EFFECT OF SELECTED MACROECONOMIC VARIABLES ON BUDGET DEFICIT IN KENYA

BY

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A Thesis Submitted to the Department of Economics in the School of Business and Economics in Partial Fulfillment of the Requirements for the Award of Masters Degree in Economics of Moi University

MOI UNIVERSITY

NOVEMBER, 2022

DECLARATION

Declaration by the student

This is my original work and has not been presented in this university or any other for the award of a degree

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DEDICATION

I dedicate this research work to the Almighty God who granted me energy and protected me.

The dedication also goes to my entire family and friends for their advice that enabled to complete this work.

ACKNOWLEDGEMENT

I wish to acknowledge my supervisors among other instructors for their professional input, contribution and continuous guidance.

I should also thank my family and friends who modeled me into a hardworking and responsible person.

ABSTRACT

Macroeconomic stability has been a concern to many economies as it shows the economic health of a nation. Kenya has had unsustainable and persistent fiscal deficit which has been phenomenal in the recent past despite several economic reforms being established in an attempt to stabilizing the economy. The study was informed by the persistent increase in the budget deficit in Kenya amidst economic stagnation and macroeconomic instability. This therefore led to an attempt to establish the effect of selected macroeconomic variables on the budget deficit in Kenya. The specific objectives were to determine the effect of interest rates; exchange rate; inflation and money supply on budget deficit in Kenya. The study sought to evaluate the significant effect of the selected macroeconomic variables on budget deficit in order to formulate the policy consideration to the economic problem. The study was guided by the Keynesian which was the main theory of the study. The Mundell-Fleming and Ricardian Equivalence theories were also employed as addition theories to back up the study. The study methodology was based on an explanatory design for time series data covering 30 years from 1991 to 2020. An Autoregressive distributed lag error correction model (ARDL) estimation was adopted to analyze and infer results of the study. The CUSUM model stability test indicated that the model was stable and the model coefficient was reliable. Diagnostic test results showed there was no autocorrelation (p=0.1510>2.062), no heteroscedasticity (p=0.0903>21.47), and there was no multicollinearity (vif=1.34). Shapiro wilk normality test indicated that the variables of the study were normally distributed. The ADF unit root test indicated that there was unit root and co-integration test confirmed that the variables had a long run relationship. The findings of the study were: interest rate had a positive significant effect on budget deficit in the long run ($\beta_1 = 0.0404, p = 0.016 < 0.05$); exchange rate had a positive significant effect on budget deficit ($\beta_2 = 0.4189, p = 0.000 < 0.05$); inflation had a negative insignificant effect on budget deficit ($\beta_3 = -0.001, p = 0.206 > 0.05$). Money supply had a positive insignificant effect on Budget deficit ($\beta_4 = 0.00004, p = 0.380 > 0.05$). The ARDL long-run results showed that the explanatory variables had Adjusted R^2=0.4666 impact on the budget deficit and an F-statistics of 135.5802. The study therefore concluded that interest rate had a positive effect on the budget deficit in the long run. Increasing interest rates in the economy ends up driving budget deficit upwards in the long run. The same was true when the variable of concern is exchange rate. The study findings recommend that there is need for the government to ensure there is stability in macroeconomic variables. This is because there was a significant link between the budget deficit and the selected macroeconomic variables. A strive by the government to reduce budget deficit would mean an adjustment in macroeconomic variables to suit the purpose. These adjustments may include reducing the interest rate in the economy. A reduction in the interest rates in the economy would end up reducing the budget deficit.

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LIST OF ABBREVIATIONS AND ACRONYMS

ARDL: Auto-Regressive Distributed Lag

CBK: Central Bank of Kenya

FY: Fiscal Year

GDP: Gross Domestic Product

GNP: Gross National Product

IMF: International Monetary Fund

KIPPRA: Kenya Institute for Public Policy Research and Analysis

KNBS: Kenya National Bureau of Statistics

LDCs: Least Developed Countries

PSBR: Public Sector Borrowing Requirement

SAPs: Structural Adjustment Programs

VAR: Vector Auto Regression

WB: World Bank

DEFINITION OF TERMS

Budget Deficit: A budget deficit occurs when expenditure exceed revenue. The deficit budget policy is famous instrument of fiscal policy used to establish the rate of economic growth of the country (Ko, 2019).

Inflation: Inflation is the rate of increase in prices over a given period of time. Inflation is typically a broad measure, such as the overall increase in prices or the increase in the cost of living in a country. Inflation is the indicator of the decline of purchasing power of a given currency over time (Sitompul, Ichsan & Nasution, 2021).

Interest Rate: Interest rate is the amount a lender charges a borrower and is a percentage of the principal (Ferrari, Masetti, & Ren,2018).

Unemployment: Unemployment refers to a situation when a person who is actively searching for employment is unable to find work. Unemployment is a key measure of the health of the economy. The most frequent measure of unemployment is the unemployment rate, which is the number of unemployed people divided by the number of people in the labor force (Singh, 2019).

Exchange Rate: Exchange rate is the value of one country versus the currency of another nation or economic zone. For example, how many Kenya Shillings does it take to buy one US Dollar (Latief & Lefen, 2018).

Money Supply: The money supply is the total amount of currency in use in an economy. Currency, printed notes, funds in bank accounts, and other liquid assets make up the circulating money (McLeay, Radia, & Thomas, 2014).

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter encompassed the background of the study, statement of the problem, objectives of the research, the research questions, significance of the study, and scope of the study.

1.1 Background of the study

1.1.1 Overview of Budget Deficit on Macroeconomic Variables

According to Eichenbaum, (2021), all of the major developed nations, including Canada, now have historically high levels of government debt. By the end of 2021, the US federal government debt to GDP ratio will have increased from around 30% in the early 1980s to approximately 100%. The pattern for the net public debt to GDP ratio in Canada is more complex. However, that ratio should eventually surpass the 90 percent mark, which would have previously made conference halls throughout Canada and Bay Street cringe. Although the amount of government debt has increased, nominal and real interest rates have been declining over time. Almost all industrialized nations exhibit this drop, which is present for both private and public sector debt at all yield curve positions (Eichenbaum, 2021).

According to James, (2020), deficit financing according to Keynesian is crucial in the enhancement of economic development. It is through the various government intervention measures of financing its budget through either internal and external financing that economic growth can be achieved. Stability of major macroeconomic variables influence whether deficit financing should be pursued or not. These

macroeconomic variables are interest rates, inflation rate, exchange rates and money supply. Several developing countries are driven by economic plans that outline economic objectives to be achieved in the short run and long run (Debbie, 2009). These objectives are usually meant to ensure that the macroeconomic variables are maintained at a sustainable rate both in the short run and in the long run. The role of budgeting in developing countries is much different from that of developed countries (Schick, 2018). Budgets are used in developing countries as an integral part of development planning owing to the chronic and un-cyclical nature of unemployment in developing countries that reflect existing structural bottlenecks. Budgets finance play a major role in the attainment of the sustainable economic growth. This necessitates the injection of additional purchasing power, instead of increasing the production level and employment which causes larger amounts of imports and raises the price levels.

Budget deficit and its financing are the major problems and concerns for policymakers in developing countries (Akgay, *et. al* 2018). Huge fiscal deficits are likely to have adverse effects on the economies of many developing countries (Musa, 2021).

These huge fiscal deficits arise from imbalances in current account (Akinyi, Odunga, & Opuodho, 2018). Additionally, many African countries depend on unstable prices of oil and exports of raw materials. Many African economies are, therefore, vulnerable to adverse external shocks whose consequence is macroeconomic instability (Gebremariam, 2018). Also in many developing countries, budgetary administration is characterized by poor monitoring of government expenditure and irregular release of budgeted funds (Gebremariam, 2018). The structural adjustment programs were as a result of the debt crisis that struck most developing countries in the 1980s. Some causes of this particular

debt crisis were poor lending policies, the oil crisis of 1970s, rise in the interest rate in the US, large withdrawal of financial resources from indebted countries, and falling commodity prices (Fishlow, 2019). The budget deficit of the government of Kenya has been reaching double digit levels in almost each fiscal year since independence in 1963 (Otieno, Odhiambo & Ombok, 2019). The budget deficits among other factors could be the causes of failure to attain macroeconomic stability in Kenya (Otieno. Odhiambo & Ombok, 2019).

Nearly all undeveloped nations in the world such in South Asian experience a budget deficit or fiscal gap, although the size of the deficit is generally greater in developing nations that are in the process of transitioning to becoming developed in the future (Alam, Sadekin & Saha, 2020).

Deficit budget policy has remained to be a common instrument of fiscal policy used to stimulate economic growth rate (Nwanna, & Umeh, 2019). The most popular instrument of deficit financing is borrowing which is done through issuance of government treasury bills and bonds. This, however, diminishes the real value of currency and makes the economic environment unpredictable. For most developing countries such as Kenya, the current public debt is larger than their economic growth rates (Makau, Njuru, & Ocharo, 2018). According to Makau, Njuru & Ocharo, (2018), budget financing through borrowing has created doubt concerning the real debt condition of states. In the need to secure better economic conditions, governments are forced to implement expansive fiscal policies with the aim of achieving macroeconomic stability.

In many developing countries, various economic stabilization programs have laid emphasis on the reduction in budget deficits (Burdekin, 2019).

The government of Kenya ran the largest budget deficit in in the 1992 fiscal year (Sirere, 2015). That particular budget deficit amounted to Kenya Shillings 24.97 million (Republic of Kenya, 1993). Large fiscal imbalances that are characterized by persistent budget deficits have negatively affected macroeconomic stability in Kenya (Easterly *et al*., 1994). Another consequence of the persistent budget deficits is a growing public debt (Bivens & Irons, 2010).

The most popular method of financing budget deficits in Kenya is borrowing which is done through the issuance of government securities and bonds in the open markets (Sirere, 2015). This, however, diminishes the real value of the currency and results in macroeconomic instability (Sirere, 2015). Since the government is the largest borrower in the capital markets, management of debt has an influence on the general credit conditions in the economy. If the government of Kenya decides to increase the return on its securities, this will impact all other financial assets, tending to increase their yields hence affecting interest rates so that they may remain competitive (Moraa, 2014).

1.2 Problem Statement

Budget deficit or sometimes referred to as the fiscal gap is a common issue globally that policy makers are grappling with (Amin & Murshed 2017). Developed countries such as the United States and the United Kingdom usually operates a budget deficit with a hope of achieving macroeconomic stability on key macroeconomic variables such as inflation, interest rates, exchange rate, and gross domestic product. The attention towards budget deficit has become a prevalent focus across the globe due to the need for achieving sustainable macroeconomic stability. Although there are contrasting view in theory on the extent of deficit finance an economy should incur, with one group believing that budget

deficit is destructive to an economy while the second group believing it is not destructive to the economy, practically however, there are few studies done to examine the impacts of selected macro-economic variables on budget deficit (Al-Khedair,1996).

Developing countries in Africa and Latin America have also been grappling with the issue of whether the stability of the economy is influenced by budget deficit. An economy characterized by deflation is likely to incur a budget deficit whereas, an economy with high inflation is unlikely to experience budget deficit (Myovella & Kisava 2018). This implies that the choice of the extent of the fiscal gap depends on the targeted level of these selected macroeconomic variables which are key determinants of budget deficit exposure in both developed and developing economies of the world (Moraa, 2014). Macroeconomic instability will likely raise inflationary pressures in the economy and adversely affect GDP growth which in effect will influence the extent of budget deficit (Moraa, 2014). Additionally, some of the techniques used to finance budget deficits, as creation of high-powered money, negates the attainment of macroeconomic stability in the long run (Imam, 2012).

The level of development of a country and the macroeconomic variables are significant in that budget deficit might be either helpful or detrimental. According to Makau, Njuru, & Ocharo, (2018), on a study of budget deficit on macroeconomic stability established to largely depend on the budget position of a country. Đukić, (2021) found out that there is a general agreement arising from both the classical and Keynesian schools of thought that fiscal policies have an effect on the aggregate demand but in different directions.

A study by Emmanuel, (2013) conducted on the Nigerian economy on the effect of budget deficit finance on selected macro-economic variables establishes that great care should be taken by governments when incurring budget deficits since excess budget deficits may lead to an economy to instability. This is because higher budget deficits cause inflation, increases money supply and affect the exchange rate which ultimately deteriorates the possibilities of sustainable economic growth of an economy.

Another study by Sirere (2015) conducted in Kenya outlines that budget deficits in an economy is characterized by mixed results. He establishes that when the Kenyan government incurred budget deficit, the resultant effect was an increase in inflation which is detrimental to the economy. On the other hand, a budget deficit also leads to an increase in economy growth. Sirere, (2015) theorized that there is a need to establish an optimal point of incurring budget deficits for the sustainable growth of the Kenya economy.

Despite the studies by Moraa, (2014), Emmanuel, (2013), Sirere (2015), little has been established to comprehensively explain the influence of selected macroeconomic variables on budget deficit and in particular Kenyan economy which this study has intended to focus.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of the study was to determine the effect of selected macroeconomic variables on budget deficit in Kenya.

1.3.2 Specific Objectives

The following specific objectives guided the study:

i) To determine the relationship between inflation rate on budget deficit in Kenya

ii) To examine the relationship between interest rate on budget deficit in Kenya

iii) To establish the relationship between exchange rate budget deficit in Kenya

iv) To ascertain the relationship between money supply on budget deficit in Kenya

1.4 Research Hypothesis

It is hypothesized that:

i) H_{01}: There is no significant relationship between inflation rate and budget deficit in Kenya.

ii) H_{02}: There is no significant relationship between interest rate and budget deficit in Kenya

iii) H_{03}: There is no significant relationship between exchange rate and budget deficit in Kenya.

iv) H_{04}: There is no significant relationship between money supply and budget deficit in Kenya.

1.5 Scope of the Study

The study examined the relationship between budget deficit and selected macroeconomic variables in Kenya. This study was limited to the period between 1991 and 2020. The macroeconomic variables that were employed in this study are categorized into independent variables which are interest rates, exchange rate, inflation rate and money supply while the dependent variable is the budget deficit. The choice of the study period was informed by the onset of reforms in Kenya that emerged in the last

decade of the 20th century, the availability of data and also to provide sufficient degrees of freedom. Reliable and comprehensive data were available in the chosen period.

1.6 Significance of the Study

The study will be useful in formulation of policy by the Central Bank of Kenya (CBK) regarding budget deficit financing in Kenya. The study will be used as a reference when examining the role of budget deficit financing for the macroeconomic stability of Kenya. For macroeconomic stability to be attained governments have to employ various policies. The findings of this study will, therefore, inform policy makers and economic planners on the long run effect of deficit on macroeconomic stability. This might inform the future policy formulation and decision making on matters regarding budget deficit.

The study will also provide a useful basis upon which further studies on relationship between budget deficit and macroeconomic variables can be done. This study will contribute a lot to the academic literature on budget deficit financing in Kenya. More literature is needed to strengthen macroeconomic stability through the results of relationship between budget deficit financing and macroeconomic stability.

Finally, the findings of this study will offer some insights to developing countries especially East Africa Community (EAC) that benchmark with Kenya on the relationship between budget deficit and macroeconomic stability and hence formulate timely and effective interventions to attain macroeconomic stability.

1.7 Justification of the study

The key issues have been whether there is a relationship between budget deficit and selected macroeconomic variables, does this relationship have any significant influence

on key policy decisions, and whether the government should or should not reduce the budget deficit in Kenya.

The bone of contention among policy makers is whether budget deficit may plunge an economy into a debt crisis trap which ultimately causes instability of the economy and sluggish economic growth. Other pundits in this field have argued that budget deficit is useful for stimulating the economy and driving an economy out of recession which usually is a period of deficient demand. This study will be useful in establishing whether deficit finance enhances the stability of an economy or not. The study will also establish whether the relationship is short term or long term in nature.

The study employed four selected macroeconomic variables. These are inflation, interest rate, money supply and exchange rate. These macroeconomic variables are crucial in determining the stability of an economy. For example, during deflation, there is always a need to spend money in the economy through the use of expansionary fiscal policy and expansionary monetary policy (Limbach, 2022). Spending money when revenue is not enough necessitating the government to borrow money. This therefore means that higher spending by the government does not only increase inflation from the increase demand but also result into a surge in budget deficit. The same is true for money supply in an economy. High money supply in the economy causes higher budget deficit. Exchange rate also influences the levels of trade balance and which also affects budget deficit.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter encompassed theoretical literature, empirical review and literature overview related to the concepts of selected Macroeconomic variables and Budget deficit. This study will examine the Keynesian, Ricardian Equivalence, and Mundell theories. The macroeconomic stability and Deficit financing conceptual framework will also be examined.

2.1 Concept of the study

2.1.1 Concept of budget deficit

The budget deficit policy is a common fiscal policy instrument used to stimulate the rate of economic growth of a country (Moraa, 2014). Some of the ways of financing a budget deficit include borrowing, taxes, and seigniorage. The most popular way of financing a budget deficit is borrowing, which the government undertakes by issuing bonds (Moraa, 2014). When financing a budget deficit through internal source, the government borrows from individuals and the private sector or the central bank (Moraa, 2014). The government sells its securities and bonds to individuals and private sector firms. In return, the government receives money from individuals and private sector firms (Moraa, 2014). The money from the sale of government securities and bonds is deposited in the government account and can be spent in the same way as tax revenues. The government of Kenya can also borrow internally from the CBK by selling securities and bonds to the CBK. When the government is over indebted, it buys back its bonds hence increasing the

flow of money in the economy. However, one potential harmful effect of financing a budget deficit through internal borrowing is a reduction in the level of private investments. This could result in adverse effects in the economy such as slower productivity, slow economic growth rate, and lower standards of living.

Budget deficit financing through tax financing assumes that an increase in government spending is financed by an equivalent increase in the collected tax revenue (Moraa, 2014). Such a policy operates via the negative effect on disposable income of individuals and therefore, on private investment and consumption. The first effect of an increase in tax is to reduce private consumption and thereafter reducing private investment in subsequent periods. The effect on any other macroeconomic variable is likely to occur in time lags (Kaplanoglou & Rapanos, 2019).

Budget deficit financing through money financing (inflation revenue) is also another way of financing a government deficit (Moraa, 2014). An increase in government expenditure is financed using an equivalent increase in inflation revenue (seigniorage). The CBK prints money from the treasury without the government being obliged to repay the principal or pay interest. When the government spends this money, aggregate demand in the economy will be increased and the currency in circulation in the economy also increases. The result will be improvement in the financial position of private sector and growth of the broad money supply. Just like in tax financing, broad money demand, private investment, and private consumption are affected with time lags (Friedman, 1978).

2.1.2 Concept of selected macroeconomic variable

According to Salim, (2019), the term "inflation" refers to a rise in prices, which over time results in a loss of purchasing power. The average price increase of a basket of chosen goods and services over time can be used to determine the rate at which buying power is decreasing.

A "basket" of commodities serves as a representation of all the goods and services that households use throughout the course of the year. Each item in this basket has a price, which is subject to change. The price of the entire basket in a particular month as compared to its price in the same month the previous year is the yearly rate of inflation (Salim, 2019),

On the hand, the interest rate represents the percentage incentive given to a lender for delaying the use of resources to a later time (Blanchard, 2019). In line with that, it gauges how much a borrower must spend to access resources right now. High interest rates increase the cost of borrowing. Fewer people and businesses can afford to borrow when interest rates are high. As a result, there is less credit available to finance purchases, which affects consumer demand. Additionally, because they earn more on their savings rate, it encourages more individuals to save. High interest rates also limit the amount of capital available for corporate expansion, squeezing the market. The economy is slowed down by this decrease in liquidity (Blanchard, 2019).

According to Sitompul, Ichsan, & Nasution, (2021), the amount of one currency that may be purchased for each unit of another currency is known as the exchange rate. A currency increases in value if it costs more in another currency to purchase it and decreases in

value if it costs less. The foreign exchange market is where currencies are traded. The value of one currency will increase as the exchange rate changes, while the value of the other currency will decrease. A currency is considered to have appreciated when its value rises. On the other side, a currency is said to have depreciated when its value falls.

The money supply gauges the overall amount of money in the economy at any one time. It includes genuine currency in the form of notes and coins as well as any deposits that may be swiftly turned into cash. Narrow definitions encompass the entire, highly liquid money supply (cash). Broader definitions encompass any forms of the money supply that are readily convertible into money, including bank deposits, savings bonds, mutual funds, and even short-term government gilts (Stellinga, De Hoog, van Riel,& de Vries, 2021).

Macroeconomic stability describes an economy that has minimized vulnerability to external shocks, which in turn increases its prospects for sustained economic growth (Vasylieva *et al.*, 2018). Macroeconomic stability is also critical for sustained and inclusive economic development (Vasylieva *et al.*, 2018). Macroeconomic stability is characterized by low and stable inflation, low long-term interest rates, low national debt relative to GDP, and stable currency (Vasylieva *et al.*, 2018).

Macroeconomic instability is one of the common structural problems facing many developing countries today (Sirere, 2015). However, budget deficit ought to be regarded as the main problem for any economy (Sirere, 2015). Budget deficits could be attributed to very high government expenditure or inability to collect adequate taxes (Onyango, 2013). There is, therefore, an urgent need to control government expenditure, foster

efficient use of existing resources to limit recourse to additional debt, and strengthen the country's capability to manage its public debt.

2.1.3 Macroeconomic variables and budget deficit finance

Just like many other developing countries, the government of Kenya has for the past many years been a perpetual casualty of budget deficit. The Kenyan government has in the past implemented various and diversified strategies with an aim of decreasing budget deficit (Sirere, 2015). Some of the strategies implemented include measures and attempts to widen the Kenyan tax base and several austerity measures aimed at reducing recurrent expenditures (Debbie, 2015). One of the most notable measures to reduce recurrent expenditures in Kenya was to reduce the number of vehicles of senior government officials to only one official vehicle which should be less than 1800cc (Otieno. Odhiambo & Ombok, 2019). Another measure was to reduce overseas travel allowances of senior government officials (Otieno. Odhiambo & Ombok, 2019). Other measures involved holding on of procurement of new furniture and vehicles and reduction in budget allocation for activities such as printing and advertising (Otieno. Odhiambo & Ombok, 2019). All these measures are as evidenced in the Finance Bills of 2018 and 2019 (Otieno. Odhiambo & Ombok, 2019).

Budget deficits in Kenya have been attributed to collected revenues falling short of expenditure demands due to inadequate budgetary resources brought about mainly by low economic performance (Odhiambo *et al.*, 2013). Budget deficits in Kenya have contributed to the weak economic performance by resulting in accumulation of huge public debt and high interest rates (Akinyi, Odunga, & Opuodho, 2018)). The government of Kenya has been trying to increase its financial resources via external

borrowing in an attempt to meet its budgetary requirements at minimum cost. The development of domestic debt markets has been encouraged to meet the borrowing requirements of the government. This particular measure will help cover budget deficits in a manner that enhances macroeconomic stability for sustainable economic growth in Kenya (Moraa, 2014).

Kenya is facing increased risk of unsustainable debt levels (International Monetary Fund, 2020; World Bank, 2020). Kenya is, therefore, at the risk of experiencing macroeconomic stability. The sustainability of Kenya's public debt will thus be dependent on a prudent borrowing technique and macroeconomic performance. Despite the several austerity measures and the various attempts by the government of Kenya to widen its tax base, it still maintains a huge budget deficit. For instance, the 2020/2021 budget deficit was 8.7% of the GDP as compared to 7.6% of GDP in 2019/2020 budget (KNBS, 2020). The issue of how best to contain budget deficit in Kenya thus need to be urgently addressed.

2.2 Theoretical Review

This study was based on Keynesian view of budget deficits. Keynes argued that government intervention in economic activity is required to help spur long term economic growth by ensuring regulation of markets, harmonization of social conflicts, efficiency in allocation of resources, and stabilization of the economy (Keynes, 1936). In the case of budget deficits, the government can intervene through borrowing either internally or externally. Financing budget deficits either through borrowing or taxation involves the absorption of real domestic resources by the public sector that otherwise would have been available to the private sector. However, it is important to note that the absorption of real domestic resources will be delayed, if unutilized resources and foreign borrowings are

available. From a purely static allocative point of view, the absorption of real resources would result in improved efficiency if the social benefits when government expenditure exceeds its private costs.

The theoretical foundation of this particular study revolved around the theories that are in support of the deficit financing and macroeconomic stability. Keynes posits that the government intervention in economic activity can help spur long term growth by ensuring efficiency in resource allocation, regulation of markets, stabilization of the economy, and harmonization of social conflicts (Keynes, 1936). Classical economists on the other hand argue that government intervention brings more harm than good to the economy. Classical economists, therefore, hold the view that government operations are inefficient and hence stifle rather than promote attainment of macroeconomic stability.

Generally, there are controversial thoughts with regard to the relationship between budget deficit and macroeconomic stability. While the Keynesian economists argued that there is positive relationship between these two variables, the neo classical economists argued the opposite. Meanwhile, the Ricardian equivalence hypothesis claimed that there is neutral relationship between budget deficit and macroeconomic stability.

2.2.1 Keynesians' View of Budget Deficit

Increased aggregate demand, according to Keynesian economists, alters the profitability of private investments and leads to a higher level of investment at any given interest rate (Eisner, 1989). As a result, despite the fact that budget deficits cause interest rates to rise, they may actually stimulate aggregate investments and savings. Increased consumption is consequently financed by underutilized resources (Eisner, 1989). Budget deficits,

according to many conventional Keynesian economists, should not stifle private investment. Increasing the budget deficit causes production to increase by the inverse of the MPS under the Keynesian model. This rise in output, according to the IS-LM model, enhances money demand. If the money supply is fixed (i.e., if budget deficits are financed with bonds), interest rates will have to rise, resulting in a drop in private investment. As a result, the amount of production produced will be reduced (Hicks, 1980).

The Keynesian approach to budget deficits, on the other hand, was slammed for two key reasons. To begin with, the Keynesian perspective on budget deficits asserts that the government may "fine tune" fiscal policy. If we believe that deficits promote aggregate demand, we must also believe that there are times when this stimulation is harmful. Real budget deficits at full employment are likely to drive out private investment and create inflation. Recognizing the consequences of private investment crowding out, many Keynesian economists advocate a policy of nominal budget deficits, which would prevent the real budget deficit from expanding until the economy reaches full employment. All of the repercussions of improperly timed budget shortfalls would be channeled into inflation under this program. The proponents of this technique appear to subscribe to the purist viewpoint that inflation is unrelated to any cost. It's vital to remember that when inflation interacts with the tax system, the outcome is severe distortions and an unfavorable redistribution of resources. Furthermore, higher inflation rates are linked to more price swings. As a result, inflation adds a lot of uncertainty and randomness to the economy. Budget deficits can have either positive or negative impacts, according to Keynesian analysis. As a result, competent fiscal policy management is required.

The repercussions of transitory budget deficits were the second critique leveled at the Keynesians' approach to budget deficit financing. The impacts of temporary budget deficits are essentially described by the Keynesians' viewpoint. They did not, however, differentiate between the effects of temporary and chronic budget deficits. As a result, it is suggested that Keynesian economists provide policymakers with erroneous advice (Sirere, 2015).

Fiscal measures, according to Keynesian economists, may result in the availability of unutilized resources in the economy and the crowding out of private ventures. This viewpoint is important in a study of macroeconomic stability because it highlights the drawbacks of adopting fiscal measures to achieve macroeconomic stability.

2.2.2 Ricardian Equivalence Theory

According to Ricardo (1951), it makes no difference to households whether they are faced with decisions about the present value of future taxes or if they are faced with taking on debt now and earning rent. Ricardo (1951) also claims that changes in macroeconomic variables like the real interest rate, the current account balance, and the amount of investment are unaffected by budget deficits and taxation. The Ricardian Equivalence Theory, in theory, eliminates any link between budget deficits and taxation.

Shifting the financing of the budget deficit from taxes to bonds is likely to result in greater consumption. This is due to the fact that consumption is mostly determined by disposable income, which is defined as income minus taxes. This means that if a country wishes to boost its consumption, it can do so by lowering taxes and financing it with bonds. If Ricardian equivalence holds, however, this will have no effect. Countries'

efforts to decrease taxes during a recession would similarly be ineffective if Ricardian equivalence existed. This is because households will anticipate higher taxes following the recession.

Many economists believe Ricardian equivalence would not hold for a variety of reasons. The population turnover could be one of the reasons. This is owing to the fact that, due to a limited lifespan, the population that is in debt and paying taxes is not the same. Individuals do not anticipate paying the taxes associated with a debt increase. As a result, when taxes are replaced with bonds, consumption rises. The fact that Ricardian equivalence is based on the permanent-income premise could be another argument. For Ricardian equivalence, this means that if consumers obtain a tax break now, they will not consume as much as they would if they knew they would face greater taxes in the future. A liquidity constraint resulting from a precautionary saving motivation, on the other hand, is likely to lead to a departure from the permanent-income hypothesis. The perpetual income hypothesis does not always hold, according to the findings of various empirical investigations.

The Ricardian equivalence theory looks at the trade-off between using taxes and using bonds to finance a budget deficit. In a study of budget deficit financing, a review of this theory is required since it compares the best choices for the government to raise money to fund its budget deficit. Ricardian equivalence theory also sheds light on household and consumer income theories, which is one of the criteria considered when assessing macroeconomic stability.

2.2.3 Mundell-Fleming Model

The Mundell model was created by Robert Mundell, one of the major pioneers of international monetary economics. The Mundell model is significant because it introduces the ideas of internal and external equilibrium. Furthermore, it incorporates Keynesian analysis with the capital account. Finally, the model presents a formal theory of policy formation. The interest rate and the level of government expenditure, or the budget deficit, are two important instruments, according to Mundell. It has two key objectives: an optimal level of revenue which is an internal target and the external target for the balance of payments.

Internal goals could include achieving full employment or, more broadly, achieving the level of nominal income that provides the least unfavorable mix of unemployment and inflation. A wide number of permutations of interest rate and government expenditure can be produced within any standard macroeconomic framework (such as the IS-LM model). Higher interest rates would reduce revenue, necessitating a higher level of government spending to compensate. Interest rate fluctuations are expected to be responsive in a model of capital account capital flows. As a result, a higher interest rate will result in capital inflows.

The total of these two, a balance of payments definition in to the balance for formal settlements, is thought to be of interest to governments. A higher interest rate will help both the current and capital accounts, whereas increased government spending will hurt the current account. As a result, different combinations of interest rate and government expenditure will provide the desired balance of payments, which may be an exact balance, a budgeted surplus, or a budget deficit.

2.3 Empirical review

A review of empirical literature shows that a large number of studies have been conducted on deficit financing. However, it is important to note that some of the relatively few studies have been conducted in developing countries compared to the more advanced economies. Many scholars have attempted to study the subject of macroeconomic stability as influenced by deficit financing. One key aspect of these empirical studies has been the focus on factors that affect macroeconomic stability. Others have largely focused on the various variables that are interlinked with deficit financing. These studies also indicate that the global economic and financial crisis reduce the levels of budget supports from developing nations thus eroding financing to developing countries budgets as well as the associated externalities.

2.3.1 Effect of Inflation Rate on budget deficit

Meltzer (1989) developed a monetarist approach to budget deficit by postulating that budget deficit financing have an impact on inflation. The researcher provided examples of countries that financed their budget deficits using inflation revenue in 1980s. Such countries include Brazil, Argentina, and Bolivia. The experience in many developed countries does not support the argument that budget deficits increase the growth of money hence producing inflation. One example is Italy, which experienced a budget deficit of about 10% of GNP throughout the 1980s. However, the rate of inflation in Italy was reduced from about 20% to about 5% annually during this period. Another good example of a country with persistent budget deficits and declining inflation is Japan. Many economists have argued that government deficit expenditure is a primary cause of

inflation and not budget deficits. However, the inflationary effect of government deficits depends upon the manner in which the budget deficit is financed.

Sirere (2015) sought to examine the relationship between budget deficit financing and economic growth in Kenya. The study period was 2005 to 2014. The study established that there is a significant relationship between budget deficit financing and economic growth in Kenya. From the findings of this particular study, the higher the budget deficit the higher the inflation rate. This will have an implication on macroeconomic stability since attainment of macroeconomic stability will result to increased economic growth.

Sunday, Bereh & Gopar (2016) investigated the relationship between budget deficit and macroeconomic variables such as inflation rates, interest rates, and exchange rates in Nigeria, with an aim of establishing causality between the variables. The study covered the period between 1981 and 2015. All the study variables were not found to Granger cause one another, except that there was a unidirectional causation from deficit financing to exchange rates to real GDP ratio. The findings of this study will hence be critical to this particular study.

2.3.2 Effect of Interest Rate on budget deficit

The study by Al-Khedar (1996) concluded that budget deficit would result in increase in interest rates in short run. The research also found that budget deficit has a positive and significant impact on the macroeconomic stability of a country. The study by Aisen & Hauner (2008) found out that budget deficit both positively and negatively affects the interest rate.

Both the Keynesian models and neo-classical models represent the standard analysis where the impact of increased budget deficits on interest rates operates via the effects of higher expenditure and increased wealth on money demand. Knot & de Haan (1999) utilized the budget deficit announcement effect technique to find out the relationship between budget deficits and interest rates in Germany in the period between 1987 and 1993. Their findings indicated that the positive relationship between budget deficits and interest rates is due to the fear that government debt might crowd out private investments (Knot & de Haan, 1999).

Many researchers have carried empirical studies concerning budget deficit and its effects. Elmendorf and Mankiw (1999) conducted a study to find out the effect of a budget deficit on accumulation of savings. An increased flow of borrowings can lead to distortionary tax measures. This is likely to ignite dissaving behavior among households and consumers. The consequence will be rise in interest rates. By implication, this reduces the funds available for investment and raises the cost of capital via increased interest rates. The final result would be a decline in private sector investments. Aschauer (1989) provided an empirical evidence pointing out to budget deficit as the major cause of crowding-out of private investments. Crowding-out of private investments will hinder a country from achieving macroeconomic stability.

2.3.3 Effect of Exchange Rate budget deficit

A number of researchers have tried to examine the relationship between the budget deficit and exchange rates. A major concern of huge budget deficits is the “exchange crowding-out effect” (Banerjee, Siddique & Amin, 2019). In an open economy, the exchange rate crowding-out can emerge from the exchange rate affecting the current

account. This particular argument stresses the significance of international capital movements in response to debt disturbances and the link between budget deficits and exchange rates (Bundt & Solocha, 1988). An illustration of "exchange rate crowding-out effect" is found in Mundell (1963) and Fleming (1962). They showed that, in a small open economy model with fixed prices and static exchange rate expectations, expansionary debt-financed fiscal policy is completely crowded out under perfect capital mobility and a flexible exchange rate.

Adesuyi & Falowo (2013) conducted a research study to determine the impact of fiscal deficit financing on macroeconomic growth in Nigeria. The findings showed that fiscal deficits have contributed significantly to macroeconomic stability hence GDP and economic growth of Nigeria. Therefore, domestic loans and external debts are significant in driving the budget deficits in Nigeria which contribute to macroeconomic stability hence growth.

Korsu, (2014) on the relationship between fiscal deficits and current account deficits in Sierra Leone found out that fiscal deficits affect the current account deficits through the monetary sector. The study opines that an increase in fiscal deficits increase the supply of money when the deficits is financed by using inflation revenue (seigniorage). Increase in money supply increases the price level in the economy, which in turn results in the appreciation of the real exchange rate and deterioration of the current account.

Akinyi, Odunga, & Opuodho (2018) examined the effect of budget deficits on current account deficits in Kenya. The study covered the period between 1970 and 2017. The results of this study indicated that budget deficit has a significant long run effect on

current account deficit and also current account deficit has a significant long run impact on budget deficit. The study also established that there exists a short run relationship between current account balance and budget deficit. The findings of this study have an implication on future studies concerning the relationship between current account balance and budget deficit.

2.3.4 Effect of Money supply on budget deficit

A study done in Turkey by Akcay, Alper, & Ozmucur (1996) established that although inflation is monetary phenomena and may plunge an economy into inflation, an expansionary monetary policy which increases money supply in an economy is also a resultant effect from budget deficit. Budget deficits prompts economies to borrow heavily which in turn increases money supply. Akcay, Alper, & Ozmucur (1996) employed the Vector Auto Regression model (VAR) and Vector Error Correction (VEC) in their analysis. The study findings were that there was significant relationship between money supply, inflation and budget deficits in the Turkey economy.

A similar study was conducted Keho, (2010) in West Africa using the ARDL model. Keho, (2010) established that money supply, inflation and budget deficit have significant relationship and therefore an increase in budget deficit would increase money supply and cause inflation. Inflationary pressures are detrimental to the well-being of an economy.

2.4 Critical review and research Gap

Studies by Medee and Nenbee (2012) investigated the effect of fiscal policy on budget deficit. Fiscal policy entails the use of taxes and government expenditure by the government to stabilize the economy. One way of stabilizing the economy is through the

use of balanced budget which can be made possible by optimal use of taxes and government expenditure. Medee and Nenbee (2012) however did use the various macroeconomic variables that play an important part in influencing the budget deficit in the economy. Their study key focus was the tools of fiscal policy as independent variables and how they influence the budget deficit. Budget deficit in an economy is influenced by a wide range of variables. Use of fiscal policy alone was not exhaustive and therefore limited information on the causes of budget deficit.

Studies by Sirere (2015), Bereh & Gopar (2016), Al-Khedar (1996), Adesuyi & Falowo (2013), Akinyi, Odunga, & Opuodho (2018) did investigation on the effect of budget deficit on the various macroeconomic variables such as economic growth, interest rates, inflation and exchange rates. As much as budget deficit affects the various macroeconomic variables in the economy, little has been done to investigate how macroeconomic variables affect budget deficits. Macroeconomic variables such as inflation, interest rates, economic growth, foreign exchange and money supply according to Keynesian theory affects to extent to which a country would incur budget deficit. There is need for empirical research to be done on the specific effect of macroeconomic variables on budget deficit.

There is need for study to be done on the current period. Majority of the studies in this area of study were done between 2000 and 2016 period. This study will extend the scope of the study period in order to acquire robust results that will inform policies made by the government.

2.5 Conceptual Framework

Independent Variables *Dependent Variable*

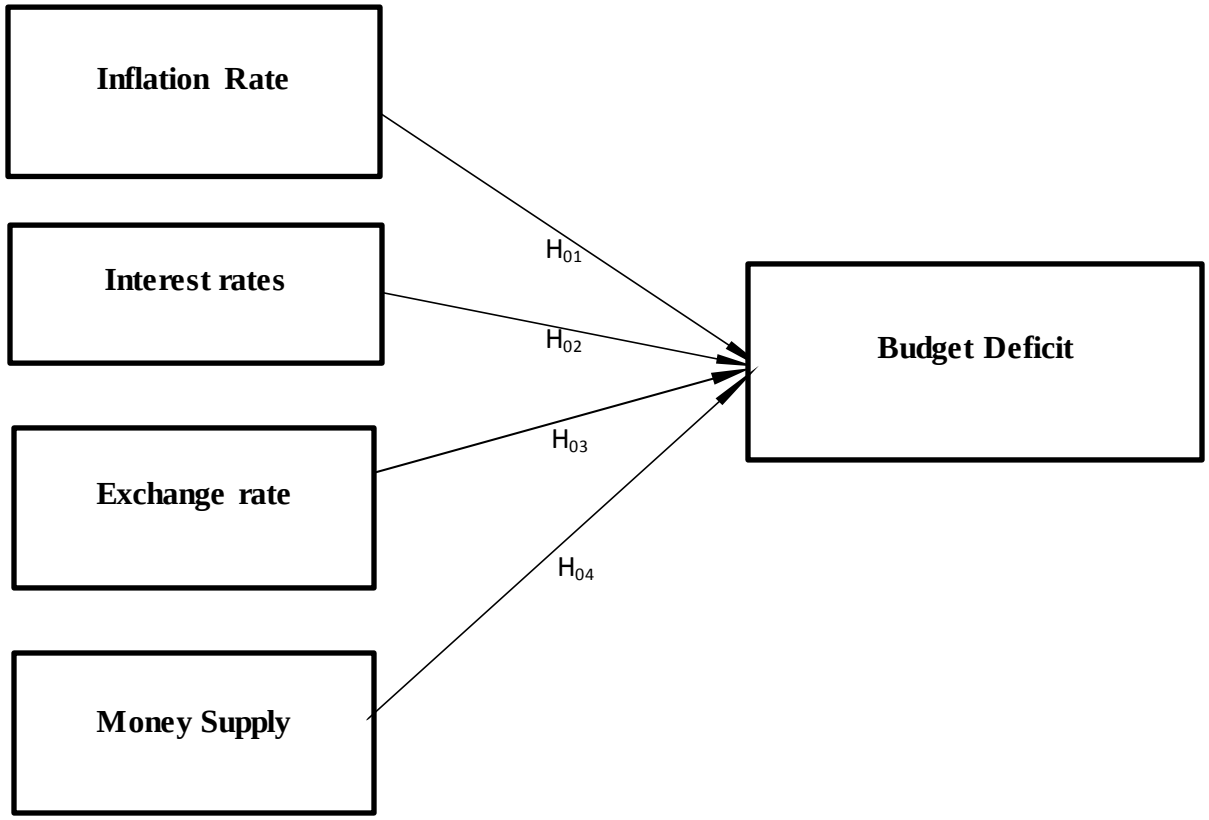


Figure 1: Conceptual framework relating budget deficit to selected macroeconomic variables

Source: Author, 2022

The conceptual model above illustrated the dependent and explanatory variables in the study. The dependent variable is budget deficit. The independent variables are inflation rate, interest rate, exchange rate and money supply. It is expected that that there will be significant relationship among the study variables.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter discussed the research methodology that was used for the study. Research Methodology gives details regarding the steps used in carrying out the study. The research design, data type, collection, and analysis techniques are elaborated.

3.2 Research Design

A research design is a tool used to guide the researcher in data collection, data analysis and interpretation of observed facts (Orodho, 2003). This study adopted explanatory research design. This is because an explanatory research design explains the causal effect between the independent variables and the dependent variables. This study was explanatory since it is concerned with analyzing the effect of selected macroeconomic variables on budget deficit in Kenya.

3.3 Data Type and Sources

The data used in the study was secondary data. Secondary data is the type of data that has already been collected and analyzed (Kothari, 2004). This type of data was used since it was readily available. Additionally, the researcher carried out desktop research to gather data on budget deficit, selected macroeconomic variables and budget deficit. The range that was used is 1991 to 2020 on a quarterly basis. Government expenditure data was obtained from the annual government budgets. Data on Government debt service was acquired from the CBK publications and Annual Public Debt Reports over

the years. Other government publications, and key institutions publications such as KNBS, KIPPRA as well as publications from international organizations such as the WB and IMF was also among the sources of data.

3.4 Definition and Measurement of Variables

Table 3. 1 Definition and Measurement of Variables

Variable	Definition	Measurement
Inflation (π)	It is the percentage change in the CPI over a one period of time	$\frac{CPI_2 - CPI_1}{CPI_1} x\ 100$
Exchange Rate (ER)	it is the value of one country currency in relation to the value of another country currency	$\frac{USD}{Ksh}$
Interest Rate (IR)	It refers to the amount charged on borrowed money by lenders to the borrowers.	$\frac{P * R * T}{100}$
Budget Deficit (BDF)	The difference in amount between total government revenue and total government expenditure	$TGR - TGE$
Money Supply Growth Rate (MSGR)	It refers to the rate of change in money supply of a period of one year	$\frac{MS_2 - MS_1}{MS_1} x\ 100$

Where:

CPI_2 it is the consumer price index in the current period or year

CPI_1 it is the consumer price index in the previous year

MS_2 it is the money supply in the current period

MS_1 it is the money supply in the previous period

USD it is the United State Dollar

Ksh it is the Kenyan Shilling

P it is the Principal Amount

R it is the rate

T it is the time

TGR it is the total government revenue

TGE it is the total government expenditure

3.5 Data Analysis and presentation

Based on the macroeconomic definition of budget deficit, the objective of the study of finding the effect of selected macroeconomic variables on budget deficit was best achieved by conducting Johansen (1988) co-integration test and Granger (1988) causality test. ARDL model techniques was also be used.

The process of data analysis involved a number of steps. Quantitative data analysis technique was used to analyze time series data from 1991 to 2020 on an annual basis. The researcher analyzed data using Stata software program. The study area was Kenya. Correlation and regression analysis were conducted to establish the association and effect of the explanatory variables on the dependent variable.

3.5.1 Model Specification

The OLS explicit equation that was used to express a representation of macroeconomic stability variables and budget deficit is as follows;

$$BDF_t = \beta_0 + \beta_1 IF_t + \beta_2 IR_t + \beta_3 ER_t + \beta_4 MSGR_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(1)$$

Where:

BDF_t is the budget deficit

IF_t is the inflation rate

IR_t is the interest rate

ER_t is the exchange rate

$MSGR_t$ is the exchange rate

β_0 is the constant

β_1 is the coefficient for inflation rate

β_2 is the coefficient for interest rate

β_3 is the coefficient for exchange rate

β_4 is the coefficient for Money supply growth rate

ε_t is the Random Error Term/Stochastic error term/Disturbance term in period t

3.5.2 ARDL Model expo of the OLS Equation

$BDF_t = \beta_0 + \beta_1 BDF_{t-1} + \beta_2 IF_t + \beta_3 IF_{t-1} + \beta_4 IR_t + \beta_5 IR_{t-1} + \beta_6 ER_t + \beta_7 ER_{t-1} + \beta_8 MSGR_t + \beta_9 MSGR_{t-1} + \varepsilon_t$...

(2)

β_0 is the constant

β_1 is the coefficient of the lagged Budget deficit

B_2 is the coefficient for inflation rate

B_3 is the coefficient for lagged inflation rate

B_4 is the coefficient for Interest rate

B_5 is the coefficient for lagged Interest rate

B_6 is the coefficient for Exchange rate

B_7 is the coefficient for lagged Exchange rate

B_8 is the coefficient for money supply growth rate

B_9 is the coefficient for lagged money supply growth rate

ε is the Random Error Term/Stochastic error term/Disturbance term

3.6 Test of Data and Model Properties

3.6.1 Normality Test

The study used Shapiro Wilk to test normality at 5% level of significance. The normality assumption assures that the ρ-values for the t-tests and F-test will be valid. The study used the Jarque-Bera, and Shapiro Wilk tests to test for normality. The null hypothesis for the test is normality, implying that the ρ-value is greater than 5% level of significance.

3.6.2 Heteroscedasticity Test

The study used Breusch Pagan test to test for the presence of heteroscedasticity. Breusch-Pagan test compares null hypothesis and the alternative hypothesis. If the p-value of the test is less than some significanceb level of 0.05, the null hypothesis is rejected and heteroscedasticity is present.

3.6.3 Multicollinearity Test

The study used Variance Inflation Factor (VIF) test to test for multicollinearity. According to VIF, multicollinearity was present if the values are greater than 10. The remedies for severe multicollinearity include first differencing, dropping one variable, increasing the sample size, or pooling the data (Gujarati, 2012).

3.6.4 Auto-correlation Test

The study used Durbin-Watson test to test for auto-correlation. Breusch-Godfrey test compares null hypothesis and the alternative hypothesis. If the p-value of the test is less than some significance level of 0.05, the null hypothesis is rejected and autocorrelation is present.

3.6.5 Unit Root Test

The study used Augmented Dickey Fuller (ADF) tests to test for the presence of a unit root. The dickey fuller test was used to determine whether the data is stationary or non-stationary in this study. The null hypothesis that a unit test is present in the autoregressive model and thus the time series data is not stationary was tested using the dickey fuller test.

3.6.6 Co-integration test

The study used Johansen test to test for the presence co-integration. The Johansen test was used to determine whether several non-stationary time series are correlated in the long run or not. The Johansen null hypothesis is that there is no co-integrating relationship between two or more-time series variable. A 5 percent level of significance will be used to test co-integration.

3.6.7 Test of Significance

The researcher used Z-test (two tailed test, at p-value=0) to evaluate the significance of the overall correlation model at 95% significance level. The aim of this particular test is to determine whether there exists a significant relationship between the dependent variable and the independent variables (Stephan & Levine, 2010).

The researcher also conducted hypothesis testing using chi-square test. Chi-square is one of the statistical tests commonly used to compare observed results with results that would be expected to obtain according to a certain hypothesis. The p-value in the chi-square test is the probability of observing a sample statistic as extreme as the test statistic. Since the test statistic is at 5% significant level, we will use 0.05 probability level as our critical value hence if the calculated chi-square value is less than the 0 .05 value, we will accept the null hypothesis (Schindler, 2008).

3.6.8 Test of model and data stability

Model stability and data stability was tested using cumulative sum of recursive residuals (CUSUM) test. The aim of this test was to examine whether the parameters of the developed model are stable or not over time. The stability test was employed using the CUSUM command in Stata. The importance of this test was to check whether there were structural breaks in the break or not. The null hypothesis of the test is that the cumulative of the residuals have zero mean which means there are no structural breaks while the alternative hypothesis is that the cumulative of the residuals are not equal a mean zero which means there are structural breaks in the model.

3.7 Ethical Considerations

Firstly, the researcher obtained the letter of introduction from Moi University School of business. Secondly, the researcher obtained a permit from NACOSTI to collect and conduct research. The researcher was conscious of multiple roles by avoiding relationships that could reasonably impair his academic performance or could exploit or harm others. Thirdly, the researcher adhered to informed-consent guidelines. The researcher respected confidentiality and privacy. Finally, the researcher ensured that his

work was free of plagiarism or research misconduct, and he accurately represented his results.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

Data analysis, the findings, and their interpretations are all covered in this chapter. The chapter will start by detailing the findings of the descriptive statistics, the results of the various diagnostic tests, the results of the correlation analysis, the results of the models, and finally, a discussion of the results and interpretations of the models will be presented at the end.

4.2 Descriptive Statistics

The summary of descriptive statistics for the variables used in this investigation are shown in Table 4.1. These descriptive statistics include minimum and maximum values as well as the mean, standard deviation, variance, skewness, and kurtosis. The mean is used to gauge the overall dataset's central value for the observation. The dataset's spread from the center values is depicted by the standard deviation. Additionally, skewness gauges how a distribution deviates from the norm; data can be either negatively or positively skewed, and kurtosis gauges how peaked a distribution is. The distribution's highest and lowest values are represented by minimum and maximum, respectively.

According to the data in table 4.1 below, Budget deficit, which was measured as percentage of GDP had a mean of 0.032 and ranged from 0.0002 to 0.81. It exhibited a positive skewness of 0.3126, which indicates a longer right tail. Additionally, the kurtosis of budget deficit was 1.5195, which is consistent with a leptokurtic distribution with a

peak distribution. A standard deviation of roughly 0.0286 demonstrated how far budget deficit deviated from its mean.

Inflation had a mean of 11.39 and ranged from 1.5543 to 45.9789. It exhibited a positive skewness of 2.0369, which indicates a longer right tail. Additionally, the kurtosis of inflation was 7.1562, which is consistent with a leptokurtic distribution with a peak distribution. A standard deviation of roughly 9,5558 demonstrated how far inflation is from its mean.

Interest rate had a mean of 8.0174 and ranged from -10.0960 to 21.0963. It exhibited a negative skewness of -0.5210, which indicates a longer left tail. Additionally, the kurtosis of interest rate was 3.0169, which is consistent with a mesokurtic distribution with a normal distribution. A standard deviation of roughly 7.6581 demonstrated how far interest rate is from its mean.

Exchange rate had a mean of 6.1186 and ranged from -8.2439 to 80.0343. It exhibited a positive skewness of 3.590408, which indicates a longer right tail. Additionally, the kurtosis of exchange rate was 17.5482, which is consistent with a leptokurtic distribution with a peak distribution. A standard deviation of roughly 15.7215 demonstrated how far exchange rate is from its mean.

Money supply had a mean of 15.8279 and ranged from 2.9313 to 39.0214. It exhibited an approximately symmetric distribution of 0.59433, which indicates a normal distribution. Additionally, the kurtosis of money supply was 3.0890, which is consistent with a mesokurtic distribution with a normal distribution. A standard deviation of roughly 8.5586 demonstrated how far money supply is from its mean.

Table 4. 1 Descriptive Statistics Results

Variable	Budget deficit	Inflation	Interest Rate	Exchange Rate	Money Supply
Observation	30	30	30	30	30
Mean	.0319	11.3916	8.0174	6.1186	15.8280
Standard deviation	.0286	9.5558	7.6581	15.7215	8.5586
Variance	.0008	91.3133	58.6464	247.1639	73.2505
Skewness	.3126	2.0370	-.5201	3.5904	.5943
Kurtosis	1.5195	7.1562	3.0169	17.5482	3.0890
Minimum	.0002	1.5543	-10.0960	-8.2439	2.9313
Maximum	.0810	45.9789	21.0963	80.0343	39.0214

Source: Author, 2022

The results in table 4.1 above are supplemented by a graphical representation of the budget deficit, inflation, money supply, exchange rate and interest rate. This graphical representation is shown in figure 4.1 below.

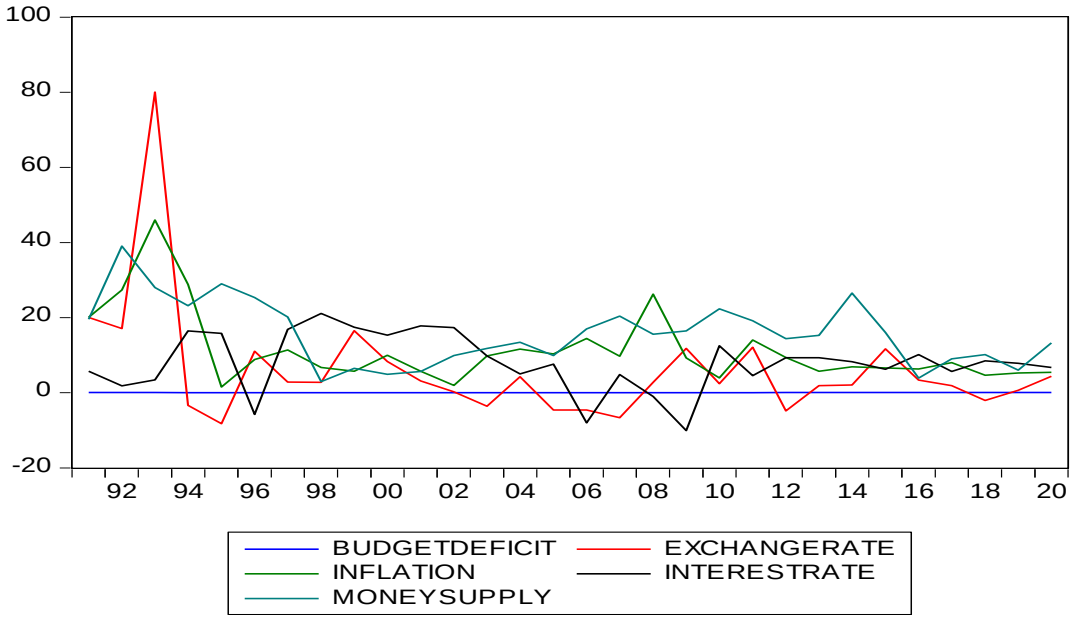


Figure 2 Budget deficit, inflation, money supply, exchange rate, interest rate Graphical representation

4.3 Diagnostic Tests

4.3.1 Normality Test

The summary of the normality tests performed on the variables used in this analysis is shown in Table 4.2. The shapiro-Wilk test of normalcy was used in the study, with a 5% level of significance. The alternative hypothesis for the Shapiro-Wilk test is that the data are not normally distributed, as opposed to the null hypothesis that they are normally distributed (Shapiro & Wilk,1965). When the p values are less than 0.05 level of significance, the judgment criteria are to reject the null hypothesis of normal distribution.

The p values for the budget deficit, inflation, and exchange rate are all below the threshold of 5% significance, indicating that they are not normally distributed variables. As evidenced by p values of 0.15434 and 0.38988, respectively, which are greater than the 5% level of significance, the interest rate and the money supply, on the other hand, are normally distributed.

Table 4. 2 Normality test results

Variable	Observation	W	V	z	Prob>z
Budget Deficit	30	0.85715	4.541	3.129	0.00088
Inflation	30	0.75731	7.714	4.224	0.00001
Interest Rate	30	0.94852	1.636	1.018	0.15434
Exchange Rate	30	0.60308	12.616	5.242	0.00000
Money Supply	30	0.96398	1.145	0.280	0.38981

Source: Author, 2022

4.3.2 Lags Selection Order Criteria

The ARDL model's ideal lag length was determined in this study using the Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC), and Schwartz Information Criterion (SIC). Akaike Information Criterion (AIC) and Final Prediction Error (FPE), however, received particular attention. When dealing with small data sets or when there are less than 60 observations, Liew (2004) asserts that the Akaike Information Criterion (AIC) and Final Prediction Error (FPE) are the most acceptable metrics to use.

This is due to the fact that AIC and FPE increase the likelihood of finding the best lag length in a model by minimizing the probability of underestimating the data. The various outcomes of the ideal lag length for the budget deficit, interest rate, exchange rate, inflation, and money supply are shown in Tables 4.3, 4.4, 4.5, 4.6, and 4.7.

Table 4. 3 Lag Selection criteria for Budget Deficit

Lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	54.8558				0.00092	-4.14275	-4.14275	-4.09436
1	89.7554	69.799	1	0.000	0.000069	-6.75041	-6.72255	-6.65364
2	93.5201	7.5294	1	0.006	0.000055*	-6.96308 *	-6.92128*	-6.81792*
3	94.0606	1.0809	1	0.298	0.000058	-6.92774	-6.872	-6.73418
4	95.0087	1.8963	1	0.168	0.000058	-6.92375	-6.92375	-6.6818

(*) Indicates that the coefficient is statistically significant at 95 percent confident interval.

Source: Author, 2022

Table 4.3 above shows the lag selection order criteria for inflation under Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC) and Schwartz Information Criterion (SIC). All the criteria suggest that budget deficit should have two lags.

Table 4. 4 Lag Selection Criteria Results for Interest Rate

Lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	-90.1561				64.9858	7.01201	7.02594	7.0604
1	-89.0442	2.2237	1	0.136	64.4461*	7.0034*	7.03127*	7.10018*
2	-88.7423	0.60394	1	0.437	68.0506	7.0571	7.0989	7.20226
3	-87.4054	2.6787	1	0.102	66.4049	7.03118	7.08692	7.22474
4	-87.1566	0.49753	1	0.481	70.5234	7.08897	7.15864	7.33091

(*) Indicates that the coefficient is statistically significant at 95 percent confident interval.
Source: Author, 2022

Table 4.4 above shows the lag selection order criteria for inflation under Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC) and Schwartz Information Criterion (SIC). All the criteria suggest that interest rate should have one lag.

Table 4. 5 Lag Selection Criteria Results for Exchange Rate

Lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	-84.2372				41.2178*	6.55671*	6.57064*	6.6051*
1	-84.0752	.32414	1	0.560	43.9738	6.62117	6.64903	6.71794
2	-82.7567	2.6368	1	0.104	42.9411	6.59667	6.63848	6.74184
3	-82.2442	1.025	1	0.311	44.6457	6.63417	6.68991	6.82773
4	-82.0038	0.48093	1	0.488	47.445	6.6926	6.76227	6.93454

(*) Indicates that the coefficient is statistically significant at 95 percent confident interval.
Source: Author, 2022

Table 4.5 above shows the lag selection order criteria for inflation under Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC) and Schwartz Information Criterion (SIC). All the criteria suggest that exchange rate should have zero lag.

Table 4. 6 Lag Selection Criteria Results for Inflation

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	-77.5367				24.6172*	6.04128*	6.05522*	6.08967*
1	-77.4401	.1931	1	0.660	26.3958	6.11078	6.13865	6.20756
2	-76.9479	.98446	1	0.321	27.4672	6.14984	6.19164	6.295
3	-76.0253	1.8452	1	0.174	27.6708	6.21153	6.21153	6.34934
4	-75.9021	.24642	1	0.620	29.6721	6.29291	6.29291	6.46518

(*) Indicates that the coefficient is statistically significant at 95 percent confident interval.
Source: Author, 2022

Table 4.6 above shows the lag selection order criteria for inflation under Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC) and Schwartz Information Criterion (SIC). All the criteria suggest that inflation should have zero lag.

Table 4. 7 Lag Selection Criteria Results for Money Supply

Lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	-87.6097				53.4259	6.81613	6.83007	6.86452
1	-81.7664	11.687*	1	0.001	36.8185*	6.44357*	6.47144*	6.54035*
2	-81.6343	.26429	1	0.607	39.389	6.51033	6.55213	6.6555
3	-80.4509	2.3668	1	0.124	38.8928	6.49622	6.55196	6.68978
4	-79.3497	2.2023	1	0.138	38.6835	6.48844	6.55811	6.73038

(*) Indicates that the coefficient is statistically significant at 95 percent confident interval.
Source: Author, 2022

Table 4.7 above shows the lag selection order criteria for inflation under Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC) and Schwartz Information Criterion (SIC). All the criteria suggest that money supply should have one lag.

4.3.3 Stationary Test

The Akaike Information Criterion (AIC) lag selection was used to test the unit root using the Augmented Dickey Fuller (ADF) test. ADF's alternative hypothesis is that there is no

unit root, while the null hypothesis is that there is a unit root. A 5% level of significance was used in this investigation. The null hypothesis is accepted if the test statistic is less than the critical value at the level of significance of 5 percent; however, the null hypothesis is rejected if the test statistic exceeds the critical value at the level of significance of 5 percent (Mushtaq, 2011). The findings of the money supply, inflation, interest rate, exchange rate and budget deficit are summarized in Table 4.8.

The results of the table below show that, at the 5% level of significance, the unit root of interest rate, inflation, and money supply cannot be ruled out. This implies that the money supply, inflation, and interest rates all have unit roots, which indicates that they are not stationary. Additionally, the unit root of the budget deficit and exchange rate was rejected from the null hypothesis at the 5% level of significance. This shows that the budget deficit and exchange rate are stationary because they lack a unit root. The findings in Table 4.7 indicate that the ARDL limits test must be conducted to determine whether there is a level relationship.

Table 4. 8 Stationarity test Results

Variable	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Budget deficit	-4.940	-4.362	-3.592	-3.235
Interest rate	-2.938	-4.352	-3.588	-3.233
Exchange rate	-5.144	-4.343	-3.584	-3.230
Inflation	-3.314	-4.342	-3.584	-3.230
Money Supply	-2.813	-4.352	-3.588	-3.233

Source: Author, 2022

4.3.4 Co-integration Test

ARDL bound tests developed by Pesaran/Shin/Smith (2001) were used to conduct the co-integration test. The test's null hypothesis claimed that there were no level relationships among the variables, and as a result, no long-term relationships. The alternative theory proposed that variables had level relationships with one another, indicating the existence of a long-term link. Five percent threshold of significance was used in this test.

Rejecting the null hypothesis of no level relationship at 5% level of significance if the F statistic was greater than the upper bound (I 1) and accepting the null hypothesis if the F statistic was less than the lower bound (I 0) or rejecting the null hypothesis of no level relationship at 5% level of significance if the t statistic was greater than the upper bound (I 1) and accepting the null hypothesis if the t statistic was less than the lower bound (I 0) were the decision Additionally, if the F statistic and/or t statistic values at the 5% level of significance are between the lower bound (I 0) and the higher bound (I 1), the results are deemed inconclusive.

Table 4. 9 Co-integration Test Results

K-4	(I_0) (L_1)	(I_1) (L_1)	(I_0) (L_05)	(L_1) (L_05)	(I_0) (L_01)	(I_1) (L_01)
F-Statistic Case (4.080*)	2.45	3.52	2.86	4.01	3.74	5.06
t-statistics (-1.352*)	-2.57	-3.66	-2.86	-3.99	-3.43	-4.60

Source: Author, 2022

The rejection of the null hypothesis of no level association is shown in Table 4.9 above. This is due to the fact that the F statistics of 4.080 was higher than the critical value of 5% of the upper bound (I 1) of 4.01. According to the data, there was a level relationship between the variables, indicating that a long-term relationship existed. The t statistics also

showed the same outcomes. These findings indicated that the model would be estimated using the ARDL Error Correction Model (ECM) in order to determine the long-term relationship among variables.

4.3.5 Autocorrelation Test

The Breusch-Godfrey Lm test was used to examine the autocorrelation of the residuals. The alternative hypothesis of serial correlation was compared against the null hypothesis of no serial correlation at the 5% level of significance. Breusch (1978) and Godfrey (1978) state that the null hypothesis of no serial correlation is rejected if the chi-square test statistic p value is less than the level of significance of 5%, and the null hypothesis of no autocorrelation is accepted if the chi-square test statistic p value is greater than the level of significance of 5%. The Durbin Watson test of serial correlation was also used to support the findings of this investigation.

Table 4. 10 Autocorrelation Test Results

Source	chi2	df	Prob>chi2
Breusch Godfrey LM test for Autocorrelation(lags(1)	2.062	1	0.1510
Durbin Watsin Test d statistic			1.518945

Source: Author, 2022

The Breusch Godfrey Lm test and DW test findings for serial correlation are displayed in Table 4.10 above. The null hypothesis of no serial correlation is accepted since the p value for chi-square in the aforementioned table, which is 0.1510, is greater than the level of significance of 5% (0.05). The Durbin-Watson test statistic of 1.518945 further supports the null hypothesis that there is no serial correlation. The common rule of thumb is that there is no serial correlation when the test statistic values fall between 1.5 and 2.5.

4.3.6 Heteroscedasticity Test

The Breusch Pagan test was used to examine the heteroscedasticity of the residuals. The alternative hypothesis of heteroscedasticity was compared against the null hypothesis of homoscedasticity. Breusch and Pagan (1979) state that the null hypothesis of homoscedasticity is accepted if the chi-square test statistic's corresponding p value is more than the 5% threshold of significance and rejected if it is less than that level.

Table 4. 11 Homoscedasticity Test Results

source	chi2	Df	Prob>chi2
Heteroscedasticity	21.47	14	0.0903

Source: Author, 2022

The results of this test, which are displayed in Table 4.11 above, reveal that the model's residuals are homoscedastic. The chi-square test results with p values of 0.0903, which is greater than the 5% level of significance, support this (0.05). This implies that the model's residuals have a constant variance.

4.3.7 Multi-collinearity Test

The model's multi-collinearity was examined using the variance inflation factor (VIF). The VIF calculates how closely related the independent variables in a model are to one another. According to a standard guideline for multi-collinearity, values more than 10 signify the presence of multi-collinearity in the model, whereas values lower than 10 signify its absence.

Table 4. 12 VIF Multicollinearity Test Results

Variable	VIF	1/VIF
Exchange rate	1.58	0.632221
Inflation	1.46	0.686021
Interest rate	1.25	0.797756
Money supply	1.06	0.947493
Mean VIF	1.34	

Source: Author, 2022

The outcomes of multicollinearity are displayed in Table 4.12 above. There is no multicollinearity among the independent variables, as indicated by the VIF in the table above, which is 1.34, which is less than the usually accepted rule of thumb of 10.

4.4 Correlation Analysis

Pairwise correlation was used to investigate any relationships between the dependent variable and the independent variables. Correlation was examined among the budget deficit, interest rate, exchange rate, inflation, and money supply variables. The Pearson coefficient value for each variable and its significance are shown in Table 4.13 below.

Table 4. 13 Pairwise Correlation Test Results

Variable	Budget deficit	Interest rate	Exchange rate	inflation	Money supply
Budget deficit	1.0000				
Interest rate	-0.1685	1.0000			
	0.3735				
Exchange rate	0.2131	-0.1932	1.0000		
	0.2582	0.3063			
Inflation	0.0569	-0.2945	0.6892*	1.0000	
	0.7652	0.1142	0.000		
Money supply	0.0569	-0.3456	0.2944	0.4883*	1.0000
	0.7652	0.0614	0.1142	0.0062	

Source: Author, 2022

The results in table 4.12 above shows the results of correlation. There was a negative insignificant relationship between interest rate and budget deficit (-0.1685) at 5 percent level of significance. Exchange rate and budget deficit have a positive insignificant relationship (0.2131) at 5 percent level of significance. Exchange rate and interest rate (-0.1932) had a negative insignificant relationship, inflation and budget deficit (0.0569) had a positive insignificant relationship, inflation and interest rate (-0.2945) had a negative insignificant relationship, inflation and exchange rate (0.6892) had a positive significant relationship, money supply and budget deficit (0.0569) had a positive insignificant relationship, money supply and interest rate (-0.3456) had a negative insignificant relationship. Money supply and exchange rate (0.2944) had a positive insignificant relationship. Finally, money supply and inflation had a positive significant relationship at 5 percent level of significance.

4.5 Structural break results

The CUSUM test was utilized to evaluate the model's variable consistency. With a larger sample size of the data being used to generate the estimation, it was feasible to follow the development of the coefficients that were being estimated. Two bands of standard error are placed either side of the calculated coefficients. If there is a significant variation in the coefficient following the addition of new data to the estimation equation, the system is clearly unstable. A definite sign that there is no stability is when the blue line is outside of the two red lines.

The CUSUM results are shown in Figures 4.2. The blue lines were within the red lines on the two graphs as shown below. This indicates that the model's input variables maintained their stability throughout time. The various graphs of the residuals for the variables utilized in the model are shown in Figure 2.

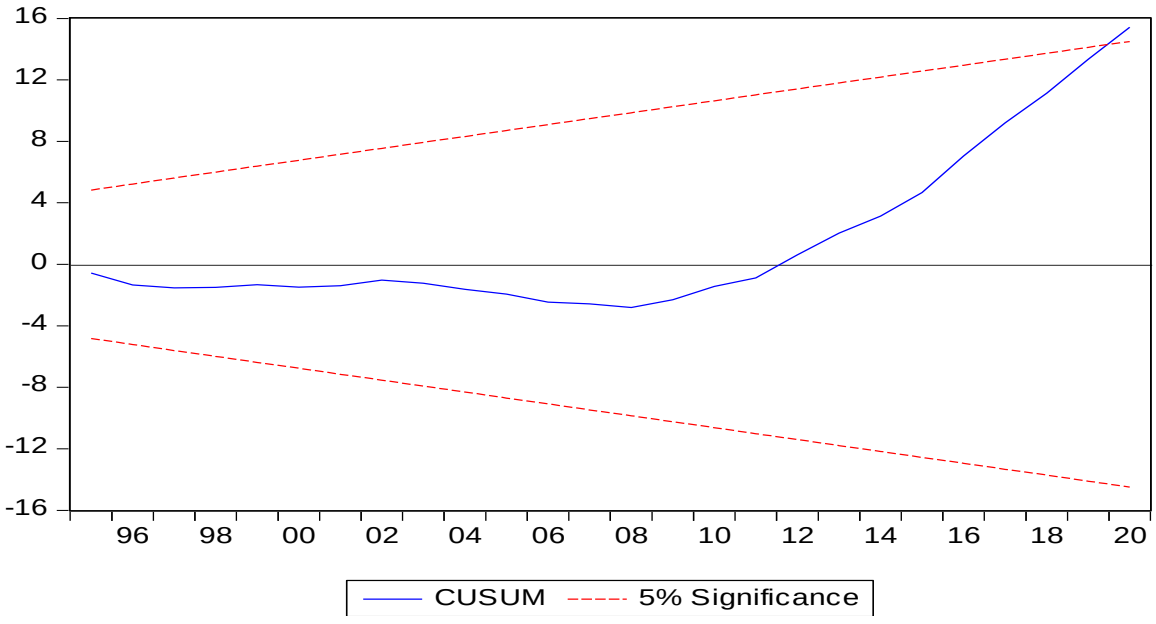


Figure 3 CUSUM Test Graph

4.6 ARDL ECM Results

Table 4. 14 ARDL ECM Results

Variables	Coefficient	Std. Error	t value	P > |t|	R-Squared	Adjusted R
LONG RUN						
Inflation	-0.00966	.0073705	-1.31	0.206		
Interest rate	0.04037	.0156864	2.57	0.016		
Exchange rate	0.41891	.0832293	5.03	0.000		
Money supply	.000042	.0061659	-0.90	0.380		
SHORT RUN						
Budget deficit LD	0.27205	.2023428	1.34	0.195		
Interest rate D1	0.00034	.0002436	1.41	0.175		
Money supply D1	-0.00004	.0002599	-1.78	0.868		
Constant	0.02166	0.0058	3.76	0.001		
R-Squared					0.6246	
Adjusted R						0.4666

Source: Author,2022

Table 4.14 above shows the results that were obtained from the ARDL Error Correction model. The results are broken down into short run and long run. It was found out that interest rate, exchange rate, inflation and money supply had a long run effect on budget deficit. On the other hand, the lag difference of budget deficit, the interest first difference, the money supply first difference had a short run effect on budget deficit. All other coefficients were found to be statistically insignificant except interest rate, exchange rate and the constant that were statistically significant at 5 percent level of significance. The coefficient of interest rate (0.04037) indicates that a one percentage increase in interest rate would have a positive significant effect on budget deficit in the long run at 5 percent level of significance. This was supported by a p value of 0.016. The possible explanation

for this result might be due to insufficient evidence in terms of adequate data. The coefficient of exchange rate (0.41891) had a positive significant effect on budget deficit in the long run at 5 percent level of significance as supported by a p value of 0.0000. The coefficient of inflation (-0.00966) had a negative insignificant effect on budget deficit in the long run. This was supported by the p values of 0.206 that was greater than the 5 percent level of significance. The possible explanation for this result might be due to insufficient evidence in terms of adequate data. The coefficient of money supply (0.000042) had a positive insignificant effect on budget deficit in the long run as supported by the p values of 0.380 that was greater than the 5 percent level of significance. The possible explanation for this result might be due to insufficient evidence in terms of adequate data.

The budget deficit lag difference coefficient (0.27205) that was positive and insignificant in the short run at 5 percent level of significance. This was supported by the p values of 0.195 that was greater than 0.05. The coefficient (0.00034) of the first difference of interest rate had a positive but insignificant effect on budget deficit in the short run. This was supported by a p value of 0.175 that was greater than the 5 percent level of significance. The coefficient (-0.00004) first difference of money supply had a negative but insignificant effect on budget deficit in the short run at 5 percent level of significance. The coefficient of constant (0.02166) was significant at 5 percent level of significance. This indicates that when all other factors are held constant, budget deficit would rise by 0.02166 percent. R squared was 62.46 percent which means that the budget deficit is explained by the independent variables by 62.46 percent. Additionally, the adjusted R was 46.66 percent which indicates that when the degrees of freedom of the variables are

incorporated then budget deficit is explained by the independent variable at 46.66 percent.

4.8 Discussion of Research Findings

The findings of the descriptive statistics and stationary test showed that the variables employed in the study were not normally distributed. The ADF test indicated that there was a unit root among the variables at different orders. This meant that the variables were non-stationary. In order to examined the usefulness of employing the error correction model, ARDL cointegration test was carried out and the results indicated that there was cointegration among the variables. This meant that there was short and long run relationship among the variables employed in the study. The results from the various diagnostics test performed indicated that the model was stable over time. This was supported by the CUSUM curve where the blue lines were within the red lines. The results of the Breusch-Godfrey Lm test and DW tested indicated that the model did suffer from serial correction. The residuals of the model were not serially corrected over time. Heteroscedasticity test that was examined using the Breusch Pagan test also showed the model did not suffer from heteroscedasticity. This means that the residuals of the model had a constant variance over time. Multicollinearity test was determined using the VIF test. The results of the VIF test indicated that the model did not suffer from multicollinearity. This means that the independent variables employed in the study were not perfectly correlated and therefore did not affect the model results. The results of the lag selection criteria were examined using the SIC and AIC lag selection criteria. The two criteria were selected because of their appropriateness when a small data set is being employed in a study. The budget deficit was determined to have two lags, exchange rate

was determined to have zero lag, inflation was determined to have zero lag, interest rate was determined to have one lag, and money supply was determined to have one lag.

ARDL ECM model results indicated that only interest rate and exchange rate had significant effect on budget deficit in the long run. The coefficient of interest rate indicated that one percent increase in the interest rates would end up raising the budget deficit by 0.04037 percent at 5 percent level of significance in the long run. The coefficients of exchange rate also showed that a one percentage increase in exchange rate would end have raising the budget deficit by 0.41891 percent in the long run at 5 percent level of significance. These findings were in conformity with findings that were obtained by Knot & de Haan (1999) and (Banerjee, Siddique & Amin, 2019). Money supply and inflation were found to have insignificant effect on budget deficit in the long run. The coefficient of inflation indicated that a percent increase in inflation would reduce budget deficit by 0.01 percent in the long run. This results were however insignificant as supported by the p value of 0.206 that was greater than the 5 percent level of significance. Money supply coefficient also showed that a percentage increase in exchange rate would drive budget deficit upward by 0.000042 percent in the long run. This result was however insignificant at 5 percent level of significance. These results did not agree with those obtained by Sunday, Bereh & Gopar (2016) and Akcay, Alper, & Ozmucur (1996) that established a significant relationship. The short run results of the ARDL model were found to be insignificant at 5 percent level of significance. The R squared and the Adjusted R of the ARDL ECM model indicated that the independent variables of the model, that is, inflation, exchange rate, interest rate and money supply did explain the budget deficit at 62.46 percent and 46.66 percent respectively. The constant of the model

was significant at 5 percent level of significance. Its coefficient indicated that the budget deficit would still rise by 0.021 percent when the independent variables are held constant.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter includes a description of the study's results, the conclusion drawn from it, advice to various economic stakeholders who might gain from them, challenges the researcher faced in carrying out the study, and ideas for future research in the field.

5.2 Summary of Findings

The purpose of the study was to examine the effect of the selected macroeconomic variables on the budget deficit in Kenya. The study period covered in this study was 30 years running from 1991 to 2020. The study employed the ARDL ECM to determine the results. The study began by analyzing the descriptive statistics of the various variables of the study. The effectiveness of the results and models were determined by first analyzing various diagnostic tests. The diagnostics tests that were analyzed are the stationarity test to access the unit root, the cointegration test was examined using the ARDL bound test to determine whether the long run relationship among the variables existed, the lag selection order was carried out using the AIC and SIC lag selection criteria, causality test was examined using the granger causality test, serial correlation was determined using the Breusch Godfrey test and DW test, heteroscedasticity was determined the Breusch pagan Lm test, model stability was checked using the CUSUM test and multicollinearity was accessed using the VIF test.

Correlation analysis results showed there was a negative correlation between interest rate and budget deficit, a positive correlation between exchange rate and budget deficit, a negative correlation between exchange rate and interest rate, a positive correlation

between inflation and budget deficit, a negative correlation between inflation and interest rate, a positive correlation inflation and exchange rate, a positive correlation between money supply and budget deficit, a negative correlation between money supply and interest rate, a positive correlation between money supply and exchange rate and a positive correlation between money supply and inflation.

The AIC and SIC lag selection criteria showed that budget deficit had two lags, inflation had zero lags, interest rates had one lag, exchange rate had zero lag and money supply had one lag. Diagnostic tests results indicated that there was absence of serial correlation, absence of heteroscedasticity, and absence of multicollinearity. The granger causality test showed there was bidirectional relationship between money supply and inflation. Money supply granger caused inflation and inflation granger caused money supply. There was unidirectional relationship between money supply and exchange rate and exchange rate and interest rate. The money supply granger caused exchange rate and exchange rate granger caused interest rate. The findings of the study also demonstrated that the model was stable overtime as indicated by CUSUM graph.

The ARDL ECM results indicated that there was a long run relationship between interest rates, exchange rate, inflation, money supply and the budget deficit. The relationship between interest rate and budget deficit was positive and significant at 5 percent level of significance, a percent increase in interest rate would results to a 0.04037 percentage increase in budget deficit. The relationship between exchange rate and budget deficit was positive and significant at 5 percent level of significance. A percentage increase in exchange rate would result into a 0.41891 increase in budget deficit at 5 percent level of significance. The rest of the variables (inflation and money supply) had insignificant

relationship to the budget deficit at 5 percent level of significance. The short run results obtained were also insignificant at 5 percent level of significance. The model dependent variable (budget deficit) was explained by the independent variables (exchange rate, interest rate, inflation, and money supply) at 62.46 percent as shown by the R squared.

5.3 Conclusion

The study concluded that interest rate had a positive effect on the budget deficit in the long run. Increasing interest rates in the economy ends up driving budget deficit upwards in the long run. The same is true when the variable of concern is exchange rate. Currency devaluation against the dollar will end up widening the budget deficit which means more borrowing to finance the high government expenditure. Inflation had an insignificant negative relationship with budget deficit. a percentage increase in inflation will end reducing budget deficit in the economy although the results was not supported by the sample size at the 5 percent level of significance. This means a persistent increase in prices of goods and services in the Kenyan economy may necessitate the government to increase the budget deficit. money supply in the economy also had a positive insignificant effect on budget deficit. This means that increasing money stock levels in the economy would up widening the budget deficit. The widening budget deficit would necessitate more borrowing either internally or externally that would be spend in the economy and therefore increasing the money stock levels in the economy.

The study findings agree with those of Knot & de Haan (1999), (Banerjee, Siddique & Amin, 2019), Bereh & Gopar (2016) and Akcay, Alper, & Ozmucur (1996) that macroeconomic variables may have an effect on the budget deficit. The study therefore concludes that in order to ensure that the budget deficit in an economy is maintained with

the required optimal levels, there is need to ensure the stability of the major macroeconomic variables. The macroeconomic variables have a direct link to the extent to which the budget deficit in an economy would be maintained. Any attempt to reduce budget deficit would therefore require a reduction in interest rate, exchange rate and money supply. This because there is a positive relationship between the budget deficit and these variables. Sound and proper macroeconomic management is necessary in the government attempts to maintain the budget deficit at the required optimal level. This is because when there is instability in these macroeconomic variables, the Kenyan budget deficit will continue increasing and plunge the economy into a debt crisis cycle.

5.4 Recommendations

The study findings recommend that there is need for the government to ensure there is stability in macroeconomic variables. This is because there is a significant link between the budget deficit and the selected macroeconomic variables. A strive by the government to reduce budget deficit would mean an adjustment in macroeconomic variables to suit the purpose. These adjustments may include reducing the interest rate in the economy. A reduction in the interest rates in the economy would end reducing the budget deficit. Reducing interest rate means more investment opportunities that drive the national income upwards which translates into a wider tax base in the economy. More tax revenues would reduce the budget deficit in the economy and prevent the economy into plunging to a debt crisis problem. The same is true for exchange rate. There was a significant link between exchange rate and budget deficit in the Kenyan economy. This finding means that a reduction in exchange rate would end reducing the budget deficit in the economy. A reduction in exchange rate means an appreciation in the Kenyan currency

against the US dollar would make the imports to Kenya expensive and this would end up reducing the huge expenditures incurred by the government, members of the households and business community. Policy makers can therefore utilize exchange rate as one of the sound avenues of controlling budget deficit in Kenya. Although the findings showed that inflation and budget deficit had an insignificant relationship, it is crucial to note that inflation can impact the budget deficit negatively. This means that the government should put in place proper measures of ensuring that inflation is marinated at the proper level that is neither too high nor too low so that it doesn't dislodge budget deficit. Additionally, there is need for the central bank which is in charge of controlling money stock levels in the economy to ensure that money supply does not exceed the required limit in order to maintain a balanced budget. This can be made possible through frequent meetings by the monetary policy committee of the Central bank. Finally, it is crucial for policy makers to ensure that there is fiscal discipline and sound macroeconomic management that would be crucial in attaining the stability of macroeconomic variables in the economy. Unstable macroeconomic variables may result into a widening budget deficit in the Kenyan economy.

5.5 Limitations of the Study

The study was limited by the unavailability of specific data as per the ARDL model that was developed. As a result, the ARDL model was restructured and proxies employed to represent the actual variable. However, these limitations did not significantly affect the results of the ARDL model since the proxies employed supported the theoretical and empirical information between the selected macroeconomic variable and budget deficit in Kenya. Another limitation was the use of aggregate inflation variables, the use of budget

deficit as a percentage of GDP and the different figures in different sources made it difficult to ascertain the correct figures.

5.6 Areas for Further Study

The study employed the ARDL time series method of estimation, a similar study can be carried out using other methods of estimation such as the VAR, VECM and GLM methods and compares the results of these estimation methods to determine whether they have similar results. The same study can also be extended to other countries in East Africa Regions such as Uganda, Rwanda, Tanzania, Burundi, South Sudan and DRC to investigate the effect of the selected macroeconomic variables on budget deficit.

Further research in future should incorporate other independent variables that influence budget deficits that are different from those employed in this study such as unemployment, economic growth, institutional quality and governance. The study can also be carried out frequently to examined any changes on the effects of these selected macroeconomic variables on budget deficit.

REFERENCES

Abd Rahman, N. H. (2012, January). The relationship between budget deficit and economic growth from Malaysia's perspective: An ARDL approach. In *2012 International Conference on Economics, Business Innovation* (Vol. 38, pp. 54-58).

Adesuyi, O. O., & Falowo, E. (2013). Impact of fiscal deficit financing on macroeconomic growth in Nigeria. *International Journal of Research in Management*, *3*(5), 143-172.

Akinyi, A. P., Odunga, R., & Opuodho, G. (2018). Relationship between Budget Deficit and Current Account Balance in Kenya. *Journal of Economics*, *2*(1), 60-85.

Akcay, O. C., Alper, C. E., & Ozmucur, S. (1996). Budget deficit, money supply and inflation: Evidence from low and high frequency data for Turkey. *Bogazici University Research Papers*, *12*.

Akgay, O. C., Alper, C. E., & Ozmucur, S. (2018). Budget Deficit, Inflation and Debt Sustainability: Evidence from Turkey, 1970-2000. In Inflation and disinflation in Turkey (pp. 83-102). Routledge.

Alam, M. M., Sadekin, M. N., & Saha, S. K. (2020). The impact of macroeconomic variables on the budget deficit in Bangladesh: an econometric analysis. *South Asian Journal of Business Studies*.

Al-Khedair, S. I. (1996). *The impact of the budget deficit on key macroeconomic variables in the major industrial countries*. Florida Atlantic University.

Amin, S., & Murshed, M. (2017). International fund inflows, economic growth and health care development: the case of Bangladesh. *Journal of Accounting, Finance and Economics*, *7*(1).

Aschauer, D. A. (1989). Is public expenditure productive?. *Journal of monetary economics*, *23*(2), 177-200.

Bahmani-Oskooee, M. (1999). Do federal budget deficits crowd out or crowd in private investment?. *Journal of Policy Modeling*, *21*(5), 633-640.

Ball, L., & Mankiw, N. G. (1995). What do budget deficits do?. *NBER working paper*, (w5263).

Banerjee, P. K., Siddique, M. M., & Amin, M. R. (2019). Deficit Financing, Crowding Out and Economic Growth: Bangladesh Perspective. In *Development and Deprivation in the Indian Sub-continent* (pp. 19-55). Routledge.

Bilan, Y., Raišienė, A. G., Vasilyeva, T., Lyulyov, O., & Pimonenko, T. (2019). Public governance efficiency and macroeconomic stability: Examining convergence of social and political determinants.

Bivens, J., & Irons, J. (2010). Government debt and economic growth. *Economic Policy Institute,*.

Blanchard, O. (2019). Public debt and low interest rates. *American Economic Review*, *109*(4), 1197-1229.

Bonam, D., & Lukkezen, J. (2019). Fiscal and monetary policy coordination, macroeconomic stability, and sovereign risk premia. *Journal of Money, Credit and Banking*, *51*(2-3), 581-616.

Branson, W. H., Halttunen, H., & Masson, P. (1977). Exchange rates in the short run: The dollar-dentschemark rate. *European Economic Review*, *10*(3), 303-324.

Burdekin, R. C. (2019). Budget Deficits and Inflation: The Importance of Budget Controls for Monetary Stability. In Establishing Monetary Stability in Emerging Market Economies (pp. 33-61). Routledge.Briotti, G. (2005). Economic reactions to public finance consolidation: a survey of the literature. *ECB occasional paper*, (38).

Crozier, R. B. (1976). Deficit financing and Inflation: Facts and Fiction. Occasional Papers, No. 3, Conference Board of Canada.

Đukić, M. (2021). Comparison of Keynesian and (neo) classical economics.

Easterly, W., & Schmidt-Hebbel, K. (1993). Fiscal deficits and macroeconomic performance in developing countries. *The World Bank Research Observer*, *8*(2), 211-237.

Eichenbaum, M. (2021). Should We Worry About Deficits When Interest Rates Are So Low?.

Eisner, R. (1987). *How Real Is The Federal deficit?*. Free Press, New York.

Eisner, R. (1989). Budget deficits: rhetoric and reality. *Journal of economic perspectives*, *3*(2), 73-93.

Elmendorf, D. W., & Mankiw, N. G. (1999). Government debt. *Handbook of macroeconomics*, *1*, 1615-1669.

Emmanuel, U. C. (2013). An analysis of the relationship between fiscal deficits and selected macroeconomic variables in Nigeria, 1970–2011. *IOSR Journal of Business and Management (IOSR-JBM)*, *12*(6), 19-27.

Epaphra, M. (2017). Analysis of budget deficits and macroeconomic fundamentals: A VAR-VECM approach. *Journal of Economics & Management*, *30*, 20-57.

Ferrari, A., Masetti, O., & Ren, J. (2018). Interest rate caps: the theory and the practice. *World Bank Policy Research Working Paper*, (8398).

Fischer, S. (1993). The role of macroeconomic factors in growth. *NBER Working Paper Series: National Bureau of Economic Research*., 4565: 1-36.

Fishlow, A. (2019). Coping with the creeping crisis of debt (pp. 97-144). Routledge.

Fleming, J. M. (1962). Domestic Financial Policies Under Fixed and Under Floating Exchange Rates. *International Monetary Fund Staff Papers*, No. 10, pp. 369-380.

Friedman, B. M. (1978). Crowding out or crowding in? The Economic Consequences of Financing Government deficits. *Brookings Papers on Economic Activity*, No. 3, pp. 593-641.

Gebremariam, T. K. (2018). The effect of budget deficit on current account deficit in Ethiopia: Investigating the twin deficits hypothesis. *International Journal of Economic and Management Science*, *7*(4), 1-6.

Granger, C. W. (1988). Causality, cointegration, and control. *Journal of Economic Dynamics and Control*, *12*(2-3), 551-559.

Hamburger, M. J., & Zwick, B. (1981). Deficits, money and inflation. *Journal of Monetary Economics*, *7*(1), 141-150.

Hicks, J. (1980). *Causality in economics*. Australian National University Press.

Imam Paiko, I. (2012). DEFICIT FINANCING AND ITS IMPLICATION ON PRIVATE SECTOR INVESTMENT: THE NIGERIAN EXPERIENCE.

IMF, T. "International monetary fund." *The Balance of Payment Statistics* (2020).

James, H. (2020). What Is Keynesian About Deficit Financing? The Case of Interwar Germany. In *The Political Power of Economic Ideas* (pp. 231-262). Princeton University Press.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control*, *12*(2-3), 231-254.

Kaplanoglou, G. (2019). Fiscal institutions and the monitoring of public finances: the case of Greece. *CGK Working Paper no. 2019-00*.

Keho, Y. (2010). Budget deficits and economic growth: causality evidence and policy implications for WAEMU countries. *European Journal of Economics, Finance and Administrative Sciences*, *18*(4), 99-104.

Kenya National Bureau of Statistics. (2020). *Statistical abstract*. Kenya National Bureau of Statistics.

Keynes, J. M. (1924). The Theory of Money and the Foreign Exchanges. *JM Keynes, A Tract of Monetary Reform: The Collected Writings of John Maynard Keynes*, *4*.

Keynes, J. M. (1936). The supply of gold. *The Economic Journal*, *46*(183), 412-418.

Ko, M. C. (2019). Fiscal policy, government debt, and economic growth in the Kaleckian model of growth and distribution. *Journal of Post Keynesian Economics*, *42*(2), 215-231.

Korsu, R. D. (2014). The inflationary effects of fiscal deficit in Sierra Leone: A simulation approach.

Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International.

Latief, R., & Lefen, L. (2018). The effect of exchange rate volatility on international trade and foreign direct investment (FDI) in developing countries along "one belt and one road". *International Journal of Financial Studies*, *6*(4), 86.

Liew, V. K. S. (2004). Which lag length selection criteria should we employ?. *Economics bulletin*, *3*(33), 1-9.

Limbach, J. G. (2022). Emergency Measures: An Analysis of Expansionary Fiscal and Monetary Policy During Crises.

Liulov, O. V., Pimonenko, T. V., Kvilinskyi, O. S., Us, Y. O., Arefieva, O., Akimov, O., & Pudryk, D. (2020). Government Policy on Macroeconomic Stability: Case for Low-and Middle-Income Economies. IBIMA Conference.

Lyeonov, S. V., Vasylieva, T. A., & Lyulyov, O. V. (2018). Macroeconomic stability evaluation in countries of lower-middle income economies, (1), 138-146.

McLeay, M., Radia, A., & Thomas, R. (2014). Money creation in the modern economy. *Bank of England Quarterly Bulletin*, Q1.

Makau, J., Njuru, S., & Ocharo, K. N. (2018). Fiscal policy and public debt in Kenya.

Makau, J. K., Njuru, S., & Ocharo, K. (2018). Macroeconomic Environment and Public Debt in Kenya. *International Journal of Economics*, *3*(1), 49-70.

McCandless, G. T. (1991). *Macroeconomic Theory*. Englewood Cliffs, New Jersey: Prentice Hall.

McMillan, W. D., & Beard, T. R. (1982). Deficits, Money and Inflation. *Journal of Monetary Economics*, Vol. 10, pp. 273-277.

Melnyk, L., Sineviciene, L., Lyulyov, O., Pimonenko, T., & Dehtyarova, I. (2018). Fiscal decentralization and macroeconomic stability: the experience of Ukraine's economy. *Problems and Perspectives in Management*, *16*(1), 105-114.

Mundell, R. A. (1963). Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates. *Canadian Journal of Economics and Political Science*, Vol. 29, pp. 475-485.

Musa, B. K. (2021). Theoretical Review of the Impact of Fiscal Deficits on Economic Growth in Nigeria.

Moraa, W. (2014). *The relationship between budget deficit financing and economic growth in Kenya* (Masters Thesis, University of Nairobi).

Myovella, G. A., & Kisava, Z. S. (2018). Budget deficit and inflation in Tanzania: ARDL bound test approach. *Journal of Business Economics and Finance*, *7*(1), 83-88.

Narayan, P. K., Narayan, S., & Prasad, A. D. (2019). Modelling the relationship between budget deficits, money supply and inflation in Fiji.

Nwanna, I. O., & Umeh, G. N. (2019). Deficit financing and economic growth: the Nigerian experience. *International Journal of Economics and Financial Management*, *4*(1), 28-49.

Odhiambo, S. O., Momanyi, G., Othuon, L., & Aila, F. O. (2013). The relationship between fiscal deficits and economic growth in Kenya: An empirical investigation. *Greener Journal of Social Sciences*, *3*(6), 306-323.

Onyango, V. O. (2013). *The determinants of deficit financing in Kenya* (Masters Thesis, University of Nairobi).

Otieno, O. G., Odhiambo, S., & Ombok, B. (2019). Effect of Internal Budget Deficit Financing On Economic Growth in Kenya.

Paiko, I. I. (2012). Deficit financing and its implication on private sector investment: The Nigerian experience. *Arabian Journal of Business and Management Review (OMAN Chapter)*, *1*(10), 45.

Rao, V. K. R. V. (1953). Deficit Financing, Capital Formation and Price Behaviour in an Under-developed Economy. *Indian Economic Review*, *1*(3), 55-91.

Romer, D. (2006). Advanced macroeconomics. McGraw-Hill, Irwin. *Massachusetts: Boston*.

Salim, A. (2019). INFLATION:-TYPES, CAUSES, AND EFFECTS. *Impact Journals*, *7*(1), 343-350.

Singh, S. N. (2019). Business Inefficiencies and Youth Unemployment in Ethiopia: A Case Study of Mettu Town.

Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of monetary economics*, *32*(3), 485-512.

SHA, H., Debbie, A., & Shaw, G. D. (2009). The handbook of inequality and socioeconomic position: concepts and measures. *Journal of Social Policy*, *38*, 545.

Shapiro, S. S., & Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). *Biometrika*, *52*(3/4), 591-611.

Schick, A. (2018). Budgeting for results: recent developments in five industrialized countries. *Performance-based budgeting*, 129-146.

Shojai, S. (ed.), (1999), "*Budget Deficits and Debt: A Global Perspective"*, Praeger Publishers, USA.

Sirere, S. S. (2015). *Relationship between budget deficit financing and economic growth in Kenya* (Masters Thesis, University of Nairobi).

Sitompul, S., Ichsan, R. N., & Nasution, L. (2021). The Influence of Exchange Rate, Inflation, For the Results of the Development Assets of Islamic Banks.

Stellinga, B., De Hoog, J., van Riel, A., & de Vries, C. (2021). *Money and Debt: The Public Role of Banks* (p. 247). Springer Nature.

Sunday, R. U., Bereh, M. N., & Gopar, J. K. (2016). Relationship between Budget Deficit Financing and Macroeconomic Variables in Nigeria.

Vasylieva, T. A., Lieonov, S. V., Liulov, O. V., & Kyrychenko, K. I. (2018). Macroeconomic stability and its impact on the economic growth of the country.

World Bank. (2020). *Global economic prospects, June 2020*. The World Bank.

APPENDICES

Appendix I: Budget Deficit as a percentage of GDP data from 1991-2020

Years	Budget Deficit % GDP
1991	0.043
1992	0.0542
1993	0.0562
1994	0.0272
1995	0.0015
1996	0.0032
1997	0.0059
1998	0.0002
1999	0.0056
2000	0.0026
2001	0.0037
2002	0.0088
2003	0.0051
2004	0.0037
2005	0.0014
2006	0.0031
2007	0.007
2008	0.0166
2009	0.0312
2010	0.0367
2011	0.0364
2012	0.0529
2013	0.0541
2014	0.059
2015	0.0668
2016	0.0745
2017	0.0737
2018	0.0691
2019	0.0739
2020	0.081

Source: KNBS Website (2022), IMF Data Base (2022)

Appendix II: Consumer Price Index and Inflation data from 1991-2020

Year	Consumer price index (2010 = 100)	Inflation, consumer prices (annual %)
1991	10.41014877	20.08449558
1992	13.25548857	27.33236445
1993	19.35021392	45.9788813
1994	24.92585992	28.81438943
1995	25.31328958	1.554328161
1996	27.55708169	8.864087416
1997	30.68807461	11.36184505
1998	32.75106095	6.722436508
1999	34.63162722	5.742001095
2000	38.08787233	9.980025154
2001	40.27358227	5.738598143
2002	41.06347134	1.961308217
2003	45.09413465	9.81569063
2004	50.33589289	11.62403554
2005	55.52692196	10.31277836
2006	63.55263568	14.45373421
2007	69.75466128	9.75888023
2008	88.0581565	26.23981664
2009	96.18955755	9.234125924
2010	100	3.961388891
2011	114.022494	14.02249396
2012	124.7152583	9.377767482
2013	131.8458452	5.71749357
2014	140.9144068	6.878154993
2015	150.1896388	6.582174403
2016	159.6473169	6.297157525
2017	172.4282386	8.005722791
2018	180.5148122	4.689819761
2019	189.966315	5.235859994
2020	200.2336423	5.404814672

Source: KNBS Website (2022), IMF Data Base (2022)

Appendix III: Interest Rate data from 1991-2020

Years	Interest Rate (percentage)
1991	5.745513
1992	1.825329
1993	3.413472
1994	16.42811
1995	15.80165
1996	-5.77659
1997	16.87957
1998	21.09633
1999	17.45405
2000	15.32743
2001	17.8125
2002	17.35814
2003	9.770511
2004	5.045258
2005	7.609988
2006	-8.00987
2007	4.819091
2008	-0.985
2009	-10.096
2010	12.52696
2011	4.526186
2012	9.313511
2013	9.293946
2014	8.249079
2015	6.268806
2016	10.11813
2017	5.656748
2018	8.48796
2019	7.831101
2020	6.729227

Source: KNBS Website (2022), IMF Data Base (2022)

Appendix IV: money supply data and annual change in money supply data from 1991-2020

Year	Money Supply	Money Supply (annual %)
1991	69470800000	19.57273078
1992	96579300000	39.02143059
1993	1.23654E+11	28.03343988
1994	1.52314E+11	23.17787241
1995	1.96486E+11	29.00047809
1996	2.46246E+11	25.32505646
1997	2.95975E+11	20.19466305
1998	3.0465E+11	2.931251626
1999	3.24415E+11	6.487695196
2000	3.40337E+11	4.907897731
2001	3.59533E+11	5.640363014
2002	3.95087E+11	9.88881026
2003	4.41657E+11	11.78729924
2004	5.01156E+11	13.47166399
2005	5.50812E+11	9.908371574
2006	6.44295E+11	16.97190638
2007	7.7588E+11	20.42304518
2008	8.9652E+11	15.5488382
2009	1.04406E+12	16.45732295
2010	1.27753E+12	22.3616747
2011	1.52221E+12	19.15205419
2012	1.74129E+12	14.39232274
2013	2.00733E+12	15.27832513
2014	2.5397E+12	26.52126265
2015	2.94782E+12	16.0698099
2016	3.0625E+12	3.890410344
2017	3.33839E+12	9.008327563
2018	3.67633E+12	10.12298105
2019	3.89755E+12	6.017497589
2020	4.41489E+12	13.27328449

Source: KNBS Website (2022), IMF Data Base (2022)

Appendix V: Exchange rate data from 1991-2020

Years	Exchange rate %Change
1991	20.04428003
1992	17.11861819
1993	80.03424711
1994	-3.36329912
1995	-8.243879151
1996	11.05396025
1997	2.831093014
1998	2.783597938
1999	16.49836196
2000	8.317417426
2001	3.134409393
2002	0.236684196
2003	-3.572829065
2004	4.264545118
2005	-4.571920427
2006	-4.570597759
2007	-6.634038139
2008	2.759576455
2009	11.82024529
2010	2.431920452
2011	12.08789258
2012	-4.820550723
2013	1.884874775
2014	2.089206647
2015	11.66519234
2016	3.387623312
2017	1.877392106
2018	-2.03890376
2019	0.680862412
2020	4.37241396

Source: KNBS Website (2022), IMF Data Base (2022)

Appendix VI: Stata Output Results

```
. pwcorr budgetdeficitgdp interestrate exchangeratechange inflation
moneysupplygrowthrate, star(0.05) sig

             | budget~p intere~e exchan~e inflat~n moneys~e
-------------+---------------------------------------------
budgetdefi~p |   1.0000
             |
             |
interestrate |  -0.1685   1.0000
             |   0.3735
             |
exchangera~e |   0.2131  -0.1932   1.0000
             |   0.2582   0.3063
             |
   inflation |   0.0569  -0.2945   0.6892*  1.0000
             |   0.7652   0.1142   0.0000
             |
moneysuppl~e |   0.0569  -0.3456   0.2944   0.4883*  1.0000
             |   0.7652   0.0614   0.1142   0.0062
             |

. swilk budgetdeficitgdp interestrate exchangeratechange inflation
moneysupplygrowthrate

                  Shapiro-Wilk W test for normal data

    Variable |        Obs       W           V         z       Prob>z
-------------+--------------------------------------------------------
budgetdefi~p |         30    0.85715      4.541     3.129    0.00088
interestrate |         30    0.94852      1.636     1.018    0.15434
exchangera~e |         30    0.60308     12.616     5.242    0.00000
   inflation |         30    0.75731      7.714     4.224    0.00001
moneysuppl~e |         30    0.96398      1.145     0.280    0.38981
```

```
. summarize budgetdeficitgdp interestrate exchangeratechange inflation
moneysupplygrowthrate,detail
```

Budget Deficit%GDP

Percentiles		Smallest		
1%	.0002	.0002		
5%	.0014	.0014		
10%	.00205	.0015	Obs	30
25%	.0037	.0026	Sum of Wgt.	30
50%	.0292		Mean	.0319433
		Largest	Std. Dev.	.0285987
75%	.0562	.0737		
90%	.0738	.0739	Variance	.0008179
95%	.0745	.0745	Skewness	.3126238
99%	.081	.081	Kurtosis	1.519471

Interest Rate

Percentiles		Smallest		
1%	-10.096	-10.096		
5%	-8.009867	-8.009867		
10%	-3.380793	-5.776588	Obs	30
25%	4.819091	-.984997	Sum of Wgt.	30
50%	8.04009		Mean	8.017371
		Largest	Std. Dev.	7.658093
75%	15.32743	17.35814		
90%	17.40609	17.45405	Variance	58.6464
95%	17.8125	17.8125	Skewness	-.5299693
99%	21.09633	21.09633	Kurtosis	3.016854

Exchange rate %Change

Percentiles		Smallest		
1%	-8.243879	-8.243879		
5%	-6.634038	-6.634038		
10%	-4.696236	-4.820551	Obs	30
25%	-2.038904	-4.57192	Sum of Wgt.	30
50%	2.771587		Mean	6.118613
		Largest	Std. Dev.	15.72145
75%	11.05396	16.49836		
90%	16.80849	17.11862	Variance	247.1639
95%	20.04428	20.04428	Skewness	3.590408
99%	80.03425	80.03425	Kurtosis	17.5482

Inflation

Percentiles		Smallest		
1%	1.554328	1.554328		
5%	1.961308	1.961308		
10%	4.325604	3.961389	Obs	30
25%	5.738598	4.68982	Sum of Wgt.	30
50%	9.049107		Mean	11.39156
		Largest	Std. Dev.	9.555797
75%	11.62404	26.23982		
90%	26.78609	27.33237	Variance	91.31325
95%	28.81439	28.81439	Skewness	2.036929
99%	45.97888	45.97888	Kurtosis	7.156204

Money supply growth rate

Percentiles		Smallest		
1%	2.931252	2.931252		
5%	3.89041	3.89041		
10%	5.274131	4.907898	Obs	30
25%	9.88881	5.640363	Sum of Wgt.	30
50%	15.41358		Mean	15.82794
		Largest	Std. Dev.	8.558649
75%	20.42305	26.52126		
90%	27.27735	28.03344	Variance	73.25048
95%	29.00048	29.00048	Skewness	.5943338
99%	39.02143	39.02143	Kurtosis	3.088991

. summarize

Variable	Obs	Mean	Std. Dev.	Min	Max
years	30	2005.5	8.803408	1991	2020
budgetdefi~p	30	.0319433	.0285987	.0002	.081
interestrate	30	8.017371	7.658093	-10.096	21.09633
exchangera~e	30	6.118613	15.72145	-8.243879	80.03425
inflation	30	11.39156	9.555797	1.554328	45.97888
moneysuppl~e	30	15.82794	8.558649	2.931252	39.02143

```
. mean budgetdeficitgdp interestrate exchangeratechange inflation
moneysupplygrowthrate

Mean estimation                   Number of obs   =         30

------------------------------------------------------------------------------
                             |       Mean   Std. Err.     [95% Conf. Interval]
-----------------------------+------------------------------------------------
          budgetdeficitgdp |   .0319433   .0052214      .0212644    .0426223
              interestrate |   8.017371    1.39817      5.157792    10.87695
         exchangeratechange |   6.118613    2.87033      .2481289     11.9891
                  inflation |   11.39156   1.744642      7.823363    14.95975
moneysupplygrowthrate |   15.82794   1.562588      12.63208    19.02379
------------------------------------------------------------------------------

. swilk resid

                  Shapiro-Wilk W test for normal data

    Variable |        Obs       W           V         z       Prob>z
-------------+--------------------------------------------------------
       resid |         30    0.90132      3.137     2.364    0.00905

varsoc budgetdeficitgdp

   Selection-order criteria
   Sample:  1995 - 2020                        Number of obs      =        26
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 |  54.8558                      .00093  -4.14275  -4.12882  -4.09436  |
  |  1 |  89.7554  69.799    1  0.000  .000069  -6.75041  -6.72255  -6.65364  |
  |  2 |  93.5201  7.5294*   1  0.006  .000055* -6.96308* -6.92128* -6.81792* |
  |  3 |  94.0606  1.0809    1  0.298  .000058  -6.92774    -6.872  -6.73418  |
  |  4 |  95.0087  1.8963    1  0.168  .000058  -6.92375  -6.85408   -6.6818  |
  +---------------------------------------------------------------------------+
```

```
 Endogenous:  budgetdeficitgdp

    Exogenous:  _cons

. varsoc interestrate

   Selection-order criteria

   Sample:  1995 - 2020                        Number of obs      =        26

  +---------------------------------------------------------------------------+

  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |

  |----+----------------------------------------------------------------------|

  |  0 | -90.1561                     64.9858   7.01201   7.02594*   7.0604* |

  |  1 | -89.0442  2.2237    1  0.136  64.4461*   7.0034*  7.03127   7.10018  |

  |  2 | -88.7423  .60394    1  0.437  68.0506    7.0571    7.0989   7.20226  |

  |  3 | -87.4054  2.6737    1  0.102  66.4049   7.03118   7.08692   7.22474  |

  |  4 | -87.1566  .49753    1  0.481  70.5234   7.08897   7.15864   7.33091  |

  +---------------------------------------------------------------------------+

   Endogenous:  interestrate

    Exogenous:  _cons

. varsoc exchangeratechange

   Selection-order criteria

   Sample:  1995 - 2020                        Number of obs      =        26

  +---------------------------------------------------------------------------+

  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |

  |----+----------------------------------------------------------------------|

  |  0 | -84.2372                     41.2178*  6.55671*  6.57064*   6.6051* |

  |  1 | -84.0752  .32414    1  0.569  43.9738   6.62117   6.64903   6.71794  |

  |  2 | -82.7567  2.6368    1  0.104  42.9411   6.59667   6.63848   6.74184  |

  |  3 | -82.2442   1.025    1  0.311  44.6457   6.63417   6.68991   6.82773  |

  |  4 | -82.0038  .48093    1  0.488   47.445    6.6926   6.76227   6.93454  |

  +---------------------------------------------------------------------------+

   Endogenous:  exchangeratechange

    Exogenous:  _cons

. varsoc inflation
```

```
   Selection-order criteria
   Sample:  1995 - 2020                        Number of obs      =        26
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -77.5367                     24.6172*  6.04128*  6.05522*  6.08967* |
  |  1 | -77.4401   .1931    1  0.660  26.3958   6.11078   6.13865   6.20756  |
  |  2 | -76.9479  .98446    1  0.321  27.4672   6.14984   6.19164     6.295  |
  |  3 | -76.0253  1.8452    1  0.174  27.6708   6.15579   6.21153   6.34934  |
  |  4 | -75.9021  .24642    1  0.620  29.6721   6.22324   6.29291   6.46518  |
  +---------------------------------------------------------------------------+
   Endogenous:  inflation
    Exogenous:  _cons
. varsoc moneysupplygrowthrate
   Selection-order criteria
   Sample:  1995 - 2020                        Number of obs      =        26
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -87.6096                     53.4253   6.81612   6.83006   6.86451  |
  |  1 |  -81.766  11.687*   1  0.001  36.8171*  6.44353*   6.4714*  6.54031* |
  |  2 | -81.6338  .26435    1  0.607  39.3874   6.51029   6.55209   6.65546  |
  |  3 | -80.4504  2.3668    1  0.124  38.8912   6.49618   6.55192   6.68973  |
  |  4 |  -79.349  2.2028    1  0.138  38.6812   6.48838   6.55805   6.73032  |
  +---------------------------------------------------------------------------+
   Endogenous:  moneysupplygrowthrate
    Exogenous:  _cons
varsoc budgetdeficitgdp
   Selection-order criteria
```

```
 Sample:  1995 - 2020                        Number of obs      =        26
+---------------------------------------------------------------------------+
|lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
|----+----------------------------------------------------------------------|
|  0 |  54.8558                       .00093  -4.14275  -4.12882  -4.09436  |
|  1 |  89.7554  69.799    1  0.000  .000069  -6.75041  -6.72255  -6.65364  |
|  2 |  93.5201  7.5294*   1  0.006  .000055* -6.96308* -6.92128* -6.81792* |
|  3 |  94.0606  1.0809    1  0.298  .000058  -6.92774    -6.872  -6.73418  |
|  4 |  95.0087  1.8963    1  0.168  .000058  -6.92375  -6.85408   -6.6818  |
+---------------------------------------------------------------------------+
 Endogenous:  budgetdeficitgdp
  Exogenous:  _cons
. varsoc interestrate
 Selection-order criteria
 Sample:  1995 - 2020                        Number of obs      =        26
+---------------------------------------------------------------------------+
|lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
|----+----------------------------------------------------------------------|
|  0 | -90.1561                      64.9858   7.01201   7.02594*   7.0604* |
|  1 | -89.0442  2.2237    1  0.136  64.4461*   7.0034*  7.03127   7.10018  |
|  2 | -88.7423  .60394    1  0.437  68.0506    7.0571    7.0989   7.20226  |
|  3 | -87.4054  2.6737    1  0.102  66.4049   7.03118   7.08692   7.22474  |
|  4 | -87.1566  .49753    1  0.481  70.5234   7.08897   7.15864   7.33091  |
+---------------------------------------------------------------------------+
 Endogenous:  interestrate
  Exogenous:  _cons
. varsoc exchangeratechange
 Selection-order criteria
```

```
 Sample:  1995 - 2020                        Number of obs      =        26
+---------------------------------------------------------------------------+
|lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
|----+----------------------------------------------------------------------|
|  0 | -84.2372                     41.2178*  6.55671*  6.57064*   6.6051* |
|  1 | -84.0752  .32414    1  0.569  43.9738   6.62117   6.64903   6.71794  |
|  2 | -82.7567  2.6368    1  0.104  42.9411   6.59667   6.63848   6.74184  |
|  3 | -82.2442   1.025    1  0.311  44.6457   6.63417   6.68991   6.82773  |
|  4 | -82.0038  .48093    1  0.488   47.445    6.6926   6.76227   6.93454  |
+---------------------------------------------------------------------------+
 Endogenous:  exchangeratechange
  Exogenous:  _cons

. varsoc inflation

 Selection-order criteria
 Sample:  1995 - 2020                        Number of obs      =        26
+---------------------------------------------------------------------------+
|lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
|----+----------------------------------------------------------------------|
|  0 | -77.5367                     24.6172*  6.04128*  6.05522*  6.08967* |
|  1 | -77.4401   .1931    1  0.660  26.3958   6.11078   6.13865   6.20756  |
|  2 | -76.9479  .98446    1  0.321  27.4672   6.14984   6.19164     6.295  |
|  3 | -76.0253  1.8452    1  0.174  27.6708   6.15579   6.21153   6.34934  |
|  4 | -75.9021  .24642    1  0.620  29.6721   6.22324   6.29291   6.46518  |
+---------------------------------------------------------------------------+
 Endogenous:  inflation
  Exogenous:  _cons
. varsoc moneysupplygrowthrate
 Selection-order criteria
```

```
   Sample:  1995 - 2020                         Number of obs      =        26
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -87.6096                     53.4253   6.81612   6.83006   6.86451  |
  |  1 |  -81.766  11.687*   1  0.001  36.8171*  6.44353*   6.4714*  6.54031* |
  |  2 | -81.6338  .26435    1  0.607  39.3874   6.51029   6.55209   6.65546  |
  |  3 | -80.4504  2.3668    1  0.124  38.8912   6.49618   6.55192   6.68973  |
  |  4 |  -79.349  2.2028    1  0.138  38.6812   6.48838   6.55805   6.73032  |
  +---------------------------------------------------------------------------+
   Endogenous:  moneysupplygrowthrate
    Exogenous:  _cons
. dfuller budgetdeficitgdp , trend lags(2)
Augmented Dickey-Fuller test for unit root         Number of obs   =        27
                                ---------- Interpolated Dickey-Fuller ---------
                   Test         1% Critical       5% Critical      10% Critical
                 Statistic          Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -4.940           -4.362           -3.592            -3.235
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0003

. dfuller interestrate , trend lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        28

                                ---------- Interpolated Dickey-Fuller ---------
                   Test         1% Critical       5% Critical      10% Critical
                 Statistic          Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.938           -4.352           -3.588            -3.233
------------------------------------------------------------------------------
```

```
MacKinnon approximate p-value for Z(t) = 0.1503

. dfuller exchangeratechange , trend lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        29

                                 ---------- Interpolated Dickey-Fuller ---------
                 Test            1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -5.144            -4.343            -3.584            -3.230
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0001

. dfuller unemployment, trend lags(0)
variable unemployment not found
r(111);

. dfuller inflation, trend lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        29

                                 ---------- Interpolated Dickey-Fuller ---------
                 Test            1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -3.314            -4.343            -3.584            -3.230
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0640

. dfuller moneysupplygrowthrate , trend lags(1)
```

```
Augmented Dickey-Fuller test for unit root         Number of obs   =        28

                                 ---------- Interpolated Dickey-Fuller ---------
                 Test            1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.813            -4.352            -3.588            -3.233
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.1921

. predict resid
(option xb assumed; fitted values)

. estat bgodfrey, lag(1)

Breusch-Godfrey LM test for autocorrelation
---------------------------------------------------------------------------
    lags(p)  |          chi2               df                 Prob > chi2
-------------+-------------------------------------------------------------
       1     |         23.934              1                   0.0000
---------------------------------------------------------------------------
                       H0: no serial correlation

. estat dwatson

Durbin-Watson d-statistic(  5,    30) =  .2658767

. tsline resid

. gen budgetdeficitgdp=d.budgetdeficitgdp
variable budgetdeficitgdp already defined
r(110);
```

```
. gen budgetdeficit=d.budgetdeficitgdp
(1 missing value generated)
. estat dwatson

Durbin-Watson d-statistic(  5,    29) =  1.518945

. predict resid
variable resid already defined
r(110);

. predict uhat, resid
(1 missing value generated)

. tsline uhat

. estat bgodfrey, lag(1)

Breusch-Godfrey LM test for autocorrelation
------------------------------------------------------------------------------
    lags(p)  |          chi2               df                 Prob > chi2
-------------+----------------------------------------------------------------
       1     |          2.062               1                   0.1510
------------------------------------------------------------------------------
                        H0: no serial correlation
estat imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(14)     =     21.47
         Prob > chi2  =    0.0903
```

```
Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |      21.47     14    0.0903
            Skewness |       3.75      4    0.4414
            Kurtosis |       4.90      1    0.0268
---------------------+-----------------------------
               Total |      30.11     19    0.0504
---------------------------------------------------

. estat vif

    Variable |       VIF       1/VIF
-------------+----------------------
exchangera~e |
         D1. |      1.58    0.632221
   inflation |
         D1. |      1.46    0.686021
interestrate |
         D1. |      1.25    0.797756
moneysuppl~e |
         D1. |      1.06    0.947493
-------------+----------------------
    Mean VIF |      1.34

. pwcorr budgetdeficitgdp interestrate exchangeratechange inflation
moneysupplygrowthrate,star(0.05) sig
```

```
             | budget~p intere~e exchan~e inflat~n moneys~e
-------------+-------------------------------------------
budgetdefi~p |   1.0000
             |
             |
interestrate |  -0.1685   1.0000
             |   0.3735
             |
exchangera~e |   0.2131  -0.1932   1.0000
             |   0.2582   0.3063
             |
   inflation |   0.0569  -0.2945   0.6892*  1.0000
             |   0.7652   0.1142   0.0000
             |
moneysuppl~e |   0.0569  -0.3456   0.2944   0.4883*  1.0000
             |   0.7652   0.0614   0.1142   0.0062
```

```
ardl budgetdeficitgdp interestrate exchangeratechange inflation
moneysupplygrowthrate, lags(2 1 0 0 1) ec btest
```

```
ARDL(2,1,0,0,1) regression

Sample:     1993 -     2020                 Number of obs     =         28
                                            R-squared         =     0.6246
                                            Adj R-squared     =     0.4666
Log likelihood =  104.65652                 Root MSE          =     0.0070
```

```
------------------------------------------------------------------------------
   D.budgetdeficitgdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
---------------------+--------------------------------------------------------
ADJ                  |
     budgetdeficitgdp |
                 L1. |  -.0698133   .0516184    -1.35   0.192    -.1778518
.0382252
---------------------+--------------------------------------------------------
LR                   |
         interestrate |  .0403702   .0156864    2.57   0.016    .0080635
.0726768
   exchangeratechange |   .4189092  .0832293   5.03   0.000    .2484217
0.5893967
            inflation |  -.0096569  .0073705   -1.31   0.206   -.0250836
.0057698
moneysupplygrowthrate |   -.005544  .0061659  -0.90   0.380   -.0184494
.0073615
---------------------+--------------------------------------------------------
SR                   |
     budgetdeficitgdp |
                 LD. |   .2720477   .2023428     1.34   0.195    -.1514606
.6955559
                     |
         interestrate |
                 D1. |   .0003435   .0002436     1.41   0.175    -.0001664
.0008533
                     |
moneysupplygrowthrate |
                 D1. |  -.0000436   .0002599    -0.17   0.868    -.0005877
.0005004
                     |
               _cons |   .0216648   .0057695     3.76   0.001      .009589
.0337406
------------------------------------------------------------------------------


note: estat btest has been superseded by estat ectest
```

as the prime procedure to test for a levels relationship.

(click to run)

Pesaran/Shin/Smith (2001) ARDL Bounds Test

H0: no levels relationship F = 4.080

t = -1.352

Critical Values (0.1-0.01), F-statistic, Case 3

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_4	2.45	3.52	2.86	4.01	3.25	4.49	3.74	5.06

accept if F < critical value for I(0) regressors

reject if F > critical value for I(1) regressors

Critical Values (0.1-0.01), t-statistic, Case 3

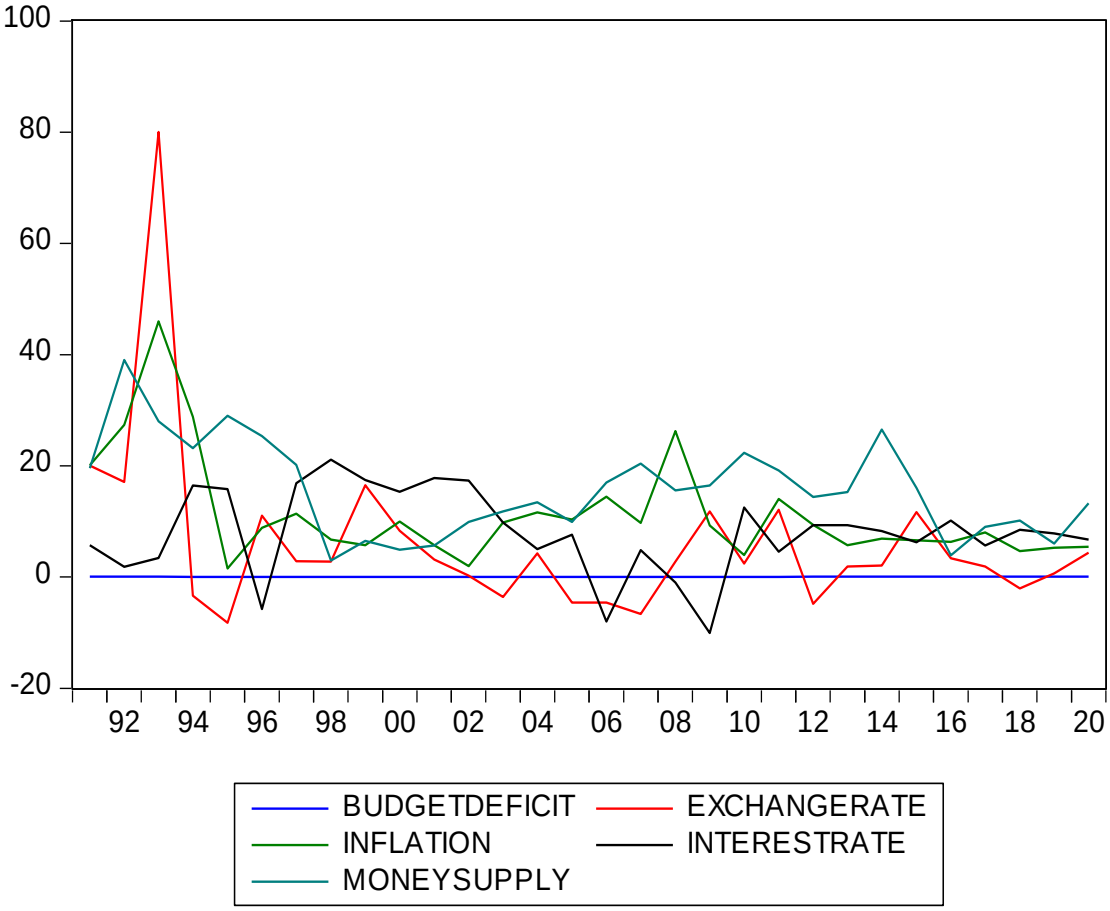
	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_4	-2.57	-3.66	-2.86	-3.99	-3.13	-4.26	-3.43	-4.60

accept if t > critical value for I(0) regressors

reject if t < critical value for I(1) regressors

k: # of non-deterministic regressors in long-run relationship

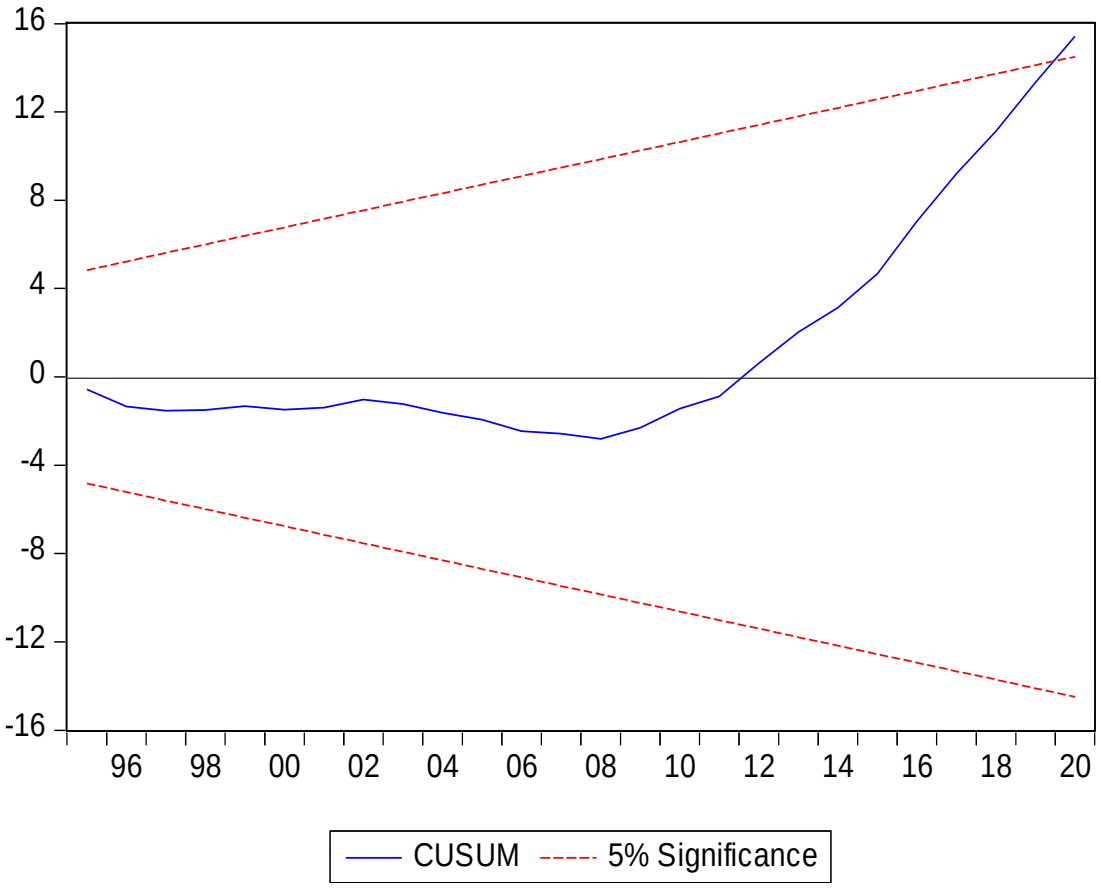
Critical values from Pesaran/Shin/Smith (2001)



Pairwise Granger Causality Tests

Date: 08/12/22 Time: 13:14
Sample: 1991 2020
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
EXCHANGERATE does not Granger Cause BUDGETDEFICIT	28	19.0157	1.E-05
BUDGETDEFICIT does not Granger Cause EXCHANGERATE		0.88649	0.4257
INFLATION does not Granger Cause BUDGETDEFICIT	28	6.11709	0.0074
BUDGETDEFICIT does not Granger Cause INFLATION		0.96051	0.3975
INTERESTRATE does not Granger Cause BUDGETDEFICIT	28	0.75115	0.4831
BUDGETDEFICIT does not Granger Cause INTERESTRATE		0.24559	0.7843
MONEYSUPPLY does not Granger Cause BUDGETDEFICIT	28	0.97827	0.3911
BUDGETDEFICIT does not Granger Cause MONEYSUPPLY		0.70784	0.5031
INFLATION does not Granger Cause EXCHANGERATE	28	0.44133	0.6485
EXCHANGERATE does not Granger Cause INFLATION		1.06653	0.3606
INTERESTRATE does not Granger Cause EXCHANGERATE	28	0.01915	0.9810
EXCHANGERATE does not Granger Cause INTERESTRATE		3.67154	0.0413
MONEYSUPPLY does not Granger Cause EXCHANGERATE	28	5.09188	0.0148
EXCHANGERATE does not Granger Cause MONEYSUPPLY		0.74937	0.4839
INTERESTRATE does not Granger Cause INFLATION	28	0.47173	0.6298
INFLATION does not Granger Cause INTERESTRATE		0.34607	0.7111
MONEYSUPPLY does not Granger Cause INFLATION	28	6.81913	0.0047
INFLATION does not Granger Cause MONEYSUPPLY		4.39295	0.0242
MONEYSUPPLY does not Granger Cause INTERESTRATE	28	1.01314	0.3787
INTERESTRATE does not Granger Cause MONEYSUPPLY		0.61784	0.5478


16
12
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CUSUM
5% Significance

Appendix VII: Letter of Introduction

MOI UNIVERSITY
POSTGRADUATE OFFICE
SCHOOL OF BUSINESS AND ECONOMICS

Tel: 0790940508
0771336914
0736138770
Fax No: (053) 43047
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P.O. Box 3900
Eldoret.
Kenya

RE: MU/SBE/PGR/ACD/21B

DATE: 22nd July, 2022

TO WHOM IT MAY CONCERN:

RE: OBED ONG'AU KERIMU -MS/ECON/5387/21

The above named is a bonafide student of Moi University, School of Business & Economics. He is undertaking **Master of Arts in Economics.**

Mr. Kerimu has successfully completed coursework, defended his proposal, and is proceeding to the field to collect data for his research titled: "***Effect of Selected Macroeconomic Variables on Budget Deficit in Kenya***".

Any assistance accorded to him will be highly appreciated.

Yours faithfully,

SCHOOL OF BUSINESS & ECONOMICS
MOI UNIVERSITY
P O Box 3900 ELDORET-30100

DR. RONALD BONUKE
ASSOCIATE DEAN AND CHAIR-POSTGRADUATE STUDIES

/pn

Appendix VIII: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Ref No: 605184

Date of Issue: 01/November/2022

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This is to Certify that Mr., OBED ONG'AU KERIMU of Moi University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Uasin-Gishu on the topic: EFFECT OF SELECTED MACROECONOMIC VARIABLES ON BUDGET DEFICIT IN KENYA for the period ending : 01/November/2023.

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    vi. Adversely affect the rights of communities
    vii. Endanger public safety and national cohesion
    viii. Plagiarize someone else's work
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