates. As the broad money supply increase in the economy the interest rate decline. This result confirms the position of the Keynesians that though the supply of money is a function of interest rate to degree, yet it considered to be fixed by the monetary authority, that is supply of money is taken to be perfectly inelastic. The other factor which proved to be statistically significant causing interest rate volatility in Nigeria by these researchers is the required reserve ratio. There is negative relationship between interest rate and required reserve ratio.

2.2.3 Exchange Rate Dynamics and Interest Rates

Hacker, Karlsson, and Månsson (2012) investigated the relationship between exchange rates and interest rate differentials. Using a wavelet approach they investigated the relationship between the spot exchange rate and the interest rate differentials for seven pair of countries, with a small country, Sweden, included in each of the cases. Their key empirical results showed that there tends to be a negative relationship between the spot exchange rate (domestic-currency price of foreign currency) and the nominal interest rate differential (approximately the domestic

interest rate minus the foreign interest rates) at the short time scales while a positive relationship was shown at the longest time scales. This indicates that among models of exchange rate determination using the asset approach, the sticky-price models are supported in the short-run while in the long-run the flexible-price models appear to better explain the sign of the relationship.

Wilson and Sheefen (2014) studied the relationship between interest rates and exchange rate in Namibia by using Vector Autoregressive (VAR) approach. The study used quarterly data for the period 1993:Q1 to 2012:Q4. Time series techniques such as unit root tests, cointegration test, and impulse response and variance decomposition were used to find the relationship between the variables. The results for cointegration show that there is no cointegration among the variables. The empirical results of their study have been unable to detect a clear systematic relationship between interest rates and exchange rates for the period under study. However, the variance decomposition further revealed that the errors in the forecast of both the exchange rate and interest rate are dominated by itself and insignificant percentage is also attributed to other variables.

Andries, Ihnatov, and Tiwari, (2014) conducted a study of analyzing time-frequency relationship between interest rate, stock price and exchange rate through continuous wavelet. In this study the scholars investigated and identified the co-movement of interest rate, stock price and exchange rate in India in the period between July 1997 and December 2010 using the cross-wavelet power, the cross-wavelet coherency, and the phase difference methodologies. The empirical findings of the study suggest that stock prices, exchange rates and interest rates are linked. The cross wavelet results showed that stock price movements are lagging both to the exchange rate and interest fluctuations. The results are mixed regarding the interest rate-exchange rate pair. The lead-lag relationship is mixed and has been identified for a relatively short interval (2005-2007). On long term (2-3 years) the interest rate is the appropriate monetary policy transmission channel, while on a shorter term (close but less than 2 years) it is the exchange rate.

Going to shorter terms, i.e. less than 12 months, the interest rate and the exchange rate seem to alternatively lead the relationship. This suggests that both instruments are used by authorities in order to achieve monetary objectives.

The study by Kayhan, Bayat, and Ugur (2013) conducted a study examining the dynamic relationship between the real exchange rate and the real interest rate in the BRIC-T (Brazil, Russia, India, China and Turkey) countries by employing monthly data from the beginning of flexible exchange rate regime to July 2011. The non-linear causality test and frequency domain causality test approaches were used in the study. According to frequency domain causality test results, interest rate affects exchange rate in only china and this effect exist only in the long run. On the other hand, exchange rate shocks induce changes in interest rate in the shorter period.

The theoretical and empirical literature proves that there exists a relationship between interest rates and exchange rates. This conclusion is not definite because of the mixed findings for instance some studies found that there exists a negative relationship in the short-run and positive in the long-run and others no relationship but economic theory postulates a negative relationship between these variables, this gap forms the basis for this study.

2.3 Conceptual framework

2.3.1 Interest Rate

Interest rate refers to the price a borrower pays for temporary usage of capital. It also implies the returns a lender expects by postponing and parting with his/her liquidity (Obi et al., 2009). It is usually expressed as an annual percentage of the principal and calculated by dividing the amount of interest by the amount of principal. Interest rates are an important tool that can be used to affect prices and output in an economy through monetary expansion and monetary tightening (Wilson et al., 2014). Interest rates are determined on the basis of demand and supply for money. However, it is the investment opportunities in the economy that create demand for money.

This means that once a new set of approved projects has been identified, it must be financed and in financing, interest rate is critical. Interest Rate is therefore the amount of money a borrower will pay a lender for the use of their funds over a period of time. It's also a monetary tool used by central bank in curbing inflation (Makinen & Labonte, 2006). The expectation is that changes in interest rates will force both firms and individuals to revise their investment and spending behaviour. In Mishkin, (2004), the assertion is that high real interest rates reduce both consumer spending and investment spending and ultimately resulting into lower real output.

2.3.2 Inflation rate

Inflation refers to the persistent increase in general prices. The rate of inflation has far-reaching implications for performance of the economy. For instance, higher rates of inflation will reduce aggregate demand, production, unemployment, trade deficits and balance of payments just to mention few. On the other hand, a low and moderate inflation will encourage economic activity particularly production. This in turn will raise gross domestic product (GDP), reduce unemployment, and ease the balance of payment problems (Obi et al., 2009). The relationship between inflation rate and interest rate has continued to generate series of debate among economist since Fisher (1930) asserted that a percentage increase in the expected inflation would lead to a percentage increase in the interest rate. The high rate of interest and inflation have adverse effect on investment demand. Despite the high rate of inflation and interest that continuing to be source of worry for both government and policy makers, the empirical studies on the existence of fisher effect in developing countries remain scanty (Obi et al., 2009)

2.3.3 Money supply

Money supply means increasing the amount of money in circulation in the economy. The special role that money plays in the economy can never be overemphasized. It has always been an issue of great concern to both the monetary policy makers and the economists.

Changes in the amount of money can have a significant effect on the major macroeconomic indicators including Inflation, unemployment, economic growth, exchange rates, the balance of payments and interest rates (Yunana et al., 2014). The economic theory postulates that as money supply increases the interest rate will fall in the short-run and then rise in the long-run as results of income effects and price. Most of the studies on the effect of money supply on interest rate have concentrated on the United States and little work has been done using data of other developing economies (Yunana et al., 2014). This research will add materials to existing literatures as long as empirical studies on the relationship between money supply and interest rates are inconclusive.

2.3.4 Exchange rates

Exchange rate is simply the price of one country's currency in terms of another country's currency. In this study the exchange rate will be Tshs/USD that is the amount of Tanzanian Shillings (Tshs) to purchase one US dollar. Theoretically currency of a country depreciates against other country's currency the interest rate of depreciating currency country will increase. Most of empirical studies have been carried out to find the relationship between Exchange rate and Interest Rate differentials and not interest rate (Hacker et al., 2010; Kayhan et al., 2013). This study intended to find the effect of exchange rate to interest rate (domestic interest rates).

2.4 Hypotheses

This study was primarily a quantitative study which requires a set of hypotheses rather than a set of research questions. Based on the results of previous empirical researches, some hypotheses were formulated in this study. The specific hypotheses that were tested are shown below in null form:

- 1) There is no existence of a short-term negative relationship between money growth and interest rates
- 2) There is no long run relationship between inflation rate and interest rate in Tanzania

- 3) There is no one way relationship between inflation rate and interest rate as suggested by Fisher hypothesis.
- 4) There is no negative relationship between the volatilities of exchange rates and the interest rates.

The Fisher hypothesis will be validated by using Johansen's co-integration analysis. This analysis technique is ideal for validating Fisher hypothesis due to the fact that, it is able to verify a long-term unit proportionate relationship between nominal interest rates and expected inflation. However, a co-integrating relationship between nominal interest rates and expected inflation only partially validates the Fisher hypothesis (Mahdi, & Masood, 2011; Mitra, 2010).

Fisher (1930) hypothesized that the nominal interest rate is made up of two components: the expected rate of inflation (π_t^e) and the real interest rate (r_t):

$$i_t = r_t + \pi_t^e + \varepsilon_t \dots \dots \dots (1)$$

Where i_t is the nominal interest rate, r_t is the real interest rate, π_t^e is the expected rate of inflation and ε_t is the error term.

In the long run, $\varepsilon_t = 0$, the Fisher equation in the long run could be shown as follows:

$$i_t = \alpha + \beta \pi_t^e \dots \dots \dots (2)$$

Where α is real interest rate, β is the coefficient of inflation rate and when $\beta = 1$, but if $\beta < 1$, then there will be Fisher effect weakly.

To determine whether causality runs from inflation to interest rates, a weakly exogeneity test suggested by Johansen (1992) will be carried out.

And the hypothesis on the relationship between money supply, exchange rate and interest rates will tested using Ordinary Least Square (OLS) regression as follows:-

$$Int_t = \alpha_0 + \alpha_1 M2_t + \alpha_2 Exch_t + \varepsilon_t \dots \dots \dots (3)$$

Where Int_t is interest rate, $M2$ is Money Supply, $Exch$ is Exchange rate, t is a time frame and α_0 , α_1 and α_2 are parameters to be estimated.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This section describes the methodological approach used in the study. In this section, researcher explains how the variables were operationalized. Econometrical models are also specified in this section. The section consists of six subsections. The first subsection explains the type of the study, followed by Area of study in subsection two. The third subsection is about the study population followed by sample size and sampling techniques in subsection four. The fifth subsection is about the types and sources of data and the sixth subsection is about data analysis methods and last Econometrical model specification is presented. This subsection explains how the variables used in this study were operationalized and the econometrical software used.

3.1 Type of the Study

In this study deductive approach will be adopted in explaining the effects of Inflation rate, money supply and Exchange rate dynamics on interest rate. Deductive approach is suitable when the aim of the study is to test a theory and not developing a theory. This is in particular the case of this study, as it aims at testing theories relating to inflation rate, money supply and exchange rate which investigate whether these variables as advocated in the theory have significant impact on the interest rates.

3.2 Area of the study

The study was conducted in Tanzania. The time series data for the desired variables for the period of 1970 to 2013 was obtained from BOT. The data from BOT was reliable and relevant for the objectives of this study.

3.3 Study population

The population for this study was series of data covering the whole period of January 1970 to December 2014.

3. 4 Sample size and sampling techniques

To obtain the representative sample for the study, purposive sampling technique was employed. Purposive sampling is non-probability sampling procedure in which the judgement of the researcher is used to select the cases that make up the sample. This can be done on the basis of extreme cases, heterogeneity (maximum variation), homogeneity (maximum similarity), critical cases, or typical cases (Saunders at el. 2009). For the purpose of this study, the sample as taken from end of period data range of variables 1970-2013 which entailed 44 observations for a single variable. The total sample size was 176 observations for all four variables. This sample of this study provided worth information pertaining to the research objectives.

3.5 Types and sources of data

In order to have sufficient observations for empirical estimation and to have reliable results, end of the period time series data covering the period 1970-2013 was used in this study. The decision to select this period was based on the fact that the 1980s financial sector reforms spearheaded by BOT begun. The reforms was deliberate efforts undertaken by the Government to free the economy from financial repression, including elimination of state controls and introduction of market mechanisms. Unfortunately, the implementation of the financial liberalization policy in Tanzania, just as in many other developing countries, resulted in a number of challenges. These include high interest rates, a wide and expanding spread between lending and deposit rates, a systematic decline in domestic credit to the private sector, an unstable exchange rate, and mixed trends in financial depth (Odhiambo, 2011). Data was collected in the following variables; the CPI represented by the inflation rate, the interest rate represented by bank rate which is the BOT official interest rate, the

exchange rate represented by the nominal exchange rate between the USA dollar and Tanzanian Shilling and the money supply represented by M2. The sources of these data series were secondary data obtained from BOT Statistical Bulletin and Annual reports. Secondary data refer to information gathered by someone other than the researcher conducting the current study. Such data can be internal or external to the organization and accessed through the internet or perusal of recorded or published information. There are several sources of secondary data, including books and periodicals, government publications of economic indicators, census data, data bases etc., (Sekaran 2003: 222-223). Secondary data include both quantitative and qualitative data and they are used principally in both descriptive and explanatory research (Saunders et al., 2009: 258).

3.6 Data analysis methods

3.6.1 Econometrical Framework and Model Specification

This study will apply two econometrical models on operationalizing the variables. First model is Johansen co-integration model. The main purpose of cointegration is to examine the existence of a long run relationship between or among variables (Johansen, 1988; Johansen & Juselius, 1990). According to Granger if cointegration is present in the long run, then the system of equations is restructured by inserting an error correction term to capture the short-run deviation of variables from their relevant equilibrium values. This is necessary as the impact of money supply, inflation rate and exchange rate behave differently in short run and long run as discussed in previous chapter. Granger (1969), Eagle and Granger (1987) and Sims, C.A (1972) further stated that, if two variables are co-integrated, causality must exist in at least one direction, either unidirectional or bidirectional.

In co-integrated series, variables may share common stochastic trends so that dependent variables in the VECM must be Granger-caused by the lagged values of the error correction terms. This is possible because error correction terms are functions of the lagged values of the level variables.

Thus, evidence of cointegration between variables itself provides the basis for the construction of an error correction model (ECM). The ECM permits the introduction of past disequilibrium as explanatory variables in the dynamic behaviour of existing variables and thus facilitates in capturing both the short-run dynamics and long-run relationships between variables. The chronological Granger causality between the variables can be explored by applying a joint F-test to the coefficients of each explanatory variable in the VECM.

Vector error-correction model is able to distinguish between short-run and long-run Granger-Causality, and also indicates the direction of causality among variables. If co-integration has been detected between series there will be existence of a long-run equilibrium relationship between them so VECM will be applied in order to evaluate the short run properties of the co-integrated series. In case of no cointegration VECM is no longer required and we directly proceed to granger causality tests to establish causal link between variables. The regression form for VECM is as follows:

$$y_t = \alpha_0 + \alpha_1 e_{t-1} + \sum_{i=0}^n \beta_i y_{t-i} + \sum_{i=0}^n \gamma_i x_{t-i} + \sum_{i=0}^n \delta_i z_{t-i} \dots \dots \dots (4)$$

In VECM the cointegration rank shows the number of Cointegrating Vectors. For instance a rank of two indicates that two linearity independent combinations of the non-stationary variables will be stationary. A negative coefficient of the ECM (i.e. e_{t-1} in the equation 4 above) indicate that short-term fluctuation between the independent variables and dependent variable will give rise to a stable long run relationship between variables (Asari et al., 2011).

These time series techniques (Johansen Co-integration and VECM) were ideal for this study as far as theoretical and empirical studies discussed in the literature review session described the short-run and long run relationship between and among the variables under study.

The time series data of desired variables collected was analyzed by using STATA econometric computer software.

The analysis was set to indicate, first, which factors reported in literature are relevant to Tanzania's Interest rate volatility and, second, what are specific factors that significantly affected interest rates.

3.6.2 Econometrical Model Specifications

This study investigated the existence of such a relationship by implementing the following procedures after performing Diagnostic tests of time series data.

- 1) To determine the order of integration for two variables by employing tests devised by Dickey and Fuller (1979) and Philips and Perron (1988).
- 2) If both variables are integrated as of the same order, a maximum likelihood method of co-integration, proposed by Johansen (1991) and later improved in Johansen (1995), will be applied in order to determine the number of co-integrating vectors. If one or more co-integrating vectors are found to exist, any short-run disequilibrium will be corrected with an error correction model.

The VECM is a specified model for this study and in VECM each variable is a function of lagged values of all the variables. Therefore the model for this study is:

$$Int_t = \alpha_0 + \alpha_1 Int_{t-1} + \alpha_2 Inf_{t-1} + \alpha_3 M2_{t-1} + \alpha_4 Exch_{t-1} + \epsilon_{t-1} \dots \dots \dots (5)$$

Where

Int_t = Interest rates at time t refers to interest rates, and it is proxied by bank rates.

$M2_{t-1}$ = broad money supply at time $t-1$ refers to the total currency in circulation in the economy.

Inf_{t-1} = inflation rate at time $t-1$ refers to inflation rate

$Exch_{t-1}$ = Exchange rate

$\alpha_0, \alpha_1, \alpha_2, \alpha_3$ and α_4 are parameters to be estimated

ϵ_{t-1} = is the error term.

3.6.3 Johansen and Juselius Cointegration Tests

According to Johansen and Juselius, (1990) there are procedures uses two tests to determine the number of cointegration vectors: the Maximum Eigenvalue test and the trace test. The Maximum Eigenvalue tests the null hypothesis of r Cointegrating relations against the alternative of $r+1$ Cointegrating relations for $r=0, 1, 2 \dots n-1$. This test statistics are computed as:

$$LR_{\max}(r / n + 1) = -T * \log(1 - \lambda)$$

Where λ is the Maximum Eigenvalue and T is the sample size. Trace statistics investigate the null hypothesis of r cointegrating relations against the alternative of n cointegrating relations, where n is the number of variables in the system for $r = 0, 1, 2 \dots n-1$. Its equation is computed according to the following formula:

$$LR_r(r / n) = -T * \sum_{i=r+1}^n \log(1 - \lambda_i)$$

In some cases Trace and Maximum Eigenvalue statistics may yield different results, in this case the results of trace test should be preferred (Alexander, C.,2001).

3.6.4 Vector Error Correction Model

The purpose of the VECM is to focus on the short run dynamics while making them consistent with long run solution. If a number of variables are found to be cointegrated with at least one cointegrating vector, then there always exists a corresponding error-correction representation which implies that changes in the dependent variable can be formulated as a function of the level disequilibrium in the cointegration relationship and fluctuation in other explanatory variables (Saluja, Bhatia & Patel, 2013).

3.6.5 Granger Causality Test

The empirical causal relationship between variables can be examined by Granger-causality analysis. The objective is to test whether lagged values of one variable help to improve the explanation of another variable from its own past, Granger (1969, 1980). A time series X is said to granger-cause another time series variable, Y if and only if the past value of X improves the prediction of the current Y . The test does not only establish causal relationship between two variables in a model but also the level by which one precedes the other. Therefore causality could be bilateral or feedback, unidirectional or no causality (independence) between the variables under study.

3.6.6 Specification Tests

The presence of autocorrelation in the model would result in specification bias. It would also appear as if there is presence of ARCH effect. Akaike Information Criterion (AIC), Schwarz-Bayesian (SBC), Final Prediction Error (FPC) and Hannan-Quinn Information (HQI) criteria would be used to determine the optimal lag length for the estimation of the model. Several lag lengths would be used but the model with the minimum value of AIC, SBC, FPC and HQI is/are chosen as the most appropriate lag length.

In economic time series analysis, the magnitude of the residuals appears to correlates with each other for the presence of serial correlation or GARCH effect. The presence of this econometric problem affects the accuracy of the estimates and therefore wrong inference can be drawn. Eagle outlined Lagrange Multiplier (LM) test, for verification of the presence or absence of ARCH effect or serial correlation. The LM follows a chi-square distribution with test statistic TR^2 , where T is a sample size, R^2 is the proportion of variation explained by the explanatory variables ($TR^2 \approx \chi^2_{p}$), $\sim$ is the confidence interval and p is the number of autoregressive terms. The null hypothesis (H_o) states that there is no serial correlation or presence of ARCH effect (all the

coefficients of the square lagged terms are statistically equal to zero). If $TR^2 > i_{\alpha,p}^2$, H_0 is rejected, implying that ARCH (p) effect is present in the original model.

Finally, normality test would be carried out to find out if the residuals are normally distributed. It is asymptotic test, and therefore incorporates measure of skewness (S) and kurtosis (K). The test statistic is Jarque-Bera (JB). For normally distributed variable, S and K should be 0 and 3 respectively. The null hypothesis states that, the residual are normally distributed. If the computed probability is low, implying that JB test statistic is different from 0, the null hypothesis is rejected.

3.6.7 Time Series Properties of Data

Unit Root Procedures

A test for stationarity that is mostly used in recent time series analysis is unit root. Stationarity or stability of time series data plays a crucial role for quality inferences that can be drawn from the estimation process. This may also have a negative impact in terms of efficiency of the conditional variance estimate as well. Two or more time series data that are not stationary would result to spurious regression despite appealing R^2 , Student's F and t tests of the explanatory variables (Kwame, 2012). Based on the reasons, monthly consumer price index, which is the proxy for the measurement of inflation, Broad money (M2), which is the proxy for money supply, Exchange rate dynamics and Bank rate, which is the proxy for interest rate would be tested for stationarity.

Augmented Dickey-Fuller (ADF) as proposed by Dickey and Fuller (1979) and Philips and Perron (PP) (1988) tests would be used for the stationarity test. The ADF test is carried out on the regression: $\Delta X_t = \hat{\alpha}_0 + \hat{\alpha}_1 t + \hat{\alpha}_2 X_{t-1} + \sum_{i=1}^k \hat{\alpha}_i \Delta X_{t-i} + U_t$, of which the existence of unit root in X_t variable at time t, the variable Δ_{t-1} expresses

the first differences with k lags and final U_t is the variable that first adjusts the errors of autocorrelation. The coefficients ϕ_0, ϕ_1 and ϕ_2 are the estimates.

The null hypothesis for the existence of unit root as against alternative is: $H_0: \delta_2=0$ for existence of unit root; $H_1: \delta_2 < 0$, for no unit root, that is variable under test is stationary. When the absolute ADF (δ_2) test statistic is greater than the *tau* (τ) value, reject the null hypothesis and accept the alternative that unit root does not exist. This implies that, the variable X is stationary at level.

PP test is a non-parametric statistical test that takes care of serial correlation without adding lagged difference terms. In PP test, the regression

$$\Delta X_t = \alpha + \beta X_{t-1} + \gamma \left[t + \frac{T}{2} \right] + \varepsilon_t$$

is done of which α, β and γ are coefficients and T is

the number of observations. The null hypothesis for the presence of unit root in the variable X_t as against the alternative is: $H_0: \pi = 0$; $H_1: \pi < 0$.

CHAPTER FOUR

ANALYSIS AND PRESENTATION OF FINDINGS

4.0 Introduction

This chapter presents the results obtained in the analysis using time series data. The chapter is made of description of basic statistics of the data, Graphical analysis, interest rates (discount rate/bank rate), inflation rates, money supply and exchange rate, stationarity status of data, Lag selection criterion and Johansen test for cointegration, Vector Error Correction Model and diagnostic tests. It also finds out the relationship and causality in both long run and short run between interest rates and inflation rate, money supply, exchange rates.

4.1 Description of Basic Statistics of Data

In an attempt to determine the dynamic determinants of interest rates in Tanzania with focus on inflation rate money supply and exchange rate, this chapter begins by examining the summary statistics of the data series employed in the study in Table 4.1.

Table 4.1 shows the observations for each variable. Mean, Standard deviation (Std. Dev.), Minimum (Min) and Maximum (Max) values of each variable are also presented in the table. The mean for the variable interest rate is 12.77114, meaning on average, interest rate is 12.77114 annually. Interest rate exhibiting the Min value 3.7 and Max value 45.1, means that the mean is closer to the Min value thus most of the values for interest rate are skewed to the Min value. The Std. Dev for interest rate is 9.63008 showing that about 9.63008 of the values deviate from the mean 12.77114.

The mean for the variable inflation rate (inflrate) is 17.36591, meaning on average, inflation rate is 17.36591 annually. Inflation rate exhibiting the Min value 2.4 and Max value 36.1, means that the mean is closer to Min value, thus most of the values

for inflation rate are skewed to the Min value. The Std. Dev for inflation rate is 11.04315 showing that about 11.04315 of the values deviate from the mean 17.36591.

The mean for variable money supply (mogrowthrate) is 22.94769, meaning on average, money supply is 22.94769 annually. Money supply exhibiting the Min value 3.7 and Max 51.3, means that the mean is closer to Min value, thus most of the values for money supply are skewed to the Min value. The Std. Dev for money supply is 10.70812 showing that about 10.70812 of the value deviate from the mean 22.94796.

The mean for variable exchange rate (exchrates) is 515.3403, meaning on average, exchange rate is 515.3403 annually. Exchange rate exhibiting the Min value 6.9 and Max 1578.6, means that the mean is closer to Min value, thus most of the values for exchange rate are skewed to Min value. The Std. Dev for exchange rate is 550.0673 showing that about 550.0673 of the value deviate from the mean 515.3403.

The above description of data for each variable under study revealed that data were not normally distributed. Noting the absence of normality as revealed in Table 4.1 (a), further examination was carried out by transforming the variables into natural logarithms so as to make them normally distributed. After transforming the interest rate into its natural logarithm (lnbankrate) the normality of data was tested by using Shapiro-Wilk w test for normal data results presented in Table 4.2 (b). The P-value in Shapiro-Wilk test for normality was greater than 0.05, so we do not reject the null hypothesis that the data are normally distributed.

Table 4.1 (a): The Summary Statistics of the Data

Variable	Observation	Mean	Std. Dev.	Min	Max
Interest rate	44	12.77114	9.630008	3.7	45.1
Inflation rate	44	17.36591	11.04315	2.4	36.1
Money Supply	44	22.94769	10.70812	3.7	51.3
Exchange rate	44	515.3403	550.0673	6.9	1578.6

Source: Author's compilation using STATA.

Table 4.1 (b): Shapiro-Wilk test for normality of data

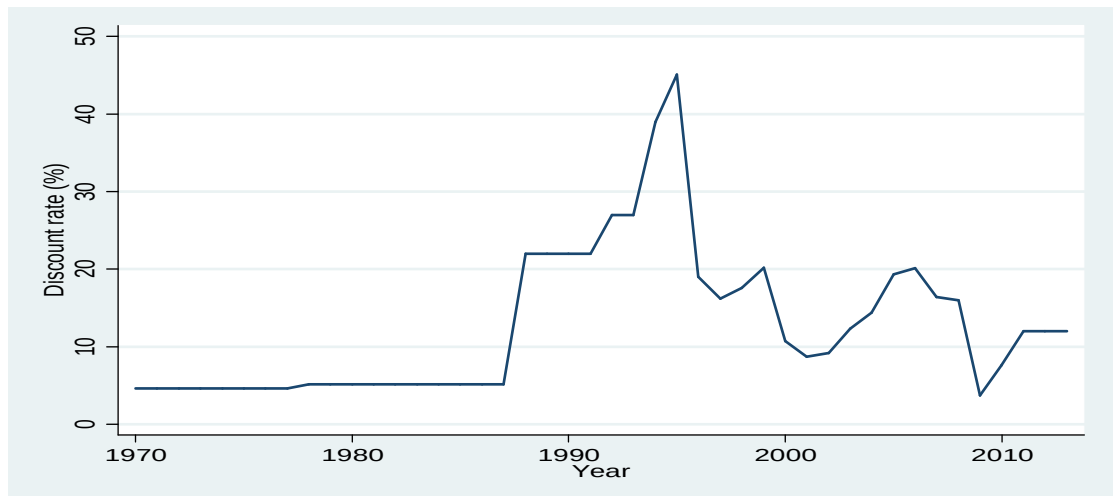
Variable	Observation	z-Statistics	Prob>z	Null Hypothesis (Ho)	Decision
Residual	44	-0.842	0.80017	Data are normally distributed	Do not reject null hypothesis

Source: Author's compilation using STATA.

4.1 (b) Graphical analysis of Data

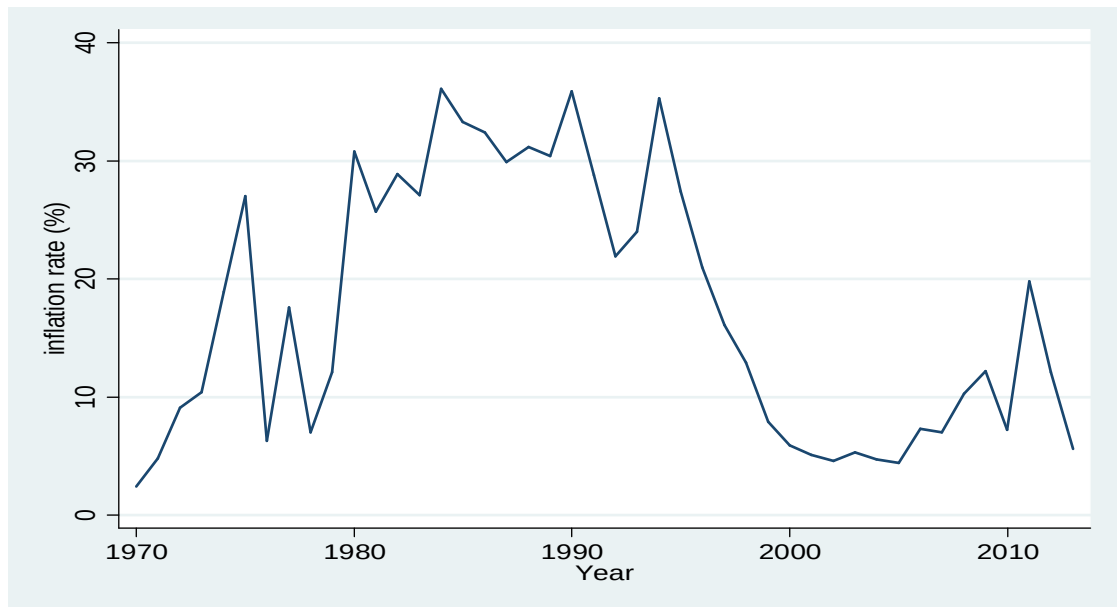
The figures below showing the trend of Interest rate, Inflation rate, Money supply and exchange rate. Interest rate, inflation and money supply (money growth rate), Figure 4.1, Figure 4.2 and Figure 4.3, exhibit stochastic trend and Exchange rate Figure 4.4 exhibit and an upward deterministic trend for the period under study.

Figure 4.1: Interest rate



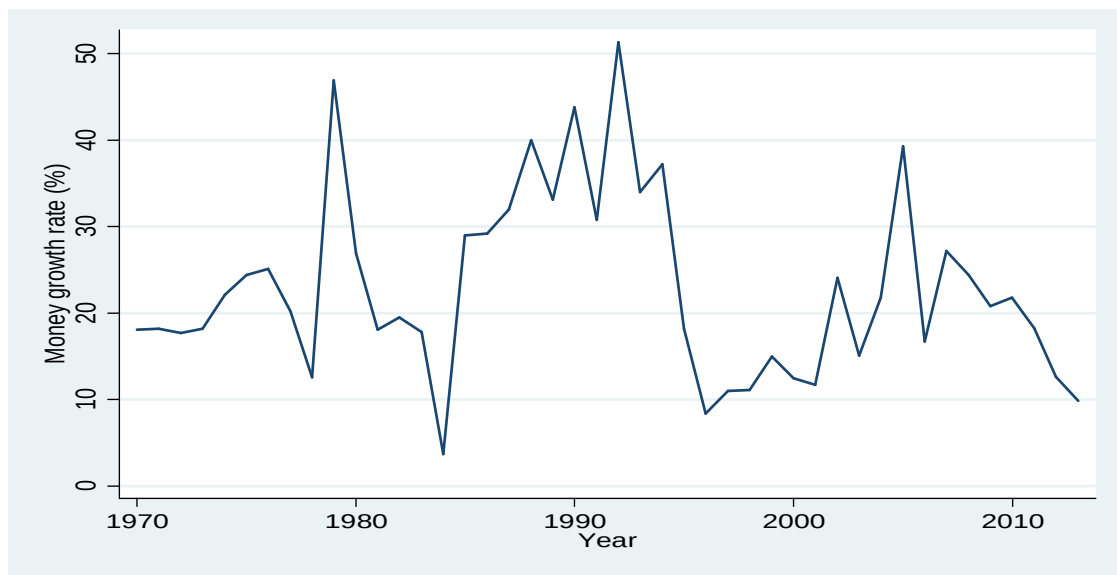
Source: Author's compilation using STATA

Figure 4.2: Inflation Rate



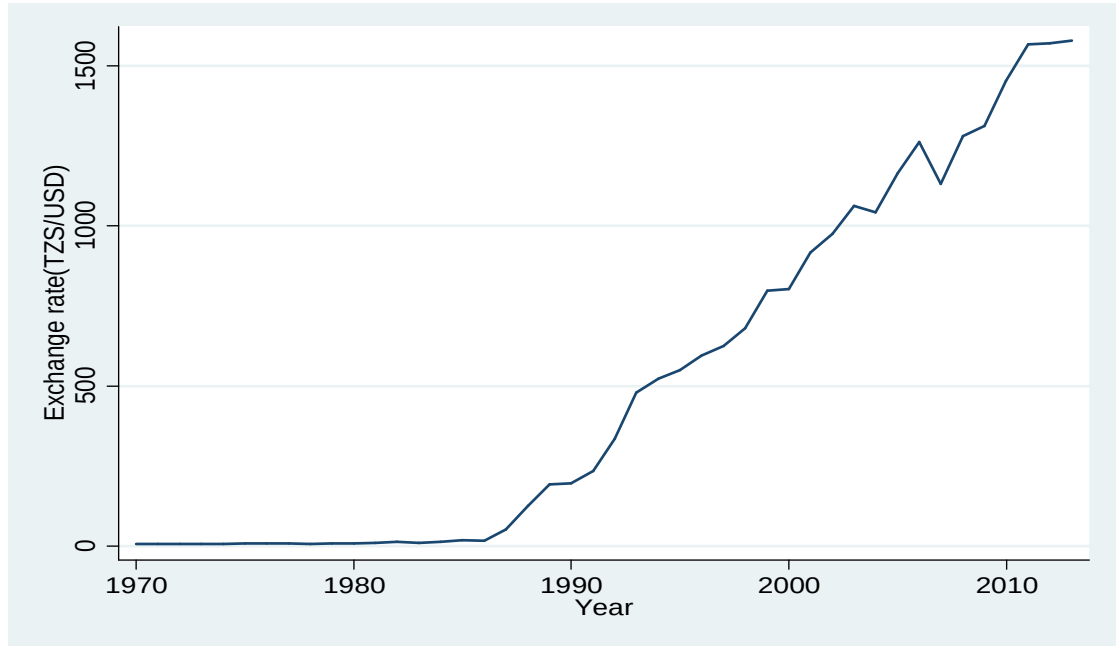
Source: Author's compilation using STATA

Figure 4.3: Money Supply



Source: Author's compilation using STATA

Figure 4.4: Exchange Rate



Source: Author's compilation using STATA

4.2 Unit Root Test

Being non-stationary implies that the mean, variance and covariance is not constant over time. When data contains unit root it means any result accrue to such data will be spurious or nonsensical (Kalikeka & Sheefen, 2013). Testing for Stationarity or non-Stationarity of the variables and determine their order of cointegration is of great important. This study employed the Augmented Dickey Fuller (ADF) statistics and the Phillips-Perron (PP) tests for unit root and 5% critical value is selected. The PP tests is necessitated by the fact that the ADF statistics has limitations of lower power and it tends to under-reject the null hypothesis of unit root (Wilson & Sheefeni, 2014). The results of the unit root test in the level form and first difference are presented in table 2(a) and table 2(b) respectively below. The tables show that the series were found to be non-stationary in level form and stationary after first difference. The P-Value in table 5 (a) is not significant ($P > 0.05$), so we do not reject the null hypothesis (H_0 : there is a unit root $\rightarrow$ not stationary).

The Stata output in table 5 (b) reveals that the observation values in inflation rate (inflrate), money supply (mogrowthrate) and exchange rate (exchrates) are stationary. After performing the first difference the P-values of the variables become significant ($P < 0.05$), so we reject the null hypothesis (H_0 : there is a unit root $\rightarrow$ not stationary).

Table 4.2 (a): Results for ADF and PP Unit Root Test at Level

Variables	Test	Statistics	P-value z(t)	Critical Values			Decision
				1%	5%	10%	
Interest Rate	ADF	-1.932	0.3172	-3.634	-2.952	-2.610	Do not reject null hypothesis
	PP	-1.935	0.3156	-3.628	-2.950	-2.608	Do not reject null hypothesis
Inflation Rate	ADF	-1.730	0.4159	-3.634	-2.952	-2.610	Do not reject null hypothesis
	PP	-2.140	0.2286	-3.628	-2.950	-2.608	Do not reject null hypothesis
Money Supply	ADF	-2.416	0.1372	-3.634	-2.952	-2.610	Do not reject null hypothesis
	PP	-4.040	0.0012	-3.628	-2.950	-2.608	Reject null hypothesis
Exchange Rate	ADF	2.166	0.9989	-3.634	-2.952	-2.610	Do not reject null hypothesis
	PP	2.324	0.9990	-3.628	-2.950	-2.608	Do not reject null hypothesis

Note: Null Hypothesis (H_0 : variables are not stationary i.e. unit root) was not rejected at level

Source: Author's compilation using STATA

Table 4.2 (b): Results for ADF and PP Unit Root Test at First Difference

Variables	Test	Statistics	P-value z(t)	Critical Values			Decision
				1%	5%	10%	Ho: unit root
Interest Rate	ADF	-5.217	0.0000	-3.641	-2.955	-2.611	Reject the null hypothesis
	PP	-6.904	0.0000	-3.634	-2.952	-2.610	Reject the null hypothesis
Inflation Rate	ADF	-5.463	0.0000	-3.641	-2.955	-2.611	Reject the null hypothesis
	PP	-8.703	0.0000	-3.634	-2.952	-2.610	Reject the null hypothesis
Money Supply	ADF	-6.164	0.0000	-3.641	-2.955	-2.611	Reject the null hypothesis
	PP	-10.855	0.0000	-3.634	-2.952	-2.610	Reject the null hypothesis
Exchange Rate	ADF	-3.757	0.0034	-3.641	-2.955	-2.611	Reject the null hypothesis
	PP	-6.326	0.0000	-3.634	-2.952	-2.610	Reject the null hypothesis

Note: All variables become stationery after the first difference.

Source: Author's compilation using STATA

4.3 Ordinary Least Square Results

Ordinary least squares (OLS) are used to estimate the influence of explanatory variables on interest rates. Table 4.3 provides regression results covering 1970 to 2013 dataset.

Table 4.3: Estimation results of OLS regression

Dependent Variable	lnbankrate			
Model	Ordinary Least Squares (OLS)			
Variables	Coefficient	Std. Err	t-Statistics	Probability> t
Inflrate	.0213561	.0096496	2.21	0.033
Mgrowthrate	.0194692	.0088773	2.19	0.034
Exchrates	.0008416	.0001869	4.50	0.000
_cons (Model)	1.042115	.2924756	3.56	0.001
R-squared	0.3803			
Adjusted R-squared	0.3338			
Prob > F (Model)	0.0002			

Sources: Author's compilation Using STATA

From table 4.3 above, it has been observed that the Coefficient of Determination (R-squared) was 0.3803 which means that about 38.03% of the interest rate in Tanzania was explained by the explanatory variables selected in this study and remaining was explained by unknown factors.

4.4 Lag Selection

The first step in multivariate cointegration analysis is the appropriate lag selection for the variables. For the selection of appropriate lag length, the study used the following criteria LR, FPE, AIC, HQIC and SBIC. The LR showed the optimal lag of 4 and FPE, AIC, HQIC and SBIC selected the lag length of 1. In this study, the lag length has been selected using lowest SBIC value as a primary concern as proposed by Hussain (2009) and Al-Majali and Al-Assaf (2014). Therefore, this study preceded further test with lag 1. The results of lag-order selection criteria are presented in Table 4.4 below.

Table 4.4: Lag-order selection criterion

Selection-order criterion								
Sample: 1974-2013				Number of Observation		=	40	
lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	-635.202				8.9e+08	31.9601	32.0212	32.129
1	-501.053	268.3	16	0.000	2.4e+06*	26.0527*	26.358*	26.8971*
2	-491.649	18.808	16	0.279	3.5e+06	26.3825	26.9321	27.9025
3	-474.133	35.034	16	0.004	3.4e+06	26.3066	27.1005	28.5022
4	-458.683	30.899*	16	0.014	4.0e+06	26.3341	27.3722	29.2052

**Indicates lag order selected by the criterion.*

Source: Author's compilation using STATA.

4.5 Testing for Cointegration

Table 4.5: Results of Johansen Cointegration Tests Based on Trace and Maximum Eigen Values of the Stochastic

Trace statistic test				Max statistic test			
Maximum rank (R)	Eigenvalue	Statistic	5% Critical value	Maximum rank (R)	Eigenvalue	Statistic	5% Critical value
0	.	54.0993	47.21	0	.	28.0139	27.07
1	0.47873	26.0854*	29.68	1	0.47873	13.5432	20.97
2	0.27018	12.5422	15.41	2	0.27018	11.4357	14.07
3	0.23352	1.1065	3.76	3	0.23352	1.1065	3.76
4	0.02541			4	0.02541		

**Trace statistics test indicates one cointegrating equation at the $\alpha = 0.05$*

Source: Author's compilation using STATA.

Cointegration is generally defined as a concept which mimics the existence of the long run equilibrium relationship among the variables. The Cointegration rank (R) can be formally tested with the trace and the maximum eigenvalue statistics.

The results for Johansen Cointegration test based on the trace and the maximum eigenvalue statistics are presented Table 4.8 above. The trace statistic either rejects the null hypothesis of no cointegration among the variables ($H_0: r = 0$) or does not reject the null hypothesis that there is one cointegration relation between the variables ($H_0: r = 0$). Start by testing $H_0: r = 0$. If it rejects, repeat for $H_0: r = 1$. When a test is not rejected, stop testing there and that value of r is commonly-used estimate of the number of cointegrating relations. In this test, the null hypothesis that there is no cointegration among the Interest rate (**Inbankrate**), Inflation rate (**inflrate**), Money supply (**mgrowthrate**) and Exchange rate (**exchrates**) at the 5% level was rejected as the trace statistics value was greater than critical value ($54.0993 > 47.21$). The hypothesis that there is one cointegration model in this system ($H_0: r = 1$) is not rejected at the 5% level as the trace statistics value is less than critical value ($26.0854 < 29.68$). Max statistics tests results are the same as trace statistics test result presented. The final number of cointegrated vectors with one lag is equal to one, i.e. rank (π) =1. Since, the rank is equal to 1 which is more than zero and less than the number of variables; the series are cointegrating among the variables implying that there is long run relationship between interest rate, inflation rate, money supply and exchange rate.

The analysis concludes that a long run cointegrating relationship exists between all of these variables. Since the existence of a long run relationship has been established between these variables, the short run dynamics of the model can be established within an error correction model (Mahdi & Masood, 2011).

4.6 Vector Error Correction Model

The presence of cointegration between variables suggests a long term relationship among the variables under consideration. Then, the VEC model can be applied. The long run relationship between interest rate, inflation rate, money supply and exchange rate for one cointegrating vector for the Tanzania in the period 1970-2013 is presented below.

$$INT = .0709INFLRATE - .2310MGROWTHRATE - .0011EXCHRATE - 1.8665 - (6)$$

In Table 4.6 below, the coefficients for inflation rate and exchange rate were not significant at 5% level of significance while the coefficient of money supply was significant at 5% level of significance.

In order to identify the direction of causality, least square regression run and the residuals are saved in order to conduct an Eagle-Granger tests.

Table 4.6 : Vector Error Correction Model

Dependent Variable		Interest Rate				
Variables	Coefficient.	Std. Err.	Z Statistics	P-value> z	[95% Conf. Interval]	
lnbankrate	1	.	.	.	.	.
Inflation Rate	.0709022	.0390224	1.82	0.069	-.0055802	.1473846
Money Supply	-.2309838	.036195	-6.38	0.000	-.3019247	-.160043
Exchange Rate	-.0011134	.0007794	-1.43	0.153	-.002641	.0004142
_cons	-1.866511	.	.	.	.	.
Cointegrating equations						
Equation	Parms	chi2	P>chi2			
_ce1	3	42.64992	0.0000			

Source: Author's compilation using STATA

Table 4.7(a): The error correction model results the interest rate (bank rate)

Dependent Variable	D.lnbankrate					
Model	Error Correction Model (ECM)					
Variable	Coefficient	Std. Error	t-Statistics	Prob.> t	[95% Conf. Interval]	
ehat L1	-.2775964	.1004643	-2.76	0.009	-.4804882	-.0747047
_cons (Model)	.0233942	.0564441	0.41	0.681	-.0905969	.1373854
R-squared	0.1570					
Adjusted R-squared	0.1364					
Prob.> F(Model)	0.0085					

Source: Author's compilation with STATA

The significant negative coefficient on $\hat{e}_{t-1}$ indicates that interest rates Table 4.7 (a) responds to a temporary disequilibrium between interest rates, inflation rates, money supply and exchange rate.

Table 4.7 (b): The error correction model results for inflation rate (inflrate)

Dependent Variable	D.inflrate					
Model	Error Correction Model (ECM)					
Variable	Coefficient	Std. Error	t-Statistics	Prob.> t	[95% Conf. Interval]	
ehat L1	-1.035773	1.927815	-0.54	0.594	-4.929074	2.857528
_cons (Model)	.0791634	1.083109	0.07	0.942	-2.108219	2.266546
R-squared	0.0070					
Adjusted R-squared	-0.0172					
Prob.> F(Model)	0.5940					

Source: Author's compilation with STATA

The inflation rate does not appear to respond to disequilibrium between the variables; the t-ratio on $\hat{e}_{t-1}$ is insignificant. The results support the hypothesis that there is one

way causal relationship run from inflation rate to interest rate as suggested by Fisher hypothesis and there is no reverse causation. Results are presented in Table 4.7 (b).

Table 4.7 (c): The error correction model results for money supply (mgrowthrate)

Dependent Variable	D.mgrowthrate					
Model	Error Correction Model (ECM)					
Variable	Coefficient	Std. Error	t-Statistics	Prob.> t	[95% Conf. Interval]	
ehat L1	.9745439	3.139784	0.31	0.758	-5.366379	7.315467
_cons (Model)	-.1965061	1.764032	-0.11	0.912	-3.759042	3.36603
R-squared	0.0023					
Adjusted R-squared	-0.0220					
Prob.> F(Model)	0.7578					

Source: Author's compilation using STATA

The money supply does not appear to respond to a disequilibrium between the variables; the t-ratio on $\hat{e}_{t-1}$ is insignificant. Results are presented in Table 4.7 (c).

Table 4.7 (d): The error correction model results for exchange rate (exchrates)

Dependent Variable	D.exchrates					
Model	Error Correction Model (ECM)					
Variable	Coefficient	Std. Error	t-Statistics	Prob.> t	[95% Conf. Interval]	
ehat L1	4.532497	15.25073	0.30	0.768	-26.26698	35.33197
_cons (Model)	36.52482	8.568354	4.26	0.000	19.22068	53.82896
R-squared	0.0021					
Adjusted R-squared	-0.0222					
Prob.> F(Model)	0.7678					

Source: Author's compilation with STATA

The money exchange rate does not appear to respond to disequilibrium between the variables; the t-ratio on $\hat{e}_{t-1}$ is insignificant. Results are presented in Table 4.7 (d).

4.7 Diagnostic tests

The presence of autocorrelation in the model would result in specification bias. Lagrange-multiplier test carried out to test presence autocorrelation on the VECM model. The results revealed that there is no autocorrelation as the P-value is greater than 0.05 (i.e., 0.35933), so we do not reject the null hypothesis (Ho: no autocorrelation at lag order), Table 4.8 (a). Also, the normality of residuals was tested by Jarque-Bera (JB) test statistics and the results was not to rejected the null hypothesis that, the residuals are normally distributed as the P-value in variables are greater than 0.05 Table 4.8 (b). This diagnostic test results show that the model (VECM) is desirable.

Table 4.8 (a) Lagrange-multiplier test

Lag	Chi2	Prob.>chi2	Ho: no autocorrelation at lag order
			Decision
1	7.4137	0.35933	Do not reject null hypothesis (Ho)

Table 4.8 (b) Jarque-Bera test for normality

Equation	chi2	Prob > chi2
D_lnbankrate	69.265	0.00000
D_inflrate	0.849	0.65413
D_mgrowthrate	2.036	0.36138
D_exchrates	5.471	0.06487
ALL	77.621	0.00000

Source: Author's compilation from STATA output

CHAPTER FIVE

DISCUSSION OF THE FINDINGS

Data extracted from the National Bureau of Statistic (NBS) and Central Bank of Tanzania (BOT) was confidently relevant for analysis in this study. In testing the hypothesis, the normality of data was tested using Shapiro-Wilk test and the data were normal after transforming the interest into its natural log. The stationarity of variables were tested by using ADF and PP and were not stationary at level and were stationary after first difference. The results are presented in Table 4.2 (a) for non-stationary and Table 4.2 (b) for stationarity after first difference.

The cointegration test between interest rate and the explanatory variables rejects the null hypothesis that there is no cointegration among the variables; concluding that inflation rate, money supply and exchange rate had a long run relationship with interest rate at 5% level. As long as there is existence of long run relationship has been established between these variables, the short run dynamics of the model can be established within an error correction model. The results for VECM are presented in table 4.6 and are discussed hereunder:-

In Table 4.6, the coefficient of inflation rate is 0.0709022 shows the marginal effect of inflation rate on interest rate, therefore a 1% change in the level of inflation rate in the economy would lead to 0.0709022% change in the level of interest rate in the economy. The positive sign of the partial coefficient shows that there is positive relationship between inflation rate and interest rate but this relationship is not one to one. This result supports partial Fisher hypothesis that there is positive relationship between nominal and inflation rate. This result is confirmed by Eagle-granger test which show that inflation rate inflation rate contain some information about interest rate and not vice versa Table 4.6 (b). The P-value (.069) is greater than 5% level, therefore the results is not statistically significant. This result indicates that there was no causality between interest rates and inflation rate for the period under review though there is long run relationship between these variables as attested by Johnsen

test for cointegration. Therefore, Fisher effect does not hold in Tanzania and inflation rate does not affect interest rate for the period under review. This result is consistent with that of Chowdhury (2012), Burument, Ceylan and Olgun (2007).

The coefficient of $-.2309838$ for money supply shows the marginal effect of broad money on interest rate, therefore a 1% change in the level of broad money supplied in the economy would lead to 0.2309838% change in the level of interest in the economy. The negative sign of the partial coefficient shows that there is a negative relationship between the broad money and interest rate. This result affirms the position of the Keynesians that though the supply of money is a function of interest to a degree, yet it considered to be fixed by the monetary authority, that is supply of money is taken to be perfectly inelastic (Dabale and Jagero, 2013). Furthermore, when there is increase in broad money in the economy, investors, individuals and corporate organizations as affirmed by the Keynes's liquidity preference theory of interest rates would have incentive to save money thereby decreasing their willingness to hold on to liquidity. The P-value ($.000$) is less than 5% level which shows that the level of money supply in the economy is significant in the model. This was confirmed by Eagle-granger test which showed that money supply contain predictive information about interest rate and not vice versa **Table 4.6 (C)**. Yunana et al., 2014, applying VAR and granger causality statistics confirmed that money supply had effect on interest rates signifies the existence of short-term liquidity theory framework in Nigeria and Michis (2011) affirmed the existence of liquidity effect in Mexico in short-run by using wavelet multiscale analysis. Also this study confirmed the existence of liquidity theory framework in Tanzania in the short run for the period under study.

The coefficient of $-.0011134$ for exchange rate shows the minimal effect of exchange rate on interest rate, therefore a 1% change in the level of exchange rate in the economy would lead to $.0011134\%$ change in the level of interest in the economy. The devaluation of Tanzanian Shilling by 1% will cause the interest rate to decrease by $.0011134\%$.

This result is not statistically significant as the P-value (.153) is greater than .05. Therefore, there was no relationship between interest rate and exchange rate for the period under study. This result is consistent with that of Wilson and Sheefen, 2014, their study using VAR failed to detect the relationship between exchange rate and interest rates in Namibia.

The OLS results presented in Table 4.3 showed that the overall performance of model is relatively low with the adjusted R-squared (.3338), implying that 33.38% of the interest rate in Tanzania is explained by the explanatory variables selected in this study. The probability value of F-tests revealed that an increase of 1% of inflation will affect the interest rate by .0214% when other variables are held constant. Also, 1% increase in the money supply will affect the interest rate by .0195%. Moreover, the increase of 1% in the exchange rate of Tanzania shilling against US dollar pushes the interest rates rise to .0008% other variables are kept constant.

The estimation (38.03%) explains the weak positive relationship between interest rates, inflation rate, money supply and exchange rate, which means that there must be other factors affecting interest rate not accounted for in this model.

CHAPTER SIX

SUMMARY, CONCLUSIONS, AND POLICY IMPLICATIONS

6.0 Introduction

The objective of this study was to determine the dynamic factors affecting interest rate in Tanzania with focus on inflation rate, money supply and exchange rate using Tanzania data so as to ascertain its importance in monetary policy. The data used were inflation rate (%), money supply, M2 (money growth rate %), exchange rate (TZS/USD) and interest rate (%). The period of study was from 1970 to 2013. This chapter highlights the summary, conclusion, policy implication, limitations of the study as well as the area for further study.

6.1 Summary

The objective of this study was to examine the effects of inflation rate, money supply and exchange rate as focused dynamic determinants of interest rates in Tanzanian. The study examined data from BOT regular economic review and Tanzania National Bureau of Statistics (NBS). Interest rate was dependent variable in this study predicted by inflation rates, money supply and exchange rate dynamics. This two documents i.e., BOT regular economic review and Tanzania NBS leading economic indicators, provided information that were needed in this study with high reliability which increases the acceptability. The data collected was then analyzed using STATA econometric software to establish the relationship between the variables.

The Johansen tests for cointegration tested with trace and max eigenvalue statistics revealed that there were long-run relationship among the variables because the null hypothesis of no cointegration among the variables ($H_0: r = 0$) was rejected because the trace statistics value was greater than critical value ($54.0993 > 47.21$) and the hypothesis of existence of one cointegration among the variables was accepted because the trace statistic value was less than critical value ($26.0854 < 29.68$).

As long as the existence of long-run relationship had been established among these variables, the short run dynamics of the model was established within an error correction model.

The VECM results as presented in Table 4.6 revealed that the coefficients of some variables were significant and others not at 5% level of confidence. The coefficient of money supply (-.2309838) was significant and had a correct coefficient sign. The decrease of interest rate are related to increase in money supply, thus, the estimated model was able to produce a consistent results for money supply and interest rate. Thus, 1% increase in money supply is likely to decrease interest rate by .2309838% and this estimate was significant. The coefficient of inflation rate (.0709022) had a correct sign. Thus, 1% increase in inflation rate was likely to increase interest rate by .0709022% but the coefficient was not significant. Furthermore, the coefficient of exchange rate (-.0011134) was not significant, therefore there was no relationship between interest rate and exchange rate. In the long run VECM results revealed that there was no causality as the error correction term (ce1) was negative (-.036) but was not statistically significant as the P-value was .181. In the short run, the model is out the equilibrium, therefore, any changes in the interest rate can be regulated by adjusting money supply in the economy, exchange rate and inflation rate toward the equilibrium. In that sense, the relation between the interest rate and explanatory variables are important for long run plan.

The Eagle-granger tests conducted to identify the direction of causality revealed that interest rates, money supply and exchange rate contained information about interest rate and not otherwise.

The diagnostic tests were carried out to see the reliability of VECM results showed that the Lagrange-multiplier test for autocorrelation at lag order was not able to reject the null hypothesis that no autocorrelation at lag order because the P-value was greater than .05 and the Jargue-Bera test for residual normality had failed to reject the null hypothesis that the residuals were normally distributed because the P-value again was greater than .05.

6.2 Conclusion

The study examined the effects of inflation rate, money supply and exchange rate as the focused dynamic determinants of interest rate in Tanzania. Economic theory stipulates the relationship between interest rates and other variables as follows; the nominal interest rate should have a direct one to one relationship with the expected rate of inflation, under the assumption that the real interest rates are independent of movement in inflation. Also there exists a negative relationship between interest rates and exchange rate. Furthermore, an increase in money supply by monetary authorities leads to a deduction in interest rates (i.e., the liquidity effect) and on the other hand, changes in demand result from income and price effects that are positively related to interest rates (i.e., fisher equation view). This therefore formed the basis for this study so as to examine whether all these theories hold for Tanzania and whether all these variables have effect on interest rates. The study employed considerable amount of secondary data from 1970-2013. It introduced the model specification and econometric procedures to be carried out which included the unit root test, lag order selection, cointegration test and Vector Error Correction Model.

VECM results revealed that money supply had effects on interest rate for the period under review. Results in Table 4.5 showed that 1% increase in money supply led to decrease in interest rate by .2309838% and it is statistically significant as the P-value is less than 5% level. Inflation rate and exchange rate did not have significant impact on interest rates in Tanzania for the period under review because the P- values were greater than 5% level (i.e., inflation rate (.069) and exchange rate (.153)). Again the VECM results revealed that there is no long run causality between interest rate and regressors as the error correction term (ce1) is negative (-0.034) but not statically significant because P-Value is .181 (Appendix III).

6.3 Policy implications

From the findings, the study maintains that money supply have a significant impact on the interest rate. For the country to control interest rate, money supply should be checked. Although other factors like inflation rate and exchange rate have impact on interest rate the effect is not significant. This does not necessarily imply that monetary authorities should not exercise restraints when regulating interest rate in respect of these variables as hypothesized in theories, but rather the interest rate should be monitored regardless of these results. Interest rate should be monitored and adjusted accordingly because it is a contributing factor in macroeconomic policy making. The interest is affected by many components such as economic stability, monetary policy etc for which exchange rate and inflation rate are among those variables.

6.4 Limitation of the Study

The study was limited itself to inflation rate, money supply and exchange rate on their impact to interest rate although other factors like economic growth and budget deficit also have impact on interest rates. The time series data used in this study was limited to end of the year data because higher frequency data such as daily, monthly and quarterly were not available from relevant website as was physical libraries. For example, monthly data were available from the year 2000 to 2013 for some variables some data were missing for some years. A higher frequency data increases the accuracy of the findings.

This study also lacked local literature review because local literature was very difficult to reach. Most of literature was from developed America and Europe and few from some African countries.

6.5 Suggestion of the area for further study

Money supply M2 has been identified as one of the major factors that impact interest rate, this calls for further research to be done intensively on how this affects the interest rate in the country.

Further research should be carried up using more frequency data, monthly or quarterly, this will aid in coming up with conclusive and consistency recommendations.

Research in the future should include other variables such as economic growth and budget deficit which also affects the interest rate.

The other variables included in this study that is inflation rate and exchange were identified to be insignificant even if they have the correct coefficient sign, therefore research have to be carried out using these variables employing higher frequency data and different analytical methods.

REFERENCES

- Alexander, C. (2001). *Market models: A guide to financial data analysis*. John Wiley & Sons Ltd.
- Alimi, R.S. (2014). ARDL Bounds Testing Approach to Cointegration: A Re-examination of Augmented Fisher Hypothesis in an Open Economy. *Asian Journal of Economic Modelling*, Vol. 2(2): pp 103-114.
- Al-majali, A. A. and Al-assaf, G. I. (2014). Long-run and short-run relationship between stock market index and main macroeconomic variables performance in JORDAN. *European Scientific Journal*. Vol. 10, Issue no.10, pp.156–171.
- Andries A.M., Ihnatov, I. and Tiwari, A.K. (2014). Analyzing time-frequency relationship between interest rate, stock price and exchange rate through continuous wavelet. *Elsevier, Economic Modelling*. Vol.41, pp. 227-238.
- Asari, F. F. A. H., Baharuddin, N. S., Jusoh, N., Mohamad, Z., Shamsudin, N., & Jusoff, K. (2011). A Vector Error Correction Model (VECM) Approach in Explaining the Relationship between Interest Rate and Inflation towards Exchange Rate Volatility in Malaysia. *World Applied Sciences Journal*, Vol.12, pp.49–56.
- Awomuse, B.O. and Alimi, S. R. (2012). The Relationship between nominal interest rates and inflation: New evidence and Implications for Nigeria. *Journal of Economics and Sustainable Development*, Vol. 3 No.9, pp 158-164
- Ayub, G., Rehman, N.U., Iqbal, M., Zaman, Q. and Atif, M. (2014). Relationship between Inflation and Interest rate: Evidence from Pakistan. *Research Journal of Recent Sciences* Vol. 3(4), pp 51-55.
- Berument, H. (1999). Determinants of Interest Rates in Turkey, *THE CENTRAL BANK OF THE REPUBLIC OF TURKEY: Research Department*, Discussion Paper: 9902

- Berument, H., Ceylan, N.B. and Olgun, H. (2007). Inflation Uncertainty and Interest Rates: Is the Fisher Hypothesis Universal; *Applied Economics*, Vol.39, pp.53-68.
- Bollerslav, T. (1986). ‘Generalized Autoregressive Conditional Heteroskedasticity’, *Journal of Econometrics*, Vol. 31 (3), pp. 307-327.
- BOT, 2011: A Review of the Role and Functions of the Bank of Tanzania (1961—2011). United Republic of Tanzania
- Chowdhury, E.K. (2012). Impact of Inflation on Bank Lending Rates in Bangladesh. *Journal of Politics & Governance*, Vol.1, No.1, pp. 5-13.
- Dabale, W.P. and Jagero, N. (2013). Causes of Interest Rate Volatility and its Economic Implications in Nigeria. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, vol. 3, No. 4, pp. 27-32.
- De Angelis, C., Aziakpono, M.J. and Faure, A.P. (2005). “The transmission of monetary policy under the repo system in South Africa: an empirical analysis”, *South African Journal Economics*, Vol. 73 (4): pp.657-673.
- Dickey, D.A. and Fuller, W.A. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, Vol. 74, Issue 366, pp 427-431.
- Eagle, R.F. and Granger C.W.J (1987). Cointegration and Error Corrections: Representation, Estimating and Testing. *Econometrica*, Vol., 55, No.2 pp 251-276.
- Ebiringa, O.T (2012). Interest Rate Transmission Effect on Money Supply: The Nigerian Experience, *Journal of Public Administration and Governance*, Vol. 2, No.1, pp.212-221.

- Engle, R. F. and Granger, C. W. J. (1987). Co-Integration and Error Correction : Representation, Estimation, and Testing, *Econometrica*, Vol.55 (2), pp.251–276.
- Fadli, F., Abu, H.A., Nurul, S.B., Nurmadihah, J., Zuraida, M., Norazidah, S. and Kamaruzaman, J. (2011). A Vector Error Correction Model (VECM) Approach in Explaining the Relationship between Interest Rates and Inflation towards Exchange Rate Volatility in Malaysia. *World Applied Science Journal*, Vol.12 (Special Issue on Bolstering Economic Sustainability): pp.49-56.
- Granger, C. W. J. (1969). Investigating Causal Relations by Econometric Models and Cross-spectral Methods. *Econometrica*, Vol.37 (3), pp. 424–438.
- Hacker, S. R., Karlsson, H. K., & Månsson, K. (2012). The Relationship between Exchange Rates and Interest Rate Differentials: A Wavelet Approach. *World Economy*, Vol. 35(217), pp.1162–1185.
- Hussain, K., 2009. Monetary Policy Channels of Pakistan and their impact on real GDP and Inflation. CID Graduate Student Working Paper Series No.40, Center for International Development at Harvard University.
- Jaradat, M.A and Al-Hhosban, S.A., 2014. Relationship and causality between Interest rate and Inflation rate: Case of Jordan. *Interdisciplinary of Contemporary Research Business* Vol.6, No.4 pp.54-65.
- Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. *Journal of Economic Dynamics and Control*, Vol. 12, No. 2–3, pp. 231–254.
- Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vectors Autoregressive Models. *Econometrica*, Vol. 59, No. 6, pp. 1551-1580.

- Johansen, S. (1995). Likelihood-Based Inference in Cointegrated Vector Autoregressive Model. *Oxford University Press*.
- Johansen, S. and Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Co integration– with Applications to the Demand for Money. *Oxford Bulletin of Economics and Statistics*, Vol. 52, No. 2, pp. 169–210.
- Kayhan, S., Bayat, T. and Ugur, A. (2013). Interest Rates and Exchange Rate Relationship in BRIC-T Countries. *Age Academic Review*, Vol.13 (2), pp 227-236.
- Kwame, D.S. (2012). The relationship between Inflation, Inflation Uncertainty and Interest Rate in Ghana. Unpublished Masters Dissertation, Kwame Nkrumah University of Science and Technology, Kumasi.
- Madura J. (2010). Financial Markets and Institutions (9th Edition), South-Western Cengage Learning.
- Mahdi, S. and Masood, S. (2011). The Long run Relationship between Interest rates and Inflation in Iran: Revisiting Fisher’s hypothesis. *Journal of Economics and International Finance*, 3(14): 705-712.
- Michis, A. (2011). Multiscale Analysis of the liquidity Effect (Working Paper Series 2011-5), Central Bank of Cyprus: Eurosystem.
- Mishkin, F.S. (2004). The Economic of Money, Banking, and Financial Markets (7th edition), Pearson Addison Wesley, USA.
- Mitra, S. K. (2010). Establishing Cointegrating Relationships Involving Interest Rates and Other Macroeconomic Variables in India. *Asian Social Science/www.ccsenet.org/ass*, Vol. 6, No. 1 pp. 103-114.
- Monnet, C. and Weber, W.E. (2001), Money and Interest Rates, *Federal Reserve Bank of Minneapolis Quarterly Review*, Vol. 25, pp. 2-3.

- Naik, P. K. (2013). Does Stock Market Respond to Economic Fundamentals ? Time series Analysis from Indian Data. *Journal of Applied Economics and Business Research*, Vol.3 (1), pp.34–50.
- Obamuyi, T.M. and Olorunfemi, S. (2011). Financial reforms, interest rate behaviour and economic growth in Nigeria. *Journal of Applied Finance & Banking*, vol.1, no.4, pp.39-55.
- Obi, B., Nurudeen, A., and Wafure, O.G. (2009). An Empirical Investigation of Fisher Effect in Nigeria: A co-integration and Error Correction Approach. *International Review of Business Research Papers*, Vol.5 No.5. pp. 96-109.
- Odhiambo, N.M. (2011). The impact of financial liberalization in developing countries: experiences from four sadc countries, *Organisation for Social Science Research in Eastern and Southern Africa (OSSREA)*.
- Phillips, P.C. and P. Perron, 1988. Testing for a unit root in time series regression. *Biometrika*, Vol.75 (2): pp.335-346.
- Phillips, P.C.B. and Perron, P. (1988). Testing for a unit root in time series regression. *Beometrika*, Vol.75 (2), pp. 335-346.
- Saluja, M.S., Bhatia, N.K. and Patel, N. (2013). A Cointegration and VECM Approach in Explaining Relationship of FDI with Current and Capital Account of India. *International Journal of Advance Research in Computer Science and Management Studies*, Volume 1, Issue 6, ISSN: 2321-7782 (Online).
- Saunders, M., Lewis, P. and Thornhill, A. (2009). Research Methods for Business Students (5th edition), Pearson Education Limited, England.
- Schabert, A. (2005). Money Supply and the implementation of Interest rate targets (Working Paper Series No.483). European Central Bank.

- Sekaran, U. (2003). *Research Methods for Business: A Skill Building Approach* (4th Edition). John Wiley & Sons, Inc. U.S.A.
- Sims, C.A (1972). Money, Income, and Causality. *The American Economic Review*, Vol.62 (4) pp 540-552
- Thabet, E. H. (2014). Examining the Long Run Relationship between the U.S. Money Supply (M2) and the Canadian Stock Market. *International Journal of Economics and Finance*, Vol.6 (10), pp.180–190
- Tsong, C.C. and Hachicha, A. (2014). Revisiting the Fisher Hypothesis for Several Selected Developing Economies: A Quantile Cointegration Approach. *Economic Issues*, Vol.19, Part 1. Pp.57-72
- Umoru, D. nad Oseme, A. (2013). Inflation Expectations and Interest Rate variations in Nigeria; An Econometric Assessment of the Evidence. *International Journal of Development and Economic Sustainability*, Vol 1, No.2. pp. 1-12.
- Wilson, L. and Sheefeni, J.P.S (2014). The Relationship between Interest Rate and Exchange rate in Namibia. *Journal of Emerging Issues in Economics, Finance and Banking*, Vol: 3 issue 1.
- Yunana, T. W, Chenbap, R. J, Yunana, Y.A and Akpan, J. E (2014). The Effect of Money Supply on Interest Rate in Nigeria, *Online Journal of Social Sciences Research*, Vol. 3(6), pp.146-152.

APPENDICES

Appendix I: Research time frame

The study will be carried out within ten months starting from September 2014 to June 2015.

Table 1: Research schedule

Activities	SEP T	OC T	NO V	DE C	JA N	FE B	MA R	AP R	MA Y	JUN E
Concept Note										
Proposal writing										
Submissio n of proposal										
Data collection										
Data analysis										
Report writing and submission										

Source: Researcher 2014

Appendix II: Budget.

S/N	ITEMS	QUANTITY	AMOUNT (Tshs)
1	Ream paper	5	50,000/=
2	Flash disk	1	30,000/=
3	Typing proposal	Lump sum	50,000/=
4	Typing research paper	Lump sum	100,000/=
5	Printing of proposal	Lump sum	120,000/=
6	Printing of research		200,000/=
7	Binding of proposal		50,000/=
8	Binding of research		100,000/=
9	Editing proposal		100,0000/=
10	Editing research paper		250,000/=
11	Transport expense		600,000/=
12	Upkeep costs in the field		2,350,000/=
13	Internet costs		300,000/=
14	Phone expenses		200,000/-
15	Contingencies		500,000/=
	GRAND TOTAL		5,000,000/-

Source: Researcher 2014

Appendix III: Vector Error Correction Results

```
. vec lnbankrate inflrate mgrowthrate exchrates, trend(constant) lags(1)
```

Vector error-correction model

Sample: 1971 - 2013

Log likelihood = -546.9041

Det(Sigma_ml) = 1310462

No. of obs = 43

AIC = 25.94903

HQIC = 26.11517

SBIC = 26.39957

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_lnbankrate	2	.394578	0.0449	1.92672	0.3816
D_inflrate	2	6.64429	0.1310	6.181015	0.0455
D_mgrowthrate	2	9.93631	0.2640	14.70969	0.0006
D_exchrates	2	53.602	0.3705	24.13148	0.0000

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
D_lnbankrate						
_cel						
L1.	-.0364893	.0272616	-1.34	0.181	-.0899211	.0169424
_cons	-.1327383	.1304103	-1.02	0.309	-.3883378	.1228612
D_inflrate						
_cel						
L1.	-1.140792	.4590566	-2.49	0.013	-2.040527	-.2410578
_cons	-4.767108	2.195973	-2.17	0.030	-9.071136	-.4630808
D_mgrowthrate						
_cel						
L1.	2.631525	.6865038	3.83	0.000	1.286002	3.977048
_cons	10.97616	3.284004	3.34	0.001	4.539632	17.41269
D_exchrates						
_cel						
L1.	-7.538109	3.703381	-2.04	0.042	-14.7966	-.2796156
_cons	4.553817	17.71573	0.26	0.797	-30.16838	39.27601

Cointegrating equations

Equation	Parms	chi2	P>chi2
_cel	3	42.64992	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
_cel						
lnbankrate	1					
inflrate	.0709022	.0390224	1.82	0.069	-.0055802	.1473846
mgrowthrate	-.2309838	.036195	-6.38	0.000	-.3019247	-.160043
exchrates	-.0011134	.0007794	-1.43	0.153	-.002641	.0004142
_cons	-1.866511	.	.	.	.	.

Source: Researcher's compilation using STATA.

Appendix IV: Research data

Year	Discount rate (%)	Inflation rate (%)	money supply (Millions, TZS)	Money growth rate (%)	Exchange rate(TZS/USD)
1970	4.635	2.4	2219.6	18.1	7.14
1971	4.635	4.8	2624.4	18.2	7.14
1972	4.635	9.1	3089.7	17.7	7.14
1973	4.635	10.4	3653	18.2	6.9
1974	4.635	18.9	4462	22.1	7.14
1975	4.635	27	5552.7	24.4	8.26
1976	4.635	6.3	6946.8	25.1	8.32
1977	4.635	17.6	8346.7	20.2	7.96
1978	5.135	7	9396.3	12.6	7.41
1979	5.135	12.1	13806.6	46.9	8.22
1980	5.135	30.8	17519.8	26.9	8.33
1981	5.135	25.7	20694.7	18.1	9.52
1982	5.135	28.9	24728.6	19.5	12.46
1983	5.135	27.1	29127.4	17.8	9.52
1984	5.135	36.1	30218.1	3.7	12.46
1985	5.135	33.3	38971	29	18.11
1986	5.135	32.4	50353.4	29.2	16.5
1987	5.135	29.9	66442.9	32	51.72
1988	22	31.2	92987.7	40	125
1989	22	30.4	123800.1	33.1	192.3
1990	22	35.9	178061.8	43.8	196.6
1991	22	28.8	232900.1	30.8	233.9
1992	27	21.9	352272.3	51.3	335
1993	27	24	472017.5	34	479.87
1994	39	35.3	647840.3	37.2	523.45
1995	45.1	27.4	765908.4	18.2	550.36
1996	19	21	684990.6	8.404668747	595.64
1997	16.2	16.1	760353.3	11	624.6
1998	17.6	12.9	844929.4	11.1	681
1999	20.2	7.9	972088.6	15	797.3
2000	10.7	5.9	1093610.9	12.5	803.3
2001	8.7	5.1	1221919.8	11.7	916.3
2002	9.2	4.6	1516807.3	24.1	976.3
2003	12.3	5.3	1745738	15.1	1063.62
2004	14.4	4.7	2125835.9	21.8	1042.96

2005	19.3	4.4	2960415.6	39.3	1165.51
2006	20.1	7.3	3454491	16.7	1261.64
2007	16.4	7	4394622.7	27.2	1132.09
2008	16	10.3	5468460.8	24.4	1280.3
2009	3.7	12.2	6603404.4	20.8	1313.29
2010	7.6	7.2	8042113.2	21.8	1453.54
2011	12	19.8000	9247900	18.23953206	1566.6552
2012	12	12.1000	10724500	12.61185151	1571.6
2013	12	5.6000	11890600	9.842203178	1578.6

Source: BOT Economic review reports, 2014