

**AN ASSESSMENT ON RELATIONSHIP BETWEEN INFLATION
AND ECONOMIC GROWTH OF TANZANIA**

**AN ASSESSMENT ON RELATIONSHIP BETWEEN INFLATION
AND ECONOMIC GROWTH OF TANZANIA**

**By
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**The Dissertation submitted in partial fulfilment of the requirements
for awards of degree of Masters of Science in Finance and Accounting
(MSc. A and F) of the Mzumbe University**

2015

CERTIFICATION

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation entitled the impact of an assessment on relationship between inflation and economic growth of Tanzania, in partial fulfillment of the requirement for the award of degree of masters of Science in Accounting and finance of Mzumbe University.

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ABBREVIATIONS AND ACRONYM

ADF	Augmented Dickey-Fuller
CPI	Consumer Price Index
DF	Dickey-Fuller
DF-GLS	Dickey-Fuller Generalised Least Squares
GDP	Gross Domestic Product
HQIC	Hannan-Quinn Information Criterion
IMF	International Monetary Fund
INFL	Inflation rate
OLS	Ordinary Least Squares
SBIC	Schwarz Bayesian Information Criteria
SC	Schwarz Information Criteria
VAR	Vector Autoregression
VECM	Vector Error Correction Model

ABSTRACT

The study on the relationship between economic growth and inflation has attracted attention from both researchers and policy makers. A high and sustained economic growth with low and stable inflation is the central objective of most policy makers.

The main purpose of this study is to ascertain the nature of the relationship between inflation and economic growth in Tanzania. In doing so, the study seeks to unravel the short-run and long-run dynamics between inflation and economic growth and establishing the nature of causality. The study reviews both theoretical and empirical aspects of inflation-economic growth relationship.

Time series analysis involving stationarity tests, co-integration tests, Granger causality tests and vector autoregressive analysis (VAR) are employed. The second logarithmic differences of Consumer Price Index (CPI) is used to measure inflation and the second logarithmic differences of real GDP per capita as a measure of economic growth to examine the relationship. The study covers a period from 1990 to 2013 and the data used are annual time series.

The study finds no co-integration between inflation and economic growth. The nonexistence of co-integration implies that there is no stable long-run equilibrium relationship between inflation and economic growth. However, the VAR analysis reveals that inflation lags of three is significantly and negatively impacts economic growth in the short-run with coefficient of -0.1487736. The study further reveals that there is directional Granger causality between inflation and economic growth.

The study concludes that inflation has a negative relationship with economic growth as well as with capital accumulation. Therefore, the Tanzania economic policy should focus on stabilizing the inflation rate which would bring and maintains optimal economic growth together with Capital Accumulation.

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CHAPTER ONE

INTRODUCTION

Introduction

These chapter discusses sub section of Background of the problem, Problem statement, Objective of the study and last the Significance of the study.

1.0 Introduction

Achieving sustainable rapid economic growth is the objective of most countries. It has been a problem to achieve such objective due to many factors that affects economic growth. Among many variables that can be stated as the determinant of economic growth is inflation (Barro, 1995). Further, the nature of the relationship between inflation and economic growth and the channels through which inflation affects real economic activities is still a debatable issue (Li, 2006).

Theories and previous empirical studies about the relationship between inflation and economic growth have shown that there might be no relationship (Sidrauski, 1967), negative relationship (Fisher, 1993) or positive relationship (Mallik and Chowdhury, 2001) between these two variables. Also these strand of literature highlights various channels through which inflation can affect economic growth and Capita accumulation is an important channel.

A few studies in the context of Tanzania have already investigated the existence of a relationship between inflation and economic growth Shitundu and Luvanda, 2000; Kasidi and Mwakanemela, 2013. However, these studies focused only on the existence of relationship and threshold effect between these two variables and ignored the channel through which inflation adversely impacts growth. As the literature stresses that capital accumulation is the important channel through which inflation affects economic growth, therefore, this study is going to fill a gap in the literature by exploring the nature of the relationship among inflation, capital accumulation, and economic growth. The following questions are analyzed in the context; does inflation have any relationship with economic growth? If yes what is the key transmission mechanism by which inflation is linking to economic growth? In other words, what is the the relationship between inflation and

capital accumulation? Does the effect of inflation on capital accumulation show a similar pattern to that of inflation and economic growth?

This paper is organized into five chapters. The first chapter is about introducing the study, formulating the study problem, showing the background of the study, defining the research objective and significant of the study. Chapter two is all about theoretical and empirical literature review, hypothesis of the study, conceptual framework and research models. Type of the study, type and source of data, data analysis method are available in chapter three. Chapter four contains information about data analysis and presentation. Following chapter four is general conclusion and recommendations of the study in chapter five.

1.1 Background of the problem

To attain sustainable economic growth coupled with price stability continues to be the central objective of macroeconomic policies for most countries in the world today. Among others the emphasis given to price stability in conduct of monetary policy is with a view to promoting sustainable economic growth as well as strengthening the purchasing power of the domestic currency (Umaru and Zubairu, 2012). The question on whether or not inflation is harmful to economic growth has recently been a subject of intense debate to policy makers and macro-economists. Several studies have estimated a negative relationship between inflation and economic growth. Specifically the bone of contention is that whether inflation is necessary for economic growth or it is detrimental to growth.

Basically the rate of economic growth depends primarily on the rate of capital formation and the rate of capital formation depends on the rate of savings and investment (Datta and Kumar, 2011). World economic growth and inflation rates have been fluctuating. Likewise, inflation rates have been dominating to compare with growth rates in virtually many years (Madhukar and Nagarjuna, 2011) and relationship between inflation and the economic growth continued to be one of the most macroeconomic problems. Similarly, Ahmed (2010) maintains that this relationship has been argued in various economic literatures and these arguments show differences in relation with the condition of world economy order. In accordance with these policies, increases in the total demand caused

increases in production and inflation too. However, inflation was not regarded as a problem in that period rather considered as a positive impact on the economic growth which was widely accepted. Amid these views, Phillips first introduced hypothesizes that high inflation positively affects the economic growth by lowering unemployment rates. In 1970s, countries with high inflation especially the Latin American countries begun to experience a decrease in growth rates and thus caused the emergence of the views stating that inflation has negative effects on the economic growth instead of the positive effects.

Evidence showing relationship between inflation and economic growth from some of the Asian countries such as India showed that the growth rate of Gross Domestic Product (GDP) in India increased from 3.5% in the 1970s to 5.5% in the 1980s while the inflation rate accelerated steadily from an annual average of 1.7% during the 1950s to 6.4% in the 1960s and further to 9.0% in the 1970s before easing marginally to 8.0% in the 1980s (Prasanna and Gopakumar, 2010). Likely, for the case of China, Xiao (2009) revealed that from 1961 to 1977, China's real GDP growth and real GDP per capita growth averaged at 4.84% and 2.68% respectively. Since 1978, China's economy grew steadily although growth rate fluctuated among the years. From 1978 to 2007, the growth rate of China's real GDP and real GDP per capita were recorded at 9.992% and 8.69% respectively. 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).

Ndyeshobola (1983) indicated that between 1964 and 1969 there was very low inflation (0.3% and 3.2%) on the average for the National Consumer Price Index (NCPI) and National Food Price Index (NFPI) respectively. After 1972, the NCPI rose by an average of 16% until 1975, (with peaks of 19% in 1974 and 25.9% in 1975). The NCPI in 1974 and 1975 seems to have been caused by the severe food problems prevailing during the second half of 1973. The NFPI reached as high as 35.0% in 1974 and 30.6% in 1975. Tanzania's 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).

Between 1952 to 1970 economic growth rate of 5.2 percent was coupled with single digit rates of official inflation, with the exclusion of the period of 1966-70 when the rate of inflation was 11.7 percent. From 1965 to 1985 the rate of economic growth constantly declined as the rate of inflation continuously increased. Tanzania showed steady price stability in the 1950s and 1960s. Annual average rates of inflation were low, in a single digit, at about 4.5% and 9.3 % during 1950s and 1960s respectively. But the rates rose to 10.5% in 1973, before it reached 26.5% in 1975. During 1980-1985 the average highest rate of inflation, 27.3% was coupled with the lowest rate of economic growth of 0.9%. Moreover, studies revealed that, as the economy recovered during 1986-1990, the average rate of inflation decreased to 23.9% in turn average growth rate rose to 3.7 % (Shitundu and Luvanda, 2000).

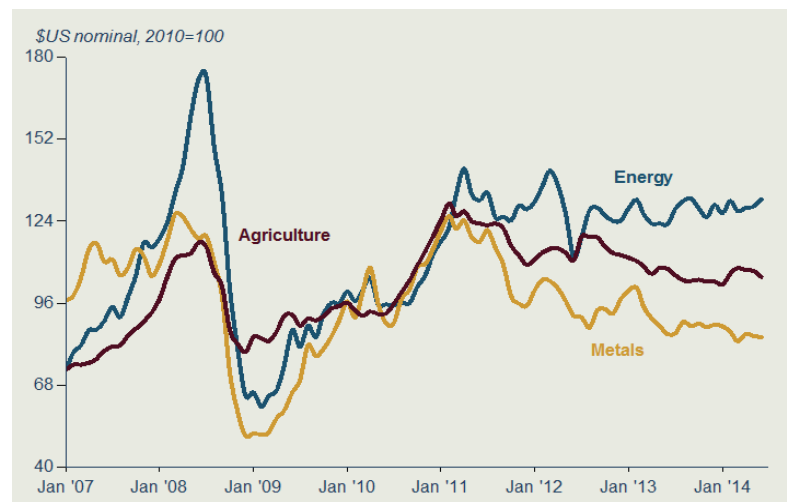
Although the central objective of Tanzania's macroeconomic policies is to promote economic growth and to keep inflation on a low level but in recent years there has been substantial debate on the relationship between inflation and economic growth. Some scholars, mainly those in favour of the Structural and Keynesian perspectives tend to believe that inflation is not harmful to economic growth whereas other scholars particularly those in favour of monetarist views, argue that inflation is harmful to economic growth. Some findings say that there is significant short-run relationship but not in the long-run (Datta and Kumar, 2011).

Motivated by this economic controversial, this studyinvestigated the impact of inflation on economic growth in Tanzania.

1.2 Statement of the problem

Global commodity prices have been on the rise. They reached record levels in 2008, declined during the financial crisis, but then rose sharply in 2010-2011. In mid-2012, commodity food prices rose even further, surpassing the peak in 2008 (Figure 1.1).

Figure 1.1: Commodity Price Indexes



Source: World Bank.

As a result, several low-income countries including Tanzania are experiencing high price levels, trade deficits, and unstable macroeconomic environments. As there has been great variation in domestic food price developments across countries, our understanding about transmission patterns remains elusive (Baltzer, 2013). Yet high commodity prices, particularly for food, clearly have adverse effects on poverty in countries with large fractions of net food-buyers (Wodon and Zaman, 2010).

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Several studies have attempted to address the underlying causes of the global price rise, typically identifying a combination of factors – ranging from long-term economic and demographic trends combined with short-term problems, such as bad weather, speculation, high oil prices, and export bans in a number of countries (Baffer and Hanioti 2010). At the same time, less is known about how world food prices affect domestic food

prices in individual developing countries; particularly in Sub-Saharan Africa (Minot, 2010).

Previous studies on inflation - economic growth relationship have revealed the complexity of the issue. They show that there might be no-relationship, negative relationship and positive relationship between inflation and economic growth according to different conditions. Most empirical studies support negative inflation - economic growth relationship especially when inflation is above the threshold level.

But for the low or moderate inflation, there is distinctive disagreement. Some studies show zero-relationship, while others shows a statistically positive inflation – economic growth relationship. From the aspect of causal direction, two opposite points of view exist. One believes inflation could be conducive to growth Fischer (1993). Other argues that growth could cause inflation Gokal and Hanif (2004); Wang Zhiyong (2008).

Furthermore, Faria and Carneiro (2001) believe in that inflation - economic growth is just a short-run phenomenon. However, Mallik and Chowdhury (2001) evidence that inflation positively relates to growth in the long run.

A few studies in the context of Tanzania have already investigated the existence of a relationship between inflation and economic growth Shitundu and Luvanda, 2000; Kasidi and Mwakanemela, 2013. However, these studies focused only on the existence of relationship and threshold effect between these two variables and ignored the channel through which inflation could relate to economic growth. As the literature stresses that capital accumulation is the important channel through which inflation affects economic growth, therefore, this study is going to fill that gap by exploring the nature of the relationship among inflation, capital accumulation, and economic growth

This study investigated the inflation-economic growth relationship of Tanzania from sampling year of 1990-2013. In methodology part correlation matrix and Granger Causality Test was adopted to detect the relationship and the causal direction between the two variables. Most of important, co-integration model was employed to explore whether inflation and economic growth have the long-run equilibrium

relationship. Besides the main task of detecting inflation-economic growth relationship, capital accumulation was also included to find whether it would relate to inflation.

The estimation was conducted by STATA 11. The data are annual time series from the World Bank Development Indicators Database.

1.3 Objective of the study

This study objective has been split into main objective and specific objectives that accelerated the achievement of the main objectives.

1.3.1 Main objective

The main objective of this study was to assess the relationship between inflation and economic growth of Tanzania.

1.3.2 Specific objectives

1. To assess the trend of inflation, capital accumulation and economic growth of Tanzania
2. To examine the relationship between inflation and economic growth of Tanzania for the period of 1990 to 2013

1.3.3 Research questions

To meet the specific objectives stated above, this study was directed by the following research questions:

1. What is the trend of inflation with respect to the economic growth of Tanzania?
2. What is the trend of inflation with respect to capital accumulation of Tanzania?
3. What is the relationship between inflation and economic growth of Tanzania for the period of 1990 to 2013?

1.2 Significance of the study

This study is very important to macroeconomists, financial analyst, academicians, policy makers and central bankers officials in understanding the responsiveness of GDP to the change in general price level and thus come up with the relevant policies so as 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. For example, 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.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section reviewed the theoretical and empirical literatures. The theories on economic growth and inflation such as Classical Growth Theory, Keynesian Theory, Money & Monetarism, Neo-classical Theory and Neo-Keynesian are presented first followed by empirical literature review from different authors before finalizing with the hypothesis of the study.

2.1 Theoretical literature review

Inflation is not a new topic in economic theories. The phenomenon of inflation and its effect on real economic variables has been discussed ever since the appearance of classical economic theory and been furthered later on as the development of modern economic theories. The following sub-sections will discuss Classical, Keynesian, Neo-keynesian, Monetarist and Neo-classical theories, each with their respective contribution to the inflation-growth relationship. Classical economics recalls supply-side theories, which emphasise the need for incentives to save and invest if the nation economy is to grow, linking it to land, capital and labour. Keynesian and Neo-keynesian theory provided a more comprehensive model for linking inflation to growth under the AD-AS framework. Monetarism updated the Quantity Theory, reemphasizing the critical role of monetary growth in determining inflation, while Neo-classical theory sought to account for the effects of inflation on growth through its impact on investment and capital accumulation.

2.1.1 Classical Growth Theory

Classical theorists laid the foundation for a number of growth theories. The foundation for Classical growth model was laid by Adam Smith who posited a supply side driven model of growth and his production function was as follows:

$$Y = f(L, K, T)$$

Where Y is output, L is labour, K is capital and T is land, so output was related to labour, capital and land inputs. Consequently, output growth (gy) was driven by population

growth (g_L), investment (g_K) and land growth (g_T) and increases in overall productivity (g_f). Therefore: $g_y = (g_f, g_K, g_L, g_T)$.

Smith argued that growth was self-reinforcing as it exhibited increasing returns to scale. Moreover, he viewed savings as a creator of investment and hence growth, therefore, he saw income distribution as being one of the most important determinants of how fast (or slow) a nation would grow. He also posited that profits decline – not because of decreasing marginal productivity, but rather because the competition of capitalists for workers will bid wages up.

The link between the change in price levels (inflation), and its “tax” effects on profit levels and output were not specifically articulated in classical growth theories. However, the relationship between the two variables is implicitly suggested to be negative, as indicated by the reduction in firms’ profit levels through higher wage costs.

2.1.2 Keynesian Theory

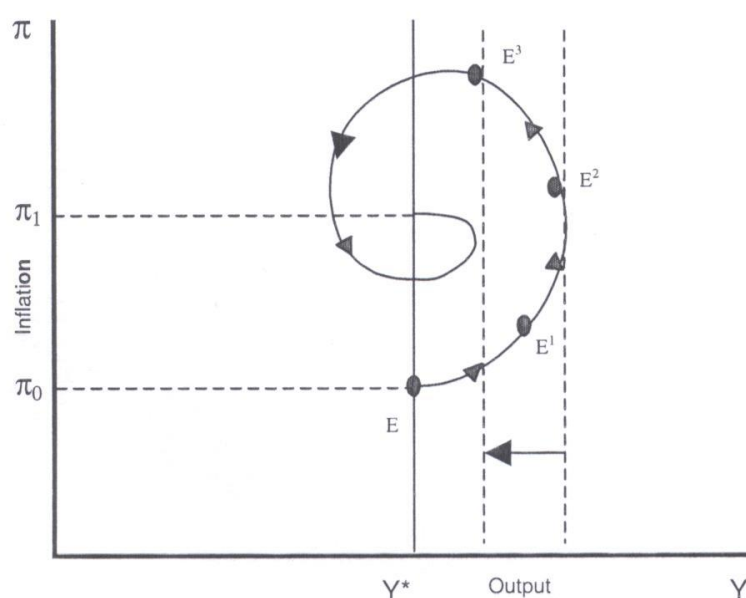
The Traditional Keynesian model comprises of the Aggregate Demand (AD) and Aggregate Supply (AS) curves, which aptly illustrates the inflation – growth relationship. According to this model, in the short-run, the (AS) curve is upward sloping rather than vertical, which is its critical feature. If the AS curve is vertical, changes on the demand side of the economy affect only prices. However, if it is upward sloping, changes in AD affect prices and output, (Dornbuschet *al.*, 1996). This holds with the fact that many factors drive the inflation rate and the level of output in the short-run. These include changes in: expectations; labour force; prices of other factors of production, fiscal and/or monetary policy.

In moving from the short-run to the hypothetical long-run, the above-mentioned factors, and its ‘shock’ on the ‘steady state’ of the economy are assumed to balance out. In this ‘steady state’ situation, ‘nothing is changing’, as the name suggests. The ‘dynamic adjustment’ of the short-run AD and AS curves yields an ‘adjustment path⁴’ which exhibits an initial positive relationship between inflation and growth, however, turns negative towards the latter part of the adjustment path.

The initial positive relationship between output and inflation, illustrated by the movement from point E0 to E1 in Figure 2.1, usually happens due to the ‘time-

inconsistency problem'. According to this concept, producers feel that only the prices of their products have increased while the other producers are operating at the same price level. However in reality, overall prices have risen. Thus, the producer continues to produce more and output continues to rise. Blanchard and Kiyotaki (1987) also believe that the positive relationship can be due to agreements by some firms to supply goods at a later date at an agreed price. Therefore, even if the prices of goods in the economy have increased, output would not decline, as the producer has to fulfill the demand of the consumer with whom the agreement was made.

Figure 2.1: Relationships between Output and Inflation



Two further features of the adjustment process are also important to note. Firstly, there are times when the output decreases and the inflation rate increases, for example, between E^2 and E^3 . This negative relationship between inflation and growth is important, as it quite often occurs in practice, as ascertained by empirical literature. This phenomenon is stagflation, when inflation rises as output falls or remains stable. Secondly, the economy does not move directly to a higher inflation rate, but follows a transitional path where inflation rises then falls.

Under this model, there is a short-run trade-off between output and the change in inflation, but no permanent trade-off between output and inflation. For inflation to be held steady at any level, output must equal the natural rate (Y^*). Any level of inflation is

sustainable; however, for inflation to fall there must be a period when output is below the natural rate.

2.1.3 Money & Monetarism

Monetarism has several essential features, with its focus on the long-run supply-side properties of the economy as opposed to short-run dynamics.⁵ Milton Friedman, who coined the term “Monetarism”, emphasized several key long-run properties of the economy, including the Quantity Theory of Money and the Neutrality of Money. The Quantity Theory of Money linked inflation and economic growth by simply equating the total amount of spending in the economy to the total amount of money in existence. Friedman proposed that inflation was the product of an increase in the supply or velocity of money at a rate greater than the rate of growth in the economy.

Friedman also challenged the concept of the Phillips Curve. His argument was based on the premise of an economy where the cost of everything doubles. Individuals have to pay twice as much for goods and services, but they don't mind, because their wages are also twice as large. Individuals anticipate the rate of future inflation and incorporate its effects into their behaviour. As such, employment and output is not affected. Economists call this concept the neutrality of money. Neutrality holds if the equilibrium values of real variables -including the level of GDP - are independent of the level of the money supply in the long-run. Super neutrality holds when real variables - including the rate of growth of GDP - are independent of the rate of growth in the money supply in the long-run. If inflation worked this way, then it would be harmless. In reality however, inflation does have real consequences for other macroeconomic variables. Through its impact on capital accumulation, investment and exports, inflation can adversely impact a country's growth rate.

In summary, Monetarism suggests that in the long-run, prices are mainly affected by the growth rate in money, while having no real effect on growth. If the growth in the money supply is higher than the economic growth rate, inflation will result.

2.1.4 Neo-classical Theory

One of the earliest neo-classical models was postulated by Solow (1956) and Swan (1956). The model exhibited diminishing returns to labour and capital separately and

constant returns to both factors jointly. Technological change replaced investment (growth of K) as the primary factor explaining long-term growth, and its level was assumed by Solow and other growth theorists to be determined exogenously, that is, independently of all other factors, including inflation (Todaro, 2000).

Mundell (1963) was one of the first to articulate a mechanism relating inflation and output growth separate from the excess demand for commodities. According to Mundell's model, an increase in inflation or inflation expectations immediately reduces people's wealth. This works on the premise that the rate of return on individual's real money balances falls. To accumulate the desired wealth, people save more by switching to assets, increasing their price, thus driving down the real interest rate. Greater savings means greater capital accumulation and thus faster output growth.

2.1.5 Neo-Keynesian

Neo-Keynesians initially emerged from the ideas of the Keynesians. One of the major developments under Neo-Keynesianism was the concept of 'potential output', which at times is referred to as natural output. This is a level of output where the economy is at its optimal level of production, given the institutional and natural constraints. This level of output also corresponds to the natural rate of unemployment, or what is also referred to as the non-accelerating inflation rate of unemployment (NAIRU). NAIRU is the unemployment rate at which the inflation rate is neither rising nor falling. In this particular framework, the 'built-in inflation rate' is determined endogenously, that is by the normal workings of the economy. According to this theory, inflation depends on the level of actual output (GDP) and the natural rate of employment.

Firstly, if GDP exceeds its potential and unemployment is below the natural rate of unemployment, all else equal, inflation will accelerate as suppliers increase their prices and built-in inflation worsens. This causes the Phillips curve to shift in the stagflationary direction; towards greater inflation and greater unemployment.

Secondly, if the GDP falls below its potential level and unemployment is above the natural rate of unemployment, holding other factors constant, inflation will decelerate as suppliers attempt to fill excess capacity, reducing prices and undermining built-in inflation, leading to disinflation. This causes the Phillips curve to shift in the desired

direction, towards less inflation and less unemployment.

Finally, if GDP is equal to its potential and the unemployment rate is equal to NAIRU, then the inflation rate will not change, as long as there are no supply shocks. In the long-run, the Neo Keynesians believe that the Phillips curve is vertical. That is, the unemployment rate is given and equal to the natural rate of unemployment, while there are a large number of possible inflation rates that can prevail at that unemployment rate.

However, one problem with this theory is that, the exact level of potential output and natural rate of unemployment is generally unknown and tends to change over time. Inflation also seems to act in an asymmetric.

2.2 Empirical literature review

Theory review section has shown different arguments about inflation and its effect on economic growth. In fact, in the context of real world, without the assumptions and restrictions of theories, the relationship between inflation and economic growth is more complicated. The results of previous studies have supported the complexity of this issue. And up to now there is still no conclusive argument about the nature of the inflation – economic growth relationship from previous empirical studies.

Previous studies not only try to test the existence of the relationship, but also try to dig this question deeper. The involved studying content includes: what is the causal direction of the relationship; is it a one-way or two-way direction; whether the relationship holds in the long-run or just a short-run phenomenon; is the relationship linear or non-linear; if there are non-linear effects, what is the structural break point of inflation and etc. Different studies have different focus in researching.

When discussing the relationship between two variables, it is important to know through which channels they relate to each other, because it will help to understand further the nature of the relationship. As mentioned in theory section, Abramovitz and Solow have adopted growth accounting to formulate the determinants of economic growth. Fischer (1993) furthers the study by relying on the growth accounting method with empirical data. He calculates Solow residuals and makes regression of economic growth and other

elements of economic growth (e.g. growth of capital accumulation, productivity residual and so on) based on inflation respectively. His studying results show that inflation can influence economic growth not only through total factor productivity but also through capital accumulation. Fischer (1993) concludes his paper that the negative relationship exists between inflation and economic growth, he still points with much caution that there is no direct evidence to support low inflation-high economic growth pattern, i.e. low inflation is not sufficient condition for economic growth. Many empirical studies support this opinion, though that high inflation is bad for growth is not doubtful, few results show a causal phenomenon that lower inflation will lead to higher growth.

Theoretical models have shown that investment (capital accumulation) moves the same direction with economic growth. But there is disagreement on the effect of inflation on investment (capital accumulation). If the inflation-investment relationship is studied under the framework of monetary economy, as mentioned in theory section, it will depend on the relationship between real money balances and investment. One argument is substitution effect of real money balances on investment, such as the studies by Mundell (1963) and Tobin (1965). The contrary argument is complementary effect of real money balances on investment, such as the study by Stockman (1981). Moreover, Fischer (1993) also believes that inflation will be detrimental to investment. He argues that inflation distorts price mechanism, and then distorted price level will affect the efficiency of resources' allocation. This influence will finally negatively relate to economic growth. Gregorio (1992) also support the view that inflation will affect growth through reducing the efficiency of resources' allocation. He develops a model to elaborate that inflation will change return on money and capital and then alter the choice by firms and consumers. These changes have affected the power of price mechanism and distort the originally effective resources' allocation.

With the development of research in inflation – economic growth relationship, there has been studies pointing out the complexity of the relationship may involve in the non-linear effect. The non-linearity has been the hotspot in the studies of the relationship between inflation and economic growth ever since 1990's. Fischer (1993) is the first that evidences the non-linearity by adopting spline functions. The spline functions estimates the results by assembling the data of inflation into three ranges according to the level of

inflation. Also his study shows that there are more than one break point between inflation and economic growth and the negative coefficients of inflation – economic growth relationship is decreasing quicker when inflation is higher. Buerdekin et al. (2000) further the study of non-linearity in inflation – economic growth relationship. They argue that levels of break points should be different and distinguished in estimation between developed and developing countries.

But totally contrary to the results of other studies which focus on studying the threshold of inflation – economic growth relationship, they find a higher threshold with 8% for developed countries and a lower one with 3% for developing countries.

Another representative research of the non-linearity in inflation - economic growth relationship is by Khan and Senhadji (2000), they adopt economic estimation tool to detect the threshold of inflation instead of fixing them by assumption like Fischer (1993) and Burdekinet *al.* (2000). In the study of Khan and Senhadji (2000), they detect the break points of 1-3% for developed countries; 7-11% for developing countries; and evidence again that above the break points, inflation negatively relates with economic growth. Mubarik (2005) follows the study of Khan and Senhadji (2000) and detects a structural break point of inflation of 9% for Pakistan, above the break point there is a negative inflation - economic growth relationship, but no significant relationship below the break point. He also evidences a one-way direction relationship from inflation to growth by Granger Causality method.

Most empirical literatures focusing on studying the threshold of inflation under the framework of inflation - economic growth relationship have detected a higher threshold for developing countries than for developed countries. One of explanation by Khan and Senhadji (2000) is that developing countries employ inflation as a kind of tax because of lacking effective tax system in these countries. Furthermore, Christoffersen and Doyle (1998) argue that the different levels in threshold of inflation actually reflect a country's structural features; therefore studies on different countries will have different results. But studies have shown that thresholds of inflation will converge to developed countries' level as developing countries progress.

Some recent studies begin to adopt new econometric techniques, like the co-integration and error correction models for dealing with time series data to examine the relationship of the model of bivariate variables. Mallik and Chowdhury (2001) first adopt the two above-mentioned models to exploit the inflation - economic growth relationship. They conclude a long-run positive relationship between inflation and economic growth. Ahmed and Mortaza (2005) further employ the above mentioned estimation models to find both long-run and short-run relationship between inflation and economic growth in Bangladesh and then followed by OLS (Ordinary Least Squares) model to evidence the structural break point of inflation for Bangladesh is 6%. Same with most of the other studies for detecting the threshold level of inflation, Ahmed and Mortaza (2005) show that the inflation - economic growth in Bangladesh is negative when inflation exceeds structural break point, but there is no statistically significant relationship below the break point.

Sidrauski (1967) testifies the super neutrality of money in his model with conclusion that inflation has no relationship with growth in the long run. Some recent empirical studies which evidence the zero inflation - economic growth relationship especially in the long run support Sidrauski (1967)'s argument. Bruno and Easterly (1995) demonstrates a non-relationship between inflation and economic growth when they delete observations of high inflation cases. Because some studies show that the inflation - economic growth relationship are very sensitive to the high inflation cases.

However, Faria and Carneiro (2001) instead study Brazil – a country with high inflation history, same result of non-relationship in the long run is concluded though still finding a short-run negative relationship. The two extreme studies give a strong support to the superneutrality of money in the long run and also provide the implication it is worthwhile for further research to test the hypothesis that high inflation contributes to the inflation - economic growth relationship in the short run.

But contrary to the conclusion of Faria and Carneiro (2001), Gregorio (1992) also conducts a study based on 12 Latin American Countries which have high inflation history. His results found a negative relationship between inflation and economic growth in the long run. Gregorio (1996) furthers the study in his work of 1996 and stresses the

importance of central bank to control the inflation, and same with the result of his work in 1992, he still concludes a robust negative relationship between inflation and economic growth.

The most distinctive part of the study by Gokal and Hanif (2004) is that they detailed review the development of inflation - economic growth relationship from theoretical angle. They also summarize that one of the externalities of inflation is inflation uncertainty, which is generated by inflation and will inversely affect growth.

Fischer (1993) has also mentioned inflation uncertainty will have same effect with inflation on growth by distorting market mechanism. More and more recent studies focus on the research of inflation uncertainty because understanding it could shed some light on the inflation - economic growth relationship. Previous studies show a consistent positive relationship between inflation and inflation uncertainty. Although Golob (1994) emphasize the downward trend of inflation uncertainty which is neglected by previous studies, the result of his study still supports a positive relationship between inflation and inflation uncertainty.

Time series data is often been adopted when analyzing a country's financial related variable, because this kind of data can capture the variability of financial data. Sweidan (2004) adopts annual time series data of Jordan by using of ARCH (Autoregressive Conditional Heteroskedasticity) model to detect the relationship between inflation and inflation uncertainty. His study confirms the positive relationship between inflation and inflation uncertainty in the context of Jordan. But he evidences no significant relationship between inflation uncertainty and economic growth, which is contrary to his assumption.

Though there is a consensus that high inflation is harmful, still high inflation cases in real world exist. The main explanation is that reducing inflation would cause higher costs in economic growth. However the effect of low-moderate inflation on growth is still debated as mentioned by the results in other empirical studies in this section. In the study of Ghosh and Phillips (1998), they explain why different level of price variability will have different influence on the inflation - economic growth relationship. They believe that low inflation is necessary and could weaken the price rigidity and then improve the

efficiency of price mechanism, but high inflation will lead inefficient allocation of resources by distorted price variability.

The study of Christoffersen and Doyle (1998) focus on growth pattern of the transition countries (including the Central European Economies and the former Soviet Union) and show the distinct effects of export growth and structural reform on economic growth for transition economies. They detect the structural break point of 13% above which inflation negatively affects economic growth, but when inflation below the threshold, there is no significant inflation - economic growth relationship.

China as one of transition economy also bears the features that export growth and structural reform are two of major constitutions of economic growth. Wang Zhiyong(2008) adopts co-integration and error correction models to detect inflation - economic growth relationship of China. He finds that economic growth positively relates to inflation with about three quarters' lag and the causal direction is one-way from growth to inflation. The findings are different to the results of other studies mentioned above most which find the causal direction from inflation to growth. The conclusion from Wang Zhiyong (2008) have strong implications for policymakers of China that it is important to keep a close eye on inflation in the context of high growth in the economy.

One of the problems that disturb the study of inflation - economic growth relationship is the robustness of estimation results. Many empirical studies show that if concluding control variables, the result of inflation - economic growth relationship is weak and non-significant. Although there still other studies also find a robust relationship when controlling other variables, cautions should be born in mind when interpreting the estimation results.

2.3 Hypothesis of the study

From both theoretical and empirical literature reviews analysed above, this study was governed by the following hypotheses:

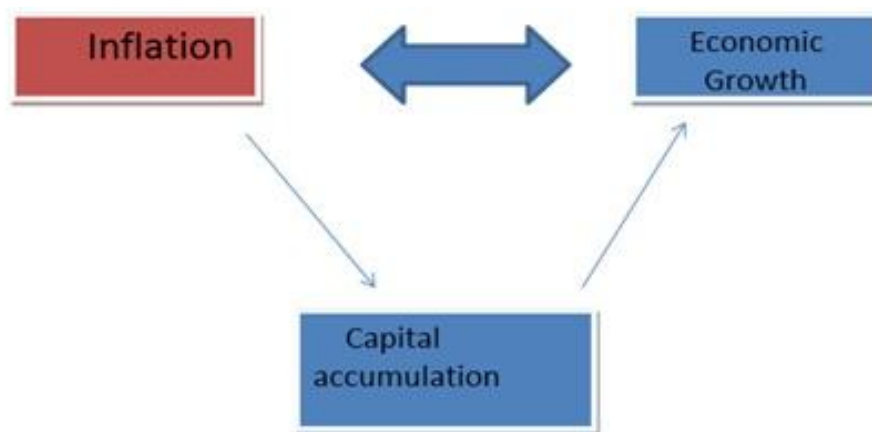
First, "There is no positive relationship between inflation and economic growth in Tanzania" This hypothesis aims to assess the relationship between inflation and economic growth of Tanzania as per the requirement of the study objectives. However

due to different studies inflation can also be related to capital accumulation in the country. Therefore the study investigated the truth of these findings for the case of Tanzania and was governed by the Hypothesis that “There is no positive relationship between inflation and capital accumulation of Tanzania”

2.4 Conceptual framework and research model

The conceptual framework of this study is presented bellow basing on both independent (Economic growth and Capital accumulation) and dependent (Inflation) variables.

Figure 2.2: Conceptual framework, analysis of relationship between Economic Growth and Capital accumulation with respect to Inflation.



Source: Researcher, 2015

The conceptual framework above shows the independent variables (Economic growth and Capital accumulation), both having impact on the Dependent variable (Inflation). Therefore basing on the above conceptual framework, the research models for the study are:

$$\text{INFLATION} = \alpha_1 + \beta_1 \text{GDP} + \varepsilon_1 \dots\dots\dots 1$$

$$\text{GDP} = \alpha_2 + \beta_2 \text{INFLATION} + \varepsilon_2 \dots\dots\dots 2$$

$$\text{INFLATION} = \alpha_3 + \beta_3 \text{CAP} + \varepsilon_3 \dots\dots\dots 3$$

$$\text{CAP} = \alpha_4 + \beta_4 \text{INFLATION} + \varepsilon_4 \dots\dots\dots 4$$

Where as:

GDP	Gross Domestic Product
CAP	Capital accumulation
ε_1 & ε_2	Random Error terms

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This part introduces the methodology and the model specifications of this study. Also the chapter indicates the type of the study, the area of the study as well as the source and types of data.

3.1 Type of the study

This study is a typical empirical study that used econometric techniques to assess the relationship between inflation and Economic growth of Tanzania from 1990 to 2013 using secondary data from World Development Indicators of the World Bank.

3.2 Types and source of data

This study used secondary annual time series data for the period of 1990 to 2013 from World Development Indicators of the World Bank. The data are real GDP per capita (constant 2005 U.S. Dollars), Consumer Price Index (Annual Average, year 2010=100) as a proxy for Inflation and last is gross fixed capital formation (constant 2005 U.S. Dollars) as a proxy for Capital accumulation.

3.3 Data analysis method

The data analysis based on the two specific objectives of this study.

For the first objective descriptive statistics shows the trend of inflation and GDP growth for the period of 1990 to 2013. Also the same approach was used to show the trend of inflation and Capital accumulation for the same period of time.

For the second objective, three economic variables were adopted to detect inflation - economic growth relationship which was obtained from World Development Indicators of the World Bank. One is real GDP per capita (constant 2005 U.S. Dollars) of Tanzania from 1990 to 2013 and the other one is Consumer Price Index (Annual Average, year 2010=100) of Tanzania from 1990 to 2013 as a proxy for Inflation and last is gross fixed capital formation (constant 2005 U.S. Dollars) of Tanzania from 1990 to 2013 as a proxy for Capital accumulation.

In order to address the main objectives of the study, the following econometric models were employed. The models that were used are

$$\text{INFLATION} = \alpha_1 + \beta_1 \text{GDP} + \varepsilon_1 \dots\dots\dots 1$$

$$\text{GDP} = \alpha_2 + \beta_2 \text{INFLATION} + \varepsilon_2 \dots\dots\dots 2$$

$$\text{INFLATION} = \alpha_3 + \beta_3 \text{CAP} + \varepsilon_3 \dots\dots\dots 3$$

$$\text{CAP} = \alpha_4 + \beta_4 \text{INFLATION} + \varepsilon_4 \dots\dots\dots 4$$

Where by:

GDP Gross Domestic Product

CAP Capital accumulation

ε_1 & ε_2 & ε_3 & ε_4 Random Error terms

The first two models (1&2) were used to see the relationship between the two relevant variables which are Inflation and Economic growth measured by GDP. And the last two models (3&4) were used to show the relationship between Inflation and Capital accumulation. Positive relationship was expected in both models. All the data is annual time series.

Time series analysis in econometrics is used to identify relationships among variables. Co-integration modeling is mostly used for long-term forecasting and long-run relationships. The word co-integration itself implies long-term equilibrium (Lin and Tsay 1996: 519 – 20).

Hence, in order to see the long-run relationship between inflation and growth in Tanzania, the co-integration test was used. In the co-integration test the Engle-Granger (1987) and Johansen (1991) methods was employed followed by VAR analysis which according to Sims (1980) the Vector Auto-regression (VAR) is an ad hoc dynamic multivariate model, treating simultaneous set of variables equally, in which each endogenous variable is regressed on its own lags and the lags of all other variables in a finite-order system. The objective of the approach is to examine the dynamic response of the system to the shocks without having to depend on "incredible identification restrictions" inherent in structural models.

Also the Granger-causality test was employed to detect the direction of influence between Inflation and GDP.

As discussed in both theoretical and empirical studies on inflation - economic growth relationship, capital accumulation is not only a critical determinant variable for economic growth but always an important channel for inflation relating to economic growth Fischer (1993). Therefore, besides exploring inflation - economic growth relationship, inflation – capital accumulation relationship was also examined in the estimation part using model (3 & 4).

This thesis employed gross fixed capital formation as proxy indicating the third variable - capital accumulation. The annual time series data of gross fixed capital formation (constant 2005 U.S. Dollars) of Tanzania from 1990 to 2013 is also obtained from World Development Indicators of the World Bank.

Therefore, the relationships of inflation – economic growth and inflation – capital accumulation growth were examined by the relationships shown in the following Equations:

$$\text{ddlog}(\text{GDPPC}_t) = \alpha_1 + \beta_1 \text{ddlog}(\text{CPI}_t) + \varepsilon_{1t} \dots\dots\dots 5$$

$$\text{ddlog}(\text{CPI}_t) = \alpha_2 + \beta_2 \text{ddlog}(\text{GDPPC}_t) + \varepsilon_{2t} \dots\dots\dots 6$$

$$\text{ddlog}(\text{CAP}_t) = \alpha_3 + \beta_3 \text{ddlog}(\text{CPI}_t) + \varepsilon_{3t} \dots\dots\dots 7$$

$$\text{ddlog}(\text{CPI}_t) = \alpha_4 + \beta_4 \text{ddlog}(\text{CAP}_t) + \varepsilon_{4t} \dots\dots\dots 8$$

CHAPTER FOUR

RESULTS, FINDINGS AND DISCUSSION

4.0 Introduction

This chapter presents the data analysis and discussion of the findings for every specific objective of this study which are: To assess the trend of inflation, capital accumulation and economic growth of Tanzania and to examine the relationship between inflation and economic growth of Tanzania for the period of 1990 to 2013.

4.1 Data for Economic Growth, Inflation and Capital Accumulation For the years 1990 to 2013

When discussing the relationship between two variables, it is important to know through which channels they relate to each other, because it will help to understand further the nature of the relationship hence the introduction of Capital accumulation in this study to investigate if Inflation is relating to Economic growth through it.

As mentioned in theory section, Abramovitz and Solow have adopted growth accounting to formulate the determinants of economic growth. Fischer (1993) furthers the study by relying on the growth accounting method with empirical data, and he concludes that inflation can influence economic growth not only through total factor productivity but also through capital accumulation. Also, Levine and Renelt (1992) and Sala-i-Martin (1997) argued that despite the existence of a large set of explanatory variables that can be potentially used in the growth regression, only a few of them may be significant which supports the researcher uses of three variable in this study.

Therefore this study builds on that background and involves the data from year 1990 to 2013 for the Inflation measured by Consumer Price Index (Annual Average, year 2010=100), Economic Growth measured by real GDP per capita (constant 2005 U.S. Dollars) of Tanzania and Capital Accumulation measured by gross fixed capital formation (constant 2005 U.S. Dollars) of Tanzania.

In 1985, when Tanzania abandoned its socialist policies and started to introduce market reforms, might be an appropriate year for the reestimation of the capital stock although there was virtually no FDI until the early 1990s, Utz (2007). And this might explain the

availability of the Capital accumulation data from 1990 from the data source used. For the consistent also the annual data of the other two variables (GDP and Inflation) were used in this study.

All the data are from World Bank Development Indicators. The researcher used the data of this range during the open economy period so as to have undistorted data and pure relationship of the variables from the Government intervention when the Economy where Central controlled. In this period the real Inflation could be measured without interference by the Government. The data used are presented on Table 4.1.

Lastly, despite that the statistical evidence was obtained using small sample of 23 observations for each variable but the researcher feels that this existing data set can still throw some light on the relationship between economic growth and inflation, and capital accumulation channel (Chow and Chew).

Table 4.1:Raw Data for Economic Growth, Inflation and Capital Accumulation for the years 1990 to 2013

YEAR	GDP(constant 2005 US\$)	CPI(2010 = 100)	CAP(constant 2005 US\$)
1990	300.8295967	8.509022282	1840194396.00
1991	297.1420999	10.95074172	2057706354.41
1992	289.035458	13.34313349	2018570250.98
1993	282.9716157	16.71591261	1787700036.35
1994	278.4255683	22.41325797	1809793350.61
1995	279.9384279	28.56071827	1540300830.56
1996	284.7286801	34.5519743	1499596003.43
1997	287.2674332	40.11161325	1505805306.99
1998	290.6501129	45.24580109	1717746984.44
1999	297.3485265	48.81589088	1824247207.98
2000	304.3592864	51.70772526	1931860552.46
2001	314.5469129	54.36936387	2163454034.79
2002	328.5247912	57.26063621	2335069036.74
2003	342.0495763	60.29749196	2661554681.11
2004	359.0366113	63.15306145	2937903736.05
2005	374.9992699	66.3325466	3487079293.61
2006	389.0816582	71.14230139	4046395998.25
2007	404.9782986	76.140414	4633123417.99
2008	422.4403004	83.96642556	4994541636.72
2009	434.7044131	94.16182029	5498766604.43
2010	451.5468171	100	6059181343.19
2011	466.3679263	112.6909695	7962861391.98
2012	483.8178897	130.7227573	8865610949.88
2013	502.0766501	141.0115842	9361711853.36

Source: World Bank, 2015

4.2 Descriptive Statistics of the Data

The overall outlook of the data is shown in Table (4.2). It was calculated by using Stata and it contains the mean, the standard deviation, maximum and minimum value of the data.

Table 4.2: Descriptive Statistics of GDP Per Capita, CPI and Gross Fixed Capital Formation (1990-2013)

```
. summarize ddlogCPI ddlogGDPPC ddlogCAP, separator(0)
```

Variable	obs	Mean	Std. Dev.	Min	Max
ddlogCPI	22	-.0080235	.0386742	-.0726662	.0679324
ddlogGDPPC	22	.0022444	.0089358	-.0153279	.0216146
ddlogCAP	22	-.0026033	.0965432	-.1735191	.1761608

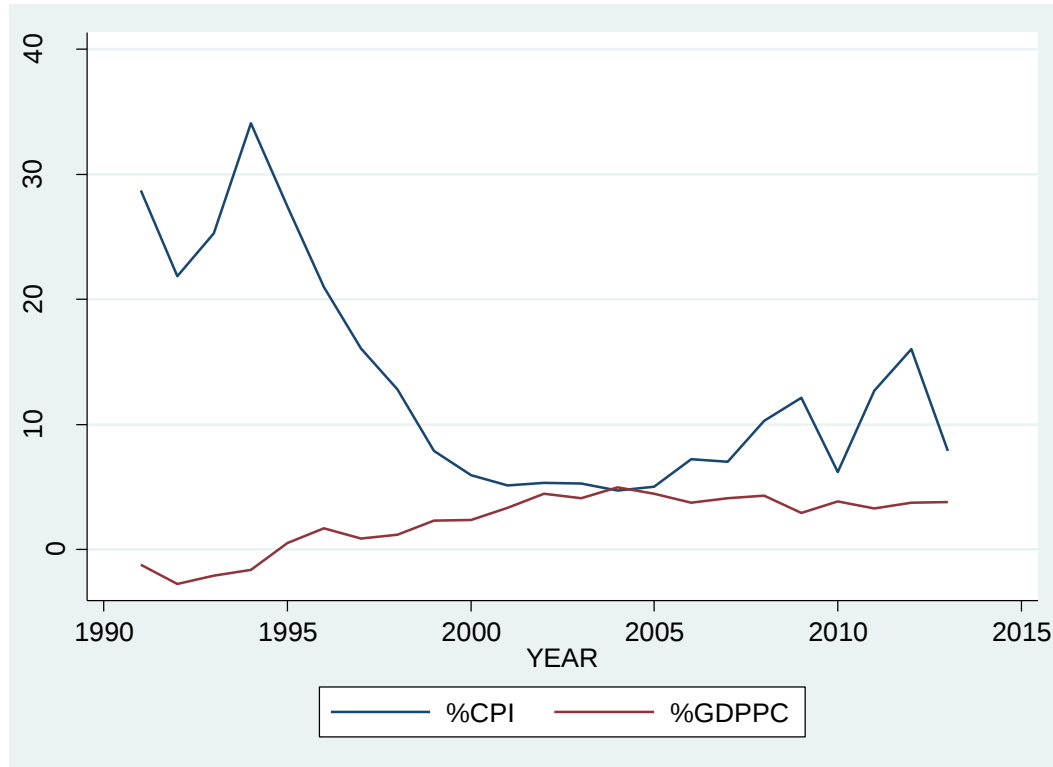
The variable ddlogGDPPC has the highest annual average and ddlogCPI has the lowest while average rate of ddlog CAP was 0.3 percent during the period for the 22 observations. The highest maximum value was for ddlogCAP in year 2011 and the lowest was for ddlog GDPPC in year 1995. The highest and lowest volatility were experienced by ddlog CAP(0.9654) and ddlog GDPPC (0.0089) respectively.

4.3 The trend of Economic Growth and Capital Accumulation in relation to Inflation

In this part the researcher presents the trend of Economic Growth and Capital Accumulation in relation to Inflation for the purpose of covering the Objective number one. The trend has been described separately for easier comparison starting with Economic Growth in relation to Inflation and followed by Capital Accumulation in relation to Inflation.

4.3.1 The trend of Economic Growth in relation to Inflation

Figure 4.1: Line Chart for Inflation and Economic Growth



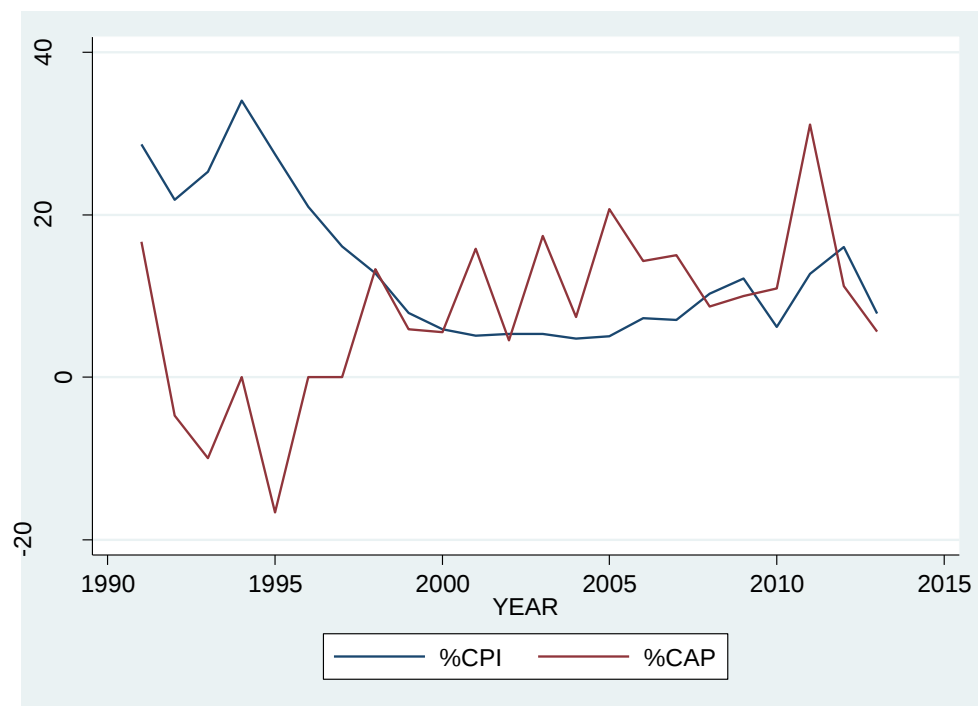
To assess the trend of Economic Growth in relation to Inflation the data from Table 4.1 was converted into percentage change for better comparison. Figure 4.1 shows the trend of Economic Growth as measured by percentage change of GDP per Capita and Inflation as measured by percentage change of CPI from 1990 to 2013.

The trend of GDP per Capital and CPI from Figure 4.1 is decreasing from year 1990 to 1993 which might have been caused by the Economic reforms which were undergoing at that period, the country was moving from Central Economy where the Government was responsible in controlling the Economy to Market Economy where the forces of the Market dictates the direction of the Economy. And year 1994 to 1995 the GDP and Inflation are trending upward. From 1995 the GDP is moving upward while the Inflation is moving downward until they intersect in 2005 then from there the GDP is starting to decrease while the Inflation is increasing and this might be due to economic recession which happened in 2008 which is characterized by low GDP and high Inflation. In 2009 to 2010 there is a little GDP increase while Inflation is significantly decreasing signaling the recovery period of the economy. Again from 2010 to 2012 Inflation is increasing and GDP fluctuates very little

downward. Last in 2013 Inflation is decreasing while there is small observable upward movement of GDP line. Therefore, from the graph the researcher suggests that GDP and Inflation shows a negative trend relationship.

4.3.2 The trend of Inflation of Capital Accumulation

Figure 4.2: Line Chart for Inflation and Capital Accumulation



And to assess the trend of Capital Accumulation in relation to Inflation the data from Table 4.2 was converted into percentage change for better comparison. Figure 4.2 shows the trend of Capital Accumulation as measured by percentage change and Inflation as measured by percentage change of CPI from 1990 to 2013.

From Figure 4.2 the Capital Accumulation (CAP) from year 1990 to 1992 is decreasing on the same trend with the CPI, in 1992, when CPI started to increase; the decreasing rate of CAP was much slower. 1993 to 1994 the CPA was increasing as the CPI increases.

But from the year 1995 to year 2010, there was no significant relationship between CPI and CAP, the results shows that there was a continuous decrease of CPI for that period, while for the case of CAP it was up and down fluctuations which might have accelerated with other factors rather than CPI. Again from 2010 to 2013, the trend seems to haveno clear relationship.

4.4 The Relationship between Inflation and Economic Growth

Under this part the objective number two of the research has been presented to show the empirical analysis on the relationship between Inflation and Economic Growth. The regression analysis was used to investigate the empirical relationship of the variables. Also in this regard Capital Accumulation was a critical determinant for the economic growth as well as an important channel for Inflation relating to economic growth, Fisher (1993).

To perform this analysis the variables was transformed to logarithm of the second differences to make the data stationary as suggested by many previous researchers, such as Khan and Senhadji (2000). They summarize the advantages that logarithmic data can smooth data distribution to some extent, Sarel (1996). They also mention that logarithmic form can have better goodness of fit for non-linearity, Ghosh and Phillips (1998). Non-stationary time series data can violate the assumption of the regression model and gives spurious results. The pre-estimation analysis was carried by using Unit Root test, Correlation Matrix and Estimation of Lag Length. In estimation part Co integration Test and Vector Autoregressive (VAR) model was employed on the variables. In the end the post estimation was carried out by using Test for Autoregressive (VAR) model stability, Autocorrelation of the residues of the variables and Granger Causality Wald Tests.

4.4.1 Unit Root Test

Unit root analysis is the univariate time series analysis which seeks to find out whether the series are stationary or not. A stochastic process, say y_t is stationary if it has time-invariant first and second moments. In other words, a series of data is stationary if its mean and variance are not time dependent and the covariance does not depend on time, but on the distance in time between the two members of the process (Enders, 2004). The presence of a unit root in the time series representation of a variable has important implications for both the econometric method used and the economic interpretation of the model in which that variable appears. For example, if the time series data is non-stationary, the estimation will either give spurious results³ or the variables may be related in the long-run. Therefore, it is indispensable that we apply unit root tests before estimation, to see whether the time series data is stationary or not. For this purpose the researcher uses through Augmented Dickey Fuller test.

The results of Unit Root test through Augmented Dickey Fuller test has been presented in Tables 4.3, 4.4 and 4.5.

Table 4.3: Augmented Dickey fuller Test for the variable of Inflation(ddlogCPI)

```
. dfuller ddlogCPI, lags(0)
```

Dickey-Fuller test for unit root

			Number of obs	=	21
	Test Statistic	1% Critical Value	Interpolated 5% Critical Value	Dickey-Fuller 10% Critical Value	
z(t)	-4.136	-3.750	-3.000	-2.630	

Mackinnon approximate p-value for z(t) = 0.0008

The results in Table 4.3 shows that we can comfortably reject the presence of unit root because the test Statistic (-4.136) is more negative than the critical value (-3.000) at 5% even at 1% level of significance we have the same result. Therefore we conclude that VAR analysis can be performed with second differences of the logarithm for the variable of Inflation.

Table 4.4: Augmented Dickey fuller Test for the variable of Economic Growth

```
. dfuller ddlogGDPPC, lags(0)
```

Dickey-Fuller test for unit root

			Number of obs	=	21
	Test Statistic	1% Critical Value	Interpolated 5% Critical Value	Dickey-Fuller 10% Critical Value	
z(t)	-5.300	-3.750	-3.000	-2.630	

Mackinnon approximate p-value for z(t) = 0.0000

Also the results in Table 4.4 similarly shows that we can comfortably reject the presence of unit root because the test Statistic (-5.300) is more negative than the critical value (-3.000) at 5% even at 1% level of significance we have the same result. Therefore we conclude that VAR analysis can be performed with second differences of the logarithm for the variable of Economic Growth.

Table 4.5: Augmented Dickey fuller Test for the variable of Capital Accumulation

Dickey-Fuller test for unit root

			Number of obs	=	21
	Test Statistic	1% Critical Value	Interpolated 5% Critical Value	Dickey-Fuller 10% Critical Value	
z(t)	-7.015	-3.750	-3.000	-2.630	

Mackinnon approximate p-value for z(t) = 0.0000

Finally, the results in Table 4.5 likewise shows that we can reject the presence of unit root because the test Statistic (-7.015) is more negative than the critical value (-3.000) at 5% even at 1% level of significance we have the same result. Therefore we conclude that VAR analysis can be performed with second differences of the logarithm for the variable of Capital Accumulation.

4.4.2 Correlation Matrix

The correlation matrix is undertaken to detect the correlation among the three variables ddlogCPI, ddlogGDPPC and ddlogCAP. Table 4.6 shows the results such that there is weak positive correlation between Capital Accumulation (ddlogCAP) and Inflation (ddlogCPI) while negative weak correlations observed with Economic Growth (ddlogGDPPC). But there is negative and weak correlation between Economic Growth (ddlogGDPPC) and Inflation (ddlogCPI).

Table 4.6: Correlation Matrix results for ddlogCPI, ddlogGDPPC and ddlogCAP
. correlate ddlogCPI ddlogGDPPC ddlogCAP
(obs=22)

	ddlogCPI	ddlogGDPPC	ddlogCAP
ddlogCPI	1.0000		
ddlogGDPPC	-0.1875	1.0000	
ddlogCAP	0.2620	-0.1900	1.0000

4.4.3 Estimation of Lag Length Based on Vector Autoregression (VAR)

Actually for time series data another problem is that the lagged observations of variables will also have impact on independent variables (autocorrelation). And the lagged observations may not only come from dependent variables but also from independent variables. To select the number of lags we use the *varsoc* command and the results are presented on Table 4.7.

Table 4.7: Results for Lag Length Test for variables ddlogCPI, ddlogGDPPC

. varsoc ddlogCPI ddlogGDPPC

Selection-order criteria
Sample: 1996 - 2013

Number of obs = 18

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	99.9981				6.4e-08*	-10.8887*	-10.875*	-10.7898*
1	100.485	.97453	4	0.914	9.5e-08	-10.4984	-10.4575	-10.2016
2	102.545	4.1196	4	0.390	1.2e-07	-10.2828	-10.2146	-9.78815
3	107.389	9.6871*	4	0.046	1.2e-07	-10.3765	-10.281	-9.68402
4	111.361	7.9454	4	0.094	1.3e-07	-10.3735	-10.2507	-9.48312

Endogenous: ddlogCPI ddlogGDPPC
Exogenous: _cons

The results reported in Table 4.7 above shows there is no lag that should be included for VAR estimation in Inflation and Economic Growth as all four asterisks lie on lag zero.

Table 4.8: Results for Lag Length Test for variables ddlogCPI and ddlogCAP

```
. varsoc ddlogCPI ddlogCAP
```

Selection-order criteria					Number of obs				=	18
Sample: 1996 - 2013										
lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC		
0	99.9981				6.4e-08*	-10.8887*	-10.875*	-10.7898*		
1	100.485	.97453	4	0.914	9.5e-08	-10.4984	-10.4575	-10.2016		
2	102.545	4.1196	4	0.390	1.2e-07	-10.2828	-10.2146	-9.78815		
3	107.389	9.6871*	4	0.046	1.2e-07	-10.3765	-10.281	-9.68402		
4	111.361	7.9454	4	0.094	1.3e-07	-10.3735	-10.2507	-9.48312		

Endogenous: ddlogCPI ddlogCAP
Exogenous: _cons

From the results reported in Table 4.8 above shows there is no lag that should be included for VAR estimation in Inflation and Capital Accumulation as all four asterisks lie on lag zero.

4.4.4 Co integration Test

Testing for co integration 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 co integration 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's maximum likelihood framework 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.

Unit root tests have shown that both inflation and economic growth are integrated of order two. Therefore, we had to test for co integration between these two variables to check

whether they have a stable long-run equilibrium relationship. The Johansen test of co integration using the trace statistic was conducted and the results are displayed below:

Table 4.9: Results for Co integration Test for variables ddlogCPI, ddlogGDPPC

Johansen tests for cointegration					
Trend: constant			Number of obs =		20
Sample: 1994 - 2013			Lags =		2
maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	6	98.469704	.	28.1244	15.41
1	9	107.67715	0.60178	9.7095	3.76
2	10	112.53188	0.38459		

Since the trace statistic at $r = 0$ of 28.1244 is greater than its critical value of 15.41, we cannot reject the null hypothesis that there are zero co integrating equations at five percent level of significance. Therefore, we conclude that inflation and economic growth are not co integrated. This means that, a linear combination of inflation and economic growth will not lead to a long-run stable equilibrium relationship.

4.4.5 Vector Autoregression (VAR) Analysis

The results from the VAR are presented in Table 4.10 the top part of the table reports the fit of the two equations estimated in a VAR. The second part of the model reports the summary statistics of these two equations estimated by OLS in a VAR. However, interpretation of the results from a VAR model requires that the model is stable, the residuals are normally distributed and that there is no presence of autocorrelation among the residuals. Therefore, we perform diagnostic tests in the next section to see if our VAR model fits well.

Table 4.10: Vector Autoregression Results for ddlogCPI and ddlogGDPPC

. var ddlogCPI ddlogGDPPC, lags(1/3)					
Vector autoregression					
Sample: 1995 - 2013			No. of obs		= 19
Log likelihood = 112.5097			AIC		= -10.36944
FPE = 1.16e-07			HQIC		= -10.25167
Det(Sigma_ml) = 2.46e-08			SBIC		= -9.673539
Equation	Parms	RMSE	R-sq	chi2	P>chi2
ddlogCPI	7	.030352	0.4966	18.74142	0.0046
ddlogGDPPC	7	.008487	0.3534	10.38319	0.1094

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
ddlogCPI						
ddlogCPI						
L1.	.0002112	.2551821	0.00	0.999	-.4999365	.5003588
L2.	-.4875006	.2007465	-2.43	0.015	-.8809566	-.0940446
L3.	.4656226	.1881833	2.47	0.013	.0967901	.8344551
ddlogGDPPC						
L1.	-.3235802	.8760274	-0.37	0.712	-2.040562	1.393402
L2.	-2.264951	.7666898	-2.95	0.003	-3.767636	-.7622668
L3.	-1.044164	.8144836	-1.28	0.200	-2.640523	.5521942
_cons	.0021569	.007104	0.30	0.761	-.0117666	.0160804
ddlogGDPPC						
ddlogCPI						
L1.	-.0042834	.0713547	-0.06	0.952	-.144136	.1355693
L2.	.0677639	.0561333	1.21	0.227	-.0422553	.1777831
L3.	-.1487736	.0526203	-2.83	0.005	-.2519075	-.0456397
ddlogGDPPC						
L1.	-.0274302	.2449571	-0.11	0.911	-.5075374	.4526769
L2.	.2323194	.2143839	1.08	0.279	-.1878652	.6525041
L3.	-.0696641	.2277481	-0.31	0.760	-.5160422	.3767139
_cons	.0010941	.0019864	0.55	0.582	-.0027992	.0049874

From Table 4.10 the first part inflation is affected negatively by its second lag value with coefficient of (-0.4875006) and positively affected by the third lag value with coefficient of (0.4656226). Also the second lag of GDP affects it negatively with coefficient value of (-2.264951).

For the second part GDP is negatively affected by the third lag of inflation with coefficient of (-0.1487736).

4.4.6 Stability Test of a VAR

For the model to be valid, one key property is that the model must be stable. A VAR is stable if the modulus of each eigenvalue of a companion matrix is strictly less than one. Lütkepohl (2005) has shown that, if a VAR is stable, it is invertible, has an infinite order vector moving average representation and the impulse response functions and forecast error variance decompositions have known interpretations. If any eigenvalue with modulus greater than one is found in a companion matrix, then the VAR is unstable and forecasts will explode. This means that either the variables in the model are nonstationary or the model is mis-specified.

Table 4.11: Results of Test for VAR stability

. varstable

Eigenvalue stability condition

Eigenvalue		Modulus
-.4195692	+.7671341i	.874376
-.4195692	-.7671341i	.874376
.857012		.857012
.2610354	+.6611913i	.710854
.2610354	-.6611913i	.710854
-.5671635		.567164

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

Table 4.11 above shows the eigenvalue condition test for stability of the VAR. Since the modulus of each eigenvalue in our model is strictly less than one, the estimates satisfy the eigenvalue stability condition. This means that our estimated VAR model is stable and meaningful interpretation of the results is guaranteed.

4.4.7 Lagrange –Multiplier (LM) test

The LM tests for autocorrelation in the residuals of VAR models as demonstrated in Johansen (1995). We test for autocorrelation of the residuals in a VAR because most of the post-estimation analysis from a VAR assumes that the residuals from a VAR are not autocorrelated. Table 4.12 presents results of LM test for autocorrelation in the residuals.

Table 4.12: Results of Test for Autocorrelation for variables ddlogCPI and ddlogGDPPC

. varlmar

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	1.5309	4	0.82115
2	6.7024	4	0.15247

H0: no autocorrelation at lag order

Table 4.12 reports the calculated chi-square values for the lags one through to three, the degrees of freedom and the p-values. The null hypothesis for LM test is that there is no autocorrelation at lag. At all lags and all conventional levels of significance, we fail to reject the null hypothesis of no autocorrelation in the residuals. This means that the residuals of our VAR model are not autocorrelated. This result also amplifies the correct specification of our VAR model.

4.4.8 Granger Causality Test

Granger causality statistics examine whether lagged values of one variable helps to predict another variable. The formal definition of Granger causality asks whether past values of X_t aid in the prediction of Y_t conditional on the fact that we have already accounted for the effects on Y_t of past values of Y_t and of past values of other variables. If this is the case, then X_t is said to Granger cause Y_t . Table 4.14 present the results for granger causality test for second differences of logarithm of Inflation on the second difference of logarithm of Economic growth.

Table 4.13: Results of Test for Granger Causality Wald Tests for variables ddlogCPI and ddlogGDPPC

```
. vargranger
```

Granger causality wald tests

Equation	Excluded	chi2	df	Prob > chi2
ddlogCPI	ddlogGDPPC	10.656	3	0.014
ddlogCPI	ALL	10.656	3	0.014
ddlogGDPPC	ddlogCPI	10.24	3	0.017
ddlogGDPPC	ALL	10.24	3	0.017

Therefore, we can conclude that there is directional causality running from inflation to economic growth and Economic growth to Inflation. We see strong evidence that lagged Economic Growth helps predict the Inflation (0.014) also lagged Inflation helps predict the Economic Growth (0.017).

Table 4.14: Results for Co integration Test for variables ddlogCPI and ddlogCAP

```
. vecrank ddlogCPI ddlogCAP
```

Johansen tests for cointegration
Trend: constant
Sample: 1994 - 2013
Number of obs = 20
Lags = 2

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	6	52.654163	.	41.0734	15.41
1	9	67.982451	0.78408	10.4168	3.76
2	10	73.19087	0.40598		

Since the trace statistic at $r = 0$ of 41.0734 is greater than its critical value of 15.41, we cannot reject the null hypothesis that there are zero co integrating equations at five percent level of significance. Therefore, we conclude that inflation and Capital accumulation are not co integrated. This means that, a linear combination of inflation and economic growth will not lead to a long-run stable equilibrium relationship.

Table 4.15: Vector Autoregression Results for ddlogCPI and ddlogCAP

```
. var ddlogCPI ddlogCAP, lags(1/3)
```

Vector autoregression

Sample: 1995 – 2013
Log likelihood = 76.99616
FPE = 4.86e-06
Det(Sigma_ml) = 1.04e-06

No. of obs = 19
AIC = -6.631174
HQIC = -6.5134
SBIC = -5.935272

Equation	Parms	RMSE	R-sq	chi2	P>chi2
ddlogCPI	7	.037322	0.2388	5.960604	0.4276
ddlogCAP	7	.044478	0.8421	101.2953	0.0000

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
ddlogCPI						
ddlogCPI						
L1.	.17771	.2309325	0.77	0.442	-.2749095	.6303294
L2.	-.3647393	.3064538	-1.19	0.234	-.9653778	.2358992
L3.	.4914461	.2437954	2.02	0.044	.0136159	.9692763
ddlogCAP						
L1.	-.008062	.145719	-0.06	0.956	-.2936661	.2775421
L2.	.0519532	.1373022	0.38	0.705	-.2171541	.3210606
L3.	-.0332688	.0975018	-0.34	0.733	-.2243688	.1578313
_cons	-.0079876	.0075639	-1.06	0.291	-.0228125	.0068373
ddlogCAP						
ddlogCPI						
L1.	-1.555671	.2752093	-5.65	0.000	-2.095071	-1.01627
L2.	-.7082479	.3652104	-1.94	0.052	-1.424047	.0075513
L3.	.5828481	.2905384	2.01	0.045	.0134032	1.152293
ddlogCAP						
L1.	-.5821084	.1736578	-3.35	0.001	-.9224715	-.2417453
L2.	-.238256	.1636272	-1.46	0.145	-.5589593	.0824474
L3.	-.4355826	.1161959	-3.75	0.000	-.6633223	-.2078429
_cons	.0092441	.0090141	1.03	0.305	-.0084232	.0269114

From Table 4.15 the first part inflation is affected positively by its third lag value with coefficient of (0.4914461).

For the second part CAP is negatively affected by the first and second lags of inflation with coefficients of (-1.555671) and (-0.7082479) respectively.

Also CAP is affected negatively by its first, second and third lags with coefficients of (-0.5821084), (-0.238256) and (-0.4355826) respectively

Table 4.16: Results of Test for Granger Causality Wald Tests for variables ddlogCPI and ddlogCAP

```
. vargranger
```

Granger causality wald tests

Equation	Excluded	chi2	df	Prob > chi2
ddlogCPI	ddlogCAP	.61311	3	0.893
ddlogCPI	ALL	.61311	3	0.893
ddlogCAP	ddlogCPI	68.268	3	0.000
ddlogCAP	ALL	68.268	3	0.000

For the results presented on Table 4.16, we fail to reject the null hypothesis that the lagged values of the second differences of logarithm of capital accumulation do not granger

causes the second differences of logarithm of Inflation. On the other side under the 95% confidence, we reject the null hypothesis that the lagged values of the second differences of logarithm of Inflation does not granger cause the second differences of logarithm of capital accumulation. So for these results there is causality that is running from inflation to Capital accumulation.

4.5 Discussion of the Findings

The discussions of findings follow the trend of the research objectives and answer the research questions that governed this study.

4.5.1 The trend of inflation with respect to the economic growth of Tanzania

The findings shows that inflation and economic growth as measured by the GDP are running on the same direction, though economic growth is more sensitive to the changes for a little change of inflation for the period of 1990 to 2013, the findings show that inflation is fluctuating in increasing trend. On the other hand the economic growth is fluctuating in decreasing trend, with a little increase experienced in the year 1992 to 1995, another increase can be shown in the year 2008 to 2009 and 2010 to 2013. The trend have evidenced that every increase or decrease of Inflation leads the same trend to the GDP.

4.5.2 The trend of inflation with respect to capital accumulation of Tanzania

The Capital Accumulation (CAP) from year 1990 to 1992 is decreasing on the same trend with the CPI, in 1992, when CPI started to increase; the decreasing rate of CAP was much slower. 1993 to 1994 the CPA was increasing as the CPI increases.

But from the year 1995 to year 2010, there was no significant relationship between CPI and CAP, the results shows that there was a continuous decrease of CPI for that period, while for the case of CAP there were unidirectional fluctuations which might have been accelerated with other factors rather than CPI. Again from 2010 to 2013, the trend seems not having a clear relationship.

From the above findings, it suggests that CPI and CAP have no clear trend relationship.

4.5.3 The relationship between inflation and economic growth of Tanzania

The study finds no existence of co integration between inflation and economic growth. This result is in line with empirical findings of Chimobi (2010), Faria and Carneiro (2001) and

Yamamoto (1995) but contrasts with studies by Bruno and Easterly (1995) and Ahmed and Mortaza (2005), among others. The implication of this result is that, a linear combination of inflation and economic growth will not lead to a long-run stable equilibrium relationship. This result is not surprising given the nature of the economy of Tanzania and its sectors. Most of the drivers to economic growth have been identified as supply side factors, which might not be affected by inflation directly in the long-run.

Furthermore, unlike developed countries, in a developing country like Tanzania, with less elastic nature of supply of output, increase in investment creates additional demand which is not matched by supply. In a bid to scale up investment by accumulating capital in order to foster economic growth, government makes huge investment expenditures such as infrastructure development. This leads to a sharp increase in aggregate demand for consumer goods, especially agricultural products. However, this increase in expenditure does not match the supply due to various tailbacks, hence inflationary pressures ensue. In a poor country like Tanzania, we expect the income elasticity of demand for agricultural products to be high. Since the agricultural products account for most part in the CPI, an increase in demand for these products will lead to rise in the price and inflation may result. Now, due to the nature of investments made by the government like investments in roads, with long gestation period, they can only help to increase supply of consumer goods in the long-run. On the other hand, in the short-run, prices generally go up under the pressure of excessive demand for goods, leading to loss of real income and erosion of purchasing power.

The results from VAR analysis are presented in table 4.9 of the previous section with two equations estimated using the OLS methodology. All the necessary tests passed and hence we proceeded to make inferences on the parameters and post-estimation analysis.

In a Vector Auto regression results the short run dynamics indicate that the past levels of inflation and GDP impact negatively the current level of inflation suggesting that controlling inflation today is important as it might negatively influence the inflation and economic growth of tomorrow.

Also GDP level is affected negatively by the past level of inflation and GDP. Therefore it is critical to have health economic growth and inflation today as it will influence the future GDP

Granger causality was tested naturally using a VAR. If inflation Granger causes GDP, then some or all of the lagged inflation values have non-zero effects, that is, lagged inflation affects GDP. On the other hand, if GDP Granger causes inflation, then some or all lagged values of GDP have non-zero effects, that is, lagged GDP affects inflation.

The result of Granger causality analysis shows that inflation Granger causes economic growth, on the same scenario economic growth Granger cause inflation. This means that, inflation impacts economic growth in Tanzania and vice versa. This result of directional Granger causality running from inflation to economic growth and economic growth to inflation concurs with empirical studies by Datta and Mukhopadhyay (2011) and, but contrasts with studies by Dipietro and Sawhney (1999), Gokal and Hanif (2004), Mubarik (2005), Erbaykal and Okuyan (2008), among others.

For the case of CPI and CAP the VAR result shows that the past value of inflation and capital accumulation is affecting negatively the today value of CAP. This observation implies that apart from the direct influence of inflation on economic growth, inflation also through capital accumulation is affecting economic growth as postulated in classical economic growth theory by Adam Smith where he showed that output growth is driven by investment among other factors.

Thus CAP and CPI relationship must be controlled for the optimum economic growth and if they are left unchecked they will cause a negative effect on each other and also on economic growth.

Therefore, the results show that CAP is very important channel through which inflation is exerting its influence on economic growth as 84% of variation in CAP is explained by CPI in our VAR results as found also by Xiao (2009).

The question is; should Tanzania policy makers worry about the effects of higher growth on inflation? The answer is yes as dictated by the results of this study. There are situations when policy makers are concerned about the effects of economic growth on inflation. For example, when growth rates are low, then the central bank is not likely to raise interest rates as present growth rates are considered to be too low to stimulate inflation. On the other

hand, when growth rates are high, the central bank is likely to increase interest rates to slow the growth rates of the economy, in order to prevent the upsurge in inflation. Dipietro and Sawhney (1999) argue that these kinds of policies have been implemented before in countries like the United States of America (USA) where at one point the Federal Reserve was to slow the economy to an annual rate of 2.5 percent to avoid significant acceleration of inflation.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.0 Introduction

In this chapter, conclusion of the findings, policy implication of the findings as well as the recommendations for further studies has been given.

5.1 Conclusion and Policy Implications

The main purpose of this study was to explore the nature of the relationship between inflation and economic growth in Tanzania. The methodology employed in this study is time series analysis using cointegration test, VAR and Granger causality analysis.

Second differences in the logarithm of the CPI has been used to measure inflation and second differences in the logarithm of real GDP per capita as a measure of economic growth to examine the relationship. The data was purposely chosen from the Free Market Economy regime so as to avoid the problem of mixing data from two different regimes. Stationarity tests have been carried out using the Augmented Dickey Fuller test and the variables were found to be Stationary in the second differences of their logarithm. This means that the variables used in this study are integrated of order two. Test of co integration has also been conducted and the results show that, for the period under study, there is no co integrating relationship between inflation and economic growth as well as for inflation and Capital accumulation.

The findings of no co integration concur with the results of Kasidi (2013), and imply that there is no stable long-run equilibrium relationship between inflation and economic growth also between inflation and capital accumulation. This result necessitated the use of unrestricted VAR analysis as opposed to using models which take care of the long-run effects such as the VECM. The VAR analysis reveals that there is significant and negative relationship between inflation and economic growth in the short-run which is the same results found by Fisher, 1993. Further effort is made to check the direction of causality that exists between the two variables by employing the VAR Granger causality test at lags one to three as chosen by the lag selection criteria. Granger causality test indicates that there is a directional causality running from inflation to economic growth and economic growth to inflation. Also there is unidirectional causality running

from capital accumulation to inflation. These results are in conformity with several studies reviewed in literature which reveal that inflation has influence on economic growth and capital accumulation.

Hence, the study through the empirical findings infer that the causality that runs from inflation to economic growth and from Economic growth to inflation is an indication of a relationship showing that inflation indeed has an impact on economic growth as well as on capital accumulation.

The most striking observation of the findings together with literature reviews is that, Inflation is among the important factors on determining economic growth as its value will influence the future economic growth of the country and also inflation has influence on capital accumulation which according to Adam Smith is imperative on economic growth. Therefore, the Tanzania economic policy should focus on stabilizing the inflation rate which would bring and maintains optimal economic growth together with Capital Accumulation.

5.2 Recommendations for future research

Future research should go further, in assessing the relationship between inflation and economic growth by including more variables (channels), like interest rate, through which inflation might relates to economic growth.

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