THE IMPACT OF INFLATION ON ECONOMIC GROWTH IN TANZANIA

1995-2017

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ECONOMICS OF THE OPEN UNIVERSITY OF TANZANIA

2020

CERTIFICATION

The undersigned certifies that has read and hereby recommends for acceptance by the Open University of Tanzania a Research Dissertation entitled; ñThe Impact of Inflation on Economic Growth in Tanzania during 1995-2017ò in partial fulfillment of the requirements for The Degree of Master of Science in Economics of Open University Tanzania.

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Date

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DECLARATION

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

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Signature

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Date

DEDICATION

To the God Almighty who has been my strength and help in times of needs and to my Mother Elipendo Shibanda and beloved Late Father Angumbukege Malipila Shibanda. During all time of my field work they have been supporting me morally and gave me strength to accomplish the entire document.

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Secondly, I would like to express my sincere gratitude to all academic and non-academic staffs at Open University of Tanzania and to my supervisor Dr. Timothy Lyanga and colleagues in class for their support during the course and report writing.

ABSTRACT

The main purpose of this study is to empirically assess the impact of inflation on economic growth in Tanzania from 1995 to 2017. Inflation is one of the fundamental objectives of macroeconomic policies in Tanzania. Specifically, the study assessed the empirical evidence for significance of inflation on economic growth in Tanzania as first hypothesis. Different statistical tests conducted revealed that inflation is significant to economic growth since the tests displayed that these two variables affect one another. Secondly, the study examined the hypothesis that inflation and economic growth has positive relationship so different econometric tests like correlation matrix test, cointegration test, Vector Autoregressive test were employed. The results revealed the following; first, there was strong positive and negative relationship between inflation and economic growth, secondly, the cointegration test showed that inflation has short run relationship with economic growth, thirdly, the Vector autoregression causality test results exposed that there was positive and negative causality relationship between inflation and economic growth, given the results above, then we reject the null hypothesis that Inflation and Economic Growth have positive relationship and accept the alternative that inflation have both positive and negative relationship on economic growth. Hence the study concludes that inflation has significant impact on economic growth in Tanzania also inflation is the sensitive macroeconomic variable to the economic growth. The study recommends that before making any inflation targeting policy, the Government should build a dynamic model that can weigh the short run costs against the long run benefits of such policies.

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LIST OF ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey Fuller
ARDL	Autoregressive Distributive Lag
ARCH	Autoregressive Conditional Heteroscedasticity
ASEAN	Association of South East Asian Nations
BOP	Balance of Payment
CE	Co-integrating Equation
CIS	Commonwealth of Independent States
CLRM	Classical Linear Regression Model
CPI	Consumer Price Index
CLS	Conditional Least Square
CUSUM	Cumulative Sum
DW	Durbin Watson
ECM	Error Correction Model
ECT	Error Correction Term
ERP	Economic Recovery Programme
GDP	Gross Domestic Product
GTP	Growth and Transformation Plan
HP	Hodrick-Prescott
IFS	International Finance Statistics
HQ	Hannan-Quinn
IMF	International Monetary Fund
IID	Independently and Identically Distributed
LM	Lagrange Multiplier

LR	Likelihood Ratio
MA	Moving Average
MDGs	Millennium Development Goals
BOT	Bank of Tanzania
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Square
PP	Phillips Perron
PWT	Penn World Table
QTM	Quantity Theory of Money
RESET	Regression Specification Error Test
RGDP	Real Gross Domestic Product
RSS	Residual Sum of Square
SAP	Structural Adjustment Program
SDPRP	Sustainable Development and Poverty Reduction Program
SIC	Schwarz Information Criteria
SSA	Sub-Saharan Africa
TAR	Threshold Autoregressive
TIR	Trade Intensity Ratio
VAR	Vector Autoregressive
VARFIMA	Vector Autoregressive Fractionally Integrated Moving Average
VECM	Vector Error Correction Model
WDI	World Development Index
WEO	World Economic Outlook

CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter discusses six sub sections of the study. It starts with introduction of the study, statement of the problem, objective of the study, hypotheses of the study, significance of the study and finally the scope and limitation of the study. The sections are set to build up the constructive understanding of the research topic.

1.2 Introduction

Inflation and economic growth are one of the most popular macroeconomic issues among central bankers, policy makers and macroeconomists (Barro 1995:166). In many countries high and sustainable economic growth and low inflation are two of the main objectives of macroeconomic policy. A widely accepted concept in macroeconomics is that low inflation is essential for economic growth. Although the debate about the precise relationship between inflation and economic growth remains open, the question of the existence and nature of this link has been the subject of considerable interest and debate (Munir and Mansur, 2009).

Different schools of thought offer different evidence on the link between inflation and economic growth. For instance, structuralists believe that inflation is necessary for economic growth, but according to monetaristsô view, inflation is harmful to economic growth (Mallik and Chowdhury, 2001). There exists a large debate in the relationship between these two macroeconomic variables both theoretically and empirically. The differences in the relationships are highly dependent on the economic condition of the world. During the rise of the Keynesian economics, after

the Great Depression, countries have been effective in implementing Keynesian policies. Increasing aggregate demand increased not only production but it has also increased the general price level. Since the 1970ôs inflation was not considered as a threat to the economy but rather it was considered to have a positive effect on growth. This is shown in the empirical study of Phillips (1958) which was quickly adopted by Keynesians in 1950ôs. According to Phillips Curve, inflation has a positive reaction to economic growth and is negatively related to unemployment.

However, this world economic condition survived only until the 1970ôs (Snowdon and Vane 2005: 134 40). In the 1970ôs, it came out that countries with high rates of inflation started to exhibit lower rates of economic growth. Due to this reason the view that inflation is positively related to growth was substituted by the fact that high level of inflation is negatively related to growth (Friedman 1976: 270-73). The latter view is well known as the monetarist view of macro-economics. The conflicting views in the relationship between inflation and growth are not only in the theoretical literature but also exist in empirical findings based on the macroeconomic and development condition of the countries under study. Among the numerous empirical studies, the findings of Khan and Senhadji (2001) reveal that the economy of developing countries can accommodate higher inflation than that of developed ones.

The experiences from East African countries, for example showed that Kenya had 5 years of very positive economic development with four consecutive years of growth above 4%. But average annual inflation of Kenya increased from 18.5% in June 2008 to 27.2% in March 2009, before falling marginally to 24.3% in July 2009.

Uganda was one of the faster growing economies in Africa with sustained growth averaging 7.8 % since 2000 with the annual inflation rate decreasing from 5.1% in 2006 to 3.5% in 2009. The average annual real GDP growth rate for Rwanda from 1990-1999 was -0.1 but from 2006 to 2009, Rwanda had an annual average growth rate of 7.3% (Stein, 2010).

Since late 1970s, Tanzanian economy experienced many internal and external shocks. All sectors of the economy were affected by shocks, whose manifestations were, among others, large budget deficits and an imbalance between productive and non-productive activities. The signs closely associated with these were high rates of inflation, large balance of payments (BOP) deficits, declining domestic savings, growing government expenditure, falling agricultural produce and decreased utilization of industrial capacity which in turn hindered economic growth (Kilindo, 1997). Tanzaniaôs economic growth has shown an erratic trend as it recorded an average GDP growth rate of about 3% between 1991 and 2000, the GDP growth rate in 1992 was only 0.584%, while the rates in 1996 and 2000 were 4.6% and 5.1% respectively (Odhiambo, 2011).

1.3 Statement of the Problem

The impact of inflation on economic growth is one of the most central points of macro-economic issues that need to be resolved. Though many empirical studies such as Barro (1995) and Ahmed and Mortaza (2005) found out that inflation and growth are negatively related, However, the positive relationship cannot be rejected since a number of empirical findings such as (Ozdemir 2010) exist, the impact of inflation and economic growth is not well defined, this is mainly due to macro-

economic and development conditions of the world, region or country under study.

Regardless of this, recently, there exists a high level of consensus among researchers and economists that positive and lower level of inflation is positively related to economic growth while high and unstable level of inflation has negative impact on the growth of an economy. These conflicting views on the relationship between inflation and economic growth motivate this study. However, this topic is yet to be discussed intensively in this regard that there is no direct effort between 1995-2017, hence this create the need and the necessities for studies to be conducted to cover this knowledge gap and provides the empirical evidence of impact of inflation on economic growth in Tanzania. In conclusion, this study aims to fill the knowledge gap on the conflicting views on effects of inflation on growth not only in global literature but also in Tanzania have motivated this paper and contributing to the knowledge in this area.

1.4 Objectives of the Study

1.4.1 General Objective of the Study

The main objective of this study is to evaluate impact of inflation on economic growth in Tanzania.

1.4.2 Specific Objectives

The study has the following specific objectives:

i. To examine the impact of inflation on economic growth in Tanzania.
ii. To assess the economic growth in Tanzania.
iii. To describe the relationship between inflation and economic growth in

Tanzania from 1995 to 2017.

1.5 Hypotheses

i. Inflation is significant to economic growth in Tanzania.

ii. The inflation and economic growth in Tanzania has positive relationship.

1.6 Significance of the Study

This topic is very important to macroeconomists, financial analyst, academicians; policy makers and central bankersô officials in understanding the relationship between economic growth and the change in general price levels and thus come up with the relevant policies to keep prices at the reasonable rate that stimulate production. It is necessary to policy makers to clear doubt as many studies on the relationship between inflation and economic growth remains inconclusive, several empirical studies confirm the existence of either a positive or negative relationship between these two macroeconomic variables. Therefore, the importance of the study is to provide policy guidance for the monetary policy makers about the inflation. Identifying this threshold point of inflation for the Tanzanian economy provides possible policy recommendation for monetary policy makers of the country.

1.7 The Scope and Limitation of the Study

Due to the conflicting findings in the relationship between inflation and economic growth several studies have analyzed this topic. Some studies use panel data for several countries while others use time series data for a specific country. This study has analyzed the impact of inflation on economic growth in Tanzania, limited to the period 1995 to 2017. The reason of choosing this period is because it was this period

that Tanzania experience the significant boost of the economic growth and the country became concerned with increase of inflation as its effects started to be evidenced in country finances and touching individuals. So, this period provides good picture of impact of inflation on economic growth, also data is available during this period compared to years before 1995.

CHAPTER TWO

LITERATURE REVIEW

2.1 Chapter Overview

The discussions in this chapter have three main sections. It starts with relevant theoretical studies regarding inflation and economic growth. The second part discusses the global empirical studies and their findings. The last part focus on the studies carried out on the influence of inflation on economic growth in Tanzania.

2.2 Theoretical Literature Review

2.2.1 Definitions of Key Terms

2. 2.1.1Inflation Rate

Inflation is defined as the rate at which prices generally increase (Brealey et al., 2001). Inflation is intensely undesired. A high rate of inflation is considered as one of the most important problems facing a country. The basic reason for adopting price stability as the primary object of monetary policy is to create a stable and non-inflationary environment for resource allocation and to stabilize price expectations.

2.2.1.2 Unemployment

Unemployment occurs when a person who is actively searching for employment is unable to find work. Unemployment is often used as a 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.

2.2.1.3 Endogenous Growth

The concept of economic growth it assumes that the long-run rate of growth is

primarily determined by endogenous variables that are internal to the system, such as human capital, innovation and investment capital; rather than exogenous factors where technological and scientific process are independent of economic forces. Accordingly, population growth and innovation have more impact on growth and innovation than physical capital.

2.2.1.4 Consumption

Consumption is the value of goods and services bought by people. Individual buying acts are aggregated over time and space. Consumption is normally the largest GDP component. Many persons judge the economic performance of their country mainly in terms of consumption level and dynamics. Productivity measures output per unit of input, such as labor, capital or any other resource and is typically calculated for the economy as a whole, as a ratio of gross domestic product (GDP) to hours worked. Labor productivity may be further broken down by sector to examine trends in labor growth, wage levels and technological improvement.

2.3 Theories Supporting the Study

Different theories have different conclusions about the relationship that exists between inflation and economic growth. For example, to compare the two mega theories, monetarists assert that inflation hinders growth while the structuralistôs argue that inflation promotes growth. Different economic theories are studied in this section regarding their views on the impact of inflation on economic growth.

2.3.1 The Mercantilists Theory

This view was popular from 1650 up to 1776, the time when Adam Smithôs book

ñWealth of Nationsò was published. During the time of enlightenment Britain achieved rapid economic growth that was highly based on trade and commerce. According to the Mercantilists, export surplus is a source of growth while balance of payment (BOP) deficit was considered as a negative growth factor. Thus, to have export surplus imports are discouraged and exports are encouraged, so that economic growth can be secured (Pentecost 2000: 3-5).

Precious metals were used as money in most places of the world during the time of enlightenment and export surplus was interpreted as an accumulation of gold bars and coins. This large amount of bars and coins in the market thus led to an increase in the price level. Though Mercantilists support the idea of export surplus, they were also aware of the general price increase that will be caused by the export surplus (Pentecost 2000: 4-6). William Petty was one of the first Mercantilist philosophers to identify the negative effects of the rise in inflow of gold bullions in a given country. To Petty, an increase in inflow of gold bullions causes inflation which in turn reduces economic growth of a given country. He explains further that inflation reduces international competitiveness of a nation. The rise in inflation makes locally produced goods expensive in the international market and that reduces the demand for the product overseas.

2.3.2 The Classical Theory

The publication of ñWealth of Nationsò in 1776 is considered as the birth of Classical economic thinking. This economic thinking was popular until it was questioned by John Maynard Keynes in 1936 with his publication of ñThe General Theory of Employment, Interest and Moneyõõ. Early classical economists, Adam

Smith and David Ricardo, adopted Richard Quesnayôs social class analysis and revised these classes as landlords, capitalists and workers. Based on the self-interest assumption of classical economists, capitalists compete even in the labour market. Such competition increases labour wage.

The rising cost of production through an increase in labour wage reduces the profit of the capitalist benefiting workers and landlords. The fall in the profit level discourages the capitalist who is the source of wealth creation. Thus, the price increase will have a negative effect on productivity of the capitalist leading to decline in the level of the economic growth (Pentecost 2000: 7 - 11). In later Classical economics output and employment is not determined by the creation of money but rather it is explained by the short-run production function where output Y is explained as a function of labour L and capital K, given by;

$$Y = Af(K,L) \quad \ldots\ldots 1$$

Where,

$Y =$ is output,

$A =$ is the level of technology,

$K =$ is capital accumulated and

$L =$ is the labour force.

According to this explanation to achieve economic growth either the labour force or capital accumulation must rise. The rise in the level of technology also helps to postpone the diminishing returns of growth caused by the rise in capital or labour force (Snowdon and Vane 2005: 38 ï 45).

The other feature of Classical thinking, the quantity theory of money (QTM), states that in the long-run money does not influence real variables but can pressure the price level. To the Cambridge economists, the theory is stated as;

$$M=kPY \quad \ldots\ldots 2$$

where, M is money supply, k is the fraction of the national income, P is the price and Y is the total national income (Snowdon and Vane 2005, 50-52). Classicals assume that there is always a full employment of resources and thus Y and k remain constant so that an increase in money supply will not have any effect on economic growth but directly increases P which is the general price level (Cottrell 1997: 1-4).

To the income version the quantity theory of money is given as;

$$MV=PY \quad \ldots\ldots 3$$

Where;

V is the velocity of money in the economy. V is the reciprocal of k and it remains constant as Y.

Again, in the Fishersô equation of the QTM an increase in money supply leads to an increase in the amount of money at hand among producers and consumers having no effect on the level of output. The rise in the level of money at the hand of agents increases the demand for goods and services produced at full employment. This rise in demand leads to a rise in inflation (Dimand 2005: 3-5). Though the relationship between inflation and economic growth is not stated clearly in the classical economic thinking as indicated by many Classical economists, it is implicitly stated that there is a negative relationship between the two variables.

2.3.3 The Keynesian Theory

The empirical finding, on the relationship between wage inflation and unemployment, by Bill Phillips in 1958 asserts that there is a long-run negative relationship between the two variables. This finding was quickly adopted by Keynesian economists because it has filled the gap in explaining inflation that was missed in the Keynesian IS ï LM model. Most Keynesian economists interpreted the Phillips curve as a sustainable negative long-run relationship between inflation and unemployment providing policy choice for authorities between inflation and growth. In other words, according to Keynesians, to lower unemployment and improve economic growth there must be a permanent increase in the level of inflation (Snowdon and Vane 2005: 135 ï 38).

In the study of Phillips, wage inflation was explained as a function of unemployment only. For Keynesians it is difficult to include inflation expectation in their model of wage inflation since expectations are exogenously determined (Snowdon and Vane 2005: 136 ï 38). Richard Lipsey was the first Keynesian economist to provide a theoretical foundation for the Phillips curve. According to his analysis wage is positively related to the demand for labour and the demand for labour is negatively related to unemployment where both relationships are nonlinear (Snowdon and Vane 2005: 136 -7).

2.3.4 The Monetarist Theory

Based on the Quantity Theory of Money (QTM), the Monetarists view argues that monetary changes are seen as a cause rather than consequences of major economic recessions and booms. Regarding the relationship between inflation and economic

growth, monetarists interpreted the Phillips curve differently from how it was interpreted by Keynesians. Milton Friedman, known as the father of the Monetarist school, argues that wage inflation should not only be explained by unemployment, but it is also explained by inflation expectations (Leeson 1994: 158 -61). For monetarists, there is a positive relationship between inflation and economic growth in the short-run but in the long run an expansionary monetary policy (effective policy measure for Monetarists) will have no real impact except the general price increase (Friedman 1968: 7-11).

This is explained well in figure 2.1, where initially the economy is at point A in which unemployment is at its natural rate and wage rate is zero. If policy makers want to reduce unemployment below the natural rate (Un), say to U_1 using expansionary monetary policy, then wage rises to W_1. Assuming that the policy measure is not anticipated, this increase in wage will be perceived by workers as an increase in their real wages. In this case, the economy will be a point B where unemployment is reduced, and money wage has risen while real wage is declining. After adjusting their expectations, workers start to seek for additional money wages to compensate the decline in their real wages.

Since firms cannot pay the high wage rate that workers seek, unemployment returns back to its natural rate and the economy settles at point C. Hence, in the long-run unemployment is at its natural rate but wage is inflated to W_1 (Friedman 1976: 270 - 74). After expectations are adjusted the short-run Phillips curve shifts from SRPC1 to SRPC2. If inflation is expected to be higher, the short-run Phillips Curve is also expected to shift to the right. If higher inflation is anticipated, then there will be no

short-run effect for expansionary monetary policy. However, if the policy measure is not anticipated then there will be a short-run effect (Friedman 1976: 270 - 74).

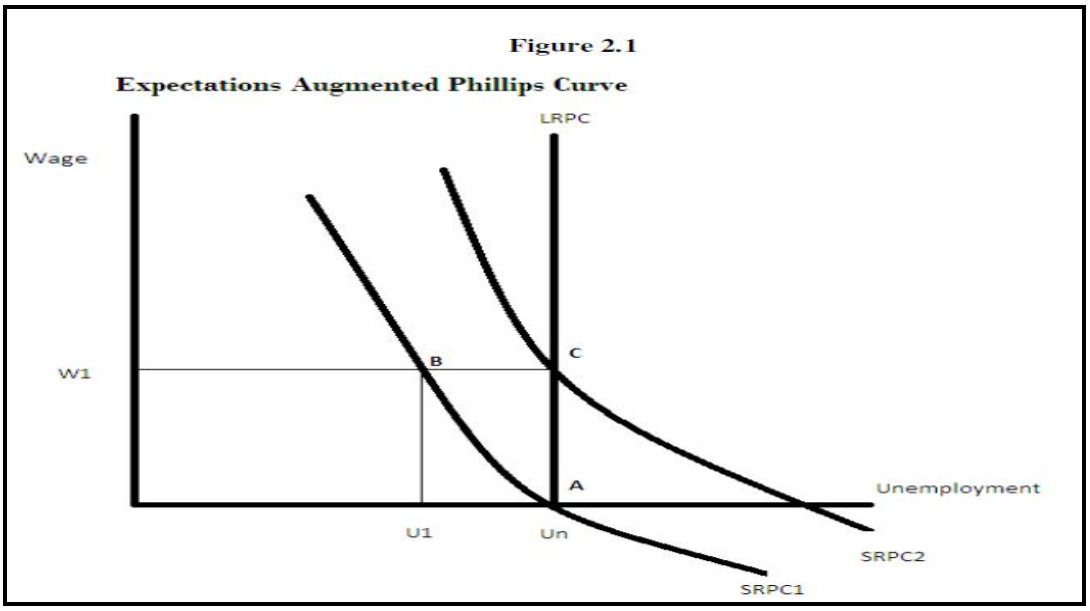

Figure 2.1: Expectation Augmented Phillips Curve
Source: Friedman 1976:272 and Snowdon and Vane 2005:177

2.4 Empirical Literature Review

There are numerous global and local studies done on the relationship between inflation and economic growth. Some of them are on a cross-countries basis and others are on a specific country basis. In this part of the literature review studies on relationships between the two variables will be explored for both developed and developing countries.

2.4.1 Global Empirical Findings on Inflation and Growth

In USA, Dotsey and Sarte (2000) studied the effects of inflation variability on economic growth for the US economy. They used the neo-classical endogenous growth model with money included as an explanatory variable. The finding of the authors shows that higher average inflation has a negative impact on the steady state

growth. This is because of the higher cost of transaction that inflation causes to the money market. On the other hand, the authors argue that inflation has a positive impact on growth in the short-run through precautionary savings. During inflation volatility, precautionary savings rise and that is positively related to growth and negatively related to welfare. In the overall finding, the negative effect of inflation outweighs the positive impact of inflation, thereby supporting the view that higher inflation has a negative impact on growth.

In UK, Ozdemir (2010) aimed to assess the dynamic linkages between inflation uncertainty, inflation and output growth for UK. The vector auto-regressive fractionally integrated moving average (VARFIMA) model is employed for quarterly data of GDP and CPI from 1957 Q2 ï 2006 Q4. The author has selected this method since it enables one to see the causal effect between inflation and growth. To get robust results the author has split the sample data into three sub-periods: from 1957Q2 ï 1973Q2, 1973Q3 ï 1988Q1 and 1988Q2 ï 2006Q4. He also analyzed the full period to compare the results.

For all types of samples, Toda ï Yamamato (1995) non-causality test is used to determine the direction of the causality between the two variables. The result of the study for the full period indicates that inflation uncertainty has a positive impact on the rate of inflation and economic growth. However, for the study of the sub periods, it is found that there exists no relationship between inflation and output growth. Thus, according to this study, inflation uncertainty is one of the important determinants of growth. This finding is like the study undertaken for the US economy by Dotsey and Sarte (2000).

Table 2.1: Summary of Global Empirical Findings on impact of Inflation on Economic Growth

SN	Author/S & Year	Country	Study Title	Data	Methodology	Findings
1	Barro (1995)	100 Countries	Relationship between inflation and growth	Panel data from 100 countries period 1960-1990	Neo classical growth model, inflation as one of explanatory variables.	Inflation has a statistically significant negative impact on growth and investment.
2	Bruno and Easterly (1996)	26 Countries	Effects of inflation on long-term growth	Panel data from 1961 -1992	Runs tests, T ï statistics	A higher level of inflation harms the growth and lower inflation has less cost on the economy
3	Erbaykal and Okuyan (2008)	Turkey	Relationship between inflation and economic growth in Turkey	Quarterly time series data from 1987Q1-2006Q2	Co-integration WALD test	Negative and statistically significant short-term relationship
4	Xiaojing (2008)	China	Trade-off between inflation and economic growth in China	Annual time series data from 1978 ï 2007	Phillips curve equation	Growth can be affected differently at different steady state levels.
5	Mallik and Chowdhury (2001)	Bangladesh, India, Pakistan and Sri Lanka.	Examines the relationship between inflation and economic growth in four South Asian countries	Annual time series from 1960-1989	Johansen and Juselius (1990) Engle and Granger (1987) Error Correction Model (ECM).	Two variables are co-integrated showing a positive long-run relationship.
6	Bittencourt (2010)	Bolivia, Peru, Argentina and Brazil	Examined how higher inflation affected the growth of four Latin American countries	Annual panel time series from 1970 ï 2007	Augmented Dickeyï Fuller (ADF) Statistical tests	Inflation was found to have harmful effects on the growth of these countries.

Source: Surveyed Literature.

2.4.2 Africa Empirical Findings on Inflation and Growth

In South Africa, Hodge (2005) aimed to check the findings of the numerous empirical findings that inflation has negative long-run impact on the economic growth in South Africa. The study also examines the level of growth sacrificed in the short-run to achieve lower inflation. To attain the results of the study annual time series data for the period of 1950 ï 2002 is used. A growth equation is used with explanatory variables of CPI, labour productivity, investment, tax on income and wealth, and terms of trade to see the long-run relationship between the two variables. OLS regression results have shown that there exists a strong and statistically significant negative long-run relationship between inflation and economic growth in South Africa. To see the short-run relationship between the two variables, an inflation equation explained by lagged inflation, lagged GDP growth rate, lagged change in labour cost and change in import prices is used.

Gokal and Hanif (2004) have analysed the relationship between inflation and economic growth in Fiji. Their study focuses mainly on whether there is any meaningful and causal relationship between the two variables in the country. To achieve their objectives, they used annual observation of 34 years (1970 ï 2003) for variables of Real GDP, annual average CPI, and year on year CPI inflation rate. To test the causal relationship Granger causality test is applied but before that the authors have examined the time series properties of the data using Augmented Dickey Fuller (ADF) and Phillips Perron (PP) tests and the variables are found to be integrated of order I (1). The findings of the analysis reveal that both inflation measures have negative weak relationship with the GDP growth. The finding of the

Granger causality test indicates that causality runs one way from economic growth to inflation. The authors conclude that inflation in Fiji is highly influenced by international factors and there is a weak and negative relationship between inflation and economic growth.

Table 2.2: Summary of Africa Empirical Findings on impact of Inflation on Economic Growth

S/N	Author/S & Year	Country	Study Title	Data	Methodology	Findings
1	Chimobi (2010).	Nigeria	Inflation and Economic Growth in Nigeria.	Time series data for the period 1970 - 2005	Johansen and Juselius (1990) Engle and Granger	There is a unidirectional causality that goes from inflation to economic growth.
2	Frimpong and Oteng-Abayie, (2010)	Ghana	When is Inflation Harmful? Estimating the threshold Effect.	Time series data for the period 1960 - 2008	Ordinary Least Squares regression (OLS)	Inflation threshold level of 11% at starts to hurt economic growth significantly.

Source: Surveyed Literature.

The finding shows that there must be accelerating inflation to achieve growth in the short-run. Hence, inflation targeting must be ignored to achieve short-term growth. But in the long-run the two variables have a negative relationship and thus an increase in inflation to achieve short-term growth will have higher cost in the long-run. In Nigeria, Fielding (2008) studied inflation volatility and economic development, the study aims to address: the determinants of inflation volatility, whether economic development brings inflation volatility and what government can do to reduce this volatility further. Fielding used monthly price data of 96 specific items in the 37 states of the country for the period 2001 ï 2006 obtained from

Nigeria Bureau of Statistics.

2.4.3 Tanzania Empirical Findings on Inflation and Growth

In Tanzania, Mubarik (2005) found that low and stable inflation promotes economic growth and vice versa. Also, the study carried by Shitundu and Luvanda (2000) on the effect of inflation on economic growth in Tanzania concluded that inflation has been harmful to economic growth in Tanzania, but they use data of different regimes. They mix the data of the pure communist regime where there was no private investment in the economy with the current market-oriented economy. An outcome with such mix of data may lead to wrong conclusion and hence wrong policy implication. This problem was dealt in this study by just focusing on the period after the post socialist regime.

2.4.4 Inflation trend against Economic Shocks in Tanzania

Starting in the mid1980s the government began to put in place market-based policies to address the falling living standards resulting from inefficient economic policies provoked by severe external shocks. In 1986, the government launched an Economic Recovery Programme (ERP) to promote a market-based open economy. The ERP focused on macroeconomic stabilization and liberalization, especially the import and agricultural sectors. During the early 1990s, the reform efforts have been aimed at improving fiscal performance, restructuring the civil service and the privatization of state enterprises.

As the effects of inflation became more and more serious, the government designed policy packages like the National Economic Survival Programme (NESP I and

NESP II); the Structural Adjustment Programme (SAP); and the Economic Recovery Programme (ERP I and ERP II) to address the problem. This followed recognition of the perverse impact of the phenomenon on output and productivity, purchasing power of wages, balance of payments, real interest rates and government fiscal operations. As pointed out earlier, all these adverse effects have contributed considerably to the worsening economic crisis in Tanzania.

It should however be pointed out that although the rate of headline inflation has been on the decline as depicted it is not within the target levels set by the government. For example, the government had targeted a headline inflation rate of about 10% by the end of June 1998 in her budget statement. The target which was not achieved. All these scenarios give this research a cutting edge to uncover the impact of inflation so far in the economy from early liberation era to the recent years of blooming private sector.

2.4.5 Empirical Findings Conclusion

The findings of the global literature on the relationship between inflation and growth are conflicting as seen in the empirical literature review. Barro (1995), Ahmed and Mortaza (2005) and Hodge (2005) have found a negative relationship between inflation and growth. On the other hand, Bruno and Easterly (1996) and Boyd and Champ (2006) have indicated that higher inflation leads to lower economic growth, but lower inflation promotes economic growth. The other group of economists such as Dotsey and Sarte (2000), Ozdemir (2010) and Mallik and Chowdhury (2001) argue that there exists a positive relationship between inflation and growth. On the other hand, economists such as Malla (1997), found out that there is no relationship

between inflation and growth. Different studies have different findings in the relationship between inflation and growth. However, most of the economists agree that there is a non-linear relationship between the two macro-economic variables, i.e., lower inflation promotes growth while higher inflation discourages growth.

2.3.5 Research Gap

Following the discussion on the literature review session, the subject is not exhaustively studied with formal modelling and appropriate econometric procedure. The conceptual gap exists on behavior of inflation on economic growth since the topic is yet still not well known and documented. Therefore, this necessitate the need to undertake research on the impact of inflation) on economic growth in effort of filling this research gap by adding new knowledge.

2.3.6 Conceptual Framework

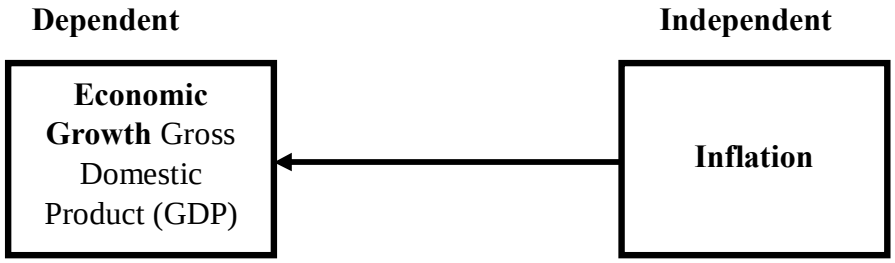

Figure 2.2: The conceptual Framework

Source: Developed by Researcher from the Literature review

2.3.7 Description of Conceptual Framework

Figure 2.2, shows that Inflation (independent variable) influence Economic Growth (GDP), (dependent variables), Founded on prior knowledge from economic theories, which means that by analyzing inflation trend someone can forecast its effect on

Economic Growth. Based on this relationship between inflation and Economic Growth, the first hypothesis of this study was created to determine if Inflation is significant to economic growth in Tanzania. Using the statistical and unit root tests of Ljung Box test, Argumented Dickey Fuller and Phillips Perron, various tests will be employed to determine the empirical evidence of impact of inflation on economic growth.

However, as mentioned in the literature review there is still wide disagreement in the direction of the coefficient for real GDP which shows its relationship with the independent variable inflation. For example, the study of Barro (1995) and Hodge (2005) shows the existence of negative relationship between inflation and growth while the study of Dotsey and Sarte (2000) and Ozdemir (2010) exhibits the positive relationship between the two variables. This study was guided by The Classical Theory of John Maynard Keynes the general theory of Employment, Interest and Money.

CHAPTER THREE

METHODOLOGY AND ECONOMETRIC MODELLING

3.1 Chapter Overview

This chapter focuses on developing methods of analysis that addresses the objectives of the study. Accordingly, econometric model was used. The model is the one utilized to examine the influence inflation on economic growth. This chapter has four main sections. The first section focuses on model specification and data characteristics. The second section discusses time series issues that are related to unit root problems. The third section deals with statistical and unit root tests of both Ljung Box test, Argumented Dickey Fuller and Phillips Perron approaches. The last section explains how the Ordinary Least Square regression (OLS) technique is employed to find out the maximum level of inflation that the economy can hold without being affected negatively. Each section was discussed in detail and different sub-sections are assigned when necessary.

3.2 Model Specification and Data Characteristics

As mentioned above, econometric model for inflation is developed to address the objectives of the study. The inflation equation is used to see the relationship between the two macro-economic variables under study. In the following sub-sections, the model is discussed.

3.2.1 The Inflation Equation

Tanzania had a stable and low inflation in its history compared to other developing countries, but since the year 2006 to 2015 the annual average rate of inflation was estimated to be 9.54% (http://www.gdpinflation.com/2013/10/inflation-rate-in-

tanzania-from-2000-to.html). There are several factors for the current flying rate of inflation in the country. Based on theoretical grounds, some of the most reasonable factors behind the increasing inflation can be specified in the inflation equation as:

$GDP_t = f(INFL_t)$ é é é é é é é é é é é é é é é é é 4

Where,

$INFL_t$ = Inflation at time t

3.2.2 Justification of the Variables

The discussion paper of Nobel memorial lecture by Friedman (1976) indicates that inflation expectation is one of the most important factors of price stability. The independent variable that explains economic growth in the model is derived from international literature. GDP is included in the inflation model mainly because in an economy where there exists supply scarcity, an increase in production leads to reduced prices. However, in an economy producing above its full employment level, an increase in productivity may lead to inflationary pressure as well. Hence, productivity may lead to lower prices or it may lead to higher prices. To see the effect of changes of inflation on Tanzania, GDP is included as dependent variable in the study model.

The inflation expectations of economic agents are highly dependent on the past records of inflation so that it is included as explanatory variable of the current growth in the model.

$ln\ GDP_t = \alpha_0 ln\ INFL_t + \mu_t$ …… 5

where, log stands for natural logarithm

Ŭ6s - coefficients of the explanatory variables

μ_t. ï residual term

Transforming variables to their natural logarithm form has two basic advantages. First, in the non-logarithmic linear equation, slope coefficients (Ŭ̂s in this case) measure only the rate of change of the mean of the dependent variable (INFL in this case). However, a transformation of variables to their natural log enables slope coefficients (Ŭ̂s) to measure not only the change of mean but also the elasticity of the dependent variable with respect to the percentage change in the independent variable. Second, the log transformation reduces the problem of heteroscedasticity since it compresses the scale in which variables are measured. Though the problem of heteroscedasticity mostly arises in cross-sectional studies, it can also occur in time series analysis such as ours (Gujarati 2003: 420 ï 22).

3.2.3 The Types and Sources of Data

The study used secondary data obtained from World Bank data source. Data for these variables Gross Domestic Product (GDP) (Constant 2010 US$) and Consumer Price Index (2010 =100) were provided in yearly basis for the period 1995-2017.

3.2.4 The Sample Period

The sample period for this study covers the period from 1995 to 2017. The year 1995 is selected because it marks the beginning of the mixed market with expansion fiscal policies and privatization-oriented economy in the country after long period of the socialism and mixed economy regime. During the socialist period there was very little development of private sector in the economy, but the State dictates monetary policy with static and fixed exchange rate regime.

3.2.5 Research Methods

In finding the empirical evidence for impact of inflation on economic growth, different methods were used. These include; the descriptive statistics, the test of goodness ï of fit and the statistical tests of inflation as well as the statistical tests for economic growth.

3.2.6 Descriptive Statistics

The descriptive statistics for the yearly data series for the Inflation (INFL) was determined and presented since one of the basic assumptions of random walk model is that the distribution of Inflation should be normal. The descriptive statistics helps in revealing the nature of the distribution of the Inflation employed in the study.

3.2.7 Test of goodness – Of-Fit: The Kolmogorov-Smirnov (K-S test)

In order to confirm whether the variables employed in this study followed the normal distribution or not, the Kolmogorov-Smirnov test was employed. The null hypothesis of normality distribution of Price is rejected at the chosen level of significant (Ŭ) in favour of alternative hypothesis, if the Kolmogorov-Smirnov test statistic (D) is greater than the critical value obtained.

3.2.8 Statistical tests for Testing Inflation

In determining the empirical evidence for inflation hypothesis, various statistical tests were used namely: Serial correlation test- the Breusch Godfrey Test, non-parametric runs test and two types of the Unit root tests- the Argumented Dickey fuller test and The Phillips-Perron Test (PP) was also used. Lastly the variance ratio test was used to confirm the results obtained from other statistical tests.

3.2.9 Serial correlation test- Ljung Box Test

In testing our first null hypothesis of this study: the impact of inflation on economic growth in Tanzania, the serial correlation test was be used. This is parametric test which determines the serial correlation (p_k)/autocorrelation between current price (p_t) and previous price (p_{t-k}) of the same series. If the autocorrelation in price is found (positive or negative) it can be concluded that the price does not behave in random fashion and hence inflation affect economic growth in Tanzania. Serial correlation test determines whether the correlation coefficients are significantly different from zero by measuring the correlation coefficient between a price and lagged price in the same series. The serial correlation coefficient for lag K is can be expressed by following model.

$$\text{J}\ (K) = \frac{\text{Covariance}\ (\mu t, \mu t-1)}{\sigma(\mu t),(\mu t-1)} = \frac{\text{Covariance}\ (\mu t, \mu t-1)}{Variance(\mu t)} \text{é é é é é é é .6}$$

Similarly written as

$$\rho_{(K)} = \frac{Cov\ (p_t,\ p_{t-K})}{\sqrt{Var(p_t)}\sqrt{Var(p_{t-1})}} = \frac{E[(p_{t-\mu})(p_{t-k}-\mu)]}{E[(p_t-\mu)^2]} \quad \text{é é é é é é é é} \quad 7$$

Where:

$\tilde{E}_{(k)}$ = Serial correlation coefficient of time series r_t

$\tilde{E}_t$ = Consumer price index at time t

K = Lag of the period

$\tilde{E}_t$ - K = the price after K lags

Var ($\tilde{E}_t$), Var ($\tilde{E}_t$ - K) = Variance on price over time period (t, t-K)

Cov ($\tilde{E}_t$, $\tilde{E}_t$ -K) = the covariance between two prices

The serial correlation can be estimated using sample autocorrelation coefficient at lag K given as follows:

$$Ɉ_{(k)} = \frac{\sum_{t-1}^{N-K}(p_t - \bar{p})(p_{t-k} - \bar{p})}{\sum_{t-1}^{N}(p_t - \bar{p})^2} \quad \text{é é é é é é é é é é é é é é é é} \quad 8$$

Where:

$Ɉ_{(k)}$ = Autocorrelation coefficient of lag K

N = Number of observations

K = The time Lag

$\hat{E}_t$ = Consumer price index at time t

$\bar{r}$ = Sample Mean of prices

$\hat{E}_t$ - K = price after K lags

If autocorrelation coefficients $Ɉ_{(k)}$ are statistically different from zero, it implies that the prices are serially correlated and hence hypothesis of random walk can be rejected. To test the significance of serial correlations of price series in this study the Breusch Godfrey test was used.

The test statistic for the Ljung Box test statistic is given by:

$$Q_{LB} = n(n+2)\sum_{k=1}^{m}\frac{\rho^2 k}{n-k} \quad \text{é ..} \quad 9$$

Where by:

Q_{LB} = Test Statistic

n = Sample size or number of observations

p_k = Is the k^{th} autocorrelation for lag K or sample autocorrelation at lag K

m = Number of lags being tested.

Using this test statistic, the following null and alternative hypothesis tested are:

H_0 = All autocorrelation up to ρ_k are zero

H_1 = At least one autocorrelation up to ρ_k is not zero.

Given the value of Q_{LB} obtained, the null hypothesis of all autocorrelation up to ρ_k are zero will be rejected if Q_{LB} statistic exceeds critical Q value (x with m degrees of freedom) from Chi-square table (Gujarat 2004). Alternatively, the P-value can be used to test the hypothesis. The null hypothesis of all zero autocorrelation can be rejected if the P-value obtained from statistical test is less than chosen level of significance.

3.3 Unit Root Tests

Unit root tests are among of widely statistical tests used to examine the randomness of the price series. Basically, the test was done to investigate the presence of unit root i.e. non-stationary of the price series. The presence of unit root is enough condition for the random walk, also it is a necessary condition for the random behavior of the series. That is the rationale for many researchers to employ unit root tests in testing the inflation. The series containing unit root is said to be non-stationary i.e. behaving in random fashion which support the inflation hypothesis.

Although there are various types of unit root tests, only two types of unit root tests namely: The Augmented Dickey-Fuller (ADF) and The Phillips-Perron Test (PP) will be employed in this study to investigate the randomness behavior of the price series. Both Augmented Dickey-Fuller (ADF) test and the Phillips-Perron Test (PP) use the following null and alternative hypotheses; and these are the hypotheses that

purse in employing unit root tests.

H_0 = the series does contain a unit root (Non-Stationary)

H_1 = the series does not contain a unit root (Stationary).

3.3.1 The Augmented Dickey-Fuller Test

The presence of unit root test in a series can be tested by ADF test using three differential-form autoregressive equations

$$æY_t = \gamma y_{t-1} + \sum_{i=1}^{p} \beta_i æ ɔy_{t-1} + \mu_t \quad é\ é\ é\ é\ é\ é\ é\ é\ é\ é\ é\ é \quad 13$$

$$æY_t = Ŭ_0 + ɔy_{t-1} + \sum_{i=1}^{p} \beta_i æ \gamma y_{t-1} + \mu\ é\ é\ é\ é\ é\ é\ é\ é\ é\ é\ é\ é \quad 14$$

$$æY_t = Ŭ_0 + ɔy_{t-1} + Ŭ_1 t + \sum_{i=1}^{p} \beta_i æ \gamma y_{t-1} + \mu_t\ é\ é\ é\ é\ é\ é\ é\ é\ é\ é\ .. 15$$

Where:

æ = represent first differences

Y_t = the log of price index

$Ŭ_0$ = the constant

$Ŭ_1$ = estimated coefficient for the trend

t = trend term

p = number of lagged terms

ɔ and ɓi = coefficients to be estimated

μ_t = Error term

The presence of deterministic elements $Ŭ_0$ (a drift term) and $Ŭ_1 t$ (a linear time trend) is what differentiate the three regressions. The first equation (13) concerns with testing a pure random walk model without constant and time trend. The second equation (equation 14) concerns with testing a random walk with drift and the third

equation (equation 15) regards to the testing of random walk with drift and deterministic trend. The following null and alternative hypotheses are corresponding to these models:

Model 1:

H_0: Y_t is random walk or $\gamma = 0$

H_1: Y_t is a stationary process or $\gamma < 0$

Model 2:

H_0: Y_t is random walk around a drift or ($\gamma = 0$, $\alpha_0 \neq 0$)

H_1: Y_t is a level stationary process or ($\gamma < 0$, $\alpha_0 \neq 0$)

Model 3:

H_0: Y_t is random walk around a trend or ($\gamma = 0$, $\alpha_1 \neq 0$)

H_1: Y_t is a trend stationary process or ($\gamma < 0$, $\alpha_1 \neq 0$)

After performing the ADF test, if the computed absolute value of the tau statistic ($|\tau|$) exceeds the DF or MacKinnon critical tau values, the hypothesis that $\gamma = 0$ is rejected in which case the time series is stationary. If computed absolute value of the tau statistic ($|\tau|$) does not exceeds the critical tau value, the null hypothesis is not rejected, in which case time series is non-stationary. Gujarat (2004 pg. 816). MacKinnon (1991 cited in Asteriou and Hall 2007p .296) computed the critical values for ADF test.

3.3.2 The Phillips-Perron Test

This is another test for unit root which was used in this study. According to Gujarat (2004 pg. 818) óThe ADF test adjust the DF test to take care of possible serial

correlation in error terms by adding the lagged difference terms of the regress and Phillips and Perron use non parametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference termsô, Asteriou and Hall (2007) asserted that ñThe PP statistics are just modifications of the ADF t statistics that take into account the less restrictive nature of the error processò. Therefore, in performing this test the same regression equations will be used, and the same critical values were used to compare with the computed test statistic values obtained. Like ADF test, the null hypothesis tested by PP test is the non-stationary of the series i.e. the presence of unit root.

3.3.3 Statistical Tests for testing Inflation and GDP

In determining the empirical evidence for inflation effect and GDP effect in Tanzania, two models were employed, the Ordinary least square (OLS) and Generalized Autoregressive Conditional Heteroscedastic (GARCH 1,1) model. These models are among of the widely used approaches in inflation effects studies.

3.3.4 Inflation effect Using GARCH Model

The second problem of heteroscedasticity can be addressed by allowing variance of errors to be time dependent to include a conditional heteroskedasticity that capture time variation of variance in Price. In this study the simplest form of autoregressive conditional heteroscedastic model GARCH (1, 1) employed with the following specification;

Mean Equation:

$$lnCPI_t = \beta_0 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \sum_{i=1}^{n} \beta_i lnCPI_{i-1} + \varepsilon_i \quad \text{é é é é é é é é ..22}$$

Variance Equation:

$h^2 = w + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}^2$

Where:

h^2 = conditional variance

W = constant

α and β = lagged squared error term and conditional variance respectively

3.3.5 Applying OLS regression and GARCH (1,1) Model (Assumptions)

Applying the regression model for statistical analysis requires non-violation of its assumptions. Wooldridge (2009 pg. 370) described the following classical linear Model assumptions for the time series regression.

Assumption 1: Linear in Parameters

The classical linear regression time series model assumes that õThe stochastic process follows the linear model (i.e. Linear in parameters).

i.e, $Y_t = \beta_0 + \beta_1 X_t +$ é é ..+ $\beta_k X_{tk} +$ U_té é é é é é é é é é é é é é é é é 23

This implies that the model must have linear coefficients. This assumption is not violated in this study as the regression equations 19 and 20 employed in this study shows that the parameters (i.e. coefficients) are linear which means the model is linear in parameters.

Assumption 2: No perfect Collinearity

This assumption requires that in a time series process the independent variable not to be constant- there must be at least some variation in the sample used. Also, there

should not be perfect linear combination between independent variables. Hence it can be concluded that this assumption it is also not violated since dropping the dummy variables have helped to solve perfect collinearity problem.

Assumption 3: Zero Conditional Mean

This assumption state that for each time t, the mean (expected value) of error term (u_t) (given any value of independent x for all time, periods must be equal to zero.

Mathematically it can be presented as:

$$E(U_t|X) = 0, t = 1, 2 é \ é \ n$$

The assumption implies that the error at time t(u_t) is not correlated with each explanatory variable in every time period. Wooldridge (2009). In relation to this study this assumption is also not violated.

Assumption 4: Homoscedasticity

According to this assumption, given conditional on x, the variance of error term (..) for all time t is constant.

Mathematically: Var (u_t | x) = Var (u_t) = σ^2

If this assumption does not hold, then the error terms are said to be heteroskedasticity. Therefore, it is very important to conduct post diagnostic test to determine if the model suffers from heteroskedasticity. In this study after running the regression model, residuals were analyzed to check the presence of heteroskedasticity using the Breusch-Pagan Godfrey test. The following null and alternative hypothesis were tested by Breusch-Pagan-Godfrey test.

H_0 : No heteroscedasticity in the residuals

H_1: There is heteroscedasticity in the residuals

Assumption 5: No Serial Correlation

The assumption states that given the conditional on X, the errors terms in two different time periods are uncorrelated with one another.

Mathematically: Corr (u_t, u_s) = 0 for all t $\neq$ s

There are several statistical tests which can be used to determine if the error terms are correlated. However, in this study the Ljung Box test and Breusch-Godfrey serial correlation LM test was used. The null and alternative hypotheses to be tested by this test are:

H_0 : There is no serial correlation in residuals

H_1: There is serial correlation in the residuals

Assumption 6: Residuals are Normally distributed

According to this assumption, the error (u_t) are independent of X and are independently and identically distributed as normal (0, σ^2) Wooldridge (2009 p. 351). To determine the normality of the residuals, the study has employed the Jacque bera test. The following null and alternative hypotheses are tested by this test.

H_0 : Residual are normally distributed

H_1: Residuals are not normally distributed

3.3.6 Applying GARCH (1,1) Model

Like OLS regression model, applying the GARCH (1, 1) model also requires the following assumptions to met for the model to be the good model.

i. **No serial correlation in residual**- similar hypotheses and the same statistical test as in OLS regression applied to determine the presence of correlation in the residual.

ii. **Normality of the residual**- the same test as in OLS regression was conducted to determine the normality assumption in the residuals.

iii. **Absence of the arch effect**- The presence of arch effect in the residual was determined using Heteroskedasticity test. The following null and alternative hypotheses were tested;

H_0: No arch effect

H_1: There is arch effect

3.4 The rationale of Statistical Tests Choice

Four different statistical tests (Serial correlation test- The Ljung box test, runs test, unit root tests and variance ratio test) used to test the first null and alternative hypotheses of this study. In determining the empirical evidence for the impact of inflation on economic growth which is the second and third null and alternative hypotheses of the study, two techniques were used Ordinary Least Square regression analysis and the GARCH (1, 1) model. Different methods used to ensure that the consistent and reliable results are obtained.

The rationale of choosing these statistical tests, is since these techniques have been proven to produce consistent results and they are generally good and well accepted techniques. As it is indicated in empirical literature review section these econometric models were used extensively in many similar studies worldwide. Hence it was necessary to follow the examples from previous studies in the field by using the

similar methodology to ensure the validity and reliability of the empirical evidence obtained.

3.4.1 Validity

Validity has been defined as the extent to which the data collection methods/methods accurately measure what they were intended to measure. Also, validity implies that the extent to which research findings are really about what they profess to be about (Saunders et all 2008). To ensure the validity of data in this study, the study will collect the secondary data from World Bank source data bank.

3.4.2 Reliability

Saunders et all (2008 pg. 600) defined reliability as ñthe extent to which data collection techniques or technique will yield consistent findings, similar observations would be made, or conclusion reached by other researchersò. The study will address the issue of reliability by employing the most reliable statistical tests. The empirical literature reviews section has revealed that all the statistical tests to be employed in this study have been used previously by other researchers and produced consistent results. Therefore, it is believed that by employing the same econometric models as previous studies, the findings obtained will be reliable and consistent.

3.4.3 Data Analysis

As the study involves the testing of hypothesis through various statistical tests, therefore data are analyzed with the help of statistical package namely; STATA. Both quantitative and qualitative approach used in interpreting and presenting the analysis the results.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the results obtained from various statistical tests used in this study as well as discussing the findings obtained with the reference of other empirical evidences obtained from previous studies worldwide.

4.2 Descriptive Statistics, Kolmogorov Smirnov Test

According to Fama (1970) one of the assumptions of a random walk model is that the Inflation model is normally distributed. Therefore, it is very important to analyze the distribution of the variables used in the study as violation of normality assumption could be a signal for the violation of a random walk model. To study the distribution of the Inflation and Economic Growth (GDP) employed in this study, the descriptive statistics was used followed by the Kolmogorov Smirnov Test. The descriptive statistics of the annual INFL and GDP in Tanzania have been presented in Table 4.1.

Table 4.1: Descriptive Statistics Results - The Kolmogorov-Smirnov

Variables	logINFL	logGDP
Mean	1.884245	4.393866
Maximum	2.243132	4.699823
Minimum	1.455769	4.126176
Std.Dev	0.2299612	0.1824477
Skewness	0.0161821	0.1006723
Kurtosis	1.961154	1.730473
Variance	0.0528821	0.0332872
Observation	23	23

Source: Researcher Data, 2019

The results from the Table 4.1, shows that the Kurtosis of logINFL and logGDP is 1.961154 and 1.730473 respectively. The Kurtosis measures the sharpness or the flatness of the distribution series. The normal distribution series has a kurtosis of 3. It is clear from the finding that logINFL and logGDP are relative normal since their kurtosis is less than 3. The asymmetric distribution of the series from its mean as measured by skewness, shows that the Inflation and GDP are right tailed as their skewness are positive. A skewness of zero indicates that a series is normally distributed, however since the skewness of variables are different from zero (i.e. positive) it can be concluded that GDP and inflation are normally distributed.

4.3 The trend of Inflation and Economic Growth

This test is carried out to assess the trend of all variables. The graph below from Table 4.2 shows the Inflation (INFL) and economic growth GDP are having stable upward trend from 1995 to 2017 this also means data generating process does not evolve around zero and therefore while testing for unit root we should include constant and trend.

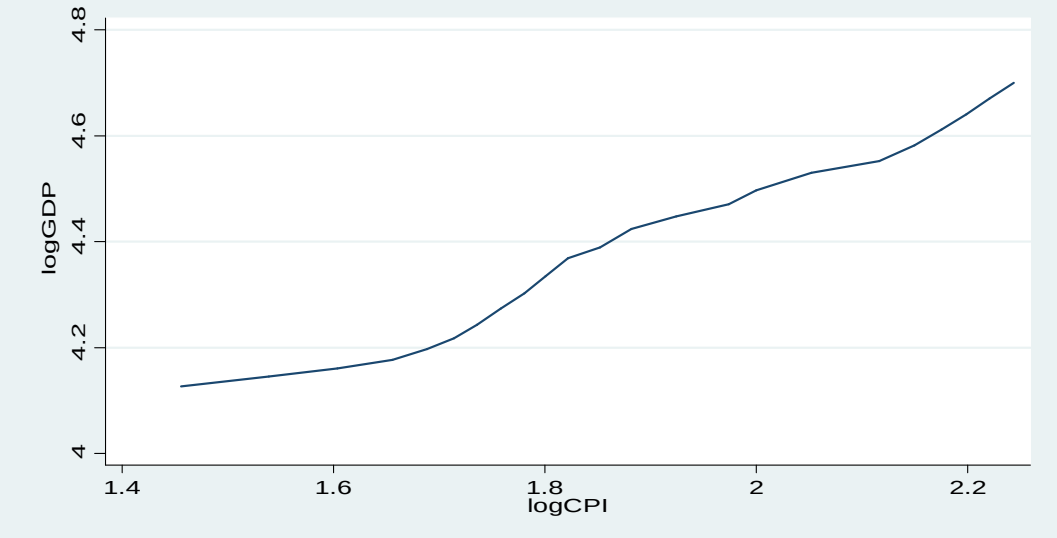

Figure 4.3: Line Graph for Inflation and Economic Growth

After checking the trend of the variables, we have to regresses the variables to check whether the series is stationary by employing Durbin Watson test. The study also intended to investigate the trend of inflation to economic growth in Tanzania from 1990s to 2017. The results show that, holding government expenditure, inflation and money supply constant the trend of inflation sought to have significant negative relationship in both short run and long run period, in which 1% rise in inflation trend leads to decrease in economic growth by 4.7% and 8.9% respectively. In general, the Tanzanian inflation levels have recorded to be volatile since 1990s. Reaching the high level of 26% in 1915, single digits were recorded in 1995 (3%), 2005 (4%) and in 2015 the annual inflation rate was 7%.

Furthermore, the overall period of 1990s was characterized by relatively high inflation rates. The rates accelerated to as high as 36% in 2004 and maintained levels above 25% throughout the period (World Data Bank 2012). It was noted that the high inflation rates of this period were mainly generated from both the output and monetary side. Therefore, from the beginning of the second half of 1990s, the government has been concentrating both on tight monetary policy and deliberate strategy to foster production as one of the strategies of combating high inflation in Tanzania (Solomoni and Wet 2004).

4.4 Durbin Watson Test Results

The results on Table 4.3 shows that R- square 0.9770 is greater than Durbin Watson t statistics therefore there is evidence that data series is not stationary data generation process does not evolve around zero. The regression is spurious therefore the outcome below cannot be used for hypothesis testing or hypothesis prediction hence

we have to employ unit root tests to make the series stationary.

Table 4.2: Regression and Durbin Watson Test Results

```
. reg  logGDP logINFL

      Source |       SS       df       MS              Number of obs =      23
-------------+------------------------------           F(  1,    21) =  893.62
       Model |  .715503743     1  .715503743           Prob > F      =  0.0000
    Residual |  .016814247    21  .000800678           R-squared     =  0.9770
-------------+------------------------------           Adj R-squared =  0.9759
       Total |  .732317991    22  .033287181           Root MSE      =   .0283

------------------------------------------------------------------------------
      logGDP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     logINFL |    .784224   .0262339    29.89   0.000     .7296675    .8387804
       _cons |   2.916196    .049782    58.58   0.000     2.812669    3.019724
------------------------------------------------------------------------------
```

4.5 Unit Root Test

Although there are several unit root tests, the study employed only two types of unit root tests: namely Augmented Dickey-Fuller test and Phillip Perron Test. The following are the results obtained from these statistical tests displayed on Table 4.3, Table 4.4, Table 4.5 and Table 4.6.

4.4.1 Augmented Dickey Fuller Test results on logGDP

Table 4.3: Augmented Dickey Fuller Test results on logGDP

```
Augmented Dickey-Fuller test for unit root         Number of obs   =        21

                                 ------------ Interpolated Dickey-Fuller ------------
                    Test         1% Critical       5% Critical     10% Critical
                 Statistic           Value             Value           Value
------------------------------------------------------------------------------
 Z(t)              1.681            -3.750            -3.000          -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9981
```

Source: Researcher (2018)

We have performed a stationarity test on logGDP and results on Table 4.4 shows that the test statistic of logGDP is lower than 5% critical value therefore we accept the null hypothesis which state that there is a presence of unit root. This means the variance of this model is not constant.

4.5.2 Augmented Dickey Fuller Test Results on logINFL:

We have performed a stationarity test on logINFL and results on Table 4.5 shows that the test statistic of logINFL is lower than 5% critical value therefore we accept the null hypothesis which state that there is a presence of unit root. This means the variance of this model is not constant.

Table 4.4: Augmented Dickey Fuller Test results on logINFL

```
. dfuller logINFL, lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        21

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -0.013            -3.750            -3.000           -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9575
```

Source: Researcher (2018)

4.5.3 Augmented Dickey Fuller Test results on ddlogGDP

The null hypothesis of the test says there is the presence of unit root however the results on Table 4.6 shows that the absolute value of t- Statistic for intercept and trend are greater than the absolute value of critical value at 5% level of significance respectively, hence the null hypothesis of presence of unit root in a second difference of logGDP is rejected at 5% level of significance and we accept the alternative

hypothesis of no presence of unit root at 5% level of significance.

Table 4.5: Augmented Dickey Fuller Test results on ddlogGDP:

```
. dfuller ddlogDGP, lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        21

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -5.952           -3.750            -3.000           -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000
```

Source: Researcher (2018)

4.5.4 Augmented Dickey Fuller Test results on ddlogINFL:

Table 4.6: Augmented Dickey Fuller Test Results on ddlogINFL

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

Augmented Dickey-Fuller test for unit root         Number of obs   =        21

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -6.336           -4.380            -3.600           -3.240
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000
```

Source: Researcher (2018)

The null hypothesis of the test says there is the presence of unit root however the results on Table 4.6 shows that the absolute value of t- Statistic for intercept and trend are greater than the absolute value of critical value at 5% level of significance respectively, hence the null hypothesis of presence of unit root in a second difference of logINFL is rejected at 5% level of significance and we accept the alternative hypothesis of no presence of unit root at 5% level of significance.

These results mean that the variables do not have unit root (i.e. the series is stationary) and therefore does not behave in random fashion. Although the presence of unit root is not sufficient condition for the random walk, however, it is necessary condition, which implies that the series cannot behave randomly if it does not have unit root. By using the second difference all variables are stationary. Based on these results the first null hypothesis of this study about the data series is not stationary is rejected therefore it can be concluded that inflation influence economic growth.

4.6 The Phillips-Perron Test

In order to confirm the stationarity of the variables, the study also employed this test. Like ADF test, the same null and alternative hypotheses were tested. The results for the PP test are shown in the Table 4.8, Table 4.9, Table 4.10 and Table 4.11.

4.6.1 The PP Test Results on logGDP

Table 4.7: The PP Test Results on logGDP

```
. pperron logGDP

Phillips-Perron test for unit root                Number of obs   =        22
                                                  Newey-West lags =         2

                                        ---------- Interpolated Dickey-Fuller ----------
                 Test                 1% Critical       5% Critical      10% Critical
               Statistic                 Value             Value            Value
------------------------------------------------------------------------------------
 Z(rho)          0.382                  -17.200           -12.500          -10.200
 Z(t)            2.319                   -3.750            -3.000           -2.630
------------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9990
```

Source: Researcher (2018)

The null hypothesis of the test says there is the presence of unit root also results from Table 4.7 shows that the z values are lower than 5% critical value for hence the null hypothesis tested by PP test is accepted at 5% level of significance therefore it is

concluded that the logGDP series is not stationary. Similar conclusion can be drawn using the P-values obtained.

4.6.2 The PP Test Results on dlogGDP

The null hypothesis of the test says there is the presence of unit root however results from Table 4.8 shows for intercept and trend equation, absolute values of test statistic are greater than Mackinnon critical value at all levels (i.e. 1%, 5% and 10%), hence the null hypothesis tested by PP test is rejected at 5% level of significance and we accept the alternative hypothesis of no presence of unit root at 5% level of significance therefore it is concluded that the first difference of logGDP series is stationary (i.e. does not behave randomly). Similar conclusion can be drawn using the P-values obtained.

Table 4.8: The PP Test Results on dlogGDP

```
. pperron DlogGDP, trend

Phillips-Perron test for unit root                Number of obs   =        22
                                                  Newey-West lags =         2

                                                  ---------- Interpolated Dickey-Fuller ----------
                 Test                 1% Critical         5% Critical         10% Critical
               Statistic                 Value               Value               Value
------------------------------------------------------------------------------------------
 Z(rho)         -20.467                  -22.500             -17.900             -15.600
 Z(t)            -5.079                   -4.380              -3.600              -3.240
------------------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0001
```

Source: Researcher (2018)

4.6.3 The PP Test Results on logINFL

The null hypothesis of the test says there is the presence of unit root also results from Table 4.9 shows that the z values are lower than 5% critical value for hence the null

hypothesis tested by PP test is accepted at 5% level of significance therefore it is concluded that the logINFL series is not stationary. Similar conclusion can be drawn using the P-values obtained.

Table 4.9: The PP Test Results on logINFL

```
. pperron  logINFL

Phillips-Perron test for unit root                  Number of obs   =        22
                                                    Newey-West lags =         2

                              ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(rho)           -0.740           -17.200           -12.500           -10.200
 Z(t)             -1.463            -3.750            -3.000            -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.5515
```

Source: Researcher (2018)

4.6.4 The PP Test Results on dlogINFL

Table 4.10: The PP Test Results on dlogINFL

```
. pperron  DlogINFL, trend

Phillips-Perron test for unit root                  Number of obs   =        22
                                                    Newey-West lags =         2

                              ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(rho)          -22.245           -22.500           -17.900           -15.600
 Z(t)             -4.136            -4.380            -3.600            -3.240
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0056
```

Source: Researcher (2018)

The results of PP test confirm the earlier results obtained by ADF test, both have the variables became stationary at first and second difference, therefore once again it is concluded that inflation influence economic growth and other variables. Therefore,

we conclude that VAR analysis can be performed with first differences of the logarithm for all variables.

4.7 Correlation Matrix

The correlation matrix is performed to detect the two-way relation inflation against other three variables GDP and other variables. The results from Table 4.12 shows that there is strong positive correlation (0.24) between Inflation (INFL) and economic growth (GDP). The positive correlation shows that variables inflation and Growth move in the same direction so when inflation increases so as growth increases.

Table 4.11: Correlation Matrix Results for ddlogINFL and ddlogGDP

```
. correlate ddlogDGP ddlogINFL
(obs=23)

             | ddlogDGP ddlogI~L
-------------+------------------
   ddlogDGP  |   1.0000
  ddlogINFL  |   0.2400   1.0000
```

Source: Researcher (2018)

4.8 Cointegration Test

Testing for cointegration is a necessary step to check if one is modeling empirically meaningful relationships. If variables have different trend processes, they cannot stay in fixed long-run relationship, implying that it is not possible to model the long-run relationship, and there is usually no valid base for inference based on standard

distributions (Lütkepohl, 2005). If there is no cointegration of the variables, the VAR model will result into spurious regression, in principal they can wander arbitrarily far away from each other (Engle and Granger, 1987). As a remedy we are required to use Vector Error Correction model so as to capture the long run relationship of the variables.

This study employs the Johansen cointegration test because it has a lot of desirable statistical properties and it has been found to be particularly useful in several comparative studies including Lütkepohl and Saikkonen (2001). The weakness of the test is that it relies on asymptotic properties and is therefore sensitive to specification errors in limited samples. However, this weakness has been suppressed by the new econometric techniques embedded in the statistical software (Stata) used in this study which is able to report small sample statistics.

The results from Table 4.12 shows since max statistics is 6.2441 is less that critical value 14.07 therefore, we cannot reject null hypothesis which was there is no cointegrated among variables therefore is no cointegrated equations. Hence, we accept the overall null hypothesis that there is no cointegrated equation in the model.

When the series is not Cointegration means the model does not exhibit a long run relationship, it also implies that series are not related and canôt be combined in a linear fashion meaning even if there are shocks in the short run which may affect movement in the individual series, they wouldnôt converge with time in a long run. Hence, we estimate the short run relationship using vector autoregressive VAR model.

Table 4.12: Results for Johansen Cointegration Test Results

```
. vecrank logGDP logINFL, trend (constant) max

                    Johansen tests for cointegration
Trend: constant                                      Number of obs =      21
Sample:  1997 - 2017                                       Lags =       2
------------------------------------------------------------------------------
                                                              5%
maximum                                          trace     critical
  rank     parms       LL       eigenvalue    statistic     value
    0        6     152.43011          .          11.5011*    15.41
    1        9     155.55214       0.25721        5.2571     3.76
    2       10     158.18068       0.22146
------------------------------------------------------------------------------
                                                              5%
maximum                                           max      critical
  rank     parms       LL       eigenvalue    statistic     value
    0        6     152.43011          .          6.2441     14.07
    1        9     155.55214       0.25721        5.2571     3.76
    2       10     158.18068       0.22146
------------------------------------------------------------------------------
```

Source: Researcher (2018)

4.9 Vector Autoregression Analysis

After cointegration test we know there is only short run relationship among variable since there was no cointegration equation on variables therefore VAR model is performed to determine the causality relationship on the economic model. We specify the VAR model to be tested:

$LogINFL_t$=ŭ+$\sum_{i=1}^{k} \beta_i \ logINFL_{t-i} + \sum_{j=1}^{k} \vartheta_j \ logGDP_{t-j}$ + μ_{1t} é é é é é é . (1)

4.9.1 Augmented Dickey Fuller test

Now that our model is set, we check whether variables are stationary or not, therefore we perform unit root test. We performed ADF test to level variables results shown:

Table 4.13: Augmented Dickey Fuller test results for logGDP and logINFL

```
. dfuller logINFL, lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        21

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -0.013           -3.750            -3.000           -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9575

. dfuller logGDP, lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        21

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)             1.681           -3.750            -3.000           -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9981
```

Source: Researcher (2018)

The above results We have performed a stationarity test on logINFL and logGDP and results on Table 4.13 shows that the test statistic of logINFL and logGDP are lower than their 5% critical values therefore we accept the null hypothesis which state that there is a presence of unit root. This means the variance of this model is not constant.

4.9.2 Augmented Dickey Fuller Test Results for DlogGDP and DlogINFL:

The results of DlogGDP on Table 4.14 show that the absolute value of t- Statistic for intercept and drift are greater than the absolute value of critical value at 5% level of significance respectively, hence the null hypothesis of presence of unit root in a first difference of logGDP is rejected.

Table 4.14: Augmented Dickey Fuller Test Results for DlogGDP

```
. dfuller DlogGDP, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        21

                                 ------------ Z(t) has t-distribution ------------
               Test              1% Critical       5% Critical      10% Critical
             Statistic              Value             Value             Value
--------------------------------------------------------------------------------
 Z(t)         -2.532               -2.552            -1.734            -1.330
--------------------------------------------------------------------------------
p-value for Z(t) = 0.0104
```

Source: Researcher (2018)

The results of DlogINFL on Table 4.15 show that the absolute value of t- Statistic for intercept and drift are greater than the absolute value of critical value at 5% level of significance respectively, hence the null hypothesis of presence of unit root in a first difference of logINFL is rejected at 5% level of significance.

Table 4.15: Augmented Dickey Fuller Test Results for DlogINFL

```
. dfuller DlogINFL, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        21

                                 ------------ Z(t) has t-distribution ------------
               Test              1% Critical       5% Critical      10% Critical
             Statistic              Value             Value             Value
--------------------------------------------------------------------------------
 Z(t)         -3.100               -2.552            -1.734            -1.330
--------------------------------------------------------------------------------
p-value for Z(t) = 0.0031
```

Source: Researcher (2018)

In conclusion results from table 4.16 shows at first difference all variables became stationary therefore we reject null hypothesis of presence of unit root and we accept the alternative hypothesis that there is no unit root problem at 5% significance level.

4.9.3 Lag order Selection Statistics

After making the series stationary we determine optimal lag length for the model simply because in estimating VAR we must use same number of lags for each variable so the results on Table 4.16, the number of lags in the first column and the parameters for optimal lags like Final Prediction Error (FPE), Akaike information criterion (AIC), Hannan Quinn Information Criteria (HQIC) and Schwartz Information Criteria (SBIC) are visible. STATA with this command computes four information criteria as well as a sequence of likelihood ratio (LR) tests, from the results we select that lag identified by the criterion which gives the lowest value hence HQIC the results suggest that we should use 2 lags to estimate the VAR analysis, since the asterisks are all align on second lag.

Table 4.26: Lag Order Selection Statistics Results

```
. varsoc logGDP logINFL, max (2)

  Selection-order criteria
  Sample:  1997 - 2017                        Number of obs      =        21
```

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	55.4381				.000021	-5.08934	-5.06775	-4.98986
1	148.831	186.79	4	0.000	4.3e-09	-13.6029	-13.5382	-13.3045
2	158.181	18.699*	4	0.001	2.6e-09*	-14.1124*	-14.0045*	-13.6151*

```
  Endogenous:  logGDP logINFL
   Exogenous:  _cons
```

Source: Researcher (2018)

4.9.4 Vector Autoregression Test

After knowing number of lags to use, we perform vector autoregression to determine causality on the variables. The results on Table 4.17 shows positive and negative

effects on inflation, (INFL) and economic growth GDP. Also, Table 4.17 shows the first lag of logINFL has negative impact on logGDP at 5% significance level on average ceteris paribus while second lag of logGDP have positive impact on logINFL at 10% significance level on average ceteris paribus. So, both lags of logINFL have causal effects on logGDP.

Table 4.17: Vector Autoregression Results

```
. var  logGDP logINFL, lag (1/2)

Vector autoregression

Sample:  1997 - 2017                            No. of obs      =         21
Log likelihood =  158.1807                      AIC             = -14.11245
FPE            =  2.60e-09                      HQIC            =  -14.0045
Det(Sigma_ml)  =  9.83e-10                      SBIC            = -13.61505

Equation            Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
logGDP                  5     .004486   0.9995   38214.09   0.0000
logINFL                 5      .00947   0.9983   12150.73   0.0000
------------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
logGDP       |
      logGDP |
         L1. |   .7235387   .2098988     3.45   0.001     .3121445    1.134933
         L2. |    .285267   .2274429     1.25   0.210    -.1605129    .7310468
             |
     logINFL |
         L1. |  -.2139856   .0845307    -2.53   0.011    -.3796626   -.0483086
         L2. |   .2196238   .0654889     3.35   0.001      .091268    .3479796
             |
       _cons |  -.0075333   .1234668    -0.06   0.951    -.2495237    .2344571
-------------+----------------------------------------------------------------
logINFL      |
      logGDP |
         L1. |   .7237937   .4430971     1.63   0.102    -.1446606    1.592248
         L2. |  -.5033793   .4801326    -1.05   0.294    -1.444422    .4376633
             |
     logINFL |
         L1. |   1.426121   .1784445     7.99   0.000     1.076376    1.775865
         L2. |   -.610469   .1382472    -4.42   0.000    -.8814284   -.3395095
             |
       _cons |  -.6218166   .2606387    -2.39   0.017    -1.132659   -.1109742
------------------------------------------------------------------------------
```

Source: Researcher (2018)

Another takeaway point is the results shows first lag of logGDP has positive impact on logINFL at 5% significance level on average ceteris paribus while second lag of logINFL has no impact on logGDP. Then, first lag of logGDP has significance

causal effect on logINFL. Therefore, we can conclude there is positive and negative short run causality effect of inflation against economic growth.

4.9.3 Vector Autoregression Diagnostic Tests

Lastly, we perform VAR diagnostic tests to check for Auto correlation, normality and stability of our VAR model using Lagrange multiplier, Jarque Bera and Eigenvalue stability condition.

4.9.3.1 Lagrange Multiplier Test

Table 4.18: Lagrange Multiplier Test Results

```
. varlmar, mlag(2)

  Lagrange-multiplier test

+-------+--------------+----+-----------+
| lag   |         chi2 | df | Prob > chi2 |
+-------+--------------+----+-----------+
|   1   |      19.9111 | 16 |     0.22425 |
|   2   |      13.9347 | 16 |     0.60358 |
+-------+--------------+----+-----------+

  H0: no autocorrelation at lag order
```

Source: Researcher (2018)

Autocorrelation is situation where there is the degree of similarity between a given time series and a lagged version of itself over successive time intervals. It is the same as calculating the correlation between two different time series, except that the same time series is actually used twice: once in its original form and once lagged one or more time periods. The results on Table 4.18 shows that we should accept

null hypothesis that there is no autocorrelation among variables. Therefore, there is no autocorrelation on variables.

4.9.3.2 Granger Causality Wald Test

The Granger causality Wald test shows the direction of causality, If the p-value is lower or equal to 0.05 value, then the null hypothesis of no causality can be rejected. The results on Table 4.20 can be interpreted as logINFL granger cause logGDP therefore we reject the null hypothesis because there is causality relationship from logINFL to logGDP at 5% level of significance. Also, the logGDP granger cause logINFL at 1% level of significance hence we reject null hypothesis that there is no causality from logGDP to logINFL.

Table 4.19: Granger causality Wald Test Results

vargranger

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
logGDP	logINFL	13.471	2	0.001
logGDP	ALL	13.471	2	0.001
logINFL	logGDP	12.064	2	0.002
logINFL	ALL	12.064	2	0.002

Source: Researcher (2018)

4.8.3.3 Eigenvalue Stability Condition Test

The results from Table 4.20 shows the VAR system model is stable because all eigenvalues lie inside the unit circle. This means the variables are stationary and the

VAR model is stable regarded to results shown. The necessary and sufficient condition for stability is that all eigenvalues lie inside the unit circle. Then causality effects between inflation and growth is effective.

Table 4.20: Eigenvalue Stability Condition Test Results

```
. varstable

   Eigenvalue stability condition

+---------------------------------------+-----------+
|               Eigenvalue              |  Modulus  |
+---------------------------------------+-----------+
| -.2725922 +  .5990158i                |   .658123 |
| -.2725922 -  .5990158i                |   .658123 |
|  .5551273 +  .1823441i                |   .584308 |
|  .5551273 -  .1823441i                |   .584308 |
|   .145206 +  .5584747i                |   .577043 |
|   .145206 -  .5584747i                |   .577043 |
| -.5477365                             |   .547736 |
|  .03654059                            |   .036541 |
+---------------------------------------+-----------+

   All the eigenvalues lie inside the unit circle.
   VAR satisfies stability condition.

.
```

Source: Researcher (2018)

4.10 Post Diagnostic Test: OLS Regression

As noted earlier, before interpreting the results based on OLS regression is necessary to determine the goodness of the fit model. The following post diagnostic tests were conducted to determine if the inflation model employed did not violate the time series OLS assumptions.

4.10.1 Post Diagnostic: Breusch- Godfrey Serial Correlation LM Test

The presence of serial correlation in the residuals was determined by the BG Test and results being reported in Table 4.21. Based on the findings of BG test as depicted in Table 4.21, the null hypothesis of no serial correlation cannot be rejected as P-values obtained are statistically insignificant therefore we accept the null

hypothesis and conclude that the model does not exhibit serial correlation in the residuals and hence it is a good model.

Table 4.21: Post Diagnostic: Breusch- Godfrey (BG) serial correlation LM Test

```
. estat bgodfrey,small lag(1/2)

Breusch-Godfrey LM test for autocorrelation
```

lags(p)	F	df	Prob > F
1	1.308	(1, 18)	0.2677
2	1.750	(2, 17)	0.2037

H0: no serial correlation

Source: Researcher (2018)

4.10.2 Post Diagnostic: Heteroskedasticity Test- Breusch-Pagan-Godfrey Test

It was necessary also to determine the presence of heteroskedasticity in the residuals using Breusch-Pagan Godfrey test. The results are reported in Table 4.22. The test is statistically insignificant as P-values are greater than 0.05 for both F-statistic and Chi-Square and hence we fail to reject the null hypothesis of no heteroskedasticity in the residual and this suggests that error variances across observations are constant the model is good.

Table 4.22: Breusch-Pagan-Godfrey Test Results

```
. rvfplot

. rvfplot, yline(0)

. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of DlogGDP

         chi2(1)      =     2.65
         Prob > chi2  =   0.1036
```

Source: Researcher (2018)

4.10.3 Post Diagnostic Test - Heteroskedasticity Test: ARCH Test

Table 4.23: ARCH Test Results

```
. predict R, residual

. twoway (tsline R)

. estat archlm, lag(1)
LM test for autoregressive conditional heteroskedasticity (ARCH)
```

lags(p)	chi2	df	Prob > chi2
1	0.804	1	0.3699

H0: no ARCH effects vs. H1: ARCH(p) disturbance

Source: Researcher (2018)

The study also analyzed the presence of the arch effect in the residuals. The results are provided below. The results from Table 4.23 suggest that the model is not affected by the arch effect and hence itôs a good model, this is because the test is statistically insignificant at 5% level and therefore the null hypothesis of no arch effect cannot be rejected. Since the mean model donôt have ARCH effect therefore there is no need to perform the ARCH and GARCH test.

4.10.4 Post Diagnostic Test: Serial Correlation Test -The Ljung-Box Test

The serial correlation test on residual was performed and the results on Table 4.24 shows that p values were greater than 5% therefore we cannot reject the null hypothesis that there is no serial correlation on the residual variable. Means the residual variable is desirable for the regression model.

Table 4.24: Serial Correlation Test -The Ljung-Box Test Results

```
. tsset Year,yearly
        time variable:  Year, 1995 to 2017
                delta:  1 year

. twoway (tsline R1)

. corrgram R1

                                                      -1       0       1 -1       0       1
LAG       AC       PAC      Q      Prob>Q  [Autocorrelation]  [Partial Autocor]
-------------------------------------------------------------------------------------------
1        0.5890   0.5997   9.0663  0.0026
2        0.1707  -0.5545   9.8639  0.0072
3       -0.1466  -0.2563   10.482  0.0149
4       -0.3035  -0.2697    13.27  0.0100
5       -0.4202  -0.2461   18.911  0.0020
6       -0.4186  -0.1014   24.837  0.0004
7       -0.3836  -0.3611   30.123  0.0001
8       -0.2692  -0.0642   32.901  0.0001
9       -0.0818  -0.3259   33.176  0.0001

.
```

Source: Researcher (2018)

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The purpose of this study was to determine the impact of inflation on economic growth in Tanzania 1995 to 2017. Specifically, the study aimed at achieving the following two specific objectives; to determine the empirical evidence whether Inflation is significant to economic growth in Tanzania. Secondly, to determine the empirical evidence whether inflation and economic growth in Tanzania has positive relationship.

To achieve the first objective of the study, four different statistical tests were employed (descriptive statistics-Kolmogorov Smirnov Test, graph trend, unit root test, and cointegration test). The results from all statistical tests are consistent that descriptive statistics showed inflation and economic growth are right skewed, graph trend revealed that inflation and economic growth both had constant upward movement therefore we can cannot reject the first null hypothesis that inflation is significant to economic growth since the test has displayed that these two variables affect one another.

This ties in with the study by Mallik and Chowdhury, (2001) which found the relationship between inflation and economic growth to be positive and statistically significant for Bangladesh, Pakistan, India and Sri Lanka. The second objective of the study was achieved through three different econometric tests like correlation matrix test, cointegration test and Vector Autoregressive test. The correlation test showed that there is strong positive relationship between inflation and economic

growth. The cointegration test revealed that inflation has short run relationship with economic growth, the Vector Autoregression causality test was employed and exposed that there is positive and negative causality relationship between inflation and economic growth. Therefore, from this point we reject the null hypothesis that Inflation and Economic Growth have positive relationship. Meaning there is also a negative relationship between inflation and economic growth in such a way that sometimes rise of general prices can bring negative impact on the economic growth.

Study by Umaru and Zubairu, (2012) suggested that results of causality revealed that GDP caused inflation and not inflation causing GDP. The results also revealed that inflation possessed a positive impact on economic growth through encouraging productivity and output level and on evolution of total factor productivity. The study by Robert J. Barro indicated that with significance that inflation had a negative effect on growth, with a coefficient of ï 0.024. The empirical analysis is that the estimated effects of inflation on growth are negative. The study employed other post diagnostic tests like Breusch Godfrey test whereby the results showed that there is no serial correlation and model was good also Breusch Pagan Godfrey test and ARCH test the results showed that variance is constant meaning there was no heteroskedasticity or ARCH effect.

Other post diagnostic test like Granger Causality Wald test shows direction of causality runs on both ends that inflation Granger cause economic growth also economic growth cause inflation. This is important because it explains the relationship between inflation and economic growth which was one of the study objectives.

5.2 Conclusion

Therefore, based on tests performed the study concludes that inflation has significance impact on economic growth in Tanzania also inflation is the most sensitive macroeconomic variable to the economic growth because it affects the growth positively and negatively. Over the period under study inflation has been impactful on economic growth in Tanzania simply because there is significant relationship between inflation and economic growth which is sensitive also economic growth of Tanzania has been impacted by different factors including inflation or increase in general prices.

5.3 Policy Implication of the Study

The findings of this study have important implication to various stakeholders such as macroeconomists, financial analyst, academicians; policy makers and central bankersô officials, academicians and researchers, investors, regulatory authorities and international organizations. To academicians and researchers, the findings of this study has important implication, the study has revealed the behaviors of inflation against economic growth, and hence lay the foundation for other researchers and academicians who would like to explore more the impact of inflation on economic growth.

In additional for being used as a reference for other scholars, the study has added a new empirical literature regarding impact of inflation on economic growth for the period which under study. To macroeconomists, financial analyst, policy makers, central bankersô officials and other stakeholders the study imply that inflation is significant to Tanzania economic growth also there is positive and negative

relationship between the macroeconomic variables there should know how regulate inflation so doesnôt affect economic growth negatively.

5.4 Limitations of the Study

Even though the study had adequate sample size and sample data, the study was limited to sample period between 1995 and 2017, the application of wider sample size might have had produce robust results**.**

5.5 Recommendations for the AREA of Further Studies

This analysis found that the effects of inflation transmits can affect the economic growth positively and negative hence, we recommend that before making any inflation targeting policy, the social planner should build a dynamic model that can weigh the short run costs against the long run benefits of such plans. The short run cost of managing inflation within the economy to a low rate is the trade-off with other macroeconomic variables that is expected to reduce in the long run when the economy starts to improve. In other words, in formulating the inflation targeting policies, the central bank should take a long-term structural view of the economy and the benefits of its policies. The success of achieving a minimal short-term cost of reducing inflation in the country would depend on the commitment of the government, which determines how the public view and behave towards such policy.

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