INFLATION AND GROWTH RELATIONSHIPS: A COMPARATIVE STUDY OF ETHIOPIA AND UGANDA

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ABSTRACT

INFLATION AND GROWTH RELATIONSHIPS: A COMPARATIVE STUDY OF ETHIOPIA AND UGANDA

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Understanding the world's need for price stability, the possible growth halting effects that emanate from the rising levels of inflation in most African countries is becoming an issue of increasing concern. This study compares the impact of inflation on economic growth between Ethiopia and Uganda .In doing so it employs annual time series data of Consumer Price Index (CPI) as a proxy for inflation and Gross Domestic Product (GDP) at current price as a proxy for growth, which covers the period 1990-2012. The analysis adopted descriptive approach to show the trend and variability of inflation and growth so as to give a clear view how the variables change through time for both countries. The ADF and Phillp-Perron tests are conducted to check for stationarity in the variables, the Johansen co-integration test is used to confirm the existence of co-integration between inflation and growth variables. After finding the existence of co-integration between the variables the Vector Error Correction Model (VECM) is used to investigate the causal relationship between inflation and growth. Comparison of the coefficient of variations of the two countries shows that the variabilities of GDP and inflation are larger for Ethiopia than Uganda. And the Vector Error Correction Model shows the existence of a positive significant bi-directional feedback relationship between inflation and economic growth for Ethiopia both in the short and long run. But for Uganda there exists only a uni-directional negative relationship between inflation and growth that runs from GDP growth to inflation. Since there is a strong long run effect of economic growth on inflation both in Ethiopia and Uganda, there is a need for a stabilization program to mitigate the inflationary situations in both countries. Therefore, focus should be given on policies that will achieve price stability in Ethiopia. This demands further research in identifying factors affecting the level of inflation in the country and also on the impact of inflation on other economic variables like on the development of a country. Uganda needs to concentrate on the adoption of a more appropriate fiscal policy instruments like increasing the provision of infrastructural facilities, provision of professional training for farmers, increment of investment opportunities and the likes that could eliminate the structural bottlenecks.

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Acronyms and Abbreviations

ADF –Augmented Dickey- Fuller

AFDB- African Development Bank

BOU- Bank of Uganda

CGE- Computable General Equilibrium

CPI- Consumer Price Index

CSA- Central Statistics Agency

ECM-Error Correction Model

GDP- Gross Domestic Product

IMF-International Monetary Fund

MDGs- Millennium Development Goals

MOFED- Ministry of Finance and Economic Development

NAIRU- Non-Accelerated Inflation Rate of Unemployment

NBE- National Bank of Ethiopia

OECD-Organization for Economic Cooperation and Development

PP- Phillip perron

ROW- Reset of the World

SAM- Social Accounting Matrix

VAR- Vector Autoregressive

VECM- Vector Error Correction Model

UBOS- Uganda Bureau of Statistics

UNDP- United Nations Development Program

WB- World Bank

I. INTRODUCTION

1.1 Background of the Study

The relationship between inflation and economic growth has been debatable. 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. Especially the focus of argument is that whether inflation is necessary or detrimental for economic growth. Several studies have estimated a negative relationship between inflation and economic growth. Studies conducted by Fischer (1993), Barro (1995), Bruno and Easterly (1996), Odhiambo (2009) showed that inflation and growth relationships have indicated significantly negative effects over time.

On the contrary, there are also arguments for the positive effect of inflation on growth. The work of Tobin (1965) indicated that the demand for money, the substitute for capital, is motivated by the optimistic speculation on the positive effect between inflation and output. Hence the higher accumulated capitals would lead to higher economic output.

The issue seems to be more important in poorer economies since inflation mainly manifests itself in rising food prices. In Sub-Saharan Africa, output grew, on average, at a rate of 5.1 percent in 2012, and is projected to increase to 5.4 percent in 2013 and 5.7 percent in 2014. Drivers of growth include investment and exports on the expenditure side, with the production side led by construction, agriculture, and new extractive industry capacity coming on stream (IMF, 2013).

On the other hand inflation in the Sub-Saharan region dropped from more than 10 percent in 2011 to 7.9 percent in 2012 and is anticipated to maintain its downward trend in 2013–14 (IMF, 2013). Disinflation was particularly marked in eastern Africa, including Ethiopia (down from 36 percent in 2011 to 13 percent by end of 2012), Uganda (from 27 percent to 6 percent), and Kenya (from 19 percent to 7 percent). The sharp slowing of inflation in the sub-region reflected several factors, including good harvests, tight monetary policies and, in some cases, the appreciation of local currencies, reversing the movements observed in 2011. This achievement in reduction of inflation level is believed to facilitate economic growth.

Currently both Ethiopia and Uganda are working towards maintaining a stable and low inflation level along with accelerating economic growth trend. However, the veracious relationship between inflation and growth is difficult to conclude unless there exists strong empirical evidence that supports the case in both countries. Therefore, this study aims at finding out the empirical relationship between inflation and growth both in Ethiopia and Uganda to provide a basis for policy approaches.

1.2 Statement of the problem

Currently, monetary policies of most countries in the world highly concentrate on the maintenance of price stability. This huge focus on price stability is with the aim of promoting sustainable growth and development; also to strengthen the purchasing power of the domestic currency (Umaru and Abdulrahman, 2012). Understanding the world's need for price stability, the possible growth and development halting effects that emanate from the rising levels of inflation in most African countries is becoming an issue of increasing concern.

From a theoretical perspective, Johnson (1967) argues that although desirable, achieving and maintaining steady inflation proves problematic because of political factors or policy differences. As a result of such policy interventions and political factors, the effects of inflation on growth vary by country and tend to be conflicting. Gregorio (1996) reviews the theory and evidence on inflation, growth and central bank independence. The empirical evidence shows a negative correlation between inflation and central bank independence, especially in OECD countries, but the effects of inflation on growth are less conclusive. Faria and Carniero (2001) analyzed the case of Brazil and found that inflation does not impact real output in the long run, but that in the short run there exists a negative effect of inflation to output growth.

On the year 2011, the inflation level in East Africa has reached as high as 20 percent on average (Alain, 2012). Such a rise in inflation is becoming a great challenge for the region's growth and development process. In Ethiopia, inflation rate reached 34 percent

and Uganda recorded the second highest level of inflation in the region hitting 30.5 percent in October 2011 (Alain, 2012). Kenya and Tanzania took the 3rd and 4th places with the inflation rate of 18.9 percent and 17.9 percent respectively during the same period. This trend of increase in inflation in the region is suspected to be harmful for the developing economies, especially for their poor residents.

Ethiopia recorded a very high inflation rate of 40 percent in October 2011 (Simpasa and Gurara, 2011). Inflation in Ethiopia has been building for some time, even before the onset of the current episode of high food prices, driven by expansionary monetary policy. Credit to the public sector grew by more than 45 percent in 2011, triggered largely by the monetization of the fiscal deficit. Although commercial banks were compelled to purchase government bonds, this did not significantly slow down the rate of monetary growth.

Inflation rate in Uganda reached 30.4 percent in October 2011, and then it decelerated to 27 percent in December 2011. But this number is also very high compared to the 3 percent inflation rate recorded at the end of 2010 (Simpasa and Gurara, 2011). Year-on-year food inflation spiked to 45.6 percent in October 2011, while non-food inflation has been increasing steadily moving to 22.8 percent from 5.5 percent in December 2010.This shows despite the decelerating trend food price inflation has been increasing over time.

The higher inflation witnessed in the two countries, particularly through higher food price, could worsen the economic inequality, may increase uncertainty about future inflation and could lower economic growth.

The relationship between inflation and growth in Ethiopia has been investigated by various researchers using different approaches. But there is lack of literature on the relationship between inflation and growth in Uganda. Researchers seem to give too much emphasis on the impact of financial crisis on economic growth and development than studying the inflation-growth relationship. Hence, this study tries to contribute to the literature by analyzing the relationship between inflation and growth in Uganda.

In doing so, the study compares the impact of inflation on economic growth between Ethiopia and Uganda, which exhibited the top two inflation rates in the East African region. Besides, conducting a comparative study is beneficial since it helps to notice the differences and similarities along with what could be learned from each other's experiences concerning the issue at hand.

1.3 Objectives of the Study

The general objective of this study is to compare the inflation-growth relationship in Ethiopia and Uganda. The specific objectives include:

- To describe the trend and variability of inflation and growth rates in the two countries
- To assess the relationship between inflation and growth for Ethiopia and Uganda
- To compare the inflation-growth relationships between Ethiopia and Uganda and draw some lessons.

1.4 Scope of the Study

This study is concerned with analyzing the relationship between inflation and growth. For this reason it only analyses the annual data on Gross Domestic Product (GDP), Consumer Price Index (CPI) for the Period 1990-2012 both in Ethiopia and Uganda.

Other variables that affect inflation (Money supply, interest rate, Government expenditure, Taxation), growth (variables like Consumption Expenditure, Investment, Saving, Government expenditure, Net export) are not included independently because the study aims at finding the direct relationship existing between GDP, CPI in general. Besides, the lagged values of GDP and CPI are used in the study in order to explain the effects of the endogenous variables.

1.5 Significance of the Study

The relationship between inflation and growth has been highly debatable. In Ethiopia the inflation-growth relationship has been assessed to some extent. On the other hand, in Uganda there is lack of literature which assesses inflation-growth relationship.

Given the two countries experienced the highest inflation levels in East Africa it is clear that there is a need for further study in the area. Therefore, this study may be beneficial for both countries since it performs an empirical investigation which will give an insight on the inflation-growth relationship in the context of comparison of the situations in the two countries. In addition, the findings of the study might help policy makers to learn from each other's experience both on their weaknesses and strengths of relevance to the trends in inflation-growth relationship.

2. LITRATURE REVIEW

2.1 THEORIES OF INFLATION AND GROWTH

The following sub-sections present Classical, Keynesian, Neo-Keynesian, Monetarist, Neo-classical and Endogenous growth theories, with their respective contribution to the inflation-growth discussion.

2.1.1 Classical Growth Theory

The founder of this growth theory was Adam Smith who argued that growth was self-reinforcing and exhibits increasing return to scale. The classical growth theory viewed saving as a creator of investment and hence growth. The link between the change in price level (inflation) and its "tax" effect on profit and output were not specifically articulated in this growth theory. But the relationship between inflation and growth is implicitly suggested to be negative as indicated by the reduction in firms profit level through higher wage costs (Gokal and Hanif, 2004)

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. In the short run, the aggregate supply curve (AS) is upward sloping rather than vertical. Had the AS curve been vertical, changes on the demand side of the economy affects only prices but since it is upward sloping, changes in aggregate demand (AD) affects both

price and output (Dornbusch et.al, 1996). Here, there are many factors that affect the inflation rate and the level of output in the short run. These include change in expectations, labor force, price of other factors of production, monetary policy and fiscal 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 implying that 'nothing is changing' in the 'steady state' (Gokal and Hanif, 2004).

The 'dynamic adjustment' of the short-run AD and AS curves yields an 'adjustment path' which exhibits an initial positive relationship between inflation and growth, however, turns negative towards the latter part of the adjustment path.

According to this view, the initial positive relationship between output and inflation usually happens due to the 'time-inconsistency problem'. Hence, producers continue to increase output as they feel that only the prices of their products have increased while the other producers are operating at the same price level, although, in reality, overall prices have risen.

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. 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. This fall in output may be caused by a fall

in aggregate demand since the product is more expensive which will lead to a decline in production level. Also there is a possibility of creating artificial shortage in the market by suppliers in expectation of greater profit in the future. 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.

2.1.3 Money and Monetarism

Friedman (1963), who coined the term "Monetarism", mentioned several key long run properties of the economy including the quantity theory of money and the neutrality of money. 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. The quantity theory of money linked inflation and growth by equating the total amount of spending in the economy to the total amount of money in existence. The neutrality of money theory took place when the equilibrium values of real variables including the level of GDP are independent of the level of 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 the neutrality of money holds then inflation will be harmless. In general monetarist suggest that in the long run prices are mainly affected by the growth rate of money, while having no real effect on growth and if the money supply growth is higher than the economic growth, then inflation will occur (Gokal and Hanif, 2004).

2.1.4 Neo-classical Theory

In 1956 Solow and Swan designed one of the earliest models of inflation-growth relationship which was named the neo-classical model. The model exhibited diminishing returns to labor 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.

Tobin (1965) is another neoclassical economist who developed further Mundell's model in making money as a store of value in the economy. Individuals in this model substitute current consumption for future consumption by either holding money or acquiring capital. Under this setup, individuals maintain precautionary balances, in spite of capital offering a higher rate of return. According to Tobin's portfolio mechanism, people will substitute away from money, with its lower return, and move towards capital. The

mechanism results in a higher steady state capital stock. Quite simply, the Tobin effect suggests that inflation causes individuals to substitute out of money and into interest earning assets, which leads to greater capital intensity and promotes economic growth. In effect, inflation exhibits a positive relationship to economic growth. However, the effect on output growth is temporary.

Inflation initially motivates capital accumulation which will contribute to higher growth. But the impact of inflation on growth is only temporary since this trend works only until the return on capital falls. Tobin (1972) also argued that, because of the downward rigidity of prices (including wages), the adjustment in relative prices during economic growth could be better achieved by the upward price movement of some individual prices.

Sidrauski (1967) proposed the next major development, with his seminal work on the context of an infinitely-lived representative agent model where money is 'Super-neutral'. Super-neutrality, as mentioned earlier, holds when real variables, including the growth rate of output, are independent of the growth rate in the money supply in the long-run. The main result in Sidrauski's economy is that an increase in the inflation rate does not affect the steady state capital stock. As such, neither output nor economic growth is affected.

Stockman (1981) developed a model in which an increase in the inflation rate results in a lower steady state level of output and a decline in people's welfare. In Stockman's model,

money is a compliment to capital, accounting for a negative relationship between the steady-state level of output and the inflation rate. With inflation eroding the purchasing power of money balances, people reduce their purchases of both cash goods and capital when the inflation rate rises. Correspondingly, the steady-state level of output falls in response to an increase in the inflation rate.

Cooley and Hansen (1989) extend the mechanism to consider capital accumulation. The key assumption is that the marginal product of capital is positively related to the quantity of labor. The return to labor falls when the inflation rate rises and people will respond by substituting away from consumption to leisure. With the decline in the quantity of labor, in response to the rise in inflation, the return to capital falls and the steady-state quantities of capital and output decline. Cooley and Hansen show that the level of output permanently falls as the inflation rate increases.

In general the theoretical view of neoclassical school can yield different results with regard to inflation-growth relationship. An increase in inflation can result in higher output (Tobin effect) or lower output (Stockman, Cooley and Hansen effect) or no change in output (Sidrauski).

2.1.5 Neo-Keynesian

It emerged from the ideas of Keynesianism and one of the major developments of neo-Keynesian was the concept of 'potential output' or natural rate of output. This is the level of output when the economy is operating at optimal level of production, given the

institutional and natural constraints. This level of output also corresponds to the natural rate of unemployment or non-accelerating Inflation rate of unemployment (NAIRU).

According to this theory, inflation depends on the level of actual output (GDP) and the natural rate of unemployment. First, if GDP exceeds its potential and unemployment is below the natural rate of unemployment, inflation will increase as suppliers increase their price and built in inflation which is often linked to the price/wage spiral because it involves workers trying to keep their wages up with prices and then employers passing higher costs on to consumers as higher prices as part of a vicious circle will worsen. Second, if the GDP falls below its potential level and unemployment is above the natural rate of unemployment, inflation will decelerate as suppliers reduce price as there will be excess capacity and this undermine built in inflation. The final case is when GDP is equal to its potential and unemployment rate is equal to NAIRU, then the inflation rate will not change as long as there is no supply shocks (Gokal and Hanif, 2004).

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 manner.

2.1.6 Endogenous Growth Theory

This growth theory describes economic growth which is generated by factors generated within the production process. In the endogenous growth theory, the growth rate depends on one variable; the rate of return of capital. Variables like inflation reduce the rate of

return of capital which in turn reduces capital accumulation and growth. In the neoclassical model discussed previously the return on capital declines as more capital is accumulated. While in the endogenous growth models per capita output continues to increase because the return on capital does not fall below a positive lower bound. The basic intuition is that only if the return on capital is sufficiently high, will people be induced to continue accumulating it.

Another form of capital i.e. human capital was later included in the endogenous model. The effect of inflation on the two forms of capital was negative. An inflation tax on capital income directly reduces the growth rate while a tax on human capital could cause labor to leisure substitution which lowers the rate of return on human capital and can also lower growth rate. (Gokal and Hanif, 2004)

In general there are different theories about the relationship between inflation and growth depending on the existing situation and choice of variables in their analysis.

2.2 EMPIRICAL LITERATURE ON INFLATION AND GROWTH

2.2.1General

Bruno and Easterly(1996) examined the determinants of economic growth using data series consisting of annual CPI inflation of 26 countries that had inflation crises at some point in time over the 1961-1992 period. Setting a threshold for an inflation crisis at inflation rate of 40 percent and over, they identified countries, which had high inflation

crisis of 40 percent and above. This was followed by assessing how the countries' growth has performed before, during, and after its high inflation crisis. The robustness of the results was examined by controlling for other factors such as shocks including political crises, terms of trade shocks, and wars. They found a negative relationship between inflation and growth, which is firmly established when looking at the temporal association of growth with discrete high inflation crises. At lower rates of inflation, growth and inflation may simply be jointly troubled by various demand and supply shocks and hence shows no consistent pattern. Inflation crises, as they believe, have a temporary effect on output but no permanent effect on output growth which led to their conclusion that inflation crises may be a cyclical phenomenon, although the cyclical swings are large indeed.

Barro (1995) attempts to find from empirical analysis the estimated effects of inflation on growth and used dataset which covers over 100 countries from 1960 to 1990. He computed annual inflation rates from consumer price indices and collected data for the other determinants of growth, which included the growth rate of real GDP per capita, and the ratio of investment to GDP for the three decades. To assess the effect of inflation on economic growth, a system of regression equations were used, in which many other determinants of growth were held constant. The results indicated with significance that inflation had a negative effect on growth, with a coefficient of –0.024. This shows that if a number of the country characteristics are held constant, then regression results indicate that the impact effects from an increase in average inflation by 10 percentage points per year causes a reduction of the growth rate of real per capita GDP by 0.2-0.3 percentage

points per year, and a decrease in the ratio of investment to GDP by 0.4-0.6 percentage points.

Hodge (2005) examined the relationship between inflation and growth in South Africa over both the medium to long term and the short run. Two base models were used to estimate these relationships, as well as some modifications of each to test the robustness thereof. The researcher used a linear OLS multivariate regression analysis to reveal some useful insights into the inflation–growth relationship in South Africa. The sample for the medium-term to long-term model comprised annual observations of the growth rate and the inflation rate, including other variables believed to influence growth over the longer term, for the period 1950–2002. The results suggest that South Africa conforms to the general finding of various large sample cross-section studies, that there is a significant negative relationship between inflation and growth over the medium to long term. The limitation of this study was that no attempt was made to model the interactions between the variables beyond a linear OLS multivariate regression analysis. That is neither Co-integration tests nor causality tests were estimated.

Umaru and Zubairu (2012) investigate the impact of inflation on economic growth and development in Nigeria between 1970-2010 through the application of Augmented Dickey-Fuller technique in testing the unit root property of the series and Granger causality test of causation between GDP and inflation. The results of unit root test suggest that all the variables in the model are stationary and the results of causality test suggest that GDP causes 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. A good performance of an economy in terms of per capita growth may therefore be attributed to the rate of inflation in the country.

Kasidil and Mwakanemela (2013) established the existence of inflation and growth relationship using time-series data for the period 1990-2011. Correlation coefficient and co-integration technique are used to examine the relationship between inflation and GDP and Coefficient of elasticity were applied to measure the degree of responsiveness of change in GDP to changes in general price levels. Results suggest that inflation has a negative impact on economic growth. The study also revealed that there was no co-integration between inflation and economic growth during the period of study and hence no long-run relationship between inflation and economic growth in Tanzania.

2.2.2 Empirical literature for Ethiopia

Asayehgn (2008) examined both the main causes and the consequences of existing inflationary pressure in Ethiopia using time series data (1991-2 to 2006-7). The main source of data is from the World Bank, International Monetary Fund, and the Ethiopian Statistical Agency. The regression coefficients were estimated using the Ordinary least square method. Results of the multiple regression analysis results, estimated based on ordinary least squares, show that the main determinants of inflation in Ethiopia are real GDP, percentage increase of the exchange rate (exchange rate of the Ethiopian Birr

against the US Dollar), and the domestic lending interest rate (used as a proxy for broad money supply).

Ticci (2011) analyzed the distributional impact of inflation in Ethiopia at the time of the global food-price shock. The analysis relies on price data (national and regional) collected by the Ethiopian Central Statistical Agency (CSA). The main data source is the 2004/2005 WMS-HICES, a household survey conducted by the CSA (2004/2005), which is representative at the national, regional, rural, and urban levels and provides detailed information on household expenditures. The researcher used a descriptive approach to analyze the 2006-08 inflationary data and found that the effect of overall inflation on poverty was differentiated both across rural and urban areas and across regions, but, overall, urban poverty and its severity increased. In rural areas, the picture is less conclusive. The policy implications of these findings is that in urban areas, the 2006-08 inflationary spell is likely to have significantly worsened poverty, in a context already characterized by stagnant poverty reduction.

Teshome (2011) revealed that higher inflation did not significantly reduce the economic growth in Ethiopia. According to this study the major challenges for the economy were mentioned to be lower agricultural productivity, slow sectoral transformation, low tax collection capacity, imperfect market, supply side constraints and external shocks. But the limitation of this study is that it used a descriptive approach to analyze the relationship between inflation and growth which makes it difficult to find out the causal relationship and the magnitude of the effect.

Eden (2012) modeled inflation volatility and analyzed its effect on economic growth in Ethiopia. Cointegrated VAR model and granger causality test were used to see the relationship between inflation, inflation uncertainty and growth. From the co-integrated VAR model, she concluded that the growth rate of GDP affects inflation positively in the long run and negatively in the short run. The granger causality result also indicates that inflation granger causes inflation uncertainty positively and inflation uncertainty granger causes output growth negatively.

Alem and Kohlin (2013) conducted a study on the impact of food price inflation on subjective well-being in urban Ethiopia. They used an ordered probit regression to measure the impact of food price inflation on subjective well-being of urban households in Ethiopia, a country which exhibited one of the highest rates of food price inflation during 2007–2008. And they showed that a food price shock reduced subjective well-being of households significantly, although the economy was growing rapidly. While questioning the pro-poorness of rapid economic growth accompanied by a decline in citizens' average reported level of life satisfaction, they argue that controlling the rise in food price and ensuring that economic growth trickles down to the average urban citizen would enhance welfare significantly.

2.2.3 Empirical literature for Uganda

There is lack of empirical literature on the relationship between economic growth and inflation in Uganda as most studies tend to concentrate on the impact of financial crisis on economic growth. The global financial crisis affected Uganda's economy through

reduced capital inflows, including remittances, portfolio investment, exports and foreign aid, as well as through capital outflows that include repatriation of profits by foreign investors and withdrawal of portfolio investments (Ssewanyana and Bategeka, 2010). Almost all these categories of capital flows decreased and manifested themselves in a depreciation of the local currency. Coupled with increasing food prices, annual inflation rose, which limited the growth rate of Uganda to 7.1 percent against a target of 8.5 percent in 2008/09. This would ordinarily have an adverse impact on poverty reduction and improvement of people's welfare.

Alani (2012) assessed the effects of growth in capital and money supply on inflation in Uganda using both the linear regression model and Error Correction Model (ECM) methods. The study confirmed that from 1970 to 2009 inflation was more of a capital stock than a monetary phenomenon. In the case of capital stock the inflation within the period could have been brought about by expenditures on capital within sectors that were not directly productive, leaving the production of essential commodities to only a few firms in the domestic market; thus leading to shortage of essential commodities, excess demand for them and consequently inflation. This might be an evidence for reverse causation of the inflation-growth relationship.

No study has so far been conducted on the overall inflation-growth relationship in Uganda. And also studies conducted in Uganda insisted on analyzing the impact of global financial crisis on the economy and ignored to assess the inflation-growth relationship.

Therefore, this study tries to fill the research gap by conducting a comparative empirical analysis on the inflation-growth relationship between Ethiopia and Uganda.

2.3 Conceptual Framework

The concept of inflation has been defined as a persistence rise in the general price level of broad spectrum of goods and services in a country over a long period of time. Inflation has been intrinsically linked to money, as captured by the often heard maxim ‘’inflation is too much money chasing too few goods’’(Hamilton 2001: 12). Inflation has been widely described as an economic situation when the increase in money supply is faster than the new production of goods and services in the same economy (Piana ,2001) .Economists usually try to distinguish inflation from an economic phenomenon of a onetime increase in prices or when there are price increases in a narrow group of economic goods or services.(Umaru and Zubairu, 2012)

Inflation rate is measured as the percentage change in the price index (consumer price index, wholesale price index, producer price index etc). Essien (2002) opine that the consumer price index (CPI), for instance, measures the price of a representative basket of goods and services purchased by the average consumer and calculated on the basis of periodic survey of consumer prices. Owing to the different weights the basket, changes in the price of some goods and services have impact on measured inflation with varying degrees. There are several disadvantages of the CPI as a measure of price level. First, it does not reflect goods and services bought by firms and/or government, such as machinery. Secondly, it does not reflect the change in the quality of goods which might

have occurred overtime. Thirdly, changes in the price of substitutable goods are not captured. Lastly, CPI basket usually does not change often. Despite these limitations, the CPI is still the most widely used measurement of the general price level. This is because it is used for indexation purposes for many wage and salary earners (including government employees).

Another measure of inflation or price movements is the GDP Deflator which reflects what is happening to the overall level of prices in the economy annually. However, it is rarely used as a measure of inflation.

This is because the CPI represents the cost of living and is, therefore, more appropriate for measuring the welfare of the people. Furthermore, because CPI is available on a more frequent basis, it is useful for monetary policy purposes.

2.4 Policies on Inflation and Growth

2.4.1 Policies to Stabilize Inflation and Accelerate Growth in Ethiopia

One of the most important aspects in a country's economic performance is monetary policy. And any policy needs a strong institutional foundation in order to achieve its envisioned goal. But if this is not the case, institutional factors could act as restraints for both the policy implementation process and its effectiveness (NBE, 2009).

The National Bank of Ethiopia is responsible for the formulation and implementation of the country's monetary policy. The main objectives of the monetary policy of NBE

include the maintenance of price stability, exchange rate stability and to provide support for sustainable economic growth. Maintenance of price stability is highly emphasized since it is considered as a proxy for the achievement of overall macroeconomic stability. The motive behind is that price stability helps to stabilize major economic activities like investment, consumption, international trade and saving; and in the end it will enhance employment and economic growth.

The National Bank of Ethiopia introduced a wide range of monetary policy instruments in anticipation of increasing competition, efficiency and transparency in the banking system. These elements would help to develop the financial intermediation and promote liquidity management in the system. As a result well-functioning money and financial markets would be created which finally accelerates economic growth and development.

Before year 2002/2003 the National Bank of Ethiopia exercised tight fiscal and monetary policies in order to tackle the chronic level of inflation. However, in the post 2002/03 period the government moved towards less conservative monetary and fiscal policy breaking the institutional legacy of fiscal and monetary policy conservatism. The bank adopted a relaxed monetary policy hoping to transform the country in to a developmental state by laying the foundation of a well-functioning financial market and economy.

2.4.2 Major Policies to Stabilize Inflation and Accelerate Growth in Uganda

The Constitution of the Republic of Uganda (1995) and the Bank of Uganda Act of 1993 empower Bank of Uganda to formulate and implement monetary policy directed at the

economic objectives of achieving and maintaining economic stability (BOU, 2012). There is no explicit numerical value of price stability for Uganda, but an average annual core inflation of about 5 percent or less over the medium-term is targeted.

Effective July 2011, the Bank of Uganda reformed the Monetary Policy Framework to an Inflation Targeting-lite to meet the challenges of macroeconomic management generated by the transformation of the economy over the last 10 years, and in particular the rapid growth and diversification of the financial system(BOU,2012). The reforms to the monetary policy framework are intended to strengthen implementation of Uganda's medium term macroeconomic framework. The new framework replaces the Reserve Money Program (RMP) that had guided the conduct of monetary policy in Uganda since 1993. The Reserve Money Program is quantity based, focusing on the growth of the Bank of Uganda's balance sheet.

The primary policy objective of monetary policy remains unchanged: the control of core inflation over a medium term horizon. As part of the process of introducing an inflation targeting lite monetary policy framework, the Bank of Uganda will set an interest rate as the operating target of monetary policy, rather than base money that has hitherto been used which was more difficult to control due to the dominant role and unpredictable behavior of currency demand.

The greatest attributes of the inflation lite monetary policy framework are the fact that it is forward looking and manages inflation expectations through communication of the monetary policy stance.

2.4.3 Comparison of Policy focus in Ethiopia and Uganda

The NBE uses a fusion of diversified monetary policy instruments in order to effectively carryout its monetary management functions. These instruments include Open Market Operation (Sale & purchase of bonds or securities issued by governments), a standing central bank credit facility, reserve requirement, setting of floor deposit interest rate (until interest rate is fully deregulated),direct borrowing/lending in the inter-bank money market and introducing re-purchase agreement (repo/reverse repo operations),and use of selected credit control when necessary. But Open Market Operation and a standing Central bank credit facility are the two major focuses of the National Bank of Ethiopia.

On the Other hand, the Bank of Uganda focuses on the interest rate which is called the Central Bank Rate (CBR) and is used to guide the seven day interbank interest rates. The CBR is set once a month and will be publicly announced, so that it clearly signals the stance of monetary policy during the month. The CBR will be set at a level which is consistent with moving core inflation towards the BOUs policy target of 5 percent over the medium term.

3. METHODS

3.1 Data Sources

The study employs annual time series data collected from IMF, which covers the period 1990-2012. IMF is chosen as a major source since the data from IMF has revised the national account data of both countries and since the study aims at comparing the situation between two countries using a common, international source of data seems more appropriate. The initial period 1990 is chosen since both countries implemented liberalization and privatization policies at the beginning of the 1990's.

3.2 Analytic approaches

This study uses both descriptive and econometric analysis. Consumer Price Index (CPI) is used as a proxy for inflation and Gross Domestic Product (GDP) at current price is used as a proxy for growth. First, descriptive approach is adopted to show the trend and variability of inflation and growth so as to give a clear view how the variables change through time for both countries. Then, the econometric approach is used to investigate the impact of inflation on economic growth. In the process the ADF and Phillp-Perron tests are conducted to check for stationarity in the variables, the Johansen Co-integration test is used to confirm the existence of co-integration between variables. After finding the existence of co-integrating variables, the Vector Error Correction Model (VECM) is used to investigate the causal relationship between inflation and growth.

3.2.1 Descriptive Analysis

Descriptive approach is used to summarize the overall trends and variability in inflation and economic growth both in Ethiopia and in Uganda. Percentage and graphic analysis are employed to describe the trends in inflation and growth in both countries. Besides, Coefficient of variation and t tests are estimated for CPI and GDP to discuss and compare the variability of inflation and growth in Ethiopia and Uganda.

3.2.2 Econometric Analysis

3.2.2.1 Stationarity

In economic research involving time series data, before any kind of statistical estimation takes place the data of all variable in the model have to be tested for their stationarity (Gujirati, 2004). A stochastic process is said to be stationary if its mean and variance are constant over time and the value of the covariance between the two time periods depends only on gap or lag between the two time periods and not the actual time at which the covariance is computed.

If a time series is non-stationary, we can study its behavior only for the time period under consideration. Each set of time series data will therefore be for a particular episode. As a consequence, it is not possible to generalize its behavior to other time periods. Therefore, for the purpose of forecasting, such (non-stationary) time series may be of little practical value.

There are various statistical tests for the detection of non-stationarity or unit root problem. The Augmented Dickey Fuller (ADF) test and Phillip-Perron (PP) tests are used in this study to test for stationarity. The ADF test takes care of possible serial correlation in the error terms by adding the lagged difference terms of the dependent variable. The ADF test avoids the problem of DF because it corrects for serial correlation; by adding lagged difference terms (Greene, 2003: 643). The ADF test can be represented as;

$$\Delta y_t = \beta_1 + \beta_t + \delta y_{t-1} + \sum_{h=1}^{m} \alpha \Delta y_{t-h} + u_t \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where β, δ and α are estimation parameters, U_t is a pure white noise error term and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$, …, $\Delta Y_{t-n} = Y_{t-n} - Y_{t-(n+1)}$). ADF test uses the same null hypothesis and the same asymptotic critical value as that of DF test (Gujarati, 2004: 815-819)

The PP test uses non-parametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms. The PP test has an advantage over the ADF test as it gives robust estimates when the series has serial correlation and time-dependent heteroscedasticity and there is a structural break (Mallik and Chaudhury, 2001). Both tests use the null hypothesis of non-sationarity against the alternative of stationarity.

3.2.2.2 Co-integration Analysis

Having confirmed that the variables are stationary the next step is to test the existence of a co-integration relationship between the variables. For this purpose, the study uses the

Johansen co-integration technique which produces two likelihood ratio test statistics namely the trace test and the maximum eigen values (λ-max) test. The number of significant non-zero eigen values determines the number of Co-integrating vectors in the system. The existence of co-integration between the two variables suggests the presence of causality between GDP and CPI in at least one direction. Both the trace test and the maximum eigen value statistics reject the null hypothesis of no co-integration relationship in both models.

3.2.2.3 Causality Test Based on the Error Correction-Model

In this study, the error-correction model within bi-variate causality system is used to examine the direction of causality between inflation and growth both for Ethiopia and Uganda. The error correction model is chosen in this paper over other alternative techniques because of its favorable response to both large and small samples. If GDP and CPI are co-integrated, the bi-variate co-integration in ECM can be represented in the following form.

$$\Delta GDP_t = a_0 + \sum_{i=1}^{n} a_{1i} \Delta GDP_{t-i} + \sum_{i=1}^{n} a_{2i} \Delta CPI_{t-i} + a_3 EC_{t-1} + U_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

$$\Delta CPI_t = b_0 + \sum_{i=1}^{n} b_{1i} \Delta GDP_{t-i} + \sum_{i=1}^{n} b_{2i} \Delta CPI_{t-i} + b_3 EC_{t-1} + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Where,

EC_{t-1} Represents one period lagged error correction term captured from the co-integration regression

GDP_t Represents the gross domestic product at time t

CPI_t Represents the consumer price index at time t

The error-correction model has an interesting temporal causal interpretation in the sense that a bivariate co-integrated system must have a causal ordering in at least one direction (Engle and Granger, 1987:259).

In the error- correction based causality test based on equations [2] and 3], Inflation (CPI) does not Granger-cause economic growth (GDP) if all a_2= 0 and a_3= 0. Likewise, economic growth (GDP) does not Granger-cause Inflation (CPI) if all b_2= 0 and b_3 = 0.

This model tests the null hypothesis that the growth of Gross Domestic Product does not granger cause the growth rate of consumer price index against the alternative hypothesis in equation (2). Similarly in equation (3) the null hypothesis is that the growth rate of consumer price index does not granger cause growth rate of gross domestic product.

4. RESULTS AND DISCUSSION

4.1 Descriptive Results

4.1.1 Descriptive results for Ethiopia

The coefficient of variation measures variability in relation to the mean (or average) and is used to compare the relative dispersion in one type of data with the relative dispersion in another type of data.

Table1 Descriptive Statistics for Ethiopia

Ethiopia (1990-2001)			
Variable	Mean	Std. Dev.	C.V
GDP(in Millions USD)	9050	1930	21.32
CPI	67.37117	10.4319	15.48
Ethiopia (2001-2012)			
Variable	Mean	Mean	C.V
GDP (in Millions USD)	20400	10800	52.94
CPI	170.2043	95.64384	56.19
Ethiopia (1990-2012)			
Variable	Mean	Mean	C.V
GDP (in Millions USD)	14500	9420	64.96
CPI	116.5522	83.49302	71.64

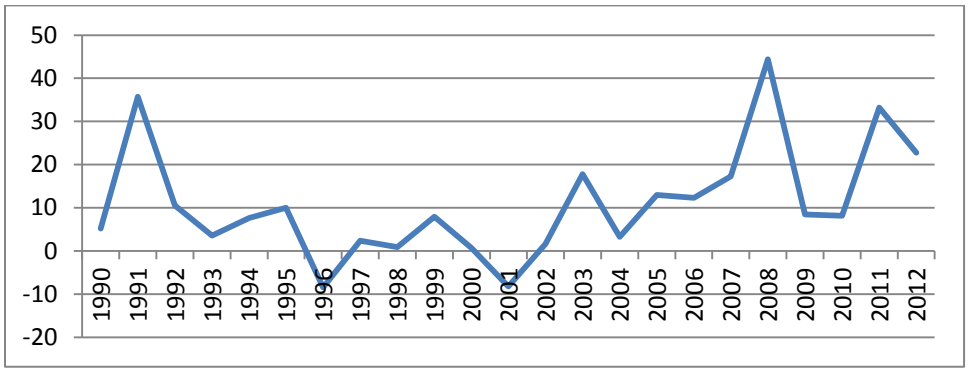
In addition, the two- sample unpaired unequal *t* test is conducted to assess if the variation between two groups is "significant" by evaluating the difference between the means of two independent or unrelated groups. That is, it evaluates whether the means for two independent groups are significantly different from each other. The null hypothesis of the t test is that the mean for the first group is equal with the mean for the second group. If p value is less than the a priori α level (in this case α= 0.05), the null hypothesis of equal means for both groups is rejected and the variation between two groups is significant at a 1 percent level of confidence interval. If p value is less than α level, the null hypothesis of equal means for both groups is accepted and the variation between the groups is insignificant at a priori level (the t-test results are presented in appendix 7).

4.1.1.1 Inflation Development and Trend

Inflation has been running at double-digit figures since 2005/06 hitting 44.4 per cent in 2007/08, up from 17.2 per cent in 2006/2007 and 12.3 per cent a year earlier (AfDB/OECD, 2009) (Figure 1). The dramatic rise in food prices was the major factor behind the unprecedented high inflation in Ethiopia in 2007/08; with food inflation and non-food (core) inflation at 34.9 per cent and 12.5 per cent, respectively. After spiking to 64.1 per cent year on year in July 2008, headline inflation had fallen back somewhat to 55.4 per cent year on year in October 2008.The decline is in cycle with the trend in food inflation – almost 92 per cent year on year in July 2008 before declining to 72.3 per cent year on year in October. Rising world commodity prices also contributed to high inflation in 2007/2008, particularly fuel. Other factors were an accommodating monetary policy, the increase in domestic demand as a result of improved economic performance, as well as the shift by donors from food donations to cash assistance.

In 2009, inflation dropped to 8.4 percent and then in 2011 annual inflation rose upward to 33.2 percent owing to increase in both food and non-food inflation, but mainly of food, which accounted 57 percent weight of the total CPI basket (IMF, 2012). It can be concluded that inflation trend has been fluctuating during the last decade its lowest being -8.4 percent in 2001 and its highest being 44.4percent in 2008.

In general, the variability of inflation over the past two decades is high with a coefficient of variation of 71.6percent (table 1). The degree of variability seems to be significantly higher in the latter decade (2001-2012) with a coefficient of variation of 56.19 percent as compared to a coefficient of variation of 15.48 percent during 1990-2001 at a 1 percent level of confidence interval. This implies that inflation uncertainty is increasing since the period 2001/2002. The possible explanation for this is the policy change from conservative monetary policy to a more relaxed monetary policy in the period 2002/2003.



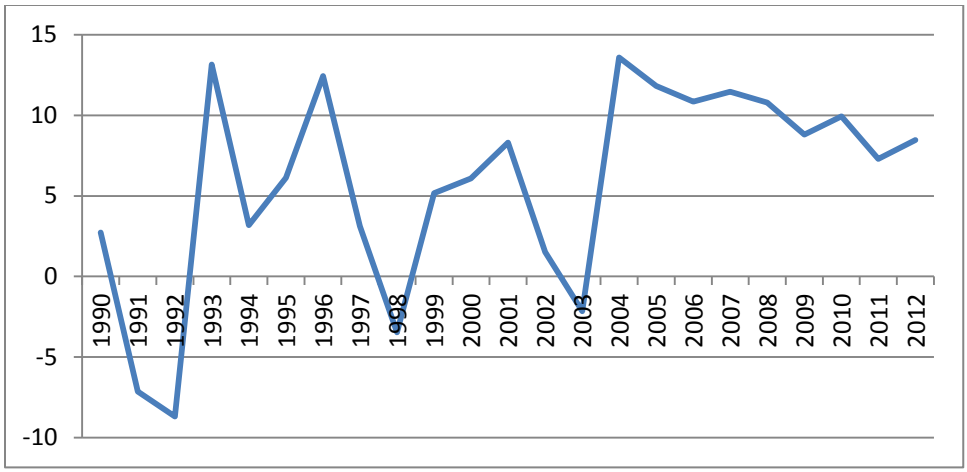
Source: Constructed based on IMF data base (2014)

Figure 1 Inflation trend of Ethiopia (1990-2012)

4.1.1.2 Economic Growth trend

Ethiopia's economy has recorded high growth rate during the period 2003-2012. While the growth rate of GDP was -2.16 percent in 2003 mainly due to drought, it rapidly rebounded and remained at more than 10 percent during 2004-2008 (Figure 2). This rapid growth was driven mainly by the agriculture and services sectors supported by strong growth of exports and sustained inflows of official development assistance and foreign direct investment (IMF, 2013). Growth slowed down but remained strong in 2008/09, at 8.8 per cent, owing to a good harvest and sustained high public investment in infrastructure. The slowdown in 2008/09 is due to the impact of the global recession on nontraditional exports and slower growth in domestic demand as a result of tighter fiscal and monetary policies. For the year 2010, growth once again rose to 9.94 percent and remained well above 7 percent for the following two years. Generally the economic growth trend of Ethiopia shows a varying level of growth but a good performance.

Overall, the variability of GDP over the past two decades is high with a coefficient of variation of 64.96percent (table 1). Just like the inflation trend, the degree of variability seems to be significantly higher in the latter decade (2001-2012) with a coefficient of variation of 52.94 percent as compared to a coefficient of variation of 21.32 percent during 1990-2000 (at a 1 percent confidence interval level). This implies that economic growth is getting highly variable and uncertain since 2001. This change in growth trend can emanate from a more relaxed fiscal policy measures by the government.



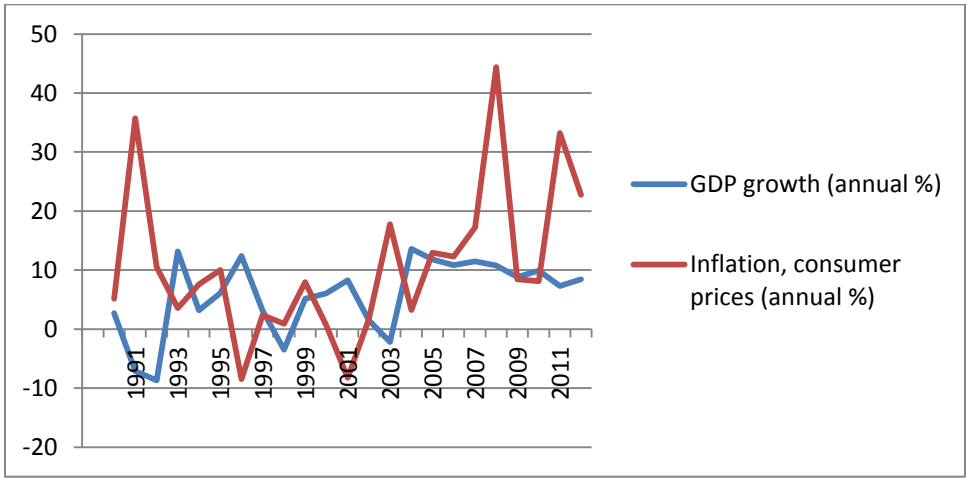
Source: Constructed based on IMF data base (2014)

Figure 2 Gross Domestic Product Growth of Ethiopia (1990-2012)

4.1.1.3 Inflation and Economic Growth Trends

In Ethiopia between the periods 2000-2012, the highest economic growth of 13.57 percent was achieved in 2004 (IMF, 2014). During this period inflation rate was witnessed to be 3.2 percent. The economic growth is 10 percent higher than the annual inflation rate (Figure 3). The lowest economic growth was -2.16 percent witnessed just a year before with a double-digit inflation rate of 17.76 percent. This trend may persuade us to believe that there is a negative relationship between economic growth and inflation. But from the year 2005 onwards there seems to be an ambiguous relationship between inflation and economic growth. Starting from this period inflation rate fluctuates in a large quantity from period to period (i.e. inflation rate was 44.4 percent in 2008, dropped to 8.14 percent in 2010 and again rose to 33.22 percent in 2011) whereas economic growth rate keeps on rising on a double digit rate from 2005 to 2009 and continued to rise in a little less amount afterwards (IMF, 2014)

The variability of CPI (71.64 percent) is significantly greater than the variability of GDP (64.96) for Ethiopia at a 1 percent significance level (table 1). This implies the inflation trend fluctuates in a larger amount than the growth rate. The Variability coefficient of GDP for the first decade is 21.32 percent but in the second decade it increased to 52.94 percent. With the same manner the degree of variability in inflation increased from 15.48 percent in the first decade to 56.19 percent in the next decade. Comparing the changes in the degree of variability during the two decades, it is clear that the variability coefficient of inflation increased by 40.71 percent whereas the variability coefficient of GDP increased by 31.62 percent. This shows that inflation volatility is a much serious problem for Ethiopia than growth uncertainty. And this could result from uncertain output production, uncertain price levels, the inertia effects of inflation volatility and flexibility in fiscal and monetary policies.



Source: Constructed based on IMF data base (2014)

Figure 3 Trend in GDP growth and Inflation rate of Ethiopia (1990-2012)

4.1.2 Descriptive Results for Uganda

The coefficient of variation of both CPI and GDP for Uganda is reported in table 2. The coefficients show a great variation between decades and also between the variables.

Table2 Descriptive Statistics for Uganda

Uganda (1990-2001)			
Variable	Mean	Std. Dev.	C.V
GDP (in Millions USD)	5030	1380	27.43
CPI	63.37	15.75	24.85
Uganda (2001-2012)			
Variable	Mean	Mean	C.V
GDP (in Millions USD)	12300	4770	38.78
CPI	126.08	38.96	30.9
Uganda (1990-2012)			
Variable	Mean	Std. Dev.	C.V
GDP (in Millions USD)	8520	5010	58.8
CPI	93.36	42.89	45.94

The t-test is conducted for Uganda to evaluate whether the means for GDP and CPI are significantly different from each other and the report is displayed in appendix 8.

4.1.2.1 Inflation Development and Trend

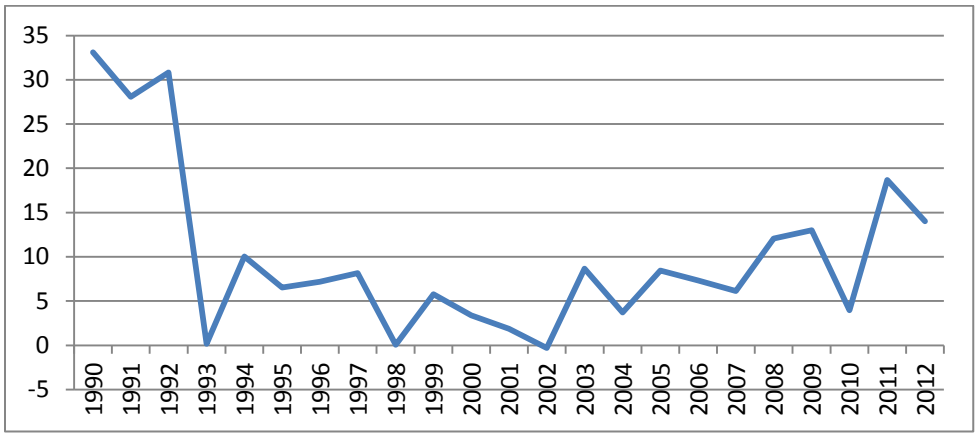
The Inflation rates maintained a single digit figure (below 10 percent) from year 2000 to 2007(IMF, 2013). In 2002 the inflation rate was -0.28 percent showing a deflationary situation in the country. But in 2003 the rate immediately increased to 8.68 percent. In 2008, the Inflation rate rose to 12 percent. The rising trend continued up to 2009 when the Inflation rate was 13 percent. In 2010 inflation rate rapidly dropped to 3.98 percent. Inflation in Uganda plummeted in 2010 as a result of the recent financial crisis, following a sharp decrease in food inflation attaining a minimum of -10 percent. And then it alarmingly rose to 18.69 percent in 2011 followed by a 14 percent inflation rate in 2012.

IMF points to three principal causes of rise in inflation, namely, higher food and fuel prices, supported by accommodative monetary policy (IMF, 2013). Rise in food prices is a result of supply and demand constraints coupled with an increase in world food prices. The increase in food price inflation puts an upward pressure on overall inflation. In addition, the region has experienced a period of food shortage due to adverse weather conditions. Hence, the shortage of supply of food causes an increase in domestic price of food. As with food prices, the IMF identifies energy prices, especially fuel price as the second determinant of inflation dynamic in Uganda. According the IMF report recent rise in petrol prices has put pressure in fuel prices in most of African countries, which is subsequently passed on to the consumer, resulting in a general rise in prices.

Besides food and fuel prices, the IMF report argues that accommodative monetary policy, in the form of massive monetary expansion, has contributed somewhat to recent surge in

inflation. The government responded to a combination decrease in inflation and output gap in September of 2009 with massive quantitative easing and money growth reached a maximum of 36 percent in November of 2011. As a result the currency depreciated and hence pushing the domestic price up even further.

The variability of inflation over the past two decades is high with a coefficient of variation of 45.94percent (table 2). The degree of variability seems to be significantly higher in the latter decade (2001-2012) with a coefficient of variation of 30.9 percent as compared to a coefficient of variation of 24.85 percent during 1990-2001(at a 1 percent level of confidence interval). This implies that inflation uncertainty is increasing since the period 2001/2002. This increment in volatility is a result of structural issues such as banks' credit limits, lumpy liquidity injection by the Treasury, market size and developing financial intermediaries. The uncertain global environment, could again weigh on the shilling, setting off a negative feedback loop of external and fiscal deficits, capital outflows and inflation. (BOU, 2012)



Source: Constructed based on IMF data base (2014)

Figure 4 Inflation Trend of Uganda (1990-2012)

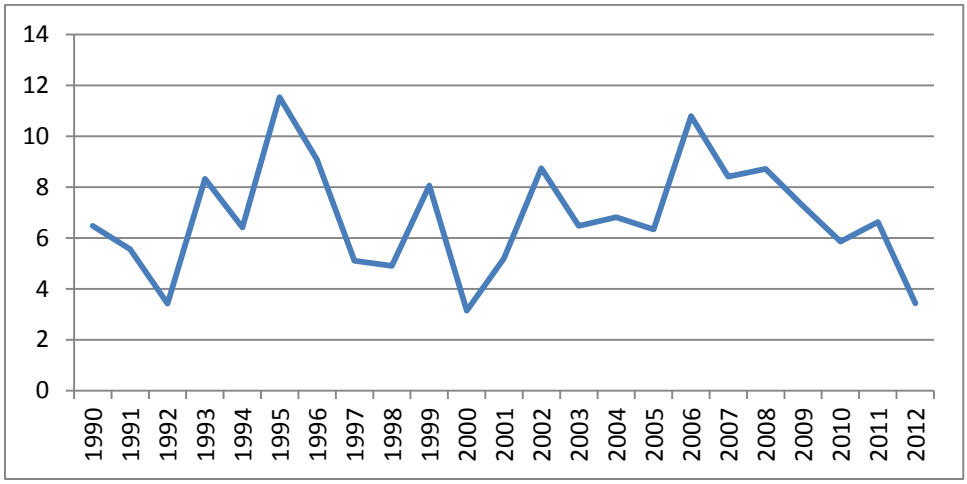
4.1.2.2 Economic Growth Trend

The past two decades have seen the Ugandan economy go through an expansive phase of sustained economic growth, with GDP growing at an average annual rate of 7.1 percent from 1992 to 2011 (AFDB, 2012).

This strong economic performance has been driven by growth in the industrial and services sectors (with value added for these activities growing at an average of 9.9 percent and 8.1 percent between 1992 and 2011) and has been underpinned by strong investment and export growth (with gross fixed capital formation growing on average by 8.6 percent per year during this period and export of goods and services growth by 17.2 percent).This prolonged phase of economic growth has benefitted from a period of relative macroeconomic and political stability, especially since the end of the armed conflict in Northern Uganda in the mid-2000s. Growth has also been bolstered by large inflows of ODA, averaging 14.7 percent of GNI from 1991 to 2010, as well as by a general policy of openness to both foreign investment and international trade (UNDP, 2012).

The variability of GDP over the past two decades is high with a coefficient of variation of 58.8 percent (table 2). The degree of variability seems to be significantly higher at a 1 percent level of confidence interval in the latter decade (2001-2012) with a coefficient of variation of 38.78 percent as compared to a coefficient of variation of 27.43 percent during 1990-2000. This implies that economic growth is getting highly variable and uncertain since 2001. This change in growth trend can emanate from households' deteriorating

income position, significant credit constraints, sticky inflation and fiscal tightening measures.



Source: Constructed based on IMF data base (2014)

Figure 5 Economic Growth Trend of Uganda (1990-2012)

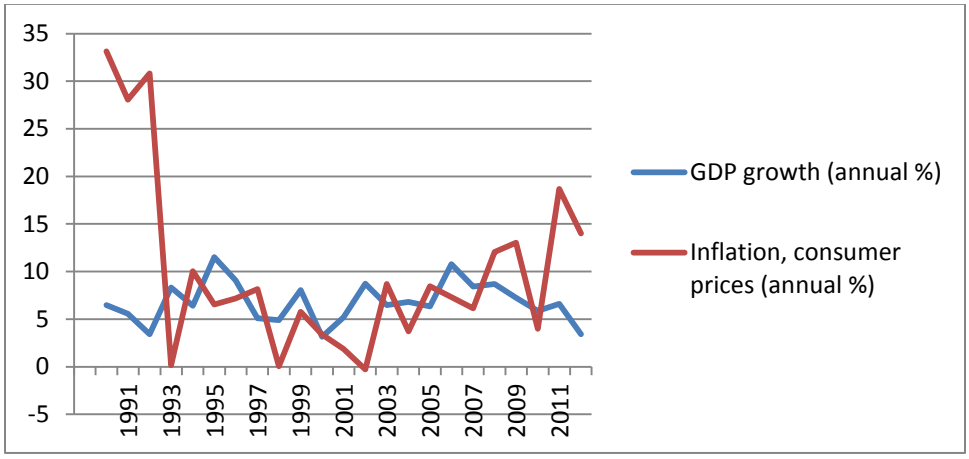
4.1.2.3 Inflation and Economic Growth

In Uganda between the periods 2000-2012, the highest economic growth rate of 10.78 percent was achieved in 2006 (IMF, 2014). During this period inflation rate was witnessed to be 7.31 percent with the economic growth being 3.47 percent higher than the annual inflation rate. The lowest economic growth was 3.14 witnessed in 2000 with an inflation rate of 3.39 percent. This trend may show a positive relationship between economic growth and inflation.

But with the lowest inflation rate recorded in the decade, -0.28 percent in 2002, the economic growth seems to be doing well with a growth rate of 8.73 percent. And also during the highest inflation period, with 18.69 percent inflation rate in 2011, the growth rate was witnessed to be 6.62 percent (IMF, 2014). With the relationship between

inflation and economic growth varying over the periods, it becomes difficult to generalize the relationship without conducting an empirical test.

The variability of GDP (58.8 percent) is significantly greater than the variability of CPI (45.94 percent) for Uganda at a 1 percent level of confidence interval (table 2). This implies the economic growth trend fluctuates in a larger amount than the inflation rate. The Variability coefficient of GDP for the first decade is 27.43 percent but in the second decade it increased to 38.78 percent. With the same manner the degree of variability in inflation increased from 24.85 percent in the first decade to 30.9 percent in the next decade. Comparing the changes in the degree of variability during the two decades, the result shows that the variability coefficient of inflation increased by 6.05 percent whereas the variability coefficient of GDP increased by 11.35 percent. This shows that Growth uncertainty is a much serious problem for Uganda than Inflation volatility. And this could result from domestic supply side shocks, global economic slowdown, investment uncertainty and inflation volatility.



Source: constructed based on IMF data base (2014)

Figure 6 Trend in GDP growth and Inflation rate of Uganda

4.2 Econometric Analysis

4.2.1 Results for Ethiopia

4.2.1.1 Stationary test

One of the most important attributes of a time series variable is its order of integration. The results of the Augmented Dickey-Fuller (ADF) unit root tests show that our variables CPI and GDP growth are stationary at level (see Table 3). That is, the null hypothesis of non-stationarity of Gross Domestic Product at current price and Consumer Price Index of Ethiopia is tested against the alternative hypothesis of stationarity. The results indicate that both time series are stationary in their levels.

Table 3 Stationarity Tests of variables using the ADF and the PP test for Ethiopia

Variable	ADF test	Phillips-Perron (PP) test	Stationary status
GDP	3.34	28.59	stationary
CPI	6.40	43.08	stationary

Critical Values: 1% level: ADF=-2.66 PP=-11.90 5% level: ADF=-1.95 PP=-7.30 10% level: ADF=-1.60 PP=-5.30

4.2.1.2 Lag length selection

To assess the optimal lag length, the study uses the Stata varsoc command with a maximum lag length of two:

Table 4 Lag length selection order criteria for Ethiopia

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-19.304				.026078	2.02896	2.05055	2.12843
1	20.9306	80.469*	4	0.000	0.00083*	-1.42196*	-1.35719*	-1.12352*
2	29.129	16.397	4	0.003	0.000565	-1.82181	-1.71386	-1.32441

This study will use one lag length for this bivariate model because the Hannan–Quinn information criterion (HQIC) method, Schwarz Bayesian information criterion (SBIC) method, and sequential likelihood-ratio (LR) test all support a lag of length one as indicated by the "*" in the output.

4.2.1.3 Co-integration Analysis

Co-integration rank (rank of matrix) is estimated using Johansen method (Johansen, 1988). Johansen's approach derives two likelihood estimators for the CI rank: a trace test and a maximum Eigen value test. The CI rank (r) can be formally tested with the trace and the maximum Eigen value statistics. The trace statistic either rejects the null hypothesis of no co-integration among the variables or does not reject the null hypothesis that there is one co-integration relation between the variables. Start by testing H0: r = 0 and If it rejects, repeat for H0: r = 1. Once a test is not rejected, the testing stops and that value of r is the commonly-used estimate of the number of co-integrating relations. In this test, H0: r = 1 is not rejected at the 1 percent level (0.00 < 3.76).

In other words, this trace test result does not reject the null hypothesis that these two variables are not co-integrated and that there is at least one co-integrating relationship between them. From this, one can infer the existence of a co-integrating relationship between GDP at current price and consumer price index for the Ethiopian economy and causality in at least one direction. The presence of co-integration between GDP and CPI suggests a long term relationship among the variables.

Table 5 Johansen Co-integration Test Results for Ethiopia

Trace test				Maximum Eigenvalue test			
Null	Alternative	Statistics	95% critical value	Null	Alternative	Statistics	95% critical value
r=0	r≥1	20.14	15.41	r=0	r≥1	20.14	14.07
r≤1	r=2	0.00	3.76	r≤1	r=2	0.00	3.76

4.2.1.4 Causality Test Based on Error Correction Model

In VECM the co-integration rank shows the number of co-integrating vectors. The co-integration rank (r=1) shows that there is a long run relationship between GDP and Inflation. For a case of two variables and one co-integrating relationship, an error-correction model is the appropriate econometric specification. In this model, the equation is differenced and an error-correction term measuring the previous period's deviation from long-run equilibrium is included. A negative and significant coefficient of the ECM,

for co-integrated variables, indicates that any short-term fluctuations between the variables will give rise to a stable long run relationship between the variables.

Table 6 Vector Error Correction Model Results for Ethiopia

Dependent Variable DLGDP				
Variable	Coefficient	Standard error	Z- stat	P>Z(95% Confidence interval)
$DLGDP_{t-1}$	-0.2071	0.1123	-1.84	0.065
DLCPI	0.1167	0.0253	4.61	0.000
C	0.0855	0.198	4.31	0.000
ECM(-1)	-0.2197	0.292	-7.52	0.000
Dependent Variable DLCPI				
Variable	Coefficient	Standard error	Z- stat	P>Z(95% Confidence interval)
$DLCPI_{t-1}$	-0.256	0.056	-4.61	0.000
DLGDP	0.455	0.247	1.84	0.065
C	0.086	0.0198	4.31	0.000
ECM(-1)	-0.455	0.066	-6.84	0.000

As can be seen from the adjustment parameters in table 6, in the short run there is a significant relationship between GDP and CPI. First, equation (2) is estimated and it proved that in the short run a change in inflation by 1 unit is going to increase GDP by 0.1167 at a 1 percent level of significance. Then, equation (3) is estimated and it showed that a change in GDP by 1 unit is going to increase inflation by 0.455 at the same level of significance.

On the other hand, the long run causality is supported by the statistically significant error-correction terms in both equations. The error correction term obtained from the VEC model for equation (2) is negative (-0.2197) and statistically significant at 1 percent. This implies that there is long run relationship between inflation and growth; and a possibility of convergence to equilibrium level in the long run. Hence, the speed of adjustment to restore long run equilibrium is 21.9 percent per year, i.e., it will take about five years to completely recover from a single shock and restore long run equilibrium. And also for equation (3) the ECM obtained is negative (-0.455) and statistically significant at 1 percent.

This result shows the possibility of convergence to an equilibrium level in the long run. In this causal relationship it will only take a little more than two years to recover from a single shock since its speed of adjustment is 45 percent per year. Therefore, the existence of a significant feedback relationship between inflation and economic growth that runs in both directions is evidenced.

The Granger causality test investigates whether past values of *CPI* aid in the prediction of *GDP*, If they do the *CPI* is said to "Granger cause" *GDP* and vice versa.

Table 7 Granger causality Wald tests for Ethiopia

Equation	Excluded	chi2	df	Prob > chi2
Lcpi	Lgdp	16.545	1	0.000
Lgdp	Lcpi	3.2046	1	0.073

There is a strong evidence that lagged GDP growth helps predict inflation (the *p*-value is less than 0.001) and also there is evidence that lagged inflation helps predict GDP growth (*p*-value is 0.073). Since there is one lag in the VECM, the Granger causality tests have only one degree of freedom. The coefficient of GDP growth in the inflation equation has a *z* value of 4.07, which is the square root of the 16.545 value reported in the vargranger table; both have identical *p*-values. And the coefficient of inflation in the GDP growth equation has a *z* value of 1.79, which is the square root of the 3.2046 value reported in the vargranger table.

To assess the validity of VECM, a stability test of the residuals is conducted. The varstable command examines the dynamic stability of the system. None of the eigenvalues is even close to one, so the system is stable.

Table 8 Eigenvalue stability condition for Ethiopia

Eigenvalue	Modulus
0.4562782	0.456278
0.5363231	0.536323

*4.*2.2 Results for Uganda

4.2.2.1 Stationarity

The results of the Augmented Dickey-Fuller (ADF) unit root tests show that GDP at current price and CPI are stationary at level (see Table 9). Thus, the null hypothesis of non-stationarity of Gross domestic product at current price and consumer price index of Uganda is tested against the alternative hypothesis of stationarity. And the results indicate that both time series variables are stationary in their levels.

Table 9 Stationarity Tests of variables using the ADF and the PP test for Uganda

Variable	ADF test	Phillips-perron(PP) test	Stationary status
GDP	4.34	50.63	stationary
CPI	7.21	83.66	stationary

Critical Values: 1% level: ADF=-2.66 PP=-11.90 5% level: ADF=-1.95 PP=-7.30 10% level: ADF=-1.60 PP=-5.3

4.2.2.2 Lag length selection

To assess the optimal lag length for Uganda, the study uses the Stata varsoc command with a maximum lag length of two:

Table 10 Lag length selection order criteria for Uganda

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	120.069				4.5e-08	-11.2447	-11.2231	-11.1452
1	167.09	94.041*	4	0.000	7.5e-10*	-15.3419*	-15.2771*	-15.0434*
2	178.083	21.986	4	0.000	3.9e-10	-16.0079	-15.8999	-15.5105

As can be seen from the result a lag length of one will be used for this bivariate model because the Hannan–Quinn information criterion (HQIC) method, Schwarz Bayesian information criterion (SBIC) method, and sequential likelihood-ratio (LR) test all support a lag of length one as indicated by the "*" in the output.

4.2.2.3 Co-integration Analysis

The results of the Johansen-Juselius co-integration tests, reported in Table 11, indicate that there exists a stable long-run relationship between GDP at current price and consumer price index for Uganda. Both the trace test and the maximum eigenvalue statistics reject the null hypothesis of no co-integration between the variables. Specifically, the results show that there is a unique co-integrating vector in the bivariate model.

Table 11 Johansen Co-integration Test Results for Uganda

Trace test				Maximum Eigenvalue test			
Null	Alternative	Statistics	95% critical value	Null	Alternative	Statistics	95% critical value
r=0	r≥1	22.16	15.41	r=0	r≥1	22.16	14.07
r≤1	r=2	0.00	3.76	r≤1	r=2	0.00	3.76

4.2.2.4 Causality Test Based on Error Correction Model

Given the results of co-integration tests, one has to estimate the VECM equations to determine the direction of causality between economic growth and inflation since the series are co-integrated. The results of the bivariate VECM are presented in table 12.

Table 12 Vector Error Correction Model Results for Uganda

Dependent Variable DLGDP					
Variable	Coefficient	Standard error	Z- stat	P>Z(95% interval)	Confidence
$DLGDP_{t-1}$	-0.4448	0.0988	-4.50	0.000	
DLCPI	-0.0097	0.0030	-3.15	0.002	
C	-0.0015	0.0002	-7.23	0.000	
ECM(-1)	25.105	1.976	12.70	0.000	
Dependent Variable DLCPI					
Variable	Coefficient	Standard error	Z- stat	P>Z(95% interval)	Confidence
DLGDP	-11.167	2.48	-4.50	0.000	
$DLCPI_{t-1}$	-0.245	0.0778	-3.15	0.002	
C	-0.0015	0.0002	-7.23	0.000	
ECM(-1)	-0.0398	0.0035	11.45	0.000	

As can be seen from the adjustment parameters in table 8 the coefficient for ECM $_{(-1)}$ for equation (2) is 25.105. Therefore, in the short run there is a weak exogenity test in equation (2) that is inflation does not contribute to the explanation of adjustments in GDP. It is wise to ignore equation (2) and move on to the estimations of equation (3).

For equation (3) the coefficient for ECM $_{(-1)}$ is negative and significant at1 percent. In the short run, a change in GDP by 1 unit is going to decrease inflation by -11.167 at the same level of significance.

And the long run causality is supported by the statistically significant error-correction term. The ECM obtained is negative (-0.0398) and statistically significant at 1 percent. This implies the possibility of inflation and growth convergence to equilibrium level in the long run. In this causal relationship speed of adjustment is 3.9 percent per year and it will take about twenty five years to recover from a single shock from equilibrium.

The granger causality test is conducted to investigate for causal relationships between GDP and CPI for Uganda.

Table 13 Granger causality Wald tests for Uganda

Equation	Excluded	chi2	df	Prob > chi2
Lcpi	Lgdp	5.2364	1	0.073
Lgdp	Lcpi	31.585	1	0.000

There is a strong evidence that lagged GDP growth helps predict inflation (the *p*-value is 0.073) and overwhelming evidence that lagged inflation helps predict GDP growth (*p*-value less than 0.001). The coefficient of GDP growth in the inflation equation has a *z* value of 2.29.And the coefficient of inflation in the GDP growth equation has a *z* value of 5.62, which is the square root of the 31.585.

A stability test is also conducted to assess the validity of VECM and all the eigenvalues lie inside the unit circle. Hence, the VECM specification satisfies stability condition.

Table 14 Eigenvalue stability condition

Eigenvalue	Modulus
0.6325671	0.632567
0.3104352	0.310435

It can be concluded that, in Uganda's case there is a uni-directional relationship between inflation and growth that runs from GDP growth to inflation.

4. 3 Comparing Ethiopia and Uganda

4.3.1 Trends and Variability in GDP and CPI

Table 15 Descriptive Statistics of Ethiopia and Uganda

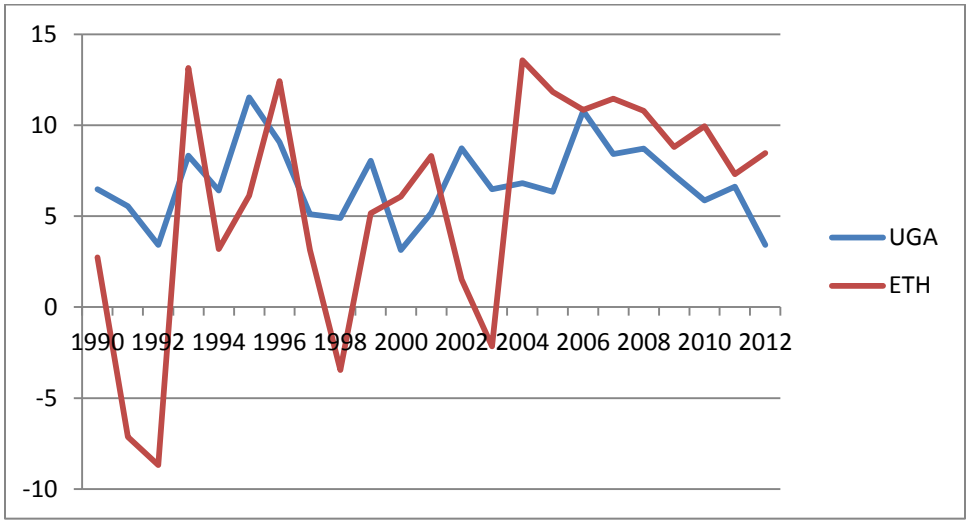
	Ethiopia			Uganda			
Variable	Mean	Std. dev.	C.V	Variable	Mean	Std. dev.	C.V
GDP (in Millions USD)	14500	9420	64.96	GDP(in Millions USD)	8520	5010	58.8
CPI	116.5522	83.49302	71.64	CPI	93.36492	42.89363	45.94

Table 15 shows that the variability of CPI (71.64 percent) is significantly greater than the variability of GDP (64.96) for Ethiopia. This implies the trend in inflation shows more fluctuation than that of the growth rate. And this could result from uncertain output production, uncertain price levels and inappropriate fiscal and monetary policies. But for Uganda the variability of GDP (58.8 percent) is significantly greater than the variability of CPI (45.94 percent). This is a good sign since it shows more stability in inflation than GDP growth.

In comparing the coefficient of variations, it can be seen that the variability of GDP is significantly higher for Ethiopia than that of Uganda at 1 percent confidence interval (appendix 9). And also the variability of inflation is greater for Ethiopia than the variability of inflation in Uganda. But the variation is not significant and there is no sufficient evidence to reject the null hypothesis of equal means for the inflation level in

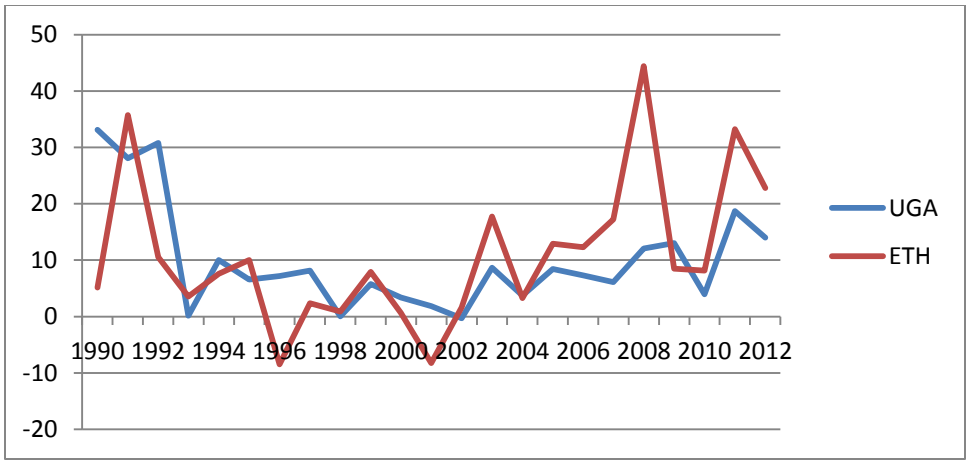
Ethiopia and the inflation level in Uganda. Nonetheless, it seems that low variability of inflation is associated with low variability of growth trends as evidenced in the case of Ethiopia and Uganda and vice versa. And the low variability in inflation and GDP in Uganda could be a manifestation of a relatively better fiscal and monetary policy on the side of Uganda.

In general, the economic growth and inflation rates are less variable in the case of Uganda than Ethiopia. This shows increased level of uncertainty concerning the economic growth level and the general price level for Ethiopia. As for Uganda the situation is relatively better than Ethiopia but still shows high level of uncertainty about economic growth and general price levels.



Source: constructed based on IMF data base (2014)

Figure 7 GDP growth variability for Ethiopia and Uganda



Source: constructed based on IMF data base (2014)

Figure 8 Inflation variability for Ethiopia and Uganda

Since the economic growth and inflation rates are less variable in the case of Uganda than Ethiopia, it can be concluded that the monetary policy adopted by Uganda is more effective in the stabilization of the economy as a whole. The bank of Uganda sets an interest rate as the operating target of monetary policy, rather than base money.

4.3.2 Relationship between Inflation and Growth

The Vector Error Correction Model shows the existence of a significant bi-directional feedback relationship between inflation and economic growth for Ethiopia both in the short run and in the long run. That is, inflation has a significant positive effect on growth and growth has a significant positive effect on inflation. But for Uganda there exists only a uni-directional relationship between inflation and growth that runs from GDP growth to inflation. That is, growth has a significant negative effect on inflation.

In the short run, for Ethiopia the granger causality running from GDP to inflation is much stronger than the causality running from inflation to GDP but for Uganda the granger causality running from GDP to inflation is strong whereas causality running from inflation to GDP does not exist.

In the long run, for Ethiopia there are two statistically significant coefficients of error terms since there is a bi-directional relationship. For the causality running from inflation to GDP, ECM_{-1} is -0.2197 and for the causality running from GDP to inflation ECM_{-1} is -0.455. That is, for the causality running from inflation to GDP the result shows that 0.22 of the discrepancy in inflation and growth in the previous year is eliminated this year. And for the causality running from GDP growth to inflation the result shows that 0.45 of the discrepancy in inflation and growth in the previous year is eliminated this year. But for Uganda there is a single statistically significant coefficient of error term for the causality running from GDP to inflation and it is -0.0398. That is the discrepancy in inflation and growth in the previous year is eliminated this year by an amount of 0.04.

From the ECM results comparison of the causality from GDP to inflation between Ethiopia and Uganda shows that the period of adjustment needed to get back to equilibrium is much faster (more than 2 years) for Ethiopia than for Uganda(about 25 years). The implications of all these is that For Ethiopia it is appropriate to use policies that focus on both economic growth and inflation as a mechanism for achieving long run equilibrium. Uganda on the other hand needs to focus on economic growth as a policy instrument for achieving long run equilibrium.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The emphasis given to price stability in the conduct of monetary policy is with a view to promoting sustainable growth and development as well as strengthening the purchasing power of the domestic currency amongst others (Umaru and Abdulrahman, 2012). Understanding the world's need for price stability, the possible growth and development halting effects that emanate from the rising levels of inflation in most African countries is becoming a concerning issue. This study compares the inflation- economic growth relationship between Ethiopia and Uganda.

The findings of the study are summarized as follows.

The variability of CPI (71.64 percent) is greater than the variability of GDP (64.96) for Ethiopia. This shows that inflation volatility is a much serious problem for Ethiopia than growth uncertainty. And this could result from uncertain output production, uncertain price levels, the inertia effects of inflation volatility and flexibility in fiscal and monetary policies.

The variability of GDP (58.8 percent) is greater than the variability of CPI (45.94 percent) for Uganda. This shows that Growth uncertainty is a much serious problem for Uganda than Inflation volatility. And this could result from domestic supply side shocks, global economic slowdown, investment uncertainty and inflation volatility.

In comparing the coefficient of variations of the two countries, it shows that the variability of GDP and inflation for Ethiopia is greater than that of Uganda. This shows a relatively better fiscal and monetary policy on the part of Uganda. The policy implication for Ethiopia is to work towards stabilization of the economy by adopting the appropriate policy measures like tightening of the fiscal and the monetary policy.

In assessing the inflation-growth relationship in Ethiopia the results show that economic growth has a positive causation on inflation both in the short-run and in the long-run. Similarly although the strength of causality is not as stronger as causation from economic growth to inflation there is a positive causation from inflation to economic growth.

As far as the inflation-growth relationship in Uganda is concerned, the result shows economic growth has a negative causation effect on inflation at a significant level. But there is no granger causality running from inflation to economic growth. This does not mean that high level of inflation is not harmful for the country; rather it implies that policy makers should concentrate on increasing economic growth as an instrument for tackling inflationary problems in the country.

In comparing the inflation-growth relationships between Ethiopia and Uganda, the Vector Error Correction Model shows the existence of a positive significant bi-directional feedback relationship between inflation and economic growth for Ethiopia both in the short run and in the long run. But for Uganda there exist only a uni-directional negative relationship between inflation and growth that runs from GDP growth to inflation.

In general it can be concluded that there is a strong bi- directional feedback relationship between inflation and economic growth in Ethiopia. But for Uganda there is only a granger causality running from economic growth to inflation. The direction of granger causality is strong for the impact of economic growth on inflation and weaker, if any, for the impact of inflation on economic growth. This implies that, for the case of Ethiopia and Uganda, growth is more affected by macroeconomic policies and other variables than by inflation. The findings of this study are more or less in line with the Keynesian and Neo-Keynesian theoretical framework.

5.2 Recommendations

Economic growth and inflation rates are less variable in the case of Uganda than Ethiopia, indicating the monetary policy adopted by Uganda is more effective in the stabilization of the economy as a whole. Ethiopia needs to emphasize on policies which control the macroeconomic stability as a whole. And since price stability is considered as a proxy for macroeconomic stability, the ongoing high level of inflation is not a good sign. Therefore, focus should be given on policies that will achieve price stability in the country and this demands further research in identifying factors affecting the level of inflation in the country.

For Ethiopia there is a strong positive long run effect of economic growth on inflation and also a strong positive effect of inflation on growth. But this is not enough evidence for concluding that inflation is not harmful at all levels. Therefore, there is a need for

further research on the impact of inflation on other economic variables like on the development of a country.

The finding of no significant long run effect of inflation on growth and a strong negative long run effect of economic growth on inflation in Uganda implies that policy should focus on other macroeconomic variables and structural bottlenecks affecting growth than inflation. This situation calls for a concentrated effort by the government in the adoption of a more appropriate fiscal policy instruments like increasing the provision of infrastructural facilities, provision of professional training for farmers, increment of investment opportunities and the likes that could eliminate the structural bottlenecks.

And the VECM results show that the effect of economic growth on inflation is much stronger than the effect of inflation on economic growth for both countries. Therefore in targeting long run sustainable development emphasis should be given to accelerate economic growth and find the threshold growth-inflation level, so that growth rate takes care of the stability in inflation.

Comparison of the causality from GDP to inflation between Ethiopia and Uganda, based on the ECM results shows that the period of adjustment needed to get back to equilibrium is much faster for Ethiopia than for Uganda. This needs a rigorous effort to develop the financial market by the introduction of new financial technologies, building the confidence of the people in the system and easing access to banking services in the country. As a result, the transmission mechanism will get faster and the time it takes to achieve equilibrium level will be shorter.

And also from the comparative study it can be implied that Ethiopia and Uganda are almost in similar economic growth and inflationary situations. Therefore the countries may benefit from a strong cooperation in different socio-economic aspects.

Lastly, all the proposed objectives are achieved through this study but the study employed a 23 years data which might not be long enough to maintain normality.

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APPENDICES

Appendix 1: Stationary results for Ethiopia

Dickey-Fuller test for unit root Number of obs = 22

---------- Interpolated Dickey-Fuller ---------

Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t) .	-2.660	-1.950	-1.600

D.gdpcup	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdpcup						
L1.	.1323848	.0396069	3.34	0.003	.0500178	.2147518

. dfuller cpi, noconstant regress lags(0)

Dickey-Fuller test for unit root Number of obs = 22

---------- Interpolated Dickey-Fuller ---------

Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t) 6.395	-2.660	-1.950	-1.600

D.cpi	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
cpi						
L1.	.1743261	.0272586	6.40	0.000	.1176387	.2310134

```
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)       2.833        -11.900           -7.300          -5.300
 Z(t)         2.943         -2.660           -1.950          -1.600
------------------------------------------------------------------------------

    gdpcup |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    gdpcup |
      L1. |   1.132385   .0396069    28.59   0.000     1.050018    1.214752
------------------------------------------------------------------------------


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)       3.812        -11.900           -7.300          -5.300
 Z(t)         5.974         -2.660           -1.950          -1.600
------------------------------------------------------------------------------

       cpi |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       cpi |
       L1. |   1.174326   .0272586    43.08   0.000     1.117639    1.231013
```

Appendix 2: Stationary Test results for Uganda

Dickey-Fuller test for unit root Number of obs = 22

---------- Interpolated Dickey-Fuller ---------

Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t) .	-2.660	-1.950	-1.600

D.gdpcup	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdpcup						
L1.	.0938565	.0216044	4.34	0.000	.0489277	.1387854

Dickey-Fuller test for unit root Number of obs = 22

---------- Interpolated Dickey-Fuller ---------

Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t) 7.206	-2.660	-1.950	-1.600

D.cpi	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
cpi						
L1.	.094251	.0130803	7.21	0.000	.0670491	.121453

```
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)       2.047        -11.900           -7.300          -5.300
 Z(t)         3.984         -2.660           -1.950          -1.600
------------------------------------------------------------------------------

    gdpcup |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    gdpcup |
      L1. |   1.093857   .0216044    50.63   0.000     1.048928    1.138785
------------------------------------------------------------------------------


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)       2.061        -11.900           -7.300          -5.300
 Z(t)         6.270         -2.660           -1.950          -1.600
------------------------------------------------------------------------------

      cpi |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      cpi |
      L1. |   1.094251   .0130803    83.66   0.000     1.067049    1.121453
```

Appendix 3: Co-integration results for Ethiopia

Johansen tests for cointegration

Trend: constant Number of obs = 22

Sample: 1991 2012 Lags = 1

---

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	2	-601.35481	.	20.1481	15.41
1	5	-591.28075	0.59981	0.0000*	3.76
2	6	-591.28075	0.00000		

---

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value
0	2	-601.35481	.	20.1481	14.07
1	5	-591.28075	0.59981	0.0000	3.76
2	6	-591.28075	0.00000		

Appendix 4: Co-integration results for Uganda

Johansen tests for cointegration

Trend: constant Number of obs = 22

Sample: 1991 2012 Lags = 1

---

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	2	-561.78639	.	22.1619	15.41
1	5	-550.70543	0.63482	0.0000*	3.76
2	6	-550.70543	0.00000		

---

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value
0	2	-561.78639	.	22.1619	14.07
1	5	-550.70543	0.63482	0.0000	3.76
2	6	-550.70543	0.00000		

Appendix5: VECM results for Ethiopia

Vector error-correction model

Sample: 1991 2012 No. of obs = 22

AIC = -.882356

Log likelihood = 14.70592 HQIC = -.8239431

Det(Sigma_ml) = .0009004 SBIC = -.6343918

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_Lgdp	2	.413343	0.1561	3.700588	0.1572
D_Lcpi	2	.093104	0.6655	39.78182	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]
D_Lgdp					
_ce1					
L1.	-.2071387	.1123949	-1.84	0.065	-.4274287 .0131513
_cons	.0482505	.0881251	0.55	0.584	-.1244716 .2209726
D_Lcpi					
_ce1					
L1.	.1167622	.0253166	4.61	0.000	.0671425 .1663819
_cons	.0855975	.0198499	4.31	0.000	.0466923 .1245026

Cointegrating equations

Equation Parms chi2 P>chi2

_ce1 1 56.51762 0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

---

beta | Coef. Std. Err. z P>|z| [95% Conf. Interval]

---+---

_ce1 |

Lgdp | 1 . . . . .

Lcpi | -2.197099 .2922522 -7.52 0.000 -2.769903 -1.624296

_cons | 1.004499 . . . . .

Vector error-correction model

Sample: 1991 2012 No. of obs = 22

AIC = -.882356

Log likelihood = 14.70592 HQIC = -.8239431

Det(Sigma_ml) = .0009004 SBIC = -.6343918

Equation Parms RMSE R-sq chi2 P>chi2

D_Lcpi 2 .093104 0.6655 39.78182 0.0000

D_Lgdp 2 .413343 0.1561 3.700588 0.1572

| Coef. Std. Err. z P>|z| [95% Conf. Interval]

---+---

```
D_Lcpi      |
      _ce1 |
       L1. |  -.2565382   .0556231    -4.61   0.000    -.3655575   -.1475188
     _cons |   .0855975   .0198499     4.31   0.000     .0466923    .1245026
-------------+----------------------------------------------------------------
D_Lgdp      |
      _ce1 |
       L1. |   .4551043   .2469428     1.84   0.065    -.0288947    .9391034
     _cons |   .0482505   .0881251     0.55   0.584    -.1244716    .2209726
------------------------------------------------------------------------------

Cointegrating equations

Equation         Parms    chi2     P>chi2
----------------------------------------
_ce1                1   46.81675   0.0000
```

```
Identification:  beta is exactly identified
            Johansen normalization restriction imposed
------------------------------------------------------------------------------
      beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_ce1         |
      Lcpi |         1          .       .       .            .           .
      Lgdp |  -.4551455   .0665196    -6.84   0.000    -.5855216   -.3247695
     _cons |  -.4571931          .       .       .            .           .
------------------------------------------------------------------------------
```

.

Appendix 6: VECM results for Uganda

Vector error-correction model

Sample: 1991 2012 No. of obs = 22

AIC = -15.53222

Log likelihood = 175.8544 HQIC = -15.47381

Det(Sigma_ml) = 3.91e-10 SBIC = -15.28426

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_Lgdp	2	.02652	0.5872	28.453	0.0000
D_Lcpi	2	.000832	0.7260	52.99884	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
D_Lgdp						
_ce1						
L1.	-.4448274	.0988399	-4.50	0.000	-.63855	-.2511048
_cons	.0000333	.0066975	0.00	0.996	-.0130936	.0131603
D_Lcpi						
_ce1						
L1.	-.0097486	.0030991	-3.15	0.002	-.0158227	-.0036745
_cons	-.001518	.00021	-7.23	0.000	-.0019296	-.0011064

Cointegrating equations

Equation	Parms	chi2	P>chi2
_ce1	1	161.3627	0.0000

```
Identification:  beta is exactly identified
                 Johansen normalization restriction imposed
------------------------------------------------------------------------------
       beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_ce1         |
       Lgdp |         1          .       .       .            .           .
       Lcpi |   25.10491   1.976319    12.70   0.000     21.2314    28.97843
      _cons |  -108.7336          .       .       .            .           .
------------------------------------------------------------------------------
Vector error-correction model
Sample:   1991     2012                  No. of obs      =        22
                                         AIC             = -15.53222
Log likelihood =  175.8544               HQIC            = -15.47381
Det(Sigma_ml)  =  3.91e-10               SBIC            = -15.28426
Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------
D_Lcpi               2      .000832   0.7260   52.99884   0.0000
D_Lgdp               2      .02652    0.5872    28.453    0.0000
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_Lcpi       |
        _ce1 |
         L1. |  -.2447373   .0778026    -3.15   0.002    -.3972277    -.092247
       _cons |   -.001518    .00021    -7.23   0.000    -.0019296   -.0011064
-------------+----------------------------------------------------------------
D_Lgdp       |
```

```
      _ce1 |
       L1. |  -11.16735   2.481366    -4.50   0.000    -16.03074   -6.303964
     _cons |   .0000333   .0066975     0.00   0.996    -.0130937    .0131602
------------------------------------------------------------------------------

Cointegrating equations

Equation         Parms    chi2     P>chi2
----------------------------------------
_ce1               1   131.1981   0.0000
----------------------------------------

Identification:  beta is exactly identified

              Johansen normalization restriction imposed

------------------------------------------------------------------------------
      beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_ce1         |
      Lcpi |         1          .       .       .            .           .
      Lgdp |  -.0398328   .0034776    11.45   0.000     .0330169    .0466488
     _cons |  -4.331169          .       .       .            .           .
------------------------------------------------------------------------------
```

Appendix 7 t-test results for Ethiopia

Two-sample t test with unequal variances

Variable | Obs Mean Std. Err. Std. Dev. [95% Conf. Interval]

---+---

cpi1stet | 12 67.37117 3.01143 10.4319 60.74305 73.99928

cpi2ndet | 11 170.2043 28.8377 95.64384 105.9499 234.4587

---+---

combined | 23 116.5522 17.4095 83.49302 80.44715 152.6573

---+---

diff | -102.8331 28.99451 -167.2505 -38.41584

---

diff = mean(cpi1stet) - mean(cpi2ndet) t = -3.5466

Ho: diff = 0 Satterthwaite's degrees of freedom = 10.2182

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.0026 Pr(|T| > |t|) = 0.0051 Pr(T > t) = 0.9974

Growth means

Two-sample t test with unequal variances

Variable | Obs Mean Std. Err. Std. Dev. [95% Conf. Interval]

---+---

gdpc~tet | 12 9.05e+09 5.59e+08 1.93e+09 7.82e+09 1.03e+10

gdpc~det | 11 2.04e+10 3.27e+09 1.08e+10 1.31e+10 2.76e+10

---+---

combined | 23 1.45e+10 1.96e+09 9.42e+09 1.04e+10 1.85e+10

---+---

diff | -1.13e+10 3.31e+09 -1.86e+10 -3.99e+09

```
------------------------------------------------------------------------------
   diff = mean(gdpcup1stet) - mean(gdpcup2ndet)                  t =  -3.4140
Ho: diff = 0                     Satterthwaite's degrees of freedom =  10.5847

 Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0031         Pr(|T| > |t|) = 0.0061          Pr(T > t) = 0.9969
```

Inflation means Vs Growth means

Two-sample t test with unequal variances

```
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
  cpiet |      23    116.5522    17.4095    83.49302    80.44715    152.6573
gdpcupet |      23    1.45e+10    1.96e+09    9.42e+09    1.04e+10    1.85e+10
---------+--------------------------------------------------------------------
combined |      46    7.23e+09    1.45e+09    9.84e+09    4.31e+09    1.02e+10
---------+--------------------------------------------------------------------
   diff |          -1.45e+10    1.96e+09               -1.85e+10   -1.04e+10
------------------------------------------------------------------------------
   diff = mean(cpiet) - mean(gdpcupet)                           t =  -7.3642
Ho: diff = 0                     Satterthwaite's degrees of freedom =       22

   Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Appendix 8 t-test results for Uganda

Inflation means

Two-sample t test with unequal variances

```
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
cpi1stug |      12    63.37315    4.545552    15.74625    53.36846    73.37785
cpi2ndug |      11    126.0832    11.74742    38.96177    99.90833    152.2581
---------+--------------------------------------------------------------------
combined |      23    93.36492    8.943941    42.89363    74.81632    111.9135
---------+--------------------------------------------------------------------
    diff |           -62.71005    12.59618               -89.93214   -35.48796
------------------------------------------------------------------------------
    diff = mean(cpi1stug) - mean(cpi2ndug)                        t =  -4.9785
Ho: diff = 0                     Satterthwaite's degrees of freedom =  12.9546

  Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0001         Pr(|T| > |t|) = 0.0003          Pr(T > t) = 0.9999
```

Growth means

Two-sample t test with unequal variances

```
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
gdpc~tug |      12    5.03e+09    3.99e+08    1.38e+09    4.15e+09    5.91e+09
gdpc~dug |      11    1.23e+10    1.44e+09    4.77e+09    9.12e+09    1.55e+10
---------+--------------------------------------------------------------------
combined |      23    8.52e+09    1.05e+09    5.01e+09    6.35e+09    1.07e+10
---------+--------------------------------------------------------------------
```

```
   diff |         -7.29e+09    1.49e+09            -1.06e+10   -4.02e+09
------------------------------------------------------------------------------
   diff = mean(gdpcup1stug) - mean(gdpcup2ndug)                 t =  -4.8865
Ho: diff = 0                     Satterthwaite's degrees of freedom =  11.5363

 Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0002         Pr(|T| > |t|) = 0.0004          Pr(T > t) = 0.9998
```

Inflatin means Vs Growth means

Two-sample t test with unequal variances

```
------------------------------------------------------------------------------
Variable |     Obs       Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
   cpiug |      23    93.36492    8.943941    42.89363    74.81632    111.9135
gdpcupug |      23    8.52e+09    1.05e+09    5.01e+09    6.35e+09    1.07e+10
---------+--------------------------------------------------------------------
combined |      46    4.26e+09    8.19e+08    5.55e+09    2.61e+09    5.91e+09
---------+--------------------------------------------------------------------
   diff |         -8.52e+09    1.05e+09            -1.07e+10   -6.35e+09
------------------------------------------------------------------------------
   diff = mean(cpiug) - mean(gdpcupug)                          t =  -8.1478
Ho: diff = 0                     Satterthwaite's degrees of freedom =       22

 Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Appendix 9 t-test results for Ethiopia and Uganda

Inflation means

Two-sample t test with unequal variances

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
cpiet	23	116.5522	17.4095	83.49302	80.44715	152.6573
cpiug	23	93.36492	8.943941	42.89363	74.81632	111.9135
combined	46	104.9586	9.83005	66.67064	85.15984	124.7573
diff		23.18732	19.57255		-16.63993	63.01458

---

diff = mean(cpiet) - mean(cpiug) t = 1.1847

Ho: diff = 0 Satterthwaite's degrees of freedom = 32.8566

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.8777 Pr(|T| > |t|) = 0.2446 Pr(T > t) = 0.1223

Growth means

Two-sample t test with unequal variances

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
gdpcupug	23	8.52e+09	1.05e+09	5.01e+09	6.35e+09	1.07e+10
gdpcupet	23	1.45e+10	1.96e+09	9.42e+09	1.04e+10	1.85e+10
combined	46	1.15e+10	1.19e+09	8.04e+09	9.10e+09	1.39e+10

```
   diff |        -5.94e+09    2.22e+09            -1.05e+10   -1.42e+09
------------------------------------------------------------------------------
   diff = mean(gdpcupug) - mean(gdpcupet)                    t =  -2.6714
Ho: diff = 0                     Satterthwaite's degrees of freedom =  33.5438
 Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0058         Pr(|T| > |t|) = 0.0116          Pr(T > t) = 0.9942
```

DECLARATION

I, the undersigned, declare that this is my original work & has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

The examiners' comments have been duly incorporated.

Declared by:-

Name: Abeba Tadele_____

Signature: _____

Date: _____

Confirmed by Advisor:

Name: Kidist G/Sillasie (Phd) _____

Signature: _____

Date: _____

Place and date of submission:

_____