THE NEXUS BETWEEN INFLATION AND FISCAL DEFICIT IN KENYA

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DECLARATION

This research paper is my original work and has not been presented in any other institution for any award**.**

Signature _____ Date_____

Juvenalis Mutiso Sammy

This research paper has been submitted for examination with my approval as the university supervisor.

Signature_____ Date_____

Dr. Owen Nyang'oro

DEDICATION

My parents, Angelina Mutio and Sammy Mutiso, I dedicate this paper to you. Your parenting from young age has made me who I am today. Above all, thank you for teaching me the importance of hard work and believing in God.

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ACRONYMS AND ABBREVIATIONS

ADF: Augmented Dickey Fuller

ARDL: Autoregressive Distributed Lag

CPI: Consumer Price Index

FTPL: Fiscal Theory of Price Level

GDP: Gross Domestic Product

KIPPRA: Kenya Institute for Public Policy Research and Analysis

KNBS: Kenya National Bureau of Statistics

NARDL: Nonlinear Autoregressive Distributed Lag

VAR: Vector Autoregression

VECM: Vector Error-correction model

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ABSTRACT

This study investigates the connection between fiscal deficit and inflation in Kenya. It also checks for structural breaks, causality between the two variables and their form of association. To achieve these objectives, it adopts ARDL-Cointegration Approach, Granger Causality test, and also considers Nonlinear ARDL model, using annual time series data for thirty-nine years, 1980 - 2018. The results show that the first lag of fiscal deficit has a negative and significant effect on inflation, while its second lag is insignificant. Granger causality results show that there is no causality between fiscal deficit and inflation in Kenya. All the control variables used i.e. lagged values of inflation, real interest rate, broad money supply, real GDP, trade openness and exchange rate were statistically significant at least in one of their lags. However, real interest rate and exchange rate gave unexpected signs.

CHAPTER ONE: INTRODUCTION

1.1 Background

The fiscal theory of price level argues that persistent fiscal deficit in an economy leads to a rise in inflation i.e. as governments try to bridge the deficits, they create money which in turn raise price of commodities (Jalil, Tariq & Bibi, 2014). Although this theory doesn't rule out other macroeconomic determinants of price level, fiscal deficit remain to be one of the most significant in influencing inflation especially in developing countries (Jiang, 2016). The fiscal view of general price level attracts more attention in developing countries viz-a-viz developed world because they experience ineffective methods of tax collection, less access to both domestic and external borrowing, as well as political instability all of which lead to lower relative seigniorage cost and increased reliance on inflation tax (Jalil et al., 2014). High inflation economies are mostly faced with high fiscal deficits which could be a consequence of persistent increase in the overall price level (Anantha & Gayithri, 2017).

Empirical and theoretical research have developed several channels through which the rate of inflation is affected. For example, the monetarists view of inflation is that, inflation is always influenced by money supply. This links fluctuations in inflation to monetary policy and specifically to supply of money (Jalil et al., 2014). Rise in inflation is linked to supply of money by several studies, for example, Hyeon & Chin (2013), Khan, Kebewar & Nenovsky (2013) and Mukras Ochieng, & Gideon (2016) found money supply to be significant in explaining changes in the levels of inflation. But central banks do not independently determine how money is supplied, instead fiscal authorities have a greater influence on the supply of money in an economy (Catão & Terrones, 2005; Jalil et al., 2014). Hence, supply of money is endogenous, often a consequence of seigniorage due to governments' deficits (Jalil et al., 2014).

Different papers have examined the connection between fiscal deficit and inflation. However, the findings conflict on their relationship, and there is little to clearly explain the connection between the two due to lack of consensus (Catão & Terrones, 2005). For example, Bleaney & Francisco (2016), Dhal (2015) and Douglas & Ia (2009) found significant relationship between the two, while Abu & Karim (2015), Anantha & Gayithri (2017) and Khan & Gill (2010) found their nexus not statistically significant.

Developing countries are faced with more macroeconomic problems e.g. low growth rate, high interest rates, high inflation and unsustainable fiscal deficits viz-a-viz advanced economies (Franses, 2013; Petrović, Mladenović, & Nojković, 2011). Most of the countries facing these macroeconomic issues are African countries like Kenya, however, with formulation of good policies their adverse effects can be eliminated (Gollwitzer, 2011).

Economic sustainability is influenced by, among other factors, the stability of the general price level (Chege, 2015). High inflation lowers standards of living of the involved societies by reducing what a given amount of money can afford and hence governments aim to lower it when it is considered to be high (Hossain & Arwatchanakarn, 2016; Wanjiru, 2014). But policymakers are usually hesitant to reduce the general price level because lowering it may sometimes hurt economies by, for example, raising unemployment (Hossain & Arwatchanakarn, 2016). Nevertheless, high inflation may cause an increase in its volatility which is harmful because it may lead to frequent changes in both interest and exchange rates (Sabaté, Fillat & Escario, 2019). Nonetheless, most policymakers especially in developing countries do not pay much attention to the effects of high inflation volatility (Were et al., 2013).

Even when governments recognize that they should lower expenditures in times of high inflation, it is usually not easy for them to reduce commitment to serve their nations effectively (Hossain, 1987). But in developing countries revenue rarely keep pace with the rate at which general price level increases as opposed to the developed world where revenue growth rate is sometimes equal or greater than the rate of inflation (Epaphra, 2019; Hossain, 1987). Standards of living are also greater in developed countries viz-a-viz emerging and developing economies (Roslan, 2013).

Empirical findings agree on the fact that economic efficiency is negatively affected by high and volatile inflation rate (Hyeon & Chin, 2013; Khan et al., 2013). What is not known is whether moderate inflation rate is good or bad for an economy (Abu & Karim, 2015). This means that if, for instance, the Kenyan inflation rate is high and also volatile there is a high chance it will lead to macroeconomic inefficiencies which will in turn affect the overall performance of the economy. Both intra-temporal and intertemporal allocation of resources in economies affected by high inflation uncertainty, caused by redistribution of income, especially between debtors and creditors, lead to uncertainty in general price level and also cause significant societal costs (Hyeon & Chin, 2013).

1.1.1 Inflation, fiscal deficit and other related macroeconomic variables in Kenya

Kenyan policymakers have been committed to ensure the country does not face unstable macroeconomic environment (Okelo et al., 2013). However, Kenya has been facing high inflation and unstable fiscal deficit alongside other macroeconomic variables. Inflation and government deficit, among other variables, have partly determined Kenya's economic growth and development status, which has not been good over the years (Mukras et al., 2016).

Table 1.1 shows macroeconomic statistics. The selected variables are related to inflation and/or fiscal deficit in Kenya from 2012 to 2018. Broad money, imports and exports are represented as a percent of Kenya's GDP in the respective years. Exchange and interest rates are also included.

Table 1.1: Annual Macro Statistics for Selected Variables in Kenya

	2012	2013	2014	2015	2016	2017	2018
Broad Money (% of GDP)	40.8	42.3	43.2	42.4	39.3	37.0	37.5
Nominal interest Rate (%)	9.4	11.5	7.8	5.5	10.4	2.8	9.9
Exports (% of GDP)	22.2	19.9	18.3	16.6	14.3	13.3	13.2
Imports (% of GDP)	35.5	33.2	33.0	27.6	23.3	24.2	23.0
Exchange Rate (LCU per US$)	84.5	86.1	87.9	98.2	101.5	103.4	101.3

Source: World Bank

From table 1.1, the values of imports have been greater than those of exports for each of the considered years. The difference between the two is actually more than ten percent. This is not good for the position of the balance of payments and it can be partly attributed to the rising inflation rate, because when the general price level in a country is high, domestic goods become expensive to foreigners (Basu & Datta, 2005).

The level of broad money has also been high in Kenya at levels of between 37% and 43.2% (% of GDP) for the last eight years. Although it has shown possibility of declining from 2014 to 2018

the figures were still high and it actually increased but at a decreasing rate in some years. Exchange rate is another variable that has been increasing at an increasing rate from 2012 to 2017. It, however, decreased by 2.1, from 103.4 in 2017 to 101.3 in 2018.

Unlike the other variables discussed above, the level of interest rate has been fluctuating, apart from between 2014 and 2015 where the it declined consistently. The greatest change occurred between 2017 and 2018 which was 7.1 when the level of interest rate increased from 2.8% to 9.9%.

Fiscal deficit and inflation rate have become two of the important factors to be considered in the pursuit of stabilizing the Kenyan economy, just like in many other emerging and developing countries (Okelo et al., 2013). Unlike in the past, instability of fiscal deficit has become one of the macroeconomic issues policymakers in developing countries prioritize in ensuring stable macroeconomic environment because of its effects on other factors (Abu & Karim, 2015; Bleaney & Francisco, 2016).

1.1.2 Fiscal Policy in Kenya

The major fiscal policy instruments in Kenya are borrowing, taxation and government spending (Were et al., 2013). Fiscal policy can be contractionary or expansionary. However, Kenya has been experiencing expansionary fiscal policy over the years (Okelo et al., 2013). This means that government expenditure has been increasing in the country which may not only partly increase fiscal deficit, because of the low capacity of tax collection, but also inflation rate as money supply increases.

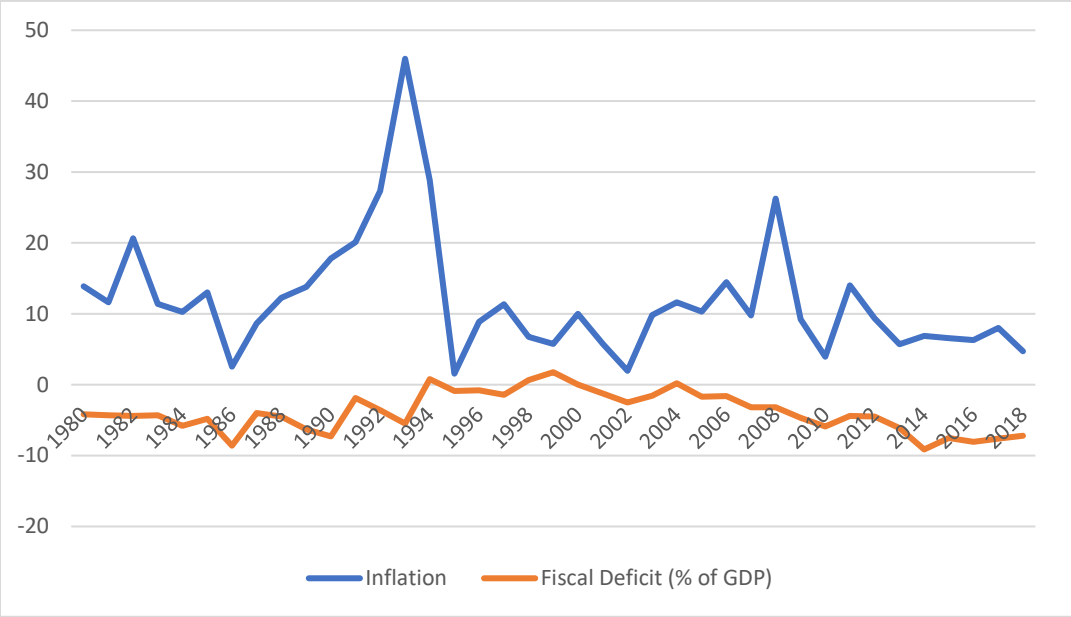
Figure 1 shows the trend of both fiscal deficit and inflation rate in Kenya from the year 1980 to 2018. Fiscal deficit is given as a percentage of GDP while inflation rate is given in terms of CPI and is also in percentage form.

In figure 1, from 1980s to early 1990s, Kenya experienced fairly stable but high inflation. The country faced the highest inflation i.e. 46% in 1993, caused by increased money supply and depreciation of the country's currency (Mukras et al., 2016).

From the year 1994 to 2006 Kenya's general inflation rate was high and stable again before rising to 26% in 2007. The rise in 2007 was due to post election violence that occurred in that year, with

food prices and interest rates drastically increasing as well (Were et al., 2013). From 2013 to 2017 inflation rate in Kenya ranged between 5.7% and 8.0% before dropping to 4.69% in 2018.

Figure 1.1: Annual Fiscal Deficit (% GDP) and Inflation Rate in the Kenyan Economy



Source: Kenya National Bureau of Statistics, Economic Survey

Fiscal deficit (GDP%) in Kenya was between -4.2% and -5.5% from 1980 to 1994. This highest level, -5.5%, of fiscal deficit experienced during that period occurred in 1993, the same year the country faced the highest inflation rate. For the whole period from 1980 to 2018 the country operated with a fiscal surplus in only five years. The last fiscal surplus was experienced in 2004 and since then fiscal deficit has been high all through to the year 2018. It should be noted that as a percentage GDP, fiscal deficit figures appear to be small but they are very significant in determining the overall performance of an economy (Okelo et al., 2013).

1.2 Problem Statement

In the Kenyan economy, the real GDP expanded by 6.3% and 5.4% in 2018 and 2019, respectively (Epaphra, 2019). However, the expansion in growth rate may not continue in 2020 because of the outbreak of coronavirus pandemic which has negatively affected economic performance. In addition, annual inflation rate rose from 4.69% in 2018 to 5.20% in 2019 and although it was within the targeted range, it was still considered to be high. High and persistent inflation rate affects the wellbeing of societies especially in developing countries because they lack effective policy formulation and implementation (Dhal, 2015). There are different causes of high inflation in most

of these countries fiscal deficit being one of them. Rapid fluctuation of fiscal deficit and inflation rate are some of the reasons the country has been facing poor economic performance over the years (Okelo et al., 2013; Abu & Karim, 2015). Therefore, there is a need for policymakers to formulate appropriate policies that can stabilize the economy, e.g. policies aiming at reducing inflation rate, so as to spur economic wellbeing and the overall development and hence contribute toward improved standards of living.

Despite the fact that, from theoretical literature, there's a connection between inflation and fiscal deficit, there are no any recent papers that have specifically investigated the causality between these two macroeconomic variables in Kenya, and also in the available literature their form of association in terms of linearity isn't clear. Changes in fiscal deficit influences inflation, in that, as governments try to raise revenue to finance fiscal deficit they create money which raises inflation because of increased demand for commodities (Catão & Terrones, 2005). This study, therefore, aimed at specifically investigating the connection between fiscal deficit and inflation in Kenya, their long-run relationship, test for structural breaks and formulate relevant policies. The methodology employed by the study was also different from the ones adopted by other closely related studies that had been reviewed.

1.3 Research Questions

i. What is the causality between fiscal deficit and inflation in Kenya?
ii. Is there a long-run relationship between inflation and fiscal deficit in Kenya?

1.4 Objectives of the Study

The general objective of the research was to investigate the nexus between inflation and fiscal deficit in Kenya. The specific objectives were to:

i. Establish the causality between fiscal deficit and inflation in Kenya.
ii. Analyze existence of a long-run relationship between fiscal deficit and inflation in Kenya.
iii. Provide policy implications.

1.5 Relevance of the study

Controlling macroeconomic variables is important for every nation. The connection between the two main variables of the study can influence the path taken by an economy as far as achieving sustained economic wellbeing is concerned. It was important to examine whether there is indeed

an association between the two variables in the Kenyan economy as suggested by the fiscal theory of price level.

The ARDL model was employed to achieve the stated objectives. Unlike the reviewed studies, this paper also considered nonlinear model i.e. NARDL model since the relationship between the two main variables may be nonlinear. In addition, fiscal theory of price level had not been tested in the recent studies done in Kenya as far as the reviewed literature was concerned. The findings will, therefore, assist policymakers in coming up with relevant policies that can effectively control inflation rate and macroeconomic instability as well as spurring economic growth and development.

1.6 Organization of the study

The other parts are organized as follows; chapter two represents reviewed literature related to the study, which included both empirical and theoretical literature and also an overview. Chapter three represents the methodology employed by the study, which included theoretical framework, empirical model, data to be used and their sources as well as definition of variables. Chapter four gives empirical findings while chapter five represents summary, conclusion and policy recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter involved both empirical and theoretical literature. Theoretical literature highlighted the relevant arguments in theories related to the study while the empirical literature gave insights on studies carried out on the same and related topics. The last part of this chapter gave their overview.

2.2 Theoretical Literature

Governments face fiscal deficits and financing them calls for keenness because the options they choose can affect inflation in economies in which the central banks are not independent (Abu & Karim, 2015). Under theoretical literature, relevant arguments in theories were discussed.

2.2.1 Fiscal Theory of Price Level (FTPL)

This theory was first brought forth by Leeper (1991) and later advanced by Sims (1994) and Woodford (1994, 1995, 2001). According to the theory, when governments face persistent fiscal deficits the general price level tends to increase. The increase in inflation is assumed to be due to the fact that when an economy faces sustained fiscal deficits, governments look for ways of financing them. In so doing, they create money and hence the levels of income increase and this increases total demand for commodities, and hence inflation rises.

The theory points out that some economists are wrong to assume that inflation rate is determined only by how the central bank in a given country controls the level of money supply. Some monetarist economists argue that the rate at which money supply rises reflects the rate at which the central bank allows it to grow and this determines inflation levels in a country (Catão & Terrones, 2005; Jalil et al., 2014). This is to say inflation rate will change only when money supply changes which the FTPL disagrees.

Therefore, apart from how the central bank deals with supply of money in an economy, the ways fiscal authorities choose to finance public deficit also determine the path inflation takes. This is to say that, according to fiscal theory of price level, unsustainable government deficit will cause the level of general price level to increase. When central banks are not independent, governments can affect monetary policies and make their central banks lower interest rate levels to control

borrowing costs and also make deficit financing less costly which mostly makes the level of inflation to rise.

2.2.2 Quantity Theory of Money (QTM)

For this theory, spike of money stock translates to a spike of inflation. When money supply rises, consumers demand for commodities increase causing an increase in prices. The theory further assumes that, at every given time money supply times its circulation-velocity equals the level of price times the volume of transaction of commodities in an economy.

The circulation-velocity of money and transactions of commodities are constant so that price level changes only when money supply changes. Hence, according to classical economists, price level will change only when there is a fluctuation in money supply, whereby a rise in inflation will be caused by increased money supply and vice versa (Kurz & Salvadori, 2013). However, they also argue that inflation can increase with an increase in fiscal deficits when governments choose to monetize the deficits (Abu & Karim, 2015). This means that when fiscal deficit rises, money supply increases as government tries to finance the deficit and hence, inflation rises.

2.2.3 The Monetarist Theory

This theory argues that money supply dictates the status of prices in an economy. The theory further postulates that, if the monetary policy in a given country is accommodative to fiscal deficit, supply of money continues to increase for many years as the government finances the deficits (Leroy & Raymon, 1987). This fiscal deficit financing by the government causes aggregate demand to rise in the involved economy. This translating to an increase in gross domestic product or output and inflation will also rise in that particular country. Aggregate demand and overall economic performance are hence affected.

According to the theory, the nexus between price level and government deficits can be eliminated when a country's central bank does not monetize deficits. To do this, the central bank refuses to purchase government bonds. This will reduce supply of money in the involved country causing a decline in demand for commodities and hence reduced positive effect of government deficits on the level of inflation (Lotz & Zhang, 2016).

2.3 Empirical Literature

A few papers have examined the connection between inflation and government deficits, especially in the developing world. Under this section, relevant literature on the same is reviewed.

FTPL has been tested by different studies in different countries with some in favor of the theory. For example, Jalil, Tariqs, & Bibi (2014), Anantha & Gayithri (2017) and Catão & Terrones (2005) found fiscal deficit and inflation rate connection to be positive, statistically significant and in favor of FTPL in their respective countries. These studies employed autoregressive distributed lag model, panel techniques and structural vector autocorrelation model, respectively. Jalil, Tariq, & Bibi (2014) and Anantha & Gayithri (2017) used time series data for Pakistan and India, respectively, while Catão & Terrones (2005) used cross sectional data involving 107 countries, i.e. developing and developed economies. Fiscal deficit is more significant in determining changes in inflation in developing countries viz-a-viz developed ones (Catão & Terrones, 2005). These studies, however, didn't analyze whether there was longrun association between the two variables. They also didn't consider a non-linear association between them.

High and persistent government deficits in most sub-Saharan countries have partly contributed to high inflation in the region (Bleaney & Francisco, 2016). This is because as governments in the region try to finance the deficits, they create money in their respective economies which in turn increase the overall quantity of money supply. In their study, Bleaney & Francisco (2016) analyzed inflation – fiscal deficit nexus in sub-Saharan Africa for twenty years from 1995 to 2015. The study found that fiscal deficit was significant in determining the level of inflation. Inflation targeting is not very effective in lowering inflation rate in most sub-Saharan countries (Bleaney & Francisco 2016). Rice and oil prices but not maize prices were significant in explaining inflation prices. The study failed to indicate the model it adopted and how other regressors such as interest rate and money supply affect inflation in sub-Saharan Africa.

European countries have been experiencing a relatively lower inflation rate compared to other regions like Africa, and stable fiscal deficits in most countries in the region may partly be playing a role on the same (Maltritz & Wüste, 2015). Fiscal deficit has been incorporated with other independent variables such as money supply, real interest rate among others, by different studies to investigate determinants of inflation rate for European countries. For example, Petrović et al. (2011) conducted a similar study for chosen European countries using cross-sectional data for

fourteen years from 1993 to 2007. Their findings supported the FTPL. A spike of fiscal deficit led to increased inflation in the region. Gross domestic product, oil and food prices, current account and exchange rates influences the path taken by inflation in the region (Petrović et al., 2011). The study involved developed and developing countries but they did not distinguish how different explanatory variables triggered inflation in the two cases.

On the other hand, there are studies that have contradicted the FTPL. For instance, Ezeabasili, Mojekwu, & Herbert (2012) in their study found positive association in fiscal deficit and inflation nexus, despite the connection been not statistically significant in Nigeria. The study employed a model that incorporated structural analysis and cointegration and error correlation model techniques for thirty-six years, 1960 – 2006. They also employed OLS - two stage approach to check the variables association, as suggested by Granger (1987). The study also found no past fiscal deficit levels impacted inflation rate but found money supply and inflation to be cointegrated. They, however, did not report on how the other explanatory variables used in their paper affects inflation in Nigeria.

Economic wellbeing in most developing countries are partly slowed by high fiscal deficit which is determined by other macroeconomic variables (Tiwari, 2011)**.** In a study done in India, Tiwari (2011) employed log linear multiple regression model to examine the determinants of fiscal/government deficit with several variables e.g. inflation rate being used as explanatory variables. The study covered thirty-nine years, 1970 – 2009. Inflation was found not statistically-significant in influencing the level of fiscal deficit. Other statistically significant regressors were government expenditure and money supply. The paper pointed out that government deficit is likely to be high when public expenditure is high but decreases when money supply is raised. What the study did not tell us is whether fiscal deficit influences the level of price in India.

In addition, similar studies have also used cross sectional data, e.g. a study done for EU countries by Maltritz & Wüste (2015) involved 27 countries to examine the determinants of fiscal deficit applying time-series data 1991-2011 and employing panel regression. The study found that inflation was not a significant determinant of fiscal deficit. It was consistent with the findings of Tiwari (2011). They however did not investigate whether inflation was dictated by the changes in fiscal deficit as FTPL suggests.

The relationship between the two main macroeconomic variables can either be linear or non-linear (Abu & Karim, 2015). In their paper on the non-linear connection between fiscal deficit and price level, in fifty-one African countries for twelve years, 1999-2011, Abu & Karim (2015) employed GMM estimators and fixed-effects. They grouped the fifty-one African countries into low income/high inflation economies and middle-income/moderate inflation economies. The study showed their relationship was non-linear for both the grouped samples and the large/whole sample. However, the study did not consider the linear association between the variables despite indicating that the relationship can be linear in some countries.

In another related study, employing Ordinary Least Squares (OLS) regression method, Ezinando & Jeroh (2017) examined the connection between fiscal administration and government deficits in sub-Saharan Africa using time-series data, cross-sectional, for the period 2002 – 2006. Fiscal administration and government deficits had significant association. However, the study did not indicate whether there was a long-run connection in the case for the main variables. They also didn't include inflation as one of their control variables.

The factors influencing the rate of inflation are not conclusive in most countries both in monetary and fiscal aspects, for instance, unlike in most countries the theory of fiscal price level doesn't hold in the economy of Pakistan (Khan & Gill, 2010). In their study, Khan & Gill (2010) found that fiscal deficit was not significant in influencing fluctuations in inflation level. The study adopted OLS to investigate the factors affecting inflation in Pakistan from 1970 – 2007. The other explanatory variables involved were money supply, interest rates, exchange rates and food prices all of which were found to be significant. The study did not, however, examine whether a long-run association between price level and government deficit exists.

The fiscal deficit and inflation association for Zimbabwean economy is positive and significant (Mehmood, 2013). Using ARDL model Mehmood (2013) examined the connection between inflation and government deficits in Zimbabwe. The paper involved annual timeseries data for a period of twenty-five years, 1980 – 2005. The study supported FTPL. It also found that there was a longrun association between the two variables in Zimbabwe. The other explanatory variables that were found to impact inflation were GDP and exchange rate. The paper did not, however, test for structural breaks.

There is unclear causality direction between inflation and government deficit Epaphra (2019). Studies conflict on the relationship between the two variables. For example, Epaphra (2019) found inflation to be a significant factor in explaining changes in public deficits in Tanzania along with money supply & interest rate. This conflicted with a similar study done by Maltritz & Wüste (2015). Epaphra (2019) adopted vector error correlation model, variance decomposition and vector autoregression model using annual in a time-series analysis from 1966 to 2015. For the other explanatory variables GDP and exchange rate were significant with a negative effect. Fiscal deficit and inflation were found to have a long-run connection. The study didn't, however, test for structural breaks and also it did not indicate whether fiscal deficit and inflation had reverse causality in Tanzania.

When governments choose to finance fiscal deficit through money creation, demand for commodities increase making price levels to rise (Dhal, 2015). Determining the relationship between the two variables, in a time series analysis, 1980 – 2019 in India, Dhal (2015) employed simplified comparative static model. The study found that price level was impacted by government deficit, especially when there was a need to raise money supply to finance the deficit. Other variables included were; exchange and interest rates, oil prices, GDP and money supply all of which were found to be significant. The study did not, however, investigate association between government deficit and inflation.

Policies formulated to control public debt and fiscal deficit may directly impact inflation in any given country (Van & Budina, 2001). As argued by Van & Budina (2001), public debt increases with as fiscal deficit rise which translate to a rise in inflation. Their study examined public debt, FD and INF connection in Poland using quarterly data from the year 1987 to 1997. They employed simple model which linked public debt, public deficit and inflation. They found that inflation and fiscal deficit were connected i.e. inflation increased with a rise in the level of government deficit which was partly influenced by public debt. The study did not, however, examine the long-run association between price level and public deficit and they also failed to test for breaks. The study didn't also include money supply as one of the explanatory variables.

Economic crises in most of developing countries has led to high and persistent fiscal deficits due to increased government spending (Douglas & Ia, 2009). This is because as policymakers try to stabilize their economies, the interaction between fiscal and monetary policies sometimes conflict,

leading to increased government deficits. In their study, Douglas & Ia (2009) employed vector autoregression model to examine how government deficit and inflation associate in the United States of America in a time-series data analysis for one hundred and eleven years from 1900 to 2011. They did not find a strong connection between price level and government deficit when the involved countries were experiencing relatively low economic growth rates and high government deficits but from 1960s to 1980s the association was strong. The study did not, however, test for breaks in the series involved.

Inflation targeting impacts fiscal deficit positively if policymakers maintain them as required (Kadria & Aissa, 2016). This is due to its effect on inflation which influences the government deficits of a country. Adopting propensity score matching approach to examine the association between inflation targeting and FD in emerging economies and time-series data which ran from 1990 to 2010, Kadria & Aissa (2016) found that during the first years of adopting inflation targeting, inflation wasn't significant determiner of fiscal deficit in emerging countries. However, later years showed significant effects of inflation targeting on the fiscal deficit i.e. fiscal deficit declined as inflation was lowered.

Domestic price gap, exchange rates, oil prices, food prices and real GDP have had significant and positive cause on price level as par different studies but foreign price gap is not statistically significant in influencing price level in Kenya (Kiptui, 2013). The study examined factors affecting inflation in the Kenyan economy and employed P-Star model involving time-series, 1960 – 2013. The study did not, however, include fiscal deficit and money supply as explanatory variables despite the fact that according to the literature they are significant determinants of inflation in the Kenyan economy.

2.4 Overview of the Literature

The available literature on the nexus between the two main variables was unclear especially on whether their relationship is linear or nonlinear. Some studies have found that government deficit had significant and positive effect on price level but most of the reviewed did not investigate the form of their connection in terms of linearity and also whether the variables have unidirectional or bidirectional causality.

It is important to consider a nonlinear model when investigating connection between variables whose relationship can be either linear or nonlinear because doing it using a linear model can give

misleading results, especially if the association is nonlinear and the researcher doesn't recognize it. The direction of causality can affect policy formulation and hence, dictate the direction of overall performance of an economy.

This study considered both linear ARDL and nonlinear ARDL approaches. This was because the connection between the two variables of interest had to be checked before deciding on the methodology to employ. The direction of causality was also established. The related studies that were reviewed, especially in the Kenyan economy, had failed to clearly address these aspects. This study, therefore, had a different perspective and methodology.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

Chapter three presented theoretical framework, empirical model, data and their sources, model specification and both post-estimation and pre-estimation tests. All these were done to achieve the stated study objectives.

3.1 Theoretical Framework

The QTM was employed as the theoretical framework of the study. It was adopted because it links inflation to fiscal deficit just as the FTPL (Ezeabasili et al., 2012). When fiscal deficit is monetized, there is a rise in prices emanating from the increased money supply.

The equation below was used by Fisher (1911) to explain the connection between price and money supply. The equation takes the following form;

$$M \times V = P \times Y \quad (3.1)$$

Where, Y is real output/GDP/income, P is price level, M is money supply and V is velocity of money. According to Equation (3.1), the total spending is equal to the total value of commodities at any given time.

Equation (3.1) can be transformed into growth rates and expressed as follows;

$$m_t + v_t = p_t + y_t \quad (3.2)$$

Where, y is the natural log of real income, p is the natural log of price level, v is the natural log of velocity of money and m is natural log of money supply.

Making p_t the subject of the formula equation (3.2) becomes;

$$p_t = m_t + v_t - y_t \quad (3.3)$$

From equation (3.3), v_t can be expressed as a function of the interest rate (Alimi, 2012; Moazzami & Gupta, 1995). This leads to equation (3.4);

$$p_t = m_t + (b_0 + bR + \mu) - y_t \quad (3.4)$$

Where R = nominal interest rate, b_o = an intercept, b = coefficient and μ = error term.

Money supply, income, and their growth rates, can be employed as exogenous variables which means equation (3.4) can be estimated without restriction of these variables (Alimi, 2012; Duck, 1993). We also note that inflation emanates from changes in both fiscal and monetary policies (Alimi, 2012). Which means that when fiscal deficit increase, the general price level will also increase.

3.2 Empirical Model

From theoretical framework, the empirical model becomes;

$$INF_t = k(FD_t, M2_t, R_t, GDP_t, TD_t, E_t) \quad (3.5)$$

Where t represents time period, INF_t is inflation rate, FD_t is fiscal deficit, $M2_t$ is the supply of broad money, R_t is real interest rate, GDP_t is real GDP, TD_t is trade openness and E_t is exchange rates, both of which are control variables used in the model. INF_t is the dependent variable, all the others are explanatory variables and they relate to the dependent variable as explained in the variable definition section.

Linear form of equation (3.5) is as follows;

$$INF_t = \beta_0 + \beta_1 FD_t + \beta_2 \ln(M2_t) + \beta_3 R_t + \beta_4 \ln(GDP_t) + \beta_5 TD_t + \beta_6 \ln(E_t) + \varepsilon_t \quad (3.6)$$

Where ln is natural logarithm, β_0 represents the intercept, β_1 to β_6 shows coefficients/parameters and ε_t is the residual or error term.

Inflation (INF): The change, in percentage terms, of consumer price index (CPI). It is measured in CPI. It is the dependent variable in the model.

Fiscal Deficit (FD): The discrepancy between national revenue, excluding borrowing, and national expenditure. It is measured as a percentage of GDP (Abu & Karim, 2015). It is expected to be positively related to inflation as suggested by the FTPL.

Real Interest Rate (R): Lending rate of interest, adjusted for inflation. It is usually measured in percentage form (Catão & Terrones, 2005). It is expected to negatively affect the rate of inflation (Khan & Gill, 2010).

Broad Money (M2): Total currency in circulation i.e. outside banks. It includes physical currency and coins (M1), assets that can easily be converted to money, checking deposits and cash (Rahman, Balic, & Swindle, 2005). It is expected to positively affect inflation as indicated by the QTM.

Real Gross Domestic Product (GDP): Value of all commodities produced within the economy in each of the selected years, adjusted for inflation. It is expected to positively affect inflation (Abu & Karim, 2015).

Trade Openness (TD): Kenyan's trade share. It is measured as the sum of imports and exports normalized by GDP (Watson, 2016). It is expected to positively affect inflation rate (Jalil et al., 2014).

Exchange Rate (E): Kenyan Shilling against the US dollar, in terms of period average i.e. yearly. It is expected to negatively affect inflation rate in the model (Epaphra, 2019).

3.3 Estimation Method

Since this paper involved time series data, equation (3.6) couldn't be regressed or estimated directly because it would give spurious results due to the possibility of non-stationarity of the variables. The study involved Autoregressive Distributed Lag (ARDL) Model. This model has several advantages viz-a-viz other approaches. For instance, it can be employed in either I(1) and/or I(0) data series; it gives consistent/unbiased results in small-samples and it is applicable in presence of endogeneity (Pesaran, Shin, & Smith, 2001; Jalil et al., 2014).

ARDL Model of equation (3.6) is presented as follows;

$$\Delta(INF)_t = \beta_0 + \sum^{p}_{i=1} \text{ฑ}_i \Delta \ln(INF)_{t-i} + \sum^{q}_{i=1} \text{€}_i \Delta \ln(FD)_{t-i} + \sum^{q}_{i=1} \delta_i \Delta \ln(M2)_{t-i} + \sum^{q}_{i=1} \text{¥}_i \Delta(R)_{t-i} + \sum^{q}_{i=1} \partial_i \Delta \ln(GDP)_{t-i} + \sum^{q}_{i=1} \prod i \Delta \ln(TD)_{t-i} + \sum^{q}_{i=1} \mathcal{M}_i \Delta(E)_{t-i} + \text{ɑ}_1(INF)_{t-1} + \text{ɑ}_2(FD)_{t-1} + \text{ɑ}_3(M2)_{t-1} + \text{ɑ}_4(R)_{t-1} + \text{ɑ}_5(GDP)_{t-1} + \text{ɑ}_6(TD)_{t-1} + U_t \quad (3.7)$$

Where β_0 represents an intercept, Δ is first differential and the symbols before Δ are short-run parameters. Superscript p represents the optimal lag for the dependent variable while superscript q represents optimal lags for the explanatory variables. It's important to note that p can be lag 1 or 2 while q can take any lag length for this model. The part of the equation (3.7) symbols of summation shows the dynamics of error correction while the last part with ɑ represents long-run relationship (Jalil et al., 2014).

This study incorporated ARDL with cointegration which involved checking whether the variables in the model had a long-run connection using the F-test for joint-significance of the level form of the lagged variables (Pesaran, Shin & Smith, 2001). According to Pesaran, Shin & Smith (2001) there are two sets of critical value. These sets give bounds of critical value to all classifications of independent variables into order of zero and one or mutually cointegrated. But these values result on large sample sizes of over 80 observations (Narayan, 2005). Since this study involves 39 observations, critical bounds as proposed by Narayan (2005) were used for analysis. This was as elaborated in table 3.1.

Table 3.1: Cointegration Decision Table

Calculated F-Statistics	**Conclusion**
a) Above the upper bound	Cointegration exists
b) Below the lower bound	Cointegration doesn't exist
c) Between a) and b) above	Inconclusive

Source: Narayan (2005)

The optimal lag length was identified before the nature of cointegration was known. If there was cointegration VECM which is a representation of a cointegrated VAR would be estimated. This was done to achieve the stated objectives. VECM was specified as follows,

$$\Delta INF_t = \beta_0 + \sum^{k-1}_{i=1}\text{ṁ}_i\Delta(INF)_{t-i} + \sum^{k-1}_{j=1}\delta_j\Delta(FD)_{t-j} + \sum^{k-1}_{m=1}\delta_m\Delta\ln(M2)_{t-m} + \sum^{k-1}_{z=1}\delta_z\Delta(R)_{t-z} + \sum^{k-1}_{q=1}\partial q\Delta\ln(GDP)_{t-q} + \sum^{k-1}_{p=1}\delta_p\Delta(TD)_{t-p} + \sum^{k-1}_{n=1}\delta_n\Delta\ln(E)_{t-n} + \gamma\ ECT_{t-1} + U_t \quad (3.8)$$

Where, ECT is error correction term, k-1 represents lag length, which means that the number of lags is reduced by 1 for every regressor, Δ is a difference operator. The variables are as defined in equation 3.6.

However, ARDL doesn't capture nonlinearity of variables and the association between INF and FD is not always linear, it can be nonlinear (Abu & Karim, 2015). Hence, test for asymmetry was necessary to decide whether the connection between the two variables was linear or nonlinear. Because of this, the study considered a nonlinear model. Nonlinear version of ARDL i.e. NARDL which is an extension of ARDL was to be employed if the relationship between the two variables was nonlinear. The study considered NARDL because its simplicity and flexibility made it ideal

in achieving the stated objectives (Shin et al., 2014; Shin et al., 2012). It also gives robust results for large and small samples. It takes the following form;

$$\Delta(INF)_t = \beta_0 + \sum^{p}_{i=1}(\text{ṁ}_i\Delta\ln(INF)_{t-1}) + \sum_{i=1}^{q+}(€^{+}_i\Delta\ln(FD)^{+}_{t-1}) + \sum_{i=1}^{q-}(€^{-}_i\Delta\ln(FD)^{-}_{t-1}) + \sum^{q+}_{i=1}(\delta^{+}i\Delta\ln(M2)^{+}_{t-1}) + \sum^{q-}_{i=1}(\delta^{-}i\Delta\ln(M2)^{-}_{t-1}) + \sum^{q+}_{i=1}(¥^{+}_i\Delta(R)^{+}_{t-1}) + \sum^{q-}_{i=1}(¥^{-}_i\Delta(R)^{-}_{t-1}) \sum^{q+}_{i=1}(\partial^{+}_i\Delta\ln(GDP)^{+}_{t-1}) + \sum^{q-}_{i=1}(\partial^{-}_i\Delta\ln(GDP)^{-}_{t-1}) + \sum^{q+}_{i=1}(\prod^{+}i\Delta\ln(TD)^{+}_{t-1}) + \sum^{q-}_{i=1}(\prod^{-}i\Delta\ln(TD)^{-}_{t-1}) + \sum^{q+}_{i=}1(\mathscr{M}^{+}i\Delta(E)^{+}_{t-1}) + \sum^{q-}_{i=1}(\mathscr{M}i\Delta(E)^{-}_{t-1}) + \text{ɑ}_1(INF)_{t-1} + \text{ɑ}^{+}_2(FD)^{+}_{t-1} + \text{ɑ}^{-}_2(FD)^{-}_{t-1} + \text{ɑ}^{+}_3(M2)^{+}_{t-1} + \text{ɑ}^{-}_3(M2)^{-}_{t-1} + \text{ɑ}^{+}_{4(R)}{}^{+}_{t-1} + \text{ɑ}^{-}_{4(R)}{}^{-}_{t-1} + \text{ɑ}^{+}_5(GDP)^{+}_{t-1} + \text{ɑ}^{-}_5(GDP)^{-}_{t-1} + \text{ɑ}^{+}_6(TD)^{+}_{t-1} + \text{ɑ}^{-}_6(TD)^{-}_{t-1} + U_t \quad (3.9)$$

Where, Δ is first differential and the symbols before Δ are short-run parameters, Superscript p represents the optimal lag for INF while superscript q represents optimal lags for the explanatory variables. It's important to note that p can be lag 1 or 2 while q can take any lag length for this model and + and – superscript signs represent the partial sum of -ve (negative) and +ve (positive) changes of the independent variables (Shin et al., 2012).The part with summation symbols shows the dynamics of error correction while the last part with ɑ represents long-run relationship (Jalil et al., 2014 & Narayan, 2005).

The optimal lags were selected using AIC – Akaike Information Criterion, before the selected model was estimated. The optimal lags were determined before regression was done (Pesaran, Shin & Smith, 2001). It was also important to examine whether the model was reliable. Therefore, the study checked the model's stability using CUSUM and also CUSUM squared tests Pesaran, Shin & Smith (2001).

3.4 Pre-estimation Tests

These tests were done in order to be sure that the variables involved in the study were reliable. The tests to be carried out were normality and unit root tests.

3.4.1 Normality Test

This test was involved to check whether there was normal distribution in the series before estimation. There are different types of normality tests which can be employed in different studies. Shapiro Wilk Test was used to test for normality before estimation. If the calculated p value was found to be greater than 0.05 then the conclusion was to not reject the null hypothesis of normality.

If the p-value was found to be smaller than 0.05, then the study would reject the normality assumption.

3.4.2 Unit Root Test in Absence of Structural Break

This test is used to test for nonstationary (or stationarity). When the variance and mean are not constant, i.e. if data series has a unit-root, it gives spurious results. When ARDL model is employed in a study, it doesn't always require stationarity test unlike other approaches (Pesaran et al., 2001). The study, however, used ADF test for stationarity to ensure that there were no variables cointegrated of order two or more. ADF test can be presented as follows;

$$\Delta y_t = \alpha + \beta y_{t-1} + \sum_{i=1}^{m} \partial_i \Delta y_{t-i} + \mu_t \quad (3.10)$$

Where α is a constant, β and ∂ represents coefficients, m is total summation of lags and μ is residue or error term. ADF test shall be adopted to test for H_0 that unit root exists. In a case where the critical value is larger than the test statistic, H_0 will not be rejected.

3.4.3 Unit Root Test in Presence Structural Break

Structural breaks occur when time series abruptly changes which can affect the mean as well as other parameters estimated in a model. If the series has a break, the bounds test for cointegration will give inconsistent results. First, the study adopted Bai and Perron (2003) unit root test to check whether there were structural breaks.

Bai & Perron (2003) will be used to test for structural breaks because apart from being applicable in partial and pure structural breaks, it's also able to identify multiple breaks. Both the alternative and null hypotheses are;

Null Hypothesis (H_0): $\beta_j = 0$; there is no structural break(s)

Alternative Hypothesis (H_1): $\beta_j \neq 0$; there is structural break(s)

The Bai and Perron test takes the following form;

$$y_t = x'_t \beta + z'_t \delta_j + \mu_t \quad (3.11)$$

where t represents time, y represents independent variables, x and z are covariate vectors, β and δ coefficient vectors and μ represents an error term.

The study also considered Gregory-Hansen (1996) test. The alternative and null hypotheses for the Gregory-Hansen (1996) test were as follows;

H_0: No cointegration at the break point

H_a: There is cointegration at the break point

If the P-value is larger than the 0.05 critical value, then H_0 is rejected Gregory & Hansen (1996). In such a case, the study will generate dummy variables for the break points and test whether the model is stable with the dummies.

3.5 Granger Causality

The direction of causality between FD and INF will be established by granger causality test. It will help us know which of these series granger cause the other or whether the causality is bidirectional. The two main equations that will be used to achieve this objective are as follows;

$$INF = a_1 + \sum_{i=1}^{n} b_1 INF_{t-1} + \sum_{j=1}^{p} b_2 FD_{i-j} + e_t \quad (3.12)$$

$$FD = a_1 + \sum_{i=1}^{z} \theta_1 FD_{t-1} + \sum_{j=1}^{p} \theta_2 INF_{i-j} + e_t \quad (3.13)$$

From these two equations, the study will test three null hypotheses which are; unidirectional causality i.e. FD to INF, unidirectional causality i.e. INF to FD and bidirectional causality i.e. FD to INF and INF to FD. The null hypothesis that one variable doesn't granger cause the other was rejected if the p value was greater than 0.05.

3.6 Post-estimation Tests

3.6.1 Autocorrelation

Autocorrelation is a situation whereby the disturbance terms of random subsequent periods are correlated in a given data set. To test for autocorrelation, the study will use Breusch Godfrey test. H_0 will be; there is no correlation between two random disturbance terms for subsequent periods. If the p-value will be greater than 0.05 then the H_0 will be rejected, otherwise, it will not be rejected. Lagged values of the dependent variable will be added if there is presence of autocorrelation.

3.6.2 Heteroscedasticity

Heteroskedasticity occurs when standard errors of variables are non-consistent. The study uses Breusch-Pagan test to check the consistency of the standard errors. Null hypothesis (H_0) will be that the standard error of the variables is not consistent. With a P-value higher than 0.05, will lead to its rejection, otherwise, robust standard errors will be employed to correct for heteroscedasticity.

3.7 Data and Sources

Annual time series data for thirty-nine years, 1980 – 2018 was used. The fiscal deficit data was collected from KIPPRA, that of inflation rate was downloaded from KNBS, while data for the other variables from World Development Indicators.

CHAPTER FOUR: EMPIRICAL FINDINGS

4.0 Introduction

This chapter presents empirical findings, which involve data description, discussion of pre-estimation tests, selection of optimal lags and model estimation. They are presented as follows.

4.1 Data Description

Table 4.1 gives summary statistics which shows the no. of observations, kurtosis, skewness, standard deviation, minimum and maximum values and mean, for every variable used in the model.

Table 4.1: Summary Statistics

Variable	N	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis
INF	39	11.97	45.98	1.55	8.57	9.98	1.98
FD	39	-3.83	-9.14	1.76	2.81	0.05	2.17
lnE	39	3.81	4.64	2.00	0.79	-0.85	2.26
R	39	7.45	21.10	-8.01	6.50	0.06	2.86
lnGDP	39	28.38	29.20	27.75	0.41	0.32	2.13
lnM2	39	3.56	3.77	3.28	0.14	-0.43	1.95
TD	39	0.41	0.55	0.27	0.09	-0.05	1.77

In table 4.1, inflation rate has a mean of 11.97, its maximum and minimum values are 45.98 and 1.55, respectively and a standard deviation of 8.57 which is the second largest in the summary statistics after that of exchange rate. Just like inflation rate, fiscal deficit has also been highly deviating from the mean as suggested by a standard deviation of 2.8. The highest recorded fiscal deficit was -9.14 while the lowest was a fiscal surplus of 1.76.

For the other variables, real interest rate has the highest standard deviation. The natural log of real GDP has a mean of 28.38. Its lowest value since 1980 is 27.75 and the highest value is 29.20 both of which are not far from the mean. Trade openness has the lowest standard deviation, i.e. 0.09, for the selected variables. Only inflation has a highly skewed distribution because all the other variables have skewness values ranging between -1 and +1. The kurtosis values for all the variables are greater than +1 meaning that they are highly peaked.

4.2 Normality Test

This was performed to check whether the data series included in the model were normally distributed or not. Shapiro – Wilk test is conducted to test for normality. For this test a p-value of greater than 0.05 means that the series is normally distributed while a p-value of less than 0.05 means that the variable is non-normally distributed. Table 4.2 illustrates this.

Table 4.2 Shapiro – Wilk Test for Normality

Variable	Observations	Wald Stat.	Covariance Matrix	Z – Stat.	P – value	Conclusion
INF	39	0.817	7.111	4.122	0.000	Non-normal
FD	39	0.977	0.900	-0.222	0.588	Normal
lnE	39	0.834	6.432	3.911	0.000	Non-normal
R	39	0.968	1.258	2.483	0.315	Normal
lnGDP	39	0.958	1.644	1.044	0.148	Normal
lnM2	39	0.922	3.023	2.324	0.010	Non-normal
TD	39	0.934	2.575	1.988	0.023	Non-normal

In table 4.2, if $p>0.05$, the H_0 is not rejected. Hence, fiscal deficit, and both real GDP and interest rate are normally distributed because they all have a P-value greater than 0.05. Broad money, inflation, exchange rate and trade openness are not normally distributed. However, no-normality of some of these variables doesn't negatively affect the objectives of the study because it is usually not a major issue in estimation. The results will, therefore, be consistent, ceteris paribus.

4.3 Unit Root Test in Presence of Structural Breaks

The study used both ADF and Bai and Perron (BP) in this section to test for stationarity and break points. First, ADFT was executed to check for the stationarity of the variables. This involved checking for stationarity at level and after 1st difference for the nonstationary variables.

Table 4.3 shows that after first difference, inflation rate, fiscal deficit, real interest rate, real GDP and broad money are stationary after first difference. Inflation rate and broad money are stationary at 1% level, real interest rate is stationary at 5% level while fiscal deficit and real GDP are stationary at 10% level of significant. E and TD are stationary at 1% significant level after second difference. The critical values are as given at the bottom of table 4.3 bellow.

Table 4.3: ADF Test Results

Level Variables	t-statistic	Differentiated Variables	t-stat after diff.	Degrees of integration
INF	-2.534	d.INF	-3.705	I(0)
FD	-0.598	d.FD	-2.839	I(0)
LnE	-1.924	d2.lnE	-3.999	I(0)
R	-2.161	d.R	-3.241	I(0)
LnGDP	1.056	d.lnGDP	-2.839	I(0)
lnM2	-1.976	d.lnM2	-3.876	I(0)
TD	-1.978	d2.TD	-3.860	I(0)

Note: at 1% level, critical value is -3.689, at 5% is -2.975 while at 10% is -2.619

In table 4.3, notation for the variables remain the same as in equation 3.5. BP test for structural break results are as presented in table 4.4.

Table 4.4 Bai and Perron Test Results

Variable	Breakpoint(s)	Scaled F-statistics	Critical Value
INF	1993, 1995, 2008	16.451**	11.32
FD	1993, 1999	23.983**	10.65
lnE	1994, 1999	22.041**	7.12
R	1997, 2004	27.566**	9.24
lnGDP	2002, 2007	13.945**	8.33
lnM2	1992	25.340**	10.11
TD	1993, 2008	14.656**	11.21

Note: **means H_0 at 5% is rejected

Table 4.4 shows several breakpoints. The breaks occurring in early 1990s were caused by trade and economic liberalization whose shocks affected the variables in different years. Post liberalization shocks of late 1990s i.e. between 1997 and 1999 occurred as the economy was adjusting to the changes (Okelo et al., 2013). The ones occurring between 2007 and 2008 are attributed to post election violence of 2007 and 2008.

4.4 Optimal Lag Selection Results

There are different criteria for optimal lag length selection which include; Final Prediction Error Criterion (FPE), Schwarz Bayesian Information Criterion (SBIC), Likelihood Ratio (LR), Hannan and Quinn criterion and the Akaike Information Criterion (AIC). Table 3.5 represents results for these criteria.

Table 3.5: Optimal Lag Results

Lag	LL	LR	FPE	AIC	HQIC	SBIC
0	-207.648	_	.000501	12.266	12.373	12.577
1	20.809	456.92	1.9e-08	2.011	2.870	4.499*
2	83.791	125.96	1.2e-08	1.213	2.823	5.878
3	146.334	125.08*	1.7e-08	0.438*	2.800*	7.282
4	-	-	-4.4e-23*	-	-	-

Note: * represents the optimal lags selected for each category of the criteria

Akaike Information Criterion is chosen because it doesn't overfit the data to suit the model (Pesaran et al., 2001). In Table 3.5 the optimal lags are 3 for AIC.

4.5 Granger Causality Test

This was done to achieve the specific objective number 1 which was about establishing the causality between inflation and fiscal deficit. The results are presented in table 4.6 below, for the 2 equation.

Table 4.6: Granger Causality Results

Equation	Excluded	Chi2	P-value
INF	FD	11.852	0.055
FD	ALL	5.897	0.455

In table 4.6 it is clear that there is no causality among the variables. This is because in inflation equation, a p-value of 0.055 is higher than 0.05 and also the fiscal deficit equation has a p-value of 0.455, hence, there is no causality between inflation and fiscal deficit in Kenya.

4.6 Cointegration

Bounds test for cointegration gave the following results. The results show that the F-stat is 4.492 which is larger than the upper bound in all significance levels and hence we conclude that cointegration exists. At 1% significance level, the upper bound is 1.95, at 5% level, the upper bound is 2.22, while at 10% level of significance it is 2.79, as show in table 4.7.

Table 4.7 Bounds Test Results

Test	Statistic	Critical	Values			
		10%		5%		1%	
		UB	LB	UB	LB	UB	LB

F-test	4.492	1.95	3.06	2.22	3.39	2.79	4.10
t-test	-2.521	-2.57	-4.40	-2.86	-4.72	-3.43	-5.37

Since cointegration among the variables was present, the long-run model was estimated i.e. VECM. The results for the model are as shown in table 4.8.

Table 4.8: Vector-Error Correction Model

Sample : 1984 – 2018		R-Squared = 0.939	
Number of Obs = 36		Log likelihood = -243.835	
Variables	Coef.	Z	p>|z|
D INF			
_ce1			
L1	.225	7.83	0.000
INF			
LD	-1.097	-4.43	0.000
L2D	-.748	-3.22	0.001
FD			
LD	-1.733	-3.15	0.002
L2D	.445	1.26	0.206
lnE			
LD	26.574	2.26	0.024
L2D	-3.259	-0.40	0.693
R			
LD	1.237	5.81	0.000
L2D	.316	2.36	0.018
lnGDP			
LD	27.394	0.71	0.480
L2D	169.408	3.40	0.001
lnM2			
LD	34.374	2.85	0.004
L2D	43.821	2.90	0.004
TD			
LD	98.553	2.12	0.034
L2D	-2.747	-0.07	0.945
dm_INF			
LD	1.020	4.39	0.000
L2D	.664	2.53	0.011
dm_FD			
LD	3.56e-10	2.40	0.016
L2D	7.05e-10	3.52	0.000
Const.	-425.662	-7.87	0.000

In table 4.8, R-squared of 0.939 means that the regressors explain 93.9 percent of the changes in inflation rate. The speed of adjustment coefficient is significant and positive. It should, however, range between -1 and 0 so that it indicates that there is convergence in the long-run. The positive coefficient may be due to structural breaks or model instability.

The other coefficients show how the regressors used in the study affect inflation rate in the Kenyan economy. The coefficient of the first lag of inflation rate is negative and statistically significant at 1 percent level. It tells us that, ceteris paribus, a one percent decrease in the first lag of inflation leads to 1.097 percent increase in the actual inflation rate. The second lag of inflation is also negative and significant at 1% level. It tells us that a 1 percent increase in lagged values of inflation leads to 0.747 percent decrease in inflation, other things held constant. This means that when the previous inflation rate is high the current rate should be expected to decline.

The first lag of fiscal deficit elasticity is negative and significant at 1% level. A coefficient of -1.733 tells us that a 1 percent rise in fiscal deficit, lead to 1.733 percent fall in inflation, ceteris paribus, at 1% significance level. However, this is against the FTPL. The findings suggest that as fiscal deficit increase inflation rate declines. There are several other studies which found the same relationship among these two variables e.g. Ezeabasili, Mojekwu, & Herbert (2012) and Douglas & Ia (2009). The coefficient of the second lag of fiscal deficit is positive but not significant.

For exchange rate, its first lag elasticity gives unexpected sign and is statistically significant at 5% level. A coefficient of 26.574 means that a 1 percent rise in E leads to 26.574% rise in inflation, other things held constant. Epaphra (2019) found similar results which contradict with Sabaté, Fillat & Escario (2019) and Roslan (2013) whose results showed inverse connection between the variables. Its second lag is not statistically significant. The reason behind this may be due to the effect of other variables that affect inflation rate and weren't included in the model.

The elasticities of the second and first lags of real interest rate give unexpected signs i.e. they are positive and significant at 5% and 1% level, respectively. Several studies have found different impact of R on inflation. For example Bleaney & Francisco (2016) and Maltritz & Wüste (2015**)** found significant and inverse impact of interest rate on inflation. For the first lag, a p-value of 0.000 and a coefficient of 1.237 means that at 1% level of significant, a 1% rise in R leads to 1.237 percent increase in inflation rate, ceteris paribus. The second lag tells us that at 5% level of

significant, a 1% rise in real interest rate leads to 0.315 percent rise in inflation rate, other things constant.

The elasticity of the second lag of real GDP is significant at 1% level. A coefficient of 169.408 is telling us that, at 1% significant level, a 1 percent rise in the real GDP leads to 169.408 percent increase in inflation, ceteris paribus. Other studies have reported similar findings, e.g. Epaphra (2019) and Hossain (2014). This means that as real GDP increases Kenyan policymakers should be aware of its positive effect on inflation rate. The first lag of real GDP is not statistically significant.

The first and the second lag coefficients of broad money are statistically significant at 1% level with the expected signs. The coefficient of the first lag is 34.374 and is telling us that, ceteris paribus, a 1% rise in broad money leads to 34.374 percent rise in inflation at 1% level of significant. For the second lag, a coefficient of 43.821 means that at 1% level of significant, an increase in broad money leads to 43.821 increase in inflation rate. The findings are in line with QTM. There are several studies that have reported the same results e.g. Anantha & Gayithri (2017), Khan & Gill (2010) and Abu & Karim (2015). The results suggest that broad money is inflationary in the Kenyan economy. It should, hence, continue to be monitored to ensure that the level of inflation is sustainable and healthy for the economy.

The second lag of trade openness is not statistically significant while its first lag is statistically significant i.e. at 5% and gives the expected sign. A coefficient of 98.553 for the first lag is telling us that, other things held constant, a 1 percent rise in trade openness leads to 98.553 percent increase in inflation rate. The findings suggest that Kenya's trade openness is inflationary and hence when it's growing, exports and imports should be controlled in order to curb inflation rate. Inflation and fiscal deficit dummy variables give expected signs. Their coefficients are both positive and significant. This means that trade and economic liberations of early 1990s had effects on inflation rate.

4.7 Testing for Asymmetry

This sub-section involved estimating NARDL. The aim was to check for asymmetry between inflation and fiscal deficit. From Table 4.9 there is no significant asymmetry among the variables both in the short-run and in the long-run.

Table 4.9 Asymmetry Statistics

		Long-run effect (+)			Long-run effect (-)		
		Coef.	F-Stat.	P-value	Coef.	F-Stat.	P-value
INF	FD	-0.396	.109	0.744	0.299	.013	0.910

	Long-run Asymmetry		short-run Asymmetry	
	F-stat	P-value	F-stat	P-value
FD	.002	0.964	.052	0.822

The results show that the p-values i.e. 0.964 and 0.822 for the long-run and short-run asymmetry, respectively, are not statistically significant. Since there was no asymmetry, linear model was estimated.

4.8 Post-estimation Tests

It is always important to carry out post-estimation tests in order to know whether estimation results in a study are reliable and can be used for forecasting. The results for autocorrelation and heteroskedasticity were as presented in the tables below.

Table 4.10: Autocorrelation Results

Test	t-statistic	p-value
Autocorrelation	Chi2 = 0.507	0.476

A p-value of 0.4764 is greater than 0.05, and hence the null hypothesis of no autocorrelation is not rejected. Table 4.10 presents this clearly.

Table 4.11 Heteroscedasticity results

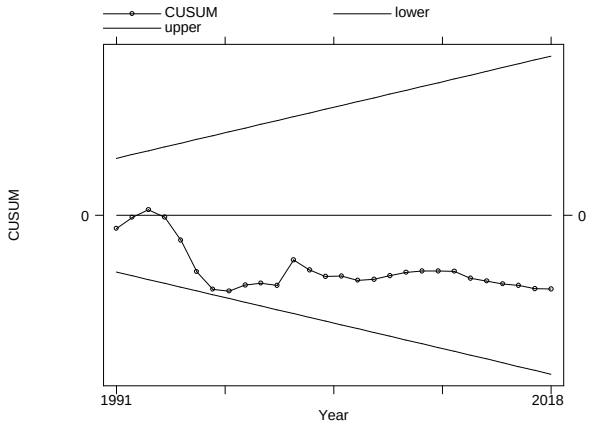
Test	t-statistic	p-value
Heteroscedasticity	chi2 = 0.12	0.725

For the case of heteroscedasticity, the null hypothesis of homoscedastic error term is also not rejected since the p-value is 0.725. Hence, the study concludes that the residual is homoscedastic, in other words, the error term is constant across elements of the vector in the model.

4.9 Stability Test Results

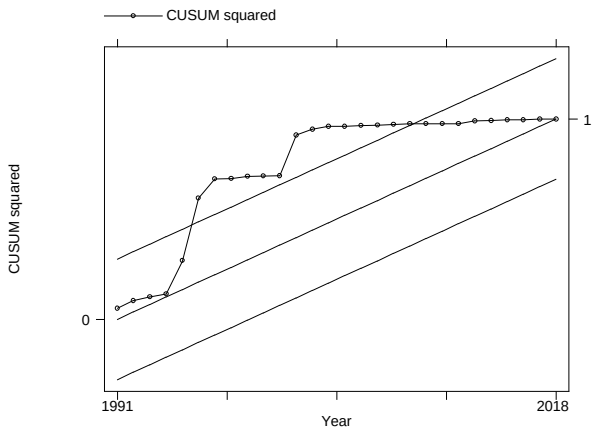
Model stability test is used to check whether the model is stable and hence, reliable. The study used both CUSUM squared and CUSUM tests to check for the stability of the model including the dummy variables. For these tests, a model is stable if the curve is within the boundaries. This means that a model is considered to be instable and unreliable when the CUSUM and CUSUM Squared curves deviate from the boundary i.e. the upper and lower control limits. Figure 4.2 shows CUSUM test results. The curve is within the boundaries. Therefore, the model is stable and hence can be used for forecasting and policy formulation purposes.

Figure 4.1: CUSUM Test Results



On the other hand, CUSUM Squared test also shows that the model is fairly stable. The curve starts closer to the center line before deviating out of the upper boundary which shows some instability in the model, it then turns back to stability. The closer to the center line the curve is, the better the model. If the curve is within the boundaries the model is considered to be reliable. Hence, both the CUSUM and CUSUM Squared tests results agree that the model is fairly stable.

Figure: 4.2 CUSUM Squared Results



However, it is important to note that, other tests, especially post estimation tests, are as important as CUSUM and CUSUM Squared tests when deciding on reliability of a model (Jiang, 2016). These tests should hence be incorporated with some other diagnostic tests in order to know whether results obtained from a particular model can be taken seriously.

CHAPTER FIVE: SUMMARY, CONCLUSION AND POLICY IMPLICATION

5.0 Introduction

This chapter gives the summary, policy implication and conclusion. Areas for further research are also briefly discussed. These subsections are separately discussed as follows.

5.1 Summary

The main objective of this research was to investigated the nexus between inflation and fiscal deficit in Kenya. It also aimed at establishing the causality between the two variables and analyze their long-run relationship. The paper also aimed at detecting the presence of structural breaks.

To achieve these objectives, Shapiro-Wilk test was used to test for normality before estimation was done. Unit root test in presence of structural breaks was carried out using ADF test and BP test. We also tested for asymmetry by estimating NARDL to get asymmetry statistics. Bounds test was used to test for cointegration. Then, VECM was estimated because cointegration among the variables existed. Granger Causality test was used to test for the causality between INF and FD in Kenya.

The VECM results showed that the first lag of fiscal deficit was statistically significant at 1% percent level but its second lag was not statistically significant. The first lag, however, gave unexpected sign which meant that there is an inverse connection between inflation and fiscal deficit in Kenya. The first and the second lag of money supply, the second lag of real GDP and the first lag of trade openness were statistically significant and had expected signs. The first and the second lag of real interest rate and the first lag of exchange rate were statistically significant but with unexpected signs. The first and the second lag of the dummy variables for fiscal deficit and inflation were statistically significant and gave expected signs. The results for Granger causality test showered that there was no causality between two main variables in the Kenyan economy.

Some diagnostic tests were done. They included, autocorrelation, heteroscedasticity and stability of the model using Breusch Godfrey test, Breusch-pagan test and both the CUSUM and CUSUM Squared, respectively. For both autocorrelation and heteroscedasticity, the decision was to reject the null hypothesis of no serial correction and homoscedastic standard errors if the p-value was lower than 0.05. A p-value of 0.4764 and 0.7254 were larger than 0.05, and hence the H_0 of no autocorrelation and homoscedastic standard errors were not rejected. The results from CUSUM

showed that the model was stable while CUSUM square curve showed a deviation at the middle meaning that the model faced some instabilities.

5.2 Conclusion

Based on the results, there are several conclusions made. First, like some studies, e.g. Dhal (2015) and Bleaney & Francisco (2016) this study concludes that there is a significant long-run relationship between inflation and fiscal deficit in Kenya. In addition, it's important to also note that the form of association between these two variables is negative and linear and, hence, persistent fiscal deficit in the Kenyan economy is deflationary.

The study also concludes that real GDP, broad money and trade openness are inflationary in Kenya. They positively affect inflation since were found to be statistically significant with positive coefficients, which was in line with some previous studies e.g. Van & Budina (2001), Bleaney & Francisco (2016) and Kiptui (2013) incorporated some of these variables in their studies. Although real interest rate and exchange rate gave unexpected signs, this study doesn't rule out their opposite effects on inflation because other studies have contradicted with these findings e.g. Chege (2015) and Kiptui (2013). At least one of the lags of all the control variables were statistically significant.

5.3 Policy Implication

Based on the findings, policymakers should still set a threshold for fiscal deficit despite the results showing that fiscal deficit is deflationary in the Kenyan economy. The rise in fiscal deficit should be carefully monitored so that it doesn't lead to high and unsustainable deflation rate. This is because unsustainable deflation can, just like inflation, affect the overall wellbeing of the country e.g. by reducing producers' propensity to produce and hence, to a decline in production.

The effect of other macroeconomic variables involved in the study as control variables such as broad money, trade openness and real gross domestic product remain to be effective in influencing inflation and need to be considered when formulating policies to curb inflation in the country. For example, broad money should not be allowed to be too high because this will directly increase general price level. This is because when consumers' incomes increase, their marginal propensity to consume rise which induces price of commodities to increase as well.

5.4 Recommendation for Further Study

This study recommends for a related research using panel data for East African countries considering the form of linearity of the two main variables i.e. inflation-fiscal deficit nexus. Although a similar study has been done, the form of association, in terms of linearity, between the two variables is not clear. It is good to test for nonlinearity before deciding on the methodology to use, failure to do so, may give misleading results.

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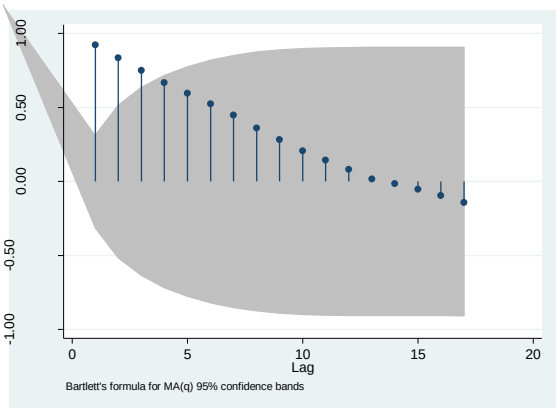
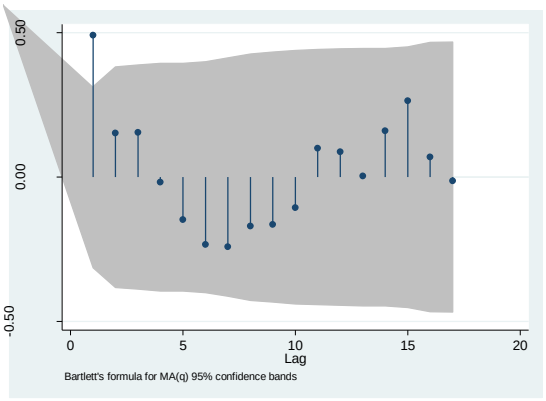
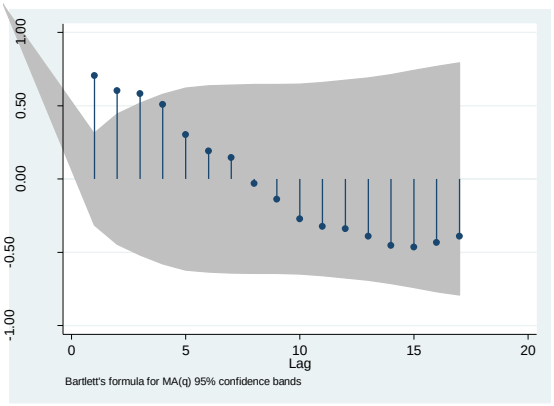
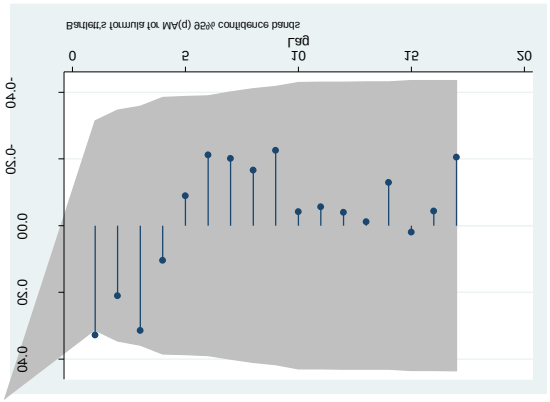
APPENDICES

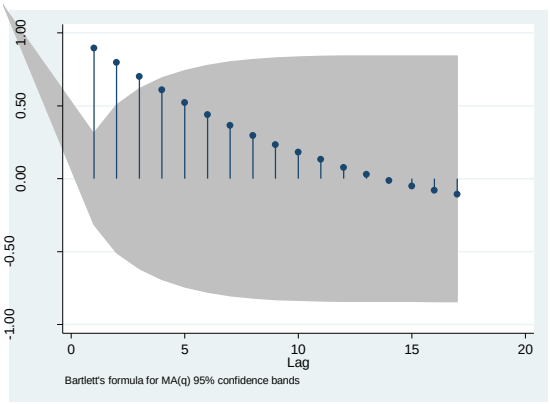
Appendix 1A: *Autocorrelation Plots*

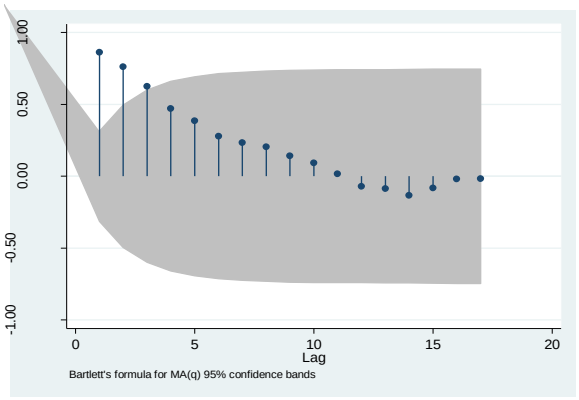


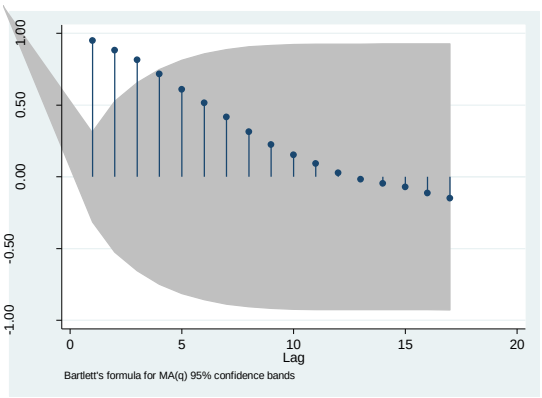




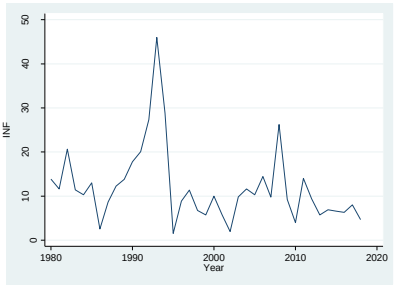


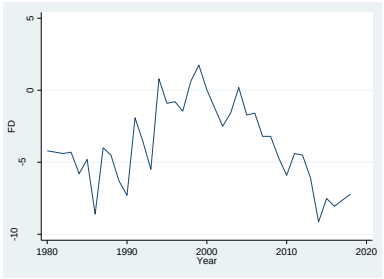


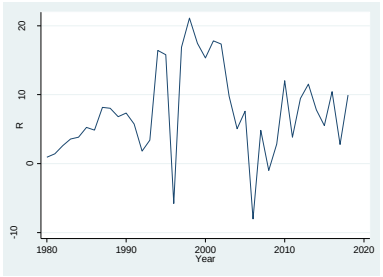


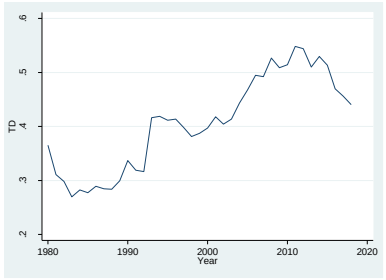


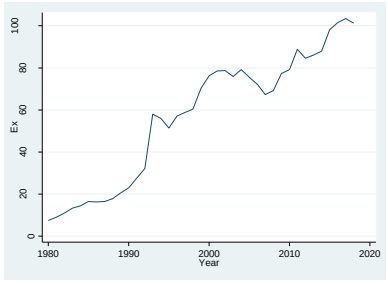
Appendix 1B: *Data Plots*

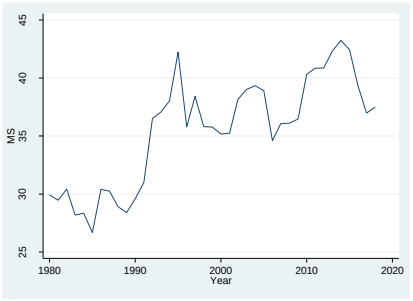


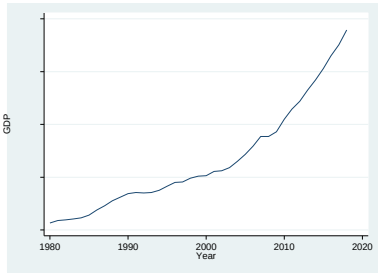












Appendix1C: ***Cointegration Equation***

Equation	**Chi2**	**P>Chi2**
_cel	1959.165	0.0000