ST.MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES INSTITUTES OF AGRICULTURE AND DEVELOPMENT ECONOMICS

ASSESSING THE IMPACT OF INFLATION ON THE ECONOMIC GROWTH OF ETHIOPIA

By

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Addis Ababa, Ethiopia

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As member of the board of examiners of the master thesis open defense examination, we certify that we have read and evaluated the thesis prepared by Medhanit Tadesseon title of assessing the impact of inflation on Economic Growth of Ethiopia. We recommended that this thesis be accepted as fulfilling the thesis requirement for the degree of masters of Arts in Development Economics.

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Feb, 2019

DECLARATION

I declare that Assessing the Impact of Inflation on the Economic Growth of Ethiopia is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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Signature: Medhanit Tadesse Feb, 2019

ENDORSEMENT

This thesis has been submitted to St. Mary's University, School of Graduate Studies for examination with my approval as University Advisor.

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ABSTRACT

One of the prime objectives of macroeconomic policy both in developed and developing countries are to achieve economic stability and obtain sustainable economic growth simultaneously with price stability. This study, therefore, seeks to assess the impact of inflation on economic growth using annual time-series data for the period 2000/01 – 2016/17, which is conducive for economic growth in Ethiopia.

Based on the data found from NBE and MoF, it is found some evidence that inflation has impact on economic growth. Estimated threshold model indicate that there is non-linear relationship between economic growth and inflation in the Ethiopian economy.

This study shows the level of inflation is must keep below the threshold level because the inflation below some level of inflation brings positive impact to the economic growth but after this level it seriously hurts the growth of the economy of Ethiopia and as a result high inflation retards growth by reducing investment and bringing inefficiency to the system. Thus, excessive inflation has a growth inhibiting effect.

As an inflation targeting country, this is a crucial finding as it provides a baseline study in search of the optimal level of inflation for sustainable economic growth. These findings are essential for monetary policy formulation by the National Bank of Ethiopia, whose primary objective is the achievement and maintenance of price stability, as it provides a guide for the bank to work on minimizing inflation rate consistent with long-term sustainable economic growth goals of the country.

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ABBREVATION

ADF- Augmented Dickey Fuller

AIK- Akaike Information Criteria

CPI- Consumer Price Index

CSA - Central Statistics Agency

GDP- Gross Domestic Product

I(1)- Integrated Order One

MoFED- Ministry of Finance and Economic Development

MoF- Ministry of Finance

NBE- National Bank of Ethiopia

OLS- Ordinary Least Square

OECD- Organization for Economic Co-operation and Development

PPI- producer price index

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

The conventional view in macroeconomics holds that permanent and predictable changes in the rate of inflation are neutral: in the long term, they do not affect real activity. However, a substantial body of evidence suggests that sustained high rates of inflation can have adverse consequences for real economic growth even in the long run. Nowadays, a consensus among economists seems to be that high rates of inflation cause "problems," not just for some individuals, but for aggregate economic performance. However, there is much less agreement about the precise relationship between inflation and economic performance, and the mechanism by which inflation affects economic activity is. One of the prime objectives of macroeconomic policy both in developed and developing countries are to achieve full employment and obtain sustainable economic growth simultaneously with price stability. Accordingly, the principal objective of the monetary policy of the National Bank of Ethiopia is to maintain low price and support sustainable economic growth. Price stability is a proxy for macroeconomic stability which is vital in private sector economic decision on investment, consumption, international trade and saving. It is therefore widely believed that price stability promotes long-term economic growth, whereas high inflation is inimical to economic growth.

Price stability is taken and acknowledged as a major goal of monetary policy and its support has been growing worldwide mainly because high inflation is known to have many adverse effects: it imposes welfare costs on the society; hinder efficient resource allocation; discourages savings and investment by creating uncertainty about future prices and its mainly hits the poor excessively. Inflation may also cause the balance of payment problems by eroding a country's international competitiveness by making its exports relatively more expensive, and reduces long-term economic growth.

Though it is generally considered that inflation has undesirable consequences, most policymakers agree that they should not allow inflation to fall below zero because zero level of inflation or disinflation has negative impacts in economic growth due to decreasing motivations

of producers, (Billi and Khan, 2008). Consequently, policymakers should aim at a moderate rate of inflation that maximizes general economic well-being. But how low should inflation be? Should the target inflation be 10 percent or 5 percent? This requires empirical study to determine at what level impedes economic growth.

The effects of permanent increases in the inflation rate for long-run activity seem to be quite complicated. The consensus about the adverse effect of inflation on real economic growth reveals only a small part of the whole picture. Recently, intensive research has focused on the nonlinear relationship between these two variables. That is, at lower rates of inflation, the relationship is not significant or even positive; but at higher rates, inflation has a significantly negative effect on economic growth.

According to MoFED (2000) for the first decade of the post socialist regime (i.e. post 1991) inflation in Ethiopia was generally stable. This can be mainly attributed to the good agricultural sector performance and the tight fiscal and monetary policies. The former is given higher importance because agricultural items, mainly food, comprises almost 60 percent of the consumer market basket in which food items can highly affect the consumer price index (CPI) of the country.

During the past decade inflation in Ethiopia has been very high compared to many countries, both developed and developing. Though Ethiopia government has been targeted at working to reducing inflation to a single digits, it is required an empirical answer to the question regarding the impact of inflation on economic growth and threshold level above which inflation is considered harmful. This study give an answer to this question will contribute a lot in guiding policy makers in choosing appropriate inflation target to improve macroeconomic management of the Ethiopian economy.

1.2. Statement of the problem

A considerable amount of literature examining the impact of inflation on economic growth in both developed and developing economies are available. Most of those studies focused specifically on whether the impact of inflation in long- run growth is negative or positive. In order to estimate the turning point, or a threshold, at which the sign of the relationship between the two variables would switch. In some books the threshold level for both developed and developing countries in a cross-country panel data framework. As a result authors arrived at a

threshold level range of 11 - 12 percent for developing countries. Regarding Ethiopia's case the historic peak level of inflationbecame36.4 percent, which was recorded in 2008/09mainly due to the millennium ceremony in Ethiopian calendar. One of the fundamental objectives of macroeconomic policies in Ethiopia is to sustain high economic growth together with low and stable inflation. However, there exists considerable debate and contention on the nature of the inflation and growth relationship.

The impact of inflation on economic growth is one of the most central points of macroeconomic issues that need to be resolved. Though there are numerous studies carried out, the relationship between inflation and economic growth is not well defined. As mentioned above, this is mainly due to macro-economic and development conditions of the world, region or country under study. Regardless of this, recently, there exists a high level of consensus among researchers and economists that positive and lower level of inflation is positively related to economic growth while high and unstable level of inflation has negative impact on the growth of an economy. Due to this reason economists and policy makers largely aim for low and stable level of inflation with rapid rate of economic growth Various cross-country studies on the nature of relationship between inflation and economic growth have been revealed that quite different results particularly for developing countries. Moreover, the divergence of results was quite wide in case of empirical studies which concentrated on estimation of threshold rate of inflation for individual countries.

Therefore, this study tries to give an answer to those the gap of the last seventeen years trend of the impact of inflation on the economic growth of Ethiopia and where it affects economic growth optimally.

1.3. Objectives of the study

The general objective of the study is to examine the impact of inflation on the economic growth of Ethiopia.

The specific objectives of the study include:

- ✓ Analyze the trend of inflation and Economic growth of the country.
- ✓ Analyze the impact (long Run) on economic growth including the significant control variables that will affect economic growth of the country.

1.4. Research Hypothesis

- ✓ Inflation by itself will not be significantly affect the Ethiopia economy

1.5. Significance of the Study

The results of this study will have importance for policy implementation regarding nature of the relationship between inflation and economic growth and therefore will keep inflation at that level which is not harmful for sustainable economic growth. The findings could be essential for monetary policy formulation as it provide a guide for the policy makers to choose an optimal target for inflation, which is consistent with long-term sustainable economic growth goals of the country.

Moreover, the study may fill the gap in this area, i.e. investigation of the nexus between Economic growth and inflation in Ethiopia economy and the impact of inflation on economic growth.

1.6. Scope and Limitation the Study

The research focus area is inflation and economic growth which is the impact of inflation on economic growth of Ethiopia. It is recognized that this study had its own shortcomings. The data by itself is a limiting factor on the collection time and range of cover. Besides, more data not directly shows the impact of inflation on economic growth.

1.7. Organization of the Paper

The paper organized as follows. Chapter one discuss about introduction, background of study, objectives, data collection method, significance and limitation of study. Chapter two reviews both theoretical and empirical literatures about the impact of inflation on economic growth in general and the paper on impact of inflation on economic growth in Ethiopia in particular. The result and discussion on impact of inflation on economic growth in Ethiopia present in chapter three. The model specification, data analysis and Estimation and interpretation of result of the study are present in chapter four. The final chapter five is conclusions and a recommendation which is based on the findings is discussed on it.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Theoretical Literature

Various scholars of economics define the term inflation in slightly different ways. But all the definitions can be boiled down to the same theme. It is seen as a continuous upward movement (increase) in the general price level. Money loses purchasing power during inflationary periods since each unit of currency buys progressively fewer goods.

There are two main indexes used to measure inflation the first one is the consumer price index (CPI) and the second one is the producer price index (PPI).

The theoretical analysis suggests some possible sources of inflation. According to Barro (1997) one way for the price level to increase is through a downward movement in the real demand for money. For example, a permanent downward shift in the production function would lower aggregate output, and thereby decrease the real quantity of money demanded. However, it should be known that a one-time shock of this type creates a single increase in the price level rather than a continuous series of increases in prices.

To generate inflation, we would need a succession of downward shifts to the production function. Adverse shocks to the production function such as oil crises, harvest failures, and strikes can influence the general level of prices over short periods. But there is no evidence that these forces can account for inflation in the sense of persistent rises in prices (Barro, 1997).

Different theorists arrive at different conclusions about the responsiveness of output growth to inflation. The monetarists claim that inflation inhibits growth while the structuralize support the opposite view, that is, inflation promotes growth. Theories are useful since they account for some observed phenomenon.

Inflation can lead to uncertainty about the future profitability of investment projects. This problem becomes highly pronounced when high inflation is associated with increased price variability which leads to more conservative investment strategies eventually resulting in lower levels of investment and economic growth.

Inflation may also reduce a country's international competitiveness by making its exports relatively more expensive thus impacting on the balance of payment. Moreover, inflation can interact with the tax system to distort borrowing and lending decisions.

There are several channels that can produce inflation. One of these possible factors that could bring about inflation is the overheating in the labor market. When the economy is overheated, there will be pressure for the real wages to increase. In other words, we should expect a real exchange rate appreciation and wages increases. Increases in the commodity prices or utility prices will push up the cost faced by the firms, and eventually forcing a consumer prices to increase. The second cause of inflation is the price of imports in particular commodities. The third one is the increase in the price of utilities. The other source of inflation is the financing of public deficit, meaning financing of fiscal deficit by printing of money.

Based on Smith (1997), the most important type of inflation is called demand-pull or excess demand inflation. It occurs when the total demand for goods and services in an economy exceeds the available supply. So the price for them rises in a market economy. Historically this has been the most common type and at times the most serious. Every war produces this type of inflation because demand for war materials and manpower grows rapidly without comparable shrinkage elsewhere. Other types of inflation occur in conjunction with demand-pull inflation.

Another type of inflation is called cost-push inflation. The name suggests the cause i.e., the rise in the costs of production. The increase in the cost of production forces up the prices of finished goods and services. Often a rise in wages in excess of any gains in labor productivity is what raises unit costs of production and thus raises prices.

A third type of inflation could be called pricing power inflation, but is more frequently called administered price inflation. It occurs whenever businesses in general decide to boost their process to increase their profit margins. This does not occur normally in recessions (slumps) but when the economy is booming and sales are strong. It could be named oligopolistic inflation, because it is oligopolies that have the power to set their own prices and raise them when they decide the time is ripe. One can at such times read in the newspapers that business is just waiting a bit to see how soon they might raise their prices. An oligopolistic firm realizes that if it raises its prices, the other major firms in the industry will likely see that as a good time to widen their profit margins too without suffering much from price competition from the few other firms in the industry. The fourth type is called sartorial inflation. The term applies whenever any of the other three factors hits a basic industry causing inflation, for example, agriculture.

Monetary growth is a good candidate as a source of inflation. Milton Friedman (1968) the prominent monetary economist once dubbed his famous statement "Inflation is always and

everywhere a monetary phenomenon" (Barro, 1997).

2.2. The costs of inflation

While most economists agree that inflation is "bad" no consensus exists over how bad it is or what should be done about it. Some believe that inflation is a major, even catastrophic, evil, and argue that monetary policy or monetary reform should be geared toward its outright elimination. Many others argue that eliminating inflation would reduce output and employment, and the cost of the lost output and employment would more than offset the gains from establishing price stability, still others argue that the costs of inflation are small anyway, and could be dealt by other means like indexing the fiscal system (Dornbusch, 1997)

There is no direct loss of output from inflation, as there is from unemployment (Dornbusch, 1997). The relevant distinction is between inflation that is perfectly anticipated and taken into account in economic transactions, and imperfectly anticipated, and unexpected inflation.

2.2.1. The costs of perfectly anticipated inflation

Suppose that an economy has been facing a 5 percent of inflation for a long time, and that everyone accurately anticipates that the rate of inflation will continue to be 5 percent. In such an economy, all contracts would build in the expected 5 percent inflation.

Borrowers and lenders would know and agree that the dollars in which a loan is repaid will be worth less than the dollars given up by the lender when making the loan. Nominal interest rates would be raised 5 percent to compensate for the inflation. Long-term labor contracts would increase wages at 5 percent per year to take account of the inflation. In short, any contracts in which the passage of time is involved would take the 5 percent inflation into consideration. The tax laws would also be indexed. This means the tax brackets would be increased at the rate of 5 percent per year.

Perfectly anticipated inflation has no real costs except for some qualifications. The first qualification arises because no interest is paid on currency (notes and coins) not least because it is very difficult to do so. This means that the costs of holding currency rise along with inflation.

The cost to the individual of holding currency is the interest forgone by not holding an interest-bearing asset. When the inflation rate rises, the nominal interest rate rises; the interest lost by holding currency increases, and the cost of holding currency therefore increases (Dornbusch, 1997). Thus, the demand for currency falls. Individuals have to keep less currency than they did

before. As a result, they make more trips to the bank to cash smaller checks. The costs of thesetrips to the bank are often termed as "shoe leather" costs of inflation because walking to the bank more often causes one's shoes to wear out more quickly.

The second qualification is the "menu costs" of inflation. High inflation motivates firms to change their posted prices more frequently. Changing prices is sometimes costly because it requires printing and distributing a new catalogue. These costs are called menu costs, because when the rate of inflation is high, restaurants have to print new menus more repeatedly.

The other cost of expected inflation results from the tax laws. Many provisions of the tax code do not take into account the effects of inflation. Inflation can alter individuals' tax liability, often in ways that lawmakers did not intend (Mankiw, 2000).

Failure to index the tax structure implies that inflation moves the public into higher tax brackets and thus raises the real value of its tax payments or reduces real disposable income.

The inconvenience of living in a world with changing price level is another cost of inflation. Money is the yardstick with which we measure economic transactions. This yardstick changes when there is inflation.

2.2.2. The costs of imperfectly anticipated inflation

Countries with long inflationary histories in their economy like Brazil and Israel have made tremendous adjustments to inflation through the use of indexing. Other countries in which inflation has not been episodic in their economy have not adopted indexation. (Dornbusch, 1994)

One important effect of unexpected inflation is to change the real value of assets fixed in nominal terms. In other words, unanticipated inflation arbitrarily redistributes wealth among individuals. One can see how this works by examining long-term loans. Loan agreements specify a nominal interest rate i.e. interest rate that is expected to prevail in the future at the time of the agreement. If inflation turns out differently from what was expected, the ex-post real return that the debtor pays to the creditor differs from what both parties anticipated. If inflation turns out to be higher than expected, the debtor wins and the creditor loses because the debtor repays the loan with less valuable dollars or Birr. Whereas, if inflation turns out, to be lower than expected, the creditor gains the benefit while the debtor is hurt because the loan repayment is worth much more than both parties expected.

Unanticipated inflation also hurts individuals on fixed income like pensioners. Highly variable and erratic inflation increases uncertainty for both creditors and debtors, which subjects them to

arbitrary and potentially large redistributions of wealth.

The redistribution effect operates with respect to all assets fixed in nominal terms, in particular, money, bonds, savings account, insurance contracts, and some pensions (Dornbusch, 1994) that realized real interest rates are lower than nominal interest rates on assets and even possibly negative. Inflation could also redistribute income by benefiting capitalists or recipients of profit income, at the expense of wage earners. This occurs because when there is unanticipated inflation; prices rise faster than wages and therefore allow profits to expand.

There is a presumption that the old are more vulnerable to the costs of unanticipated inflation than the youth in that they own more nominal assets. Some studies also show that there is little evidence supporting the view that the poor suffer especially from unanticipated inflation.

Uncertain and highly variable inflation reduces the efficiency of the price system and thus reduces the efficiency with which the economy allocates goods and factors of production, and could affect the level of output.

2.3. Theories of economic growth and inflation

This section will discuss a classical, Keynesian, neo-Keynesian, monetarist, Neo-classical and endogenous growth theories each with their respective contribution to the inflation-growth relationship.

2.3.1. Classical Theory

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

Y = f (L, K, T) where Y is output, L is labor; K is capital and T island.

Smith argued that growth was self-reinforcing as it exhibited increasing returns to scale. Besides, he considered savings as a creator of investment and hence growth.

The link between inflation and its 'tax' effects on profit levels and output were not specifically articulated in classical growth theories. However, the relationship between the two variables is implicitly suggested to be negative, as indicated by the reduction in firms. Profit levels through higher wage costs. (Gokal and Harif, 2004)

The relationship between inflation and economic growth remains a controversial one in both theory and empirical findings. There is immense debate between structuralizes and monetarists as well as other schools of thought (economic theorists) regarding the issue.

The structuralize believe that inflation is essential for economic growth, whereas the monetarists see inflation as detrimental to economic progress. There also exists a debate about the direction of causality. Friedman (1973:41) succinctly summarized the inconclusive nature of the relationship between inflation and economic growth as follows: "historically, all possible combinations have occurred: inflation with and without development, no inflation with and without development."

2.3.2. Keynesian Theory

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

In the long-run "steady state" situation or (equilibrium) nothing is changing as the name suggests. 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, but eventually turns negative towards the latter part of the adjustment path.

The initial positive relationship between inflation and output usually happens due to the time inconsistency problem'. According to this concept, producers feel that only the prices of their products have increased while the other producers are operating at the same price level.

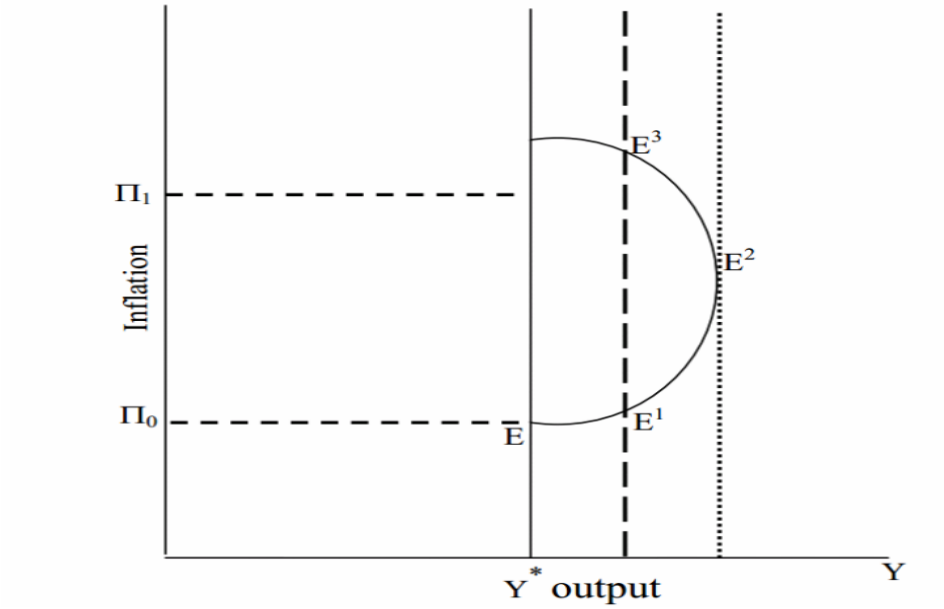
However, in reality, overall prices have increased. Hence, the producer continues to produce more and more output. Blanchard and Kiyotaki (1987) also believe that the positive relationship can be due to agreements by some firms to supply goods at a later date at an agreed price. Therefore, even if the prices of goods in the economy have increased, output would not decline, as the producers have to fulfill the demand of the consumer with whom the agreement was made.

There are also two other features of the adjustment process. Firstly, there are times when the output decreases and the inflation rate increases (between E2 & E3 in the figure below).

This negative relationship between inflation and growth is important as it occurs in practice, as attested by empirical literature. This phenomenon is called stagflation, when inflation rises as

output falls or remains stable. Secondly, the economy does not move directly to a higher inflation rate, but follows a transitional path where inflation rises and them falls.

Figure 2.1: Inflation and output Relation



Source: Gokal and Hanif (2004)

2.3.3. Monetarism

Monetarism a term coined by Milton Friedman has several essential features. This focuses on the long-run supply-side properties of the economy as opposed to short-run dynamics. Monetarism focused on several essential long run properties of the economy like the quantity theory of money and the neutrality of money. The quantity theory of money linked inflation and economic growth by simply equating the total amount of spending in the economy to the total amount of money inexistence. Friedman proposed that inflation was the product of an increase in the supply or velocity of money at a rate greater than the rate of growth in the economy.

Friedman also challenged the concept of the Phillips curve. His argument was based on the premise of an economy where the cost of everything doubles. Individuals have to pay twice as much for goods and services, but they do not mind, because their wages are also twice as large.

Individuals anticipate the rate of future inflation and incorporate its effects into their behavior. As such, employment and output is not affected. Economists call this concept the neutrality of money.

Neutrality holds if the equilibrium values of real variables, including the level of GDP are

independent of the level of the money supply in the long-run. Super neutrality holds when real variables- including the rate of growth of GDP, are independent of the rate of growth in the money supply is the long-run. If inflation worked this way, then it would be harmless. In reality however, inflation does have real consequences for other macroeconomic variables. Through its impact on capital accumulation, investment and exports, inflation can adversely affect a country's growth rate, (Gokal and Hanif, 2004).

In a nutshell, monetarism suggest that is the long-run prices are mainly affected by the growth rate is money, while having no real effect on growth. If the growth in the money supply is higher than the economic growth rate, inflation will occur.

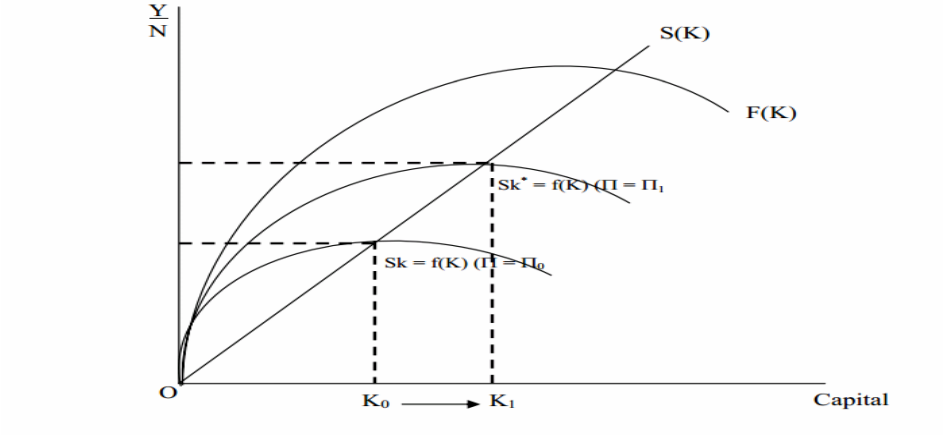
2.3.4. Neo-classical Theory

One of the earliest neo-classical models was developed by Solow (1956) and Swan (1956). The model exhibited diminishing returns to labor and capital separately and constant returns to both factors combined. Technological progress (change) replaced investment, that is growth of capital, 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 individuals' 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 mean high capital accumulation and hence speedy output growth.

Tobin, another neoclassical economist (1965) developed mundell's model further by following Solow (1956) and Swan (1956) in making money 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.

Figure 2.2: portfolio allocation mechanism



The above figure illustrates the portfolio allocation mechanism. When inflation rate increases from Π_0 to Π_1, ($\Pi_1 > \Pi_o$), the return to money declines. Based on Tobin's portfolio mechanism, people will substitute away from money, which has lower return and shift towards capital. In figure 2, this substitution effect is portrayed by a movement in the SK line to SK. The portfolio mechanism results in a higher steady state capital stock (from K0 to K1). Tobin's framework shows that a higher inflation rate permanently raises the level of output. But, the effect on output growth is temporary, occurring during the transition from steady state capital stock, K0 to the new steady state capital stock K1. The impact of inflation can be classed as having a 'lazy dog effect' where it induces greater capital accumulation and higher growth, only until the return to capital falls.

Therefore, higher investment will cease and only steady state growth will result. Indeed, growth in the neoclassical economy is ultimately driven by exogenous technological advancement- upward shifts in the F(K) curve not by a one-off change in the inflation rate.

Quite simply, the Tobin effect proposes 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. Tobin (1972) also argued that because of the down ward 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 role of money in the context of an infinitely-lived representative agent model as "super neutral" super neutrality, as mentioned in the preceding paragraphs holds when real variables like 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 incentive in the inflation rate results in a lower steady state level of output and peoples' welfare declines. In stockman's model, money is a complement to capital, accounting for a negative relationship between the steady-state level of output and inflation rate. Stockman's insight is promoted by the fact that firms put up some cash in financing their investment projects. Sometimes the cash is directly part of the financing packages, whereas at other times, banks require compensating balances. Since inflation erodes 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.

The stockman effect can also operate through the effects on the labor-leisure decision. Greenwood and Huffman (1987) developed the basic labor- leisure mechanism and Cooley and Hansen (1989) identified the implication for capital accumulation. In Greenwood and Huffman's research people hold money to purchase consumption goods and derive utility both from consumption and leisure. Fiat money7 is used because there is a cash-in-advance constraint on consumption goods.

Greenwood and Huffman show that the return to labor falls when the inflation rate rises. People substitute away from consumption to leisure, because the return to labor falls.

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.

Thus, when the number of laborers declines in response to a 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.

This theoretical review demonstrated that models in the neoclassical framework can yield very different results with regard to inflation and growth. An increase in inflation can result in higher output (Tobin effect) or lower output (Stockman effect) or no change in output (Sidrauski effect).

2.3.5. Neo-Keynesian Theory

Neo-Keynesians originally emerged from the ideas of the Keynesians. One of the crucial developments under neo-Keynesianism was the concept of "Potential output", which is

sometimes referred to as natural output. This is a level of output where the economy is at its optimal level of production. In other words, the factors of production are fully utilized. This level of output also corresponds to the natural rate of unemployment. The natural rate of unemployment is also termed as the non-accelerating inflation rate of unemployment (NAIRU). NAIRU is the unemployment rate at which the inflation rate is neither rising nor falling. According to this theory, inflation depends on the level of actual output (GDP) and the natural rate of employment.

If GDP surpasses its potential and unemployment is below the natural rate of unemployment, other things held constant, inflation will accelerate as suppliers increase their prices and built-in inflation worsens. This causes the Phillips curve to shift in the stagflationary direction, towards greater inflation and greater unemployment (lower output).

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

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

The 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 way, rising more quickly than it falls, mainly due to the downward rigidity in prices.

2.3.6. Endogenous growth theory

Endogenous growth theories describe economic growth, which is generated by factors within the production process. For example, economies of scale, increasing returns or induced technological change as opposed to outside or exogenous factors such as the increase in population. In endogenous growth, the growth rate has depended on one variable, that is, the rate of return on capital variables, like inflation, that decrease that rate of return, which in turn reduces capital

accumulation and decreases the growth rate.

There is one basic difference between the endogenous growth models and the neo-classical economies. In the neo-classical economies, the return on capital declines as more capital is accumulated. In the simplest versions of the endogenous growth models, per capita output continuous 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. Models of endogenous growth also permit increasing returns to scale in aggregate productions, and also focus on the role of externalities in determining the rate of return on capital (Gokal and Hanif, 2004).

Endogenous models that explain growth further with human capital develop growth theory by implying that the growth rate also depends on the rate of return to human capital, as well as physical capital. The rate of return on all forms of capital must be equal in the balanced-growth equilibrium. A tax on either form of capital induces a lower return. When such endogenous growth models are set within a monetary exchange framework Macallum and Goodfriend (1987) the inflation rate (tax) lowers both the return on all capital and the growth rate.

A tax on capital income directly reduces the growth rate, while tax on human capital would cause labor to leisure substitution that lowers the rate of return on human capital and eventually lower the growth rate.

Some versions of the endogenous growth economies find that the inflation rate effects on growth are small. Gomme (1993) studied an economy similar to the one specified by Cooley and Hansen, that is, an inflation rate increase results in a decline in employment. According to Gomme research, efficient allocations satisfy the condition that the marginal value of the last unit of today's consumption equals the marginal cost of last unit of work. A rise in inflation reduces the marginal value of today's last unit of consumption, thus inducing people to work less. With less labor, the marginal product of capital is permanently reduced resulting in a slower rate of capital accumulation. Gomme found that in this economy, eliminating moderate inflation rate for example, 10 percent, result in only a very small less than 0.01 percent point, and gain in the growth of output.

Alternative models examine low inflation might directly affect capital accumulation and hence output growth. Marquis and Reffert (1995) and Haslag (1995) specify economies in which capital and money are complementary goods. In Has lag research banks pool small savers but are

required to hold money as deposits to satisfy a reserve requirement. Therefore, an inflation rate increase drives down the return to deposits, resulting in deposits being accumulated at a slower rate since capital is a fraction of deposits; capital accumulation and output growth are slow.

2.4. Empirical Literature Review:

Several evidences link higher inflation will lower growth over the long term. But it is not yet certain what mechanisms produce the inflation and slow growth link.

There is considerable evidence that inflation has an identifiable negative effect on economic activity. Much of this evidence relates to the effect of inflation rate on economic and productivity growth. While few doubt that very high inflation is bad for growth, there have been mixed empirical studies presented as to their precise relationship.

As the authors point out, their analysis leaves little room for interpretation. Inflation is not neutral, and in no case does it favor rapid economic growth. Higher inflation never leads to higher levels of income in the medium and long run which is the time period they analyze. This negative correlation persists even when other factors are added to the analysis, including the investment rate, population growth, schooling rates, and the constant advances in technology. Even when the other factor in the effects of supply shocks characteristic of a part of the analyzed period, there is a still a significant negative correlation between inflation and growth.

Inflation not only reduces the level of business investment, but also the efficiency with which productions factors are put to use. The benefits of lowering inflation are great, according to the authors, but also dependent on the rate of inflation. The lower the inflation rate, the greater are the productive effects of a reduction, for example, reducing inflation by 1 percentage point when the rate of inflation is 20 percent may increase growth by 0.5 percent. But, at a 5 percent inflation rate, output increases may be 1 percent or higher. It is therefore more costly for a low inflation country to concede an additional point of inflation than it is for a country with a higher starting point.

They mention that inflation restricts economic growth largely by reducing the efficiency of investment rather than its level. To date, although the relationship between inflation and economic growth remains controversial or somewhat inconclusive, general empirical studies confirm the existence of either a positive or negative relationship between these two major macroeconomic variables. Moreover, with time, a general consensus evolved that low and stable inflation promotes economic growth and vice versa (Mubarik, 2005). This further raises the

questions how low inflation should be. The answer evidently depends on the nature and structure of the economy and varies across countries. In this regard, recently macroeconomists have adopted an econometric technique simply by looking at a nonlinear or structural break effect which states that the impact of inflation on economic growth could be positive up to a certain threshold level and beyond this level the effect turns to be negative (Sweidan, 2004). This supports both the view of the structuralisms and the monetarists up to a certain extent, that is, low inflation is helpful for economic growth but once the economy achieves faster growth then inflation is detrimental for the sustainability of such growth. At very low rates of inflation (around 2-3 percent a year or lower) inflation and growth are positively correlated. Otherwise, inflation and growth are negatively correlated, but the relationship is convex, so that the decline in growth associated with an increase from 10 percent to 20 percent inflation is much larger than that associated with moving from 40 percent to 50 percent. Their policy message suggests that even lowering moderate inflation rates can yield gains in GDP growth of up to 0.8-0.9 percentage points. Sarel (1995, 1996) finds that there is evidence of structural break that is significant. The break is estimated to occur when the inflation rate is 8 percent. Below that rate, inflation does not have any significant effect on growth or it may even have a slightly positive effect. When the inflation rate is above 8 percent, however, the estimated effect of inflation on growth rates is negative, significant, robust and extremely powerful. Fario and Carneiro (2001) find a zero long-run response of output to a permanent inflation shock in the context of a high inflation country, in this case Brazil. The results could be considered as evidence against the view that inflation and output are reliably related in the long run. These results are argued to support Sidrauski's (1967) super neutrality of money in the long run in that inflation does not affect long-run growth. However, in the short-run, it did provide contradictory evidence against Sidrauski's model. In the short-run, there is a negative impact of inflation on output. Bruno and Easterly (1995) 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. However, they found the case for growth effects of low to moderate rates of inflation very much ambiguous. According to the results obtained, causality remained problematic, but their results are consistent with the view that costs of inflation only become significant at relatively high rates of inflation. At lower rates of inflation, growth and inflation may simply be jointly affected by various demand and supply shocks and hence shows no consistent pattern. From the

findings of most of the papers cited in the foregoing paragraphs, the confidently repeated claim that nothing but price stability or very low inflation can maximize the level or growth rate or the standard of living goes far beyond the current state of knowledge.

This section examines related empirical studies on the relationship between inflation and economic growth with particular interest on data used, methodology adopted, nature of the relationship and the estimated inflation thresholds. Most studies on the threshold effect of inflation on economic growth are dominated by cross-country panel studies (Sarel, 1996; Khan and Senhadji, 2001; Mallik and Chowdhury, 2001; and Kremer *et al*., 2009). On the other hand, due to the peculiarity of certain economies, especially developing economies, specific country studies might reveal specific evidences fundamental to the country under study. This is what instigated the study. In this regard, identified some country specific studies, especially on developing countries, on the inflation and economic growth nexus, which include Ahmed and Mortaza (2005) for Bangladesh; Hussain (2005) and Mubarik (2005) for Pakistan; Singh (2003) for India; Hodge (2005) for South Africa.

Sarel (1996) examined the non-linear effects of inflation on economic growth using annual data on GDP, CPI, population, terms of trade, real exchange rate, and investment rates andgovernmentexpendituresof87countriesfrom1970-1990.The20year'sampleperiodwas divided into four equal periods of five years each, obtaining a total of 248 observations for the study. He found a significant structural break (inflation threshold) in the function that relates economic growth to inflation. The threshold was estimated at 8 per cent, below which inflation did not have any effect on economic growth or it may have a slight positive effect. When it rose above the 8 per cent threshold, however, the estimated effect of inflation was significant, robust and extremely powerful. He demonstrated that when the existence of the structural break is ignored, the estimated effect of inflation on economic growth for higher inflation rates decreased by a factor of three.

Khan and Senhadji (2001) re-examined the issue of the existence of threshold effects in the relationship between inflation and economic growth using a new econometric technique that allows for appropriate estimation procedures and inference. They utilized an unbalanced panel dataset covering the period 1960-1998 from 140 countries, comprising industrialized and developing countries. They estimated inflation threshold levels of 1-3 per cent and 11-12 per cent for industrialized and developing countries, respectively. The empirical results suggested

that beyond threshold levels of 3 and 12 per cent for industrialized and developing countries, respectively, the relationship between inflation and economic growth became negative. The authors noted that the peculiarities of industrialized economies remained different from those of the developing economies. However, they did not acknowledge the peculiarities existing among developing countries in terms of resources base, population size, level of corruption, poverty level, etc.

Mallik and Chowdhury (2001) studied the relationship between inflation and GDP growth for four Asian countries, namely, Bangladesh, India, Pakistan and Sri Lanka. The study used un-even sample size of 1974-97 for Bangladesh, 1961-97 for India, 1957-97 for Pakistanand 1966-97 for Sri Lanka. The variables used for the study were CPI and real GDP to measure inflation rates and economic growth, respectively. They found evidence of a long- run positive relationship between inflation and GDP growth rate for all the four countries with significant feedbacks. According to the authors, moderate inflation level helps economic growth but faster growth feedbacks into inflation, thus, the countries are on a″knife-edge″. However, this study did not estimate what the moderate inflation rate (threshold level) that will help economic growth in the four countries should be.

A study by Kremer *et al*. (2009) using panel data from 63 countries (comprising industrial and non-industrial countries) confirmed the effect of inflation on long-term economic growth. Their findings revealed that inflation affected growth when it exceeded 2 per cent threshold for industrial countries and 12 per cent for non-industrial countries, and that below these levels the relationship between inflation and economic growth was significantly positive. However, they suggested that the inflation threshold in non- industrial countries and the appropriate level of inflation target might be country specific. Therefore, they recommended that the identification of country specific threshold might provide useful information about the appropriate location and width of an inflation targeting band. The authors' recommendation is valid because it is indeed an important policy issue for economies adopting or planning to adopt inflation targeting approach to monetary management to study the relevant threshold level to serve as aguide.

In Bangladesh, Ahmed and Mortaza (2005) found a statistically significant long-run negativerelationshipbetweeninflationandeconomicgrowthusingannualdataonrealGDP and CPI covering the period 1980 to 2005. The study utilized co-integration and error correction models.

They estimated an inflation threshold level of 6 per cent (structural-break point) above which inflation will adversely affect economic growth. They concluded that their findings have direct relevance to the conduct of monetary policy by the Bangladesh Bank.

Hussain (2005) and Mubarik (2005) examined inflation and growth in Pakistan using annual time series data for the periods 1973-2005 and 1973-2000, respectively; and estimated the threshold levels of inflation to be 4-6 per cent and 9 per cent, respectively, beyond which inflation will deter economic growth. Similarly, Singh (2003) suggested an inflation threshold range of between 4-7% for India. It is noted that both Pakistan and India are both developing countries but the findings of the authors differ significantly from the findings of Khan and Senhadji (2001) and Kremer *et al.* (2009) for developing countries. This might be partly because of difference in methodology adopted or data set used. This reiterate the validity of Kremer *et al*. (2009) recommendation that conduct of country specific study due to peculiarities of economies would reveal more useful information.

Hodge (2005) conducted a study on the relationship between inflation and growth in South Africa in order to test whether South African data support the findings of cross-section studies that inflation has long-run negative effect on growth and if higher growth can be gained at the cost of higher inflation in the short-run. According to Hodge (2005), inflation drags down growth over the long-term, while in the short run growth above its trend requires accelerating inflation. It is generally noted in literatures that high inflation has negative impact on economic growth in the long run and relates positively in the short run.

Therefore, Hodge (2005) would have estimated a threshold at which authorities needed to take measures to ensure inflation does not hamper economic growth.

Fabayo and Ajilore (2006) in their paper titled "inflation How Much is too Much for Economic Growth in Nigeria" using annual data from 1970-2003 suggested the existence of threshold inflation level of 6 per cent for Nigeria. They explained that above this threshold, inflation retards growth performance of the economy while below it, the inflation-growth relationship is significantly positive. They suggested that the goal of macroeconomic management in Nigeria should be to bring down inflation to a moderate single digit of 6 per cent (optimal inflation target policy).

Also, Chimobi (2010) used Nigerian data on CPI and GDP for the period 1970-2005 to examine the existence or not, of a relationship between inflation and economic growth and its causality.

He adopted the Johansen-Juselius co-integration technique and Engle-Granger causality test. A stationary test was carried out using Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests and stationary was found at both 1 and 5 per cent level of significance. After testing for causality at two different lag periods (lag 2 and lag 4), he found the result suggesting unidirectional causality running from inflation to economic growth. Thus, the study maintained that the unidirectional causality found is an indication that inflation indeed impacts on economic growth. However, this study did not estimate or suggest any threshold level at which the impact could be positive or negative, significant or not, in the long run or short run. Thus, a study that attempt to estimate the inflation threshold level would have added to the debate especially that most economies are turning towards adopting inflation.

To summarize the findings ofthe above studies it can be safely noted that there is relationship between inflation and economic growth, which is often non-linear in nature. Under a certain level of inflation, the relationship is positive and beyond that level of inflation, the relationship is negative. Simple implication of this kind of relationship between inflation and economic growth is that modest increase in the rate of inflation would not be harmful for the long-run real economic growth for the economies with initially low rates of inflation. But for economies with initially high rates of inflation, further increase in the inflation rate would have adverse effects on real economic growth.

2.4.1. Empirical Literature Review on Ethiopia

Alemayehu and Kibrom (2008) were studied the galloping inflation in Ethiopia by using VAR model for estimation and quarter data for the period 1994/95 to 2007/08 of Ethiopia. The result shows in long-run the main determinants of inflation for food sectors are money supply, inflation expectation and international food price hike while for non-food sectors money supply, interest rate and inflation expectation. Additionally, in short-run wages, international prices, exchange rates and constraints in supply are the main source of inflation. To sum up, even if the determinants of inflation are different for food and non-food and short-run and long-run, they showed that inflation and economic growth have positive relationship in long-run.

As summarized by Teshome (2011) in his study of sources inflation and economic growth in Ethiopia for the year 2004 to 2010: Ethiopia experienced an average of 11 percent economic growth` and 16 percent inflation rate. But, higher inflation rate did not significantly reduce

economic growth of the country which implies in some years inflation and economic growth had positive relationship. Since, for that specified period higher consumption spending desire and increasing imported goods price considered as a major source of inflation in the country.

One of the studies on Ethiopia using annual data from 1974/75 to 2009/10 by Aynalem (2013) has examined the relationship between inflation and economic growth. The study has employed co-integration and error correction models having with correlation matrix and Granger Causality test by using annual data set that are collected from MoFED, NBE and CSA. The empirical evidence demonstrates that there exists a statistically significant long-run and short-run negative relationship between inflation and economic growth for the country. He found 4-percent as the threshold level of inflation above in which inflation adversely affects economic growth.

Abeba (2014), was studied the impact of inflation on economic growth between Ethiopia and Uganda comparatively. The study employed annual time series data of CPI as a proxy for inflation and GDP at current price as a proxy to for growth from 1990-2012. The analysis adopted the descriptive approach to show the trend and variability of inflation and growth for both countries to have clear image on changes of variables through time. To check the stationary of the variables, ADF and Phillip-Perron tests were conducted while Johansen test was applied to confirm the presence of co-integration between inflation and economic growth. VECM also implemented after checking co-integration to see the casual relationship between inflation and growth. Depending on the results found, the co-efficient variation of the two countries shows that the variability of GDP and inflation were larger for Ethiopia than Uganda. VECM shows the existence of positive significant bi-directional relationship between inflation and economic growth for Ethiopia both in long-run and short-run. However, in Uganda there exists only unidirectional negative relationship between inflation and growth that runs from GDP growth to inflation.

2.5. Inflation and Economic Growth in Ethiopia

This part deals with the relationship of inflation and economic growth in Ethiopia. To this end, tries to introduce the Ethiopian economy, the trend of inflation in Ethiopia in recent years and focuses on the performance of the economy.

2.5.1. Introduction to the Ethiopian economy

Since 1992 the government of Ethiopia has been introducing numerous reforms aimed at improving macroeconomic stability, accelerating economic growth, and reducing poverty. Tariffs have been reduced, quota constraints relaxed, licensing procedures simplified, foreign exchange controls eased, compulsory grain delivery and forced membership to cooperatives discontinued, a privatization process began, private banks flourished, interest rates decontrolled, and an inter-bank money and foreign exchange markets were introduced (Alemayehu and Tadese, 2004).

The other important departure from the past trend was the abandonment of planning, as an explicit mode of government economic policy formulation and implementation. However, beginning from 2002 the Ethiopian government has adopted a development strategy centered on the principal goal of poverty reduction. This strategy is officially coined as sustainable development and poverty reduction program. To achieve this program, the government has launched deeper fiscal decentralization, judicial and civil service reform, and public sector capacity building erected. By the beginning of the 1990s, the Ethiopian economy was in deep crisis. There were economic woes and chaos right after the demise of the military junta.

Economic reforms, initiated in 1988 by the Dergue government as a 'mixed economy' alternative to the controlled economy, were further implemented and took on the form of a structural adjustment program (SAP) with donor support from 1994. The return to relative peace after the defeat of the Dergue and the installation of an EPRDF government in 1991 provided an opportunity for recovery (Dercon, 2000).

Early measures taken by the current government included agricultural market liberalization, price liberalization, a large devaluation, tax reforms, and some steps towards international trade liberalization. During the latter part of the 1990s, reforms focused more on financial market liberalization, privatization, fertilizer market reforms, and initiatives regarding input and extension delivery. Sectoral policies included plans related to education, roads, health, and agricultural extension, mainly involving substantial donor financed capital expenditure (Dercon, 2000).

2.5.2. The Trend of Inflation in Ethiopia in Recent Years

In the past three years or so, Ethiopia has been experiencing a growing rate of overall inflation which is mainly caused by persistently high food price inflation. The food price inflation has

pushed overall inflation into double digit figures; currently well above 13 percent (NBE, 2017)

It has been the case in Ethiopia for food prices to be negatively correlated with agricultural output or availability of rainfall. Inflation has been low in Ethiopia for the most part of its past history. Prices were stable albeit bad weather sometimes led to unprecedented price variations.

During the Imperial era, inflation was not a problem in Ethiopia. The military Junta, i.e. the Derg regime, also deliberately controlled prices artificially.

However, recently due to the various economic reform measures and pressures of international price hikes such as the price of oil and other materials, inflation is rising unabated.

Until recently, Ethiopia has been a low inflation country in sub-Saharan Africa. This was achieved due to a strong currency, prudent monetary and fiscal policies (1960s-1973), general price control (1974-1992) and implementation of economic reform and stabilization programs (1992-2005).The historic peak level of inflation has been 36.4 percent (CSA 2010), which was recorded in 1991/92, mainly due to the severe drought that hit agricultural production the most and absence of peace in the country. On the other hand, a significant deflation was observed during fiscal year basically due to the decline in food prices associated with the bumper agricultural production following the good weather condition of the period.

Deflationary situation observed during fiscal year 2001/02 continued until October 2002 after which prices continued to escalate at a significant pace reaching 10.9 percent by the end of 2002/03 fiscal year. Since November 2003, however, the national annual average general inflation was on a continuous decline registering 7.3 percent annual average by the end of fiscal year 2003. Despite the relatively good weather conditions and better harvest in 2004/05, the price decline lasted until November 2004. Beginning from December 2004 onwards, for 12 months, general inflation has been steadily on the rise up to December 2005.

Such developments in 2004/05 and 2005/06 were quite unusual in that price increase has been observed despite good agricultural produce. Moreover, non-food or core inflation, which takes up to 44.3 percent 2008/09 of the General CPI at country level, registered a significant increase influencing the upward movement of the general price level. Accordingly, general inflation at the end of fiscal year 2005/06 reached 10.6 percent, food inflation 13 percent and core inflation, as proxies by non-food prices 7.1 percent from their respective levels of 6.1, 7.4, and 4.4 percent in 2004/05 (NBE, 2007).

The inflation of 2013/2014, 2014/2015 and 2015/2016 in Ethiopia normal and single digit which

is the general inflation level is 8.1 in 2013/2014 and also 5.9 food and 10.6 nonfood inflation. At end of 2014/2015 the general inflation level is 7.7, this means 7.4 for food and 8 for nonfood inflation. The general, food and nonfood inflation level at 2015/2016 is 9.7,11.2 and 8 respectively.

The increase in core inflation was basically due to the increase in house rent, prices of construction materials, water, and fuel and power subgroup of the CPI in connection with the increase in import prices of fuel and construction materials. Moreover, increasing prices of locally produced construction materials such as cement had also considerable impact on the inflation rate of the non-food items (NBE 2017).

Table 2.1: Annual average inflation rates (in %)

Item	**Year**				
	2014/15	**2015/16**	**2016/17**	**Change in point**	**Change in point**
	A	B	C	C-A	C-B
General	7.7	9.7	7.2	-0.5	2.0
Food	7.4	11.2	7.4	0.0	-3.8
Non-food	8.0	8.0	7	-1.0	-1.0

Source: CSA & NBE

2.5.3. Consumer price Development in regional states

Overall inflation increased in all regional states. The lowest regional inflation was registered in Addis Ababa (2.9 percent) and the highest in Amhara (10.9 percent).

The regions, the rising food inflation contributed significantly to higher overall inflation it was only in SNNP, Amhara, Tigray, Somalia are more than 10 percent of inflation rate. Regions that high inflation rate of non-food inflation is Afar, SNNP, Tigray which greater than 10 percent.

Table 2.2: Regional Average Annual Inflation (2016/17 F.Y)

Region	General	Food	Non-food
Afar	7.8	1.0	15.8
Amhara	10.9	12.2	9.7
Benishangul	5.3	5.4	5.2
Dire Dawa	7.5	9.4	6.7
Gambella	4.9	7.1	7.6
Harari	6.6	9.0	4.0
Oromia	3.3	1.0	6.3
SNNP	8.6	15.6	15.0
Somalia	10.5	11.2	9.9
Tigray	10.0	8.9	10.9
Addis Ababa	2.9	1.3	4.2
Regions Average	7.1	7.3	7.7

Source: NBE Annual Report 2016/17

2.5.4. The performance of the Ethiopian Economy

In many ways, the performance of the Ethiopian economy has been remarkable in the recent decade. First, the transition from war to peace and from a controlled economy to more market-oriented economy in the early 1990s has been relatively smooth and accompanied by a quick returntobroadmacroeconomicstability.Bythemid-1990s, a rapid convergence of the parallel market exchange rate took place, while inflation was generally within one digit during this period, despite a large devaluation and domestic price liberalization. The fiscal deficit was also kept within reasonable bounds. Secondly, growth in GDP has been rather impressive between (fiscal years') 1990 and 2000, the economy grew by 4 percent per annum on average but limiting the period to 1993 to 2000, the growth rate was 5.2 Percent per year (Dercon, 2000).

During fiscal year 2006/07, GDP at constant prices grew by 11.8 percent. This high growth was achieved for the third time in a raw (i.e., 10.5 percent in 2005/06, 11.2 percent in 2007/08and 11.4 percent in 2010/11), which places Ethiopia among the top performing economies in sub-Saharan Africa (NBE, 2016/17).

Although all sectors contributed to this relatively high economic growth performance, agriculture stands first growing by 11.2 percent and contributing about 54 percent of the 9.6 percent overall

GDP growth. Industry and service sectors also grew by 7.4 and 9.2 percent respectively.

The Ethiopian economy which had exhibited 9.9 percent average annual growth during 2012/13-2016/17, registered 10.9 percent growth in 2016/17, depicting recovery from challenging macroeconomic and weather conditions of the previous year. The registered growth rate in real GDP was 0.2 percentage point lower than base case scenario GTPII target set for the fiscal year although it was significantly higher than 2.6 percent average growth estimated for Sub-Saharan Africa (World Economic Outlook Update, October 2017).

The growth in real GDP was mainly attributed to 10.3 percent growth in services, 6.7 percent in agriculture and 18.7 percent in industrial sectors (Table 2.3).

In 2016/17, the agricultural sector exhibited 6.7 percent growth rate which showed recovery from El- Nino effect of the previous year which merely saw 2.3 percent expansion. Yet, it was 1.3 percentage point lower than the 8 percent target for the year.

Table 2.3: Sectoral contribution to GDP and GDP growth

Item		Fiscal Year					
		2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Real GDP in million Birr		517.1	568.0	627.0	692.0	747.0	1577.1
Sector	*Agriculture*	222.9	238.8	251.8	267.8	274.0	573.1
	Industry	59.6	73.9	86.5	103.7	125.0	404.3
	Services	237.0	259.0	292.0	325.0	353.0	620.2
Growth in Real GDP		8.7	9.9	10.3	10.4	8.0	10.9
Growth rate in Real GDP per capita		6.1	7.1	7.5	13.4	9.5	7.8
Share in GDP(%)	*Agriculture*	43.1	42.0	40.2	38.7	36.7	36.4
	Industry	11.5	13.0	13.8	15.0	16.7	25.6
	Services	45.9	45.5	46.6	47.0	47.3	39.3
Growth in Real GDP per capita		32.2	6.8	14.4	13.4	9.5	7.8
Agriculture	*Absolute growth*	4.9	7.1	5.4	6.4	2.3	6.7
	Contribution to GDP growth	2.2	3.1	2.3	2.5	0.9	2.5
	Contribution in %	25.3	31.2	22.3	24.0	11.3	22.9
Industry	*Absolute growth*	19.6	24.1	17.0	19.8	20.6	18.7
	Contribution to GDP growth	2.1	2.8	2.2	2.7	3.1	4.4
	Contribution in %	24.1	27.9	21.4	26.0	38.8	40.4
Services	*Absolute growth*	9.6	9.0	13.0	11.2	8.7	10.3
	Contribution to GDP growth	4.4	4.1	5.8	5.2	4.0	4.0
	Contribution in %	50.6	41.0	56.3	50.0	50.0	36.7

Source: NBE Annual Report 2016/17

During 2016/17, the share of agriculture in GDP went down to 36.3 percent, more or less equivalent with GTPII target of 36.4 percent for the fiscal year. Likewise, the sector's contribution to GDP growth rate was 22.9 percent. Industrial sector accounted for 25.6 percent of GDP. The sector contributed 40.4 percent to the overall economic growth during the fiscal year. (Table 2.3).

Service sector continued to dominate the economy as its share in GDP was about 39.3 percent and its contribution to GDP growth reached 36.7 percent (Table 2.3).

Table 2.4: Macroeconomic Indicators, 2000/01 to 2016/17

Year	Real GDP per capita in birr	Inflation (in %)	Fiscal performance		Financial deficient	
			Export	Trade Balance	Gov't tax Revenue to % GDP	Fiscal Deficit to % GDP
2000/01	3,495.7	-0.3	8,146.0	-7962.4	11.0	-8.3
2001/02	3,458.8	-10.6	8,389.0	-9317.8	12.0	-11.0
2002/03	3,300.5	10.9	9,779.0	-10352.3	11.3	-12.9
2003/04	3,652.6	7.3	12,913.6	-14453.2	12.7	-7.7
2004/05	3,976.7	6.1	16,076.9	-21699.4	11.8	-8.7
2005/06	4,300.5	10.6	18,205.4	-29,887.0	10.8	-7.5
2006/07	4,634.2	15.8	21,854.2	-33,234.4	10.2	-8.1
2007/08	4,962.8	25.3	28,317.0	-48,247.0	9.7	-7.0
2008/09	5,266.1	36.4	35,233.0	-61,052.0	7.0	-3.6
2009/10	5,776.6	2.8	52,168.0	-74,151	11.42	-4.6
2010/11	5,895.0	18.1	85,949.8	-76,537	11.45	-4.8
2011/12	6,947.5	34.1	102,887	-133,498	11.47	-2.9
2012/13	7,299.1	13.5	108,227.1	-143,073.5	12.50	-3.5
2013/14	7,625.2	8.1	123,496	-185195.3	12.71	-3.8
2014/15	8,571.2	7.7	121,532.2	-271656	13.37	-3.5
2015/16	8,864.0	9.7	122,366	-302160	12.40	-2.8
2016/17	18,257.5	7.2	139,805	-288599	11.6	-4.0

Source: NBE Annual Report 2016/17

2.5.5. Gross Domestic Product by Sectors of theEconomy

During 2016/17, the share of agriculture in GDP went down to 36.3 percent, the fiscal year. Likewise, the sector's contribution to GDP growth rate was 22.9 percent the share is decreasing through time which is 43.1 percent at 2011/12 but the contribution of agriculture to GDP at 2011/12 is 25.3 percent. (Table 2.3).

Industrial sector showed accounted 25.6 percent of GDP and sector contributed 40.4 percent to the overall economic growth during the fiscal year of 2016/17. The share of industry increased through time which is 11.5 percent at 2011/12 and the contribution of industry to GDP at 2011/12 is 25.3 percent. (Table 2.3).

Service sector continued to dominate the economy as its share in GDP was about 39.3 percent and its contribution to GDP growth reached 36.7 percent at 2016/17. The service sector share was 45.9 and the contribution in percent 50.6 at 2011/12.(Table 2.3).

2.6. Overview of Inflation and Economic Growth in Ethiopia

Historical inflation data indicated that the country has experienced two major episodes of high inflation in excess of 30 percent 2000/01 to 2016/17. The first event occurred at2008 and 2011 which is 36.4 percent and 34.1 percent respectively. The sharp increase in inflation rate within the mentioned period was attributed to the millennium ceremony in Ethiopia and high supply of money seen and poor agricultural product performance at 2008. Inflation rate has continuously high while the growth performance has been stable. This event was credited to excess money supply and high devaluation of a birr in recent period. (NBE Annual report)

The importance of this study is in order to fill the gap which is not studied and cover the updated inflation in Ethiopia and the impact on Economic growth of the country. Most of the research assessed is not updated and not cover the last five years of impact of inflation on the economic growth of Ethiopia so the study fills the gap of time difference.

CHAPTER THREE

3. RESOURCH METHODOLOGY

3.1. MODEL SPECIFICATION

3.1.1. The Model

The threshold regression model was developed by Khan and Senhadji (2001) for the analysis of threshold level of inflation for both industrial and developing countries. The model was also applied by Mubarik (2005) and Hussain (2005) in computing the threshold inflation rate for Pakistan, and Frimpong and Oteng- Abayie (2010) for Ghana.

This study applies the model to estimate the threshold level of inflation above which inflation may affect economic growth in Ethiopia. To test for the existence of a threshold effect, a log model of inflation was estimated. The log of inflation was preferred, as the inflation growth relationship was relatively more apparent. The regressions of real GDP growth on the level of inflation instead of the log, would give greater weight to the extreme observations, with the potential to skew the results. The log transformation eliminated, at least partially, the strong asymmetry in the inflation distribution.

The threshold level of inflation is based on the following equation:

$$Grow_t = B_0 + B_1 Inf + B_2 D_t\,(Inf - K^*) + B_3 GGCA + U_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 1}$$

Where economic growth and inflation are computed as:

Growth = ΔLN (RGDP), Inflation =ΔLN (CPI) and Growth of Gross Capital formation= ΔLN (GGCA).

RGDP - real gross domestic product

GGCA- Growth of Gross Capital

formation CPI -consumer price index

K^*- Threshold level of Inflation U_t - random error term

The growth rates of RGDP and inflation used in the analysis were computed by taking the first difference of the current and the corresponding values of RGDP and CPI i.e. current value of the current year less the corresponding value of the previous year. The growth rate of gross domestic investment (INV), considered to be an important determinant of economic growth, was the only variable included as a control variable in the main threshold regression model.

The dummy variable $D_t$is defined as:

$$D_t = 1: 100*DlogPt > k$$

$$0: 100*DlogPt \leq k$$

$D_t$is a dummy variable that takes a value of 1 for inflation levels greater than K^* percentotherwise 0.The parameter K^* represents the threshold inflation level with the property that the relationship between output growth and inflation is given by: (i) β1 representing low inflation; (ii) β1 + β2 representing high inflation. The high inflation means that when β2 is significant, then both (β1 + β2) would be added to see their impact on economic growth and that would be the threshold level of inflation.

If the threshold were known a priori, the model could be estimated by ordinary least square (OLS). Since K^* is unknown, it has to be estimated along with the other regression parameters. The appropriate estimation method in this case is nonlinear least square. Instead, estimation has to be carried out with method called conditional least square which can describe as follows. While the value of K^* is given arbitrarily for the estimation, the optimal K^* is obtained by finding that value that minimizes the residual sum of squares (RSS). Thus, the optimal threshold level is that which minimizes the sequence of residual sum of square (RSS).

Eview Model of Unit Root Test

In case of Dickey fuller test, there may create a problem of autocorrelation. To tackle autocorrelation problem, Dickey fuller have developed a test called Augmented dickey Fuller test stated by equation below

ΔYt= B1 + ZYt-1 + ai + et .....Equation 1 > intercept only

ΔYt= B1 + B2t + ZYt-1 + ai + et..... Equation 2 > Trend and intercept

ΔYt= ZYt-1 + ai + et..... Equation 3> No Trend and No intercept

Hypothesis is the variable is not stationary or got unit root unless the alternative which is stationary.

3.2. Data Specification

The study has sought to target the impact of inflation rate for economic growth. Since the different regime has followed varies economic approaches. So far, this paper has focused on the current Ethiopian government regime period. The annual time series data is enough to carry out

robust and sensible econometric analysis. For this matter, this paper uses the annual time-series data for the period 2000/01 to 2016/17, the data of the variables listed above is on annual basis.. As a consequence, in order to have a longer time-series data, Eviews software was used in order to carry out a cubic interpolation of the annual time-series. However, the methodological technicalities and underpinnings behind the interpolation technique adopted are beyond the scope of this paper.

After the interpolation procedure, the real GDP data covering 2000/01 to 2016/17 was used and this yielded 17 observations. The variables were further transformed into logarithm form due to the following advantages as suggested by Sarel (1996) and, Ghosh and Phillips (1998): The log transformation provides the best fit. That is to say, the log transformation also, to some extent, smoothest time trend in the dataset. The log transformation can be justified by the fact that its implications are more plausible than those of a linear model.

Data on Ethiopian macroeconomic variables differs between sources. The data from national sources such as MoFED now the name has been changed to MoF and NBE are different from those from IMF and World Bank.

3.3. Data source and data collection Method

The main source of information for data analysis of real GDP, Inflation and others has been National bank of Ethiopia and Central Statistical Agency of Ethiopia. For literature review books, published articles both internet and journals, varies research papers that published or unpublished, Government publication etc.For data consistency attempts have been made to rely on national sources. The secondary data is collected from National source which is NBE, CSA and MoF.

CHAPTER FOUR

4. RESULT AND DISCUSSION

4.1. Data Analysis

The classical time series regression model is based on the assumption that the data generating processes are stationary, i.e., the moments of the variables under consideration are time invariant. However, as the economy grows and evolves over time, most macroeconomic variables are likely to grow over time rendering them non-stationary (Granger and Newbold, 1974). Regression using non- stationary variables will only reflect a relationship that is not real, and accordingly such regression is termed as "spurious regression". In this case, as the sample size Increases, the coefficient variance doesn't tend to be constant and the consistency property of OLS estimators breaks down. The sampling distribution of the estimators will be non-standard and the usual statistics (*t* and *F*) based on normal become invalid (Maddala, 1992). Nelson and Plosser (1982) distinguish between two types of stationary series: trend stationary processes (TSP) and difference stationary processes (DSP). These two distinctions derive from the two widely used techniques of converting non stationary series into stationary series: de-trending and differencing. Though both techniques may lead to stationary series, caution is needed in choosing between the two as de-trending a DSP series or differencing a TSP series may lead to spurious autocorrelation (Nelson and Kang, 1984). Nelson and Plosser (1982) indicate that in most economic time series DSP is more appropriate and the TSP should be applied only if we assume the residuals exhibit strong autocorrelation.

For testing the stationary/non-stationary (i.e., to test for the existence of unit roots) of the variables used in this study Dickey-Fuller (DF)/Augmented Dickey- Fuller (ADF) and Phillips Perron (PP) tests are used. ADF test is biased towards accepting the null hypothesis of unit root in the series if the series exhibits significant structural break (Badawi, 2007; Kim, 1990 cited in Maddala, 1992). In the presence of structural breaks, the Phillips-Perron test (Phillips and Perron, 1988) gives more robust estimates. Before estimating the model; Granger-Causality test is applied to measure the linear causation between inflation and economic growth.

As shown in the graph below, inflation and economic growth has moved in opposite direction they tend to move together with a closer relationship. However in recent period the inflation accelerates with stable economic growth performance. It has been raised a concern by many that

the current growth performance cannot be sustained in the face of high inflation. It can be noted from the graph below that the relationship between inflation and economic growthis difficult to decide. So far, to understand the long run relationship between inflation and economic growth in Ethiopia, the paper attempt forward using granger causality and threshold analysis introduced by khan and senhadji (2001)

Table: 4.1.Real GDP Growth and Inflation

Date	GDP Growth (%)	Inflation
2000/01	7.40	-0.3
2001/02	1.60	-10.6
2002/03	-2.10	10.9
2003/04	11.70	7.3
2004/05	12.60	6.1
2005/06	11.50	10.6
2006/07	11.80	15.8
2007/08	11.20	25.3
2008/09	10.00	36.4
2009/10	10.57	2.8
2010/11	11.40	18.1
2011/12	8.70	34.1
2012/13	9.90	13.5
2013/14	10.30	8.1
2014/15	10.40	7.7
2015/16	8.00	9.7
2016/17	10.90	7.2

Source: NBE Annual Report 2016/17

Figure 4.1 Growth in Ethiopia (2000/01 till 2016/17)

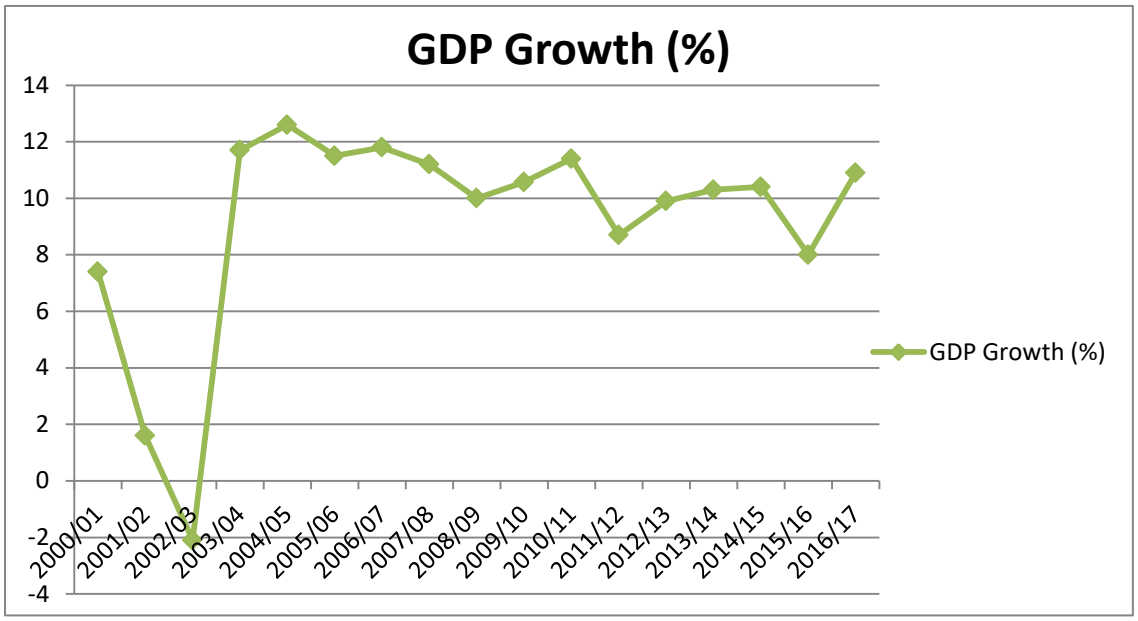
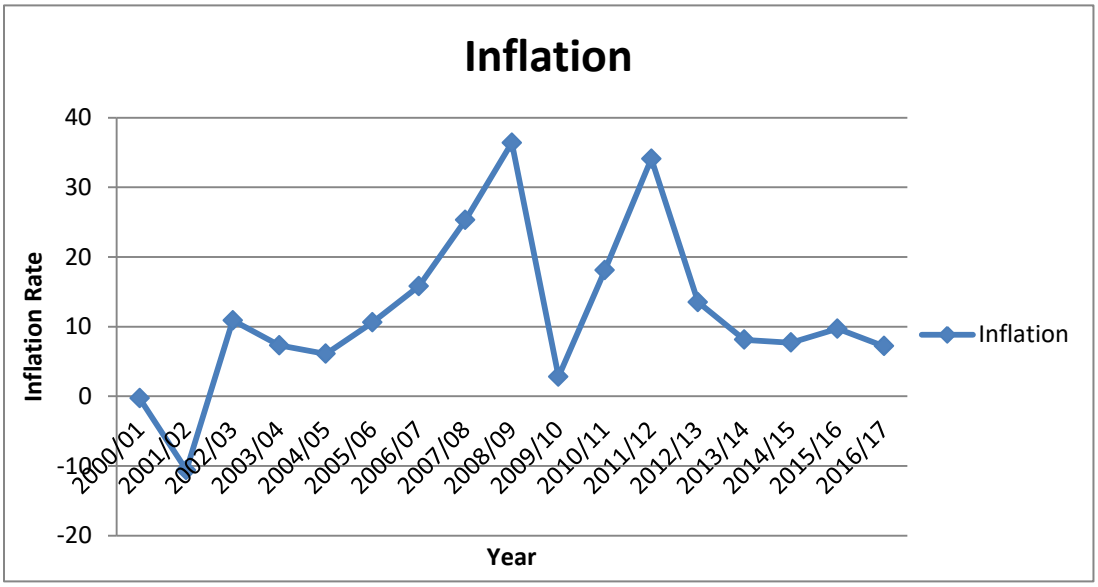


Figure 4.2 inflation in Ethiopia (2000/01 till 2016/17)



The basic statistics on real GDP growth and inflation rate was examined. The table below shows that the relationship between average inflation and average economic growth within the given range.

Table 4.2. Average inflation and Average growth relationship

Inflation Range	Average INF	Average growth
<0	-5.4	-2.1
0-5	2.8	1.6
5.01-10	8.03	8.8
>10.01	20.59	11.24

Source: From Table 4.1

The recorded data shows that when the rates of inflation are negative the corresponding average economic growth is less than zero is -2.1 percent, which is not good enough the country like Ethiopia. This indicates that deflation is not desirable for economic growth. It is also seen that from the table that when inflation rates in between of zero to five the average growth is slightly increased to 1.6 percent. Similarly when inflation rates stuck between five to ten and more than ten is the related average economic growth are increased to 8.8 and 11.24 percent respectively. Among the considered range inflation the high economic growth was recorded when the inflation rates are greater than 10 percent.

The relation between the two variables is also become negative. Thus the above variety relationship between average inflation and average GDP growth indicates some sort of non-linearity with a structural break or turning point when the relationship between inflation and GDP growth switched.

Figure 4.3 Average Inflation and Economic Growth relation

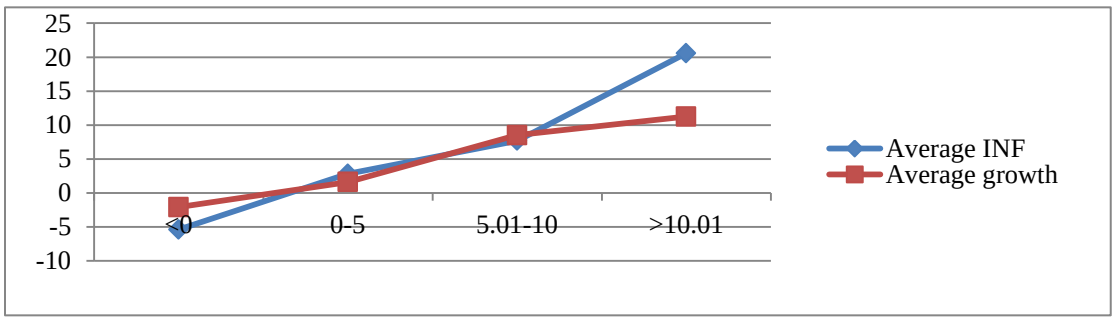


Figure 4.2 shows that Average output growth average inflation have a positive relationship up to 10 percent inflation rates, and beyond that level there is negative relationship. Moreover, when inflation rates go down to zero and become negatives the corresponding average economic growth is turning out to be low, which is not desirable for economic growth. Due to this reason it

would be important to computes the optimal lowest inflation rate, but the study is limited in the sense that it does not estimate the lower level inflation favorable for economic growth.

4.2. Estimation and Interpretation of Result

Unit Root Test

Before testing the causal relationship, it is necessary to examine the time-series properties of the data. One of the major problems encountered in studying economic relationships is the likelihood of spurious regression (seemingly related variables). To deal with this problem it is crucial to study the long run relationship of the variables. This is often done by checking if the variables are co integrated. The first step in co integration analysis is studying the order of integration of the variables under consideration. The order of integration of the variables in this study is determined using unit root tests.

An important exercise in time series analysis is the test of whether the macroeconomic variables in the modeling exercise are stationary or not. Augmented dickey fuller test for unit root is conducted on the variables to be included in inflation threshold estimation model. The result is shown below in table 4.3

Table 4.3 Unit Root Test

Variables	Test Equation				Order of Integration
	Test Statics Intercept	Critical Value at 5% Significance level	Test Statistics Trend and Intercept	Critical Value at 10% significance level	
D(GRGDP)	-4.338258	-3.081002	-4.098524	-2.681330	I(1)
D(INF)	-5.038778	-3.098896	-5.038778	-2.690439	I(1)
D(GGCA)	-4.368862	-2.897223	-4.362667	-3.465548	I(1)

The unit root tests conducted revealed all variables have unit root in their level, thus have to be differenced to achieve stationary. Unit root tests revealed that all variables used in this study are I (1), which all variable are stationary at first difference. Thus, the determination of co-integrating relationships doesn't suffer from mixed order of integration.

The result revealed in the above table indicates that inflation has a positive effect on long run

growth. This is different from theory has proposed the relationship between the two is negative and most recent studies also confirmed. However, this positive result of long run relationship between inflation and economic growth in Ethiopia is consistent with some similar studies. For example, Arai et al (2002) found a positive and significant relationship between average inflation and average growth for OECD countries. One a basic reasoning behind it is when inflation is high; wealth could be allocated away from money and into physical assets which are related to investment.

It is similar to Ethiopian economy, positive long run relationship between inflation and economic growth on the case of Lesotho. He reasoned out for economies with initially low rates of inflation, modest increase in the rate of inflation don't affect long run rates of real economic growth. This explanation may work for the Ethiopian case as well since it is low level of average inflation for the period covered.

Although high inflation rate was observed to stimulate economic growth in some countries, many studies advise that the inflation rate should be kept as low as possible since high inflation is inherently unstable due to inflation inertia.

Linear Regression

Simple linear regression is estimated on the long run relationship between output growth and inflation before inflation threshold estimation.

Table 4.4 Shows OLS estimation of Inflation and Economic Growth: without Threshold
Dependent Variable: GRGDP

Variable	Coefficient	Std. Error	t-statistic	Prob
C	0.058241	0.006900	8.440257	0.000
INF	0.048972	0.045504	1.076202	0.2850
GGCA	0.081010	0.043565	1.859516	0.0665

$R^2 = 0.185552$

The result revealed in the above table indicates that inflation has a positive effect on long run growth. This is different from theory has proposed the relationship between the two is negative and most recent studies also confirmed. However, this positive result of long run relationship between inflation and economic growth in Ethiopia is consistent with some similar studies. For example, Arai et al (2002) found a positive and significant relationship between average inflation and average growth for OECD countries. One a basic reasoning behind it is when inflation is

high; wealth could be allocated away from money and into physical assets which are related to investment. Similar to Ethiopian economy, positive long run relationship between inflation and economic growth was obtained on the case of Lesotho. He reasoned out for economies with initially low rates of inflation, modest increase in the rate of inflation don't affect long run rates of real economic growth. This explanation may work for the Ethiopian case as well since it is low level of average inflation for the period covered. Although high inflation rate was observed to stimulate economic growth in some countries, many studies advise that the inflation rate should be kept as low as possible since high inflation is inherently unstable due to inflation inertia.

Estimation of the Threshold Inflation Level

The study hypothesis that high inflation in Ethiopia has an adverse effect on economic growth after it exceeds a certain limit. Khan and Senhadji (2001) estimated the threshold level of inflation above which inflation significantly slows growth at 11 per cent for developing countries. The estimation of equation gives a specific value of the threshold inflation level and also measure the impact of that level on economic growth. The equation was estimated and residual sum of square and the adjusted coefficient of determination (R2) from 5 percent to 15 percent threshold level of inflation was computed. The optimal threshold level is the one minimize residual sum of square (RSS) or that maximizes the adjusted coefficient of determination (R^2). The analysis shows that inflation is causing growth for the given period of 2000/01 to 2016/17; therefore, inflation is kept the estimate.

Table 4.5 OLS Estimation on the threshold level of inflation K*=10
Dependent Variable GRGDP

Variable	Coefficient	Std. Error	t-statistic	Prob
C	0.050176	0.007024	7.143431	0.000
INF	0.131037	0.050318	2.604200	0.0109
DT*(INF(-6)-0.10)	-0.269845	0.084862	-3.179826	0.0021
GGCA	0.078726	0.041360	1.903422	0.0605

Adjusted R^2 .156

Sum of squared residual 0.148048

The table shows that the OLS estimation of the model on optimal inflation rate. Inflation rate

was found in economic growth at a lag of Six (lag = 6) and for the given period of 2000/01 to 2016/17 annual data; therefore inflation is kept at lag six in the estimate. According to Khan and Senhadji (2001) inflation 0.10 is estimated as significant threshold level.

For inflation level below the threshold, the significance and size of high coefficient of high inflation is increasing as we approach the threshold level. However, above the threshold level, as inflation increases, there is a general trend of declining significance and magnitude of the inflation coefficient.

Figure 4.4 value of threshold k versus Residual sum of Square

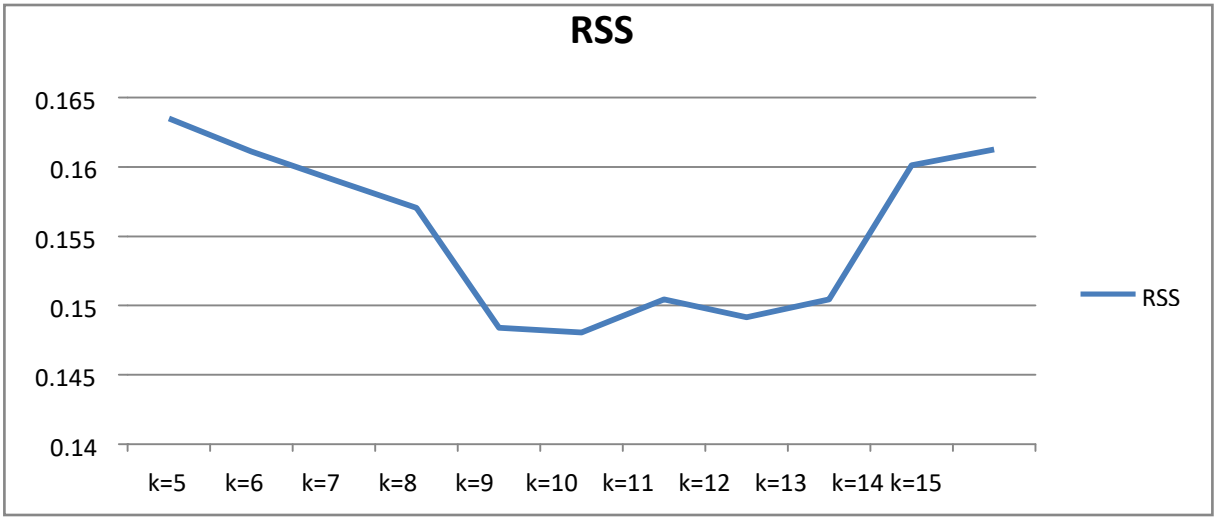


Figure 4.3 demonstrate the level of inflation, which is conducive for economic growth, and this found to be 10 percent and this is line with finding khan and Senhadaji (2001).

Based on the finding of Khan and Senhadji re-examined the issue of the threshold effects in the relationship between inflation and economic growth using a new econometric technique that allows for appropriate estimation procedures and inference. They cover the period 1960-1998 from 140 countries, comprising industrialized and developing countries. They estimated inflation threshold levels of 1-3 per cent and 11-12 per cent for industrialized and developing countries, respectively. The relationship between inflation and economic growth became negative. The authors noted that the peculiarities of industrialized economies remained different from those of the developing economies.

Diagnostic tests

Table 4.6 Diagnostic test

R^2	0.02784
Adj-R^2	0.03669
F-statistic	0.42959
DW	2.09260

The numbers in parentheses are the t –values

Test	**Test statistics**	**p-value**
Jarque-Bera normality test	0.49	0.78
Ramsey's RESET test	2.20	0.10
Breush-Godfrey LM test	3.45	0.19
ARCH test	0.23	0.63
White heteroskedasticity test	14.44	0.64

The 0LS regression was run conditional on Newer- West HAC (Hetroskedasticity and Autocorrelation Consistent) standard errors and covariance. In other words, the OLS results are corrected for heteroskedasticity and autocorrelation

As the diagnostic tests indicate, the test results of the long run model have no problems of auto correlation, non-normality, heteroskedasticity, model misspecification. This could be verified based on the Breusch-Godfrey test for serial correlation, the Jarque-Bera normality test, the ARCH test, and the Ramsey's RESET test respectively.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

Governments and central banks worldwide want to achieve price stability for several reasons, with the most compelling being the potential for long-term growth. The objective of this study is to assess the impact of inflation on the economic growth of Ethiopia. In doing so, this study uses various tables and graphs. Unit root test was done to set up the dependent and independent variables. Finally the base on the secondary data collected from NBE, CSA and MoF of the annual time series data covering of the sample period 2000/01 to 2016/17.

Historical data as depicted in several tables and graphs show that the average economic growth reaches its peak when inflation rates in and turn down when inflation rates goes above certain percent level, besides the impact of inflation on the economic growth but not vice versa.

The findings of the study are evidence to conclude that inflation and GDP growth has been found for the studied annual time-series data for the period of 2000/01 to 2016/17 are employed in the study. Inflation in the economy of Ethiopia is harmful for the growth of GDP. This statistically significant result indicates that persistent increase in the general price level hurts the economic growth. The study also finds the feasible certain level of inflation which causes to reduce the growth of GDP. This threshold has been found at the level of 10 percent of inflation. Inflation below this level brings positive impact to the economic growth. But after this level it seriously hurts the growth of the economy of Ethiopia.

Inflation can lead investors to uncertainty about the future profitability of investment projects. This particularly happens when high inflation is associated with increased price variability. This leads to more conservative investments strategies eventually leading to lower levels of investment and economic growth. It may also reduce a country's competitiveness by making its exports more expensive, thus impacting on the balance of payments. This manifests itself that maintaining a low inflation is a viable option.

5.2. Recommendation

In light of the findings of the study, the following recommendations are forwarded. One of the most fundamental objectives of macroeconomic policies in Ethiopia is to sustain high economic

growth together with low inflation. These findings are essential for monetary policy formulation by the National Bank of Ethiopia, whose primary objective is the achievement and maintenance of price stability, as it provides a guide for the Bank to choose an optimal inflation rate, which is consistent with long-term sustainable economic growth goals of the country. However, this study shows the level of inflation is must keep below the threshold level because the inflation below threshold level brings positive impact to the economic growth but after this level it seriously hurts the growth of the economy of Ethiopia and as a result high inflation retards growth by reducing investment and bringing inefficiency to the system. Thus, excessive inflation has a growth inhibiting effect.

On the basis of this study, recommended to keep the inflation below the level of 10 percent in the economy. Therefore, the policy makers and the National Bank of Ethiopia should concentrate on those options which keep the inflation rate stable and below the level which has been found helpful for the achievement of sustainable economic growth. Moderate and stable inflation is also helpful for minimizing the fluctuations and uncertainties in the financial sector of economy, which, in turn, boost the capital formation activities in the country. So that it may exert its positive effects on the economy. So, maintaining price stability will ultimately be the best policy recommendation to stable and sustained economic growth of the economy.

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Not stationary at Level constant (Intercept) -fail to reject null hypothesis

Null Hypothesis: INFLATION has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.870761	0.0709
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 16
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION)
Method: Least Squares
Sample (adjusted): 2 17
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFLATION(-1)	-0.708029	0.246635	-2.870761	0.0123
C	9.126318	4.158877	2.194419	0.0456

R-squared	0.370539	Mean dependent var	0.471670
Adjusted R-squared	0.325578	S.D. dependent var	13.95402
S.E. of regression	11.45949	Akaike info criterion	7.831982
Sum squared resid	1838.479	Schwarz criterion	7.928556
Log likelihood	-60.65586	Hannan-Quinn criter.	7.836927
F-statistic	8.241267	Durbin-Watson stat	1.981488
Prob(F-statistic)	0.012334		

Stationary at first difference and Constant (Intercept) -Reject the null hypothesis

Null Hypothesis: D(INFLATION) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.038778	0.0016
Test critical values:	1% level	-4.004425	
	5% level	-3.098896	
	10% level	-2.690439	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION,2)
Method: Least Squares
Sample (adjusted): 4 17
Included observations: 14 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATION(-1))	-1.945066	0.386019	-5.038778	0.0004
D(INFLATION(-1),2)	0.496126	0.232505	2.133826	0.0562
C	0.669221	3.168931	0.211182	0.8366

R-squared	0.771613	Mean dependent var	-1.714021
Adjusted R-squared	0.730088	S.D. dependent var	22.63054
S.E. of regression	11.75727	Akaike info criterion	7.954229
Sum squared resid	1520.566	Schwarz criterion	8.091170
Log likelihood	-52.67960	Hannan-Quinn criter.	7.941553
F-statistic	18.58188	Durbin-Watson stat	2.062785
Prob(F-statistic)	0.000297		

Stationary at second difference constant (Intercept) -Reject the null hypothesis

Null Hypothesis: D(INFLATION,2) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.141456	0.0109
Test critical values:	1% level	-4.200056	
	5% level	-3.175352	
	10% level	-2.728985	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 11
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION,3)
Method: Least Squares
Sample (adjusted): 7 17
Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATION(-1),2)	-5.874690	1.418508	-4.141456	0.0061
D(INFLATION(-1),3)	3.544410	1.172454	3.023070	0.0233
D(INFLATION(-2),3)	1.840976	0.748422	2.459809	0.0491
D(INFLATION(-3),3)	0.675499	0.322069	2.097372	0.0808
C	-3.237160	4.543226	-0.712524	0.5029

R-squared	0.927667	Mean dependent var	-0.924783
Adjusted R-squared	0.879445	S.D. dependent var	41.82814
S.E. of regression	14.52318	Akaike info criterion	8.492325
Sum squared resid	1265.537	Schwarz criterion	8.673186
Log likelihood	-41.70778	Hannan-Quinn criter.	8.378317
F-statistic	19.23736	Durbin-Watson stat	2.695746
Prob(F-statistic)	0.001432		

Not stationary Level Constant(Intercept), Linear Trend -fail to reject null hypothesis

Null Hypothesis: INFLATION has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.724953	0.2406
Test critical values:	1% level	-4.667883	
	5% level	-3.733200	
	10% level	-3.310349	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 16
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION)
Method: Least Squares
Sample (adjusted): 2 17
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFLATION(-1)	-0.743969	0.273021	-2.724953	0.0173
C	7.431397	6.324933	1.174937	0.2611
@TREND("1")	0.251086	0.687967	0.364968	0.7210

R-squared	0.376924	Mean dependent var	0.471670
Adjusted R-squared	0.281066	S.D. dependent var	13.95402
S.E. of regression	11.83161	Akaike info criterion	7.946788
Sum squared resid	1819.832	Schwarz criterion	8.091648
Log likelihood	-60.57430	Hannan-Quinn criter.	7.954206
F-statistic	3.932109	Durbin-Watson stat	1.927680
Prob(F-statistic)	0.046187		

Not stationary Level and none -fail to reject null hypothesis

Null Hypothesis: INFLATION has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.659128	0.0905
Test critical values:	1% level	-2.717511	
	5% level	-1.964418	
	10% level	-1.605603	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 16
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION)
Method: Least Squares
Sample (adjusted): 2 17
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFLATION(-1)	-0.315700	0.190281	-1.659128	0.1178

R-squared	0.154029	Mean dependent var	0.471670
Adjusted R-squared	0.154029	S.D. dependent var	13.95402
S.E. of regression	12.83445	Akaike info criterion	8.002604
Sum squared resid	2470.846	Schwarz criterion	8.050891
Log likelihood	-63.02083	Hannan-Quinn criter.	8.005077
Durbin-Watson stat	2.239105		

Not stationary First Difference Constant(Intercept), Linear Trend -fail to reject null hypothesis

Null Hypothesis: D(INFLATION) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.779902	0.0575
Test critical values:	1% level	-4.992279	
	5% level	-3.875302	
	10% level	-3.388330	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 12
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION,2)
Method: Least Squares
Sample (adjusted): 6 17
Included observations: 12 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATION(-1))	-4.976587	1.316591	-3.779902	0.0092
D(INFLATION(-1),2)	2.917898	1.060371	2.751771	0.0332
D(INFLATION(-2),2)	1.515184	0.688931	2.199327	0.0702
D(INFLATION(-3),2)	0.570376	0.313689	1.818288	0.1189
C	41.47024	15.48042	2.678884	0.0366
@TREND("1")	-3.754449	1.379676	-2.721253	0.0346

R-squared	0.893160	Mean dependent var	-0.106541
Adjusted R-squared	0.804128	S.D. dependent var	23.48038
S.E. of regression	10.39182	Akaike info criterion	7.826769
Sum squared resid	647.9401	Schwarz criterion	8.069222
Log likelihood	-40.96061	Hannan-Quinn criter.	7.737004
F-statistic	10.03180	Durbin-Watson stat	2.240622
Prob(F-statistic)	0.007062		

Stationary at First difference and none-Reject the null hypothesis

Null Hypothesis: D(INFLATION) has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.265569	0.0001
Test critical values:	1% level	-2.740613	
	5% level	-1.968430	
	10% level	-1.604392	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION,2)
Method: Least Squares
Sample (adjusted): 4 17
Included observations: 14 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATION(-1))	-1.934952	0.367473	-5.265569	0.0002
D(INFLATION(-1),2)	0.492200	0.222344	2.213691	0.0470

R-squared	0.770687	Mean dependent var	-1.714021
Adjusted R-squared	0.751577	S.D. dependent var	22.63054
S.E. of regression	11.27952	Akaike info criterion	7.815418
Sum squared resid	1526.731	Schwarz criterion	7.906712
Log likelihood	-52.70793	Hannan-Quinn criter.	7.806967

Non Stationary Second difference Constant(Intercept), Linear Trend-fail to reject null hypothesis

Null Hypothesis: D(INFLATION,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.853633	0.0560
Test critical values:	1% level	-5.124875	
	5% level	-3.933364	
	10% level	-3.420030	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 11
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION,3)
Method: Least Squares
Sample (adjusted): 7 17
Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATION(-1),2)	-5.997320	1.556277	-3.853633	0.0120
D(INFLATION(-1),3)	3.656591	1.291546	2.831175	0.0366
D(INFLATION(-2),3)	1.916195	0.826313	2.318971	0.0681
D(INFLATION(-3),3)	0.716617	0.360814	1.986112	0.1038
C	3.773156	17.61062	0.214255	0.8388
@TREND("1")	-0.647158	1.561702	-0.414393	0.6958

R-squared	0.930069	Mean dependent var	-0.924783
Adjusted R-squared	0.860137	S.D. dependent var	41.82814
S.E. of regression	15.64299	Akaike info criterion	8.640375
Sum squared resid	1223.516	Schwarz criterion	8.857409
Log likelihood	-41.52206	Hannan-Quinn criter.	8.503566
F-statistic	13.29971	Durbin-Watson stat	2.818761
Prob(F-statistic)	0.006506		

Stationary at Second Difference and none -Reject the null hypothesis

Null Hypothesis: D(INFLATION,2) has a unit root
Exogenous: None
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.245774	0.0006
Test critical values:	1% level	-2.792154	
	5% level	-1.977738	
	10% level	-1.602074	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 11
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION,3)
Method: Least Squares
Sample (adjusted): 7 17
Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATION(-1),2)	-5.620754	1.323847	-4.245774	0.0038
D(INFLATION(-1),3)	3.329166	1.092305	3.047835	0.0186
D(INFLATION(-2),3)	1.700056	0.695972	2.442707	0.0446
D(INFLATION(-3),3)	0.621013	0.301657	2.058671	0.0785

R-squared	0.921546	Mean dependent var	-0.924783
Adjusted R-squared	0.887923	S.D. dependent var	41.82814
S.E. of regression	14.00317	Akaike info criterion	8.391732
Sum squared resid	1372.621	Schwarz criterion	8.536421
Log likelihood	-42.15452	Hannan-Quinn criter.	8.300525
Durbin-Watson stat	2.499400		

Not stationary at Level constant (Intercept) -fail to reject null hypothesis

Null Hypothesis: GDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.350134	0.1697
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 16
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 01/16/19 Time: 11:30
Sample (adjusted): 2 17
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.565505	0.240627	-2.350134	0.0340
C	5.342577	2.366800	2.257300	0.0405

R-squared	0.282902	Mean dependent var	0.218750
Adjusted R-squared	0.231680	S.D. dependent var	4.203159
S.E. of regression	3.684230	Akaike info criterion	5.562469
Sum squared resid	190.0297	Schwarz criterion	5.659042
Log likelihood	-42.49975	Hannan-Quinn criter.	5.567414
F-statistic	5.523128	Durbin-Watson stat	1.615888
Prob(F-statistic)	0.033955		

Stationary at first difference constant (Intercept) -Reject the null hypothesis

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.338258	0.0050
Test critical values:	1% level	-3.959148	
	5% level	-3.081002	
	10% level	-2.681330	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 15
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 01/16/19 Time: 11:32
Sample (adjusted): 3 17
Included observations: 15 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.119317	0.258011	-4.338258	0.0008
C	0.624773	1.068704	0.584608	0.5688

R-squared	0.591458	Mean dependent var	0.580000
Adjusted R-squared	0.560032	S.D. dependent var	6.239823
S.E. of regression	4.138880	Akaike info criterion	5.802293
Sum squared resid	222.6943	Schwarz criterion	5.896700
Log likelihood	-41.51720	Hannan-Quinn criter.	5.801288
F-statistic	18.82048	Durbin-Watson stat	2.272444
Prob(F-statistic)	0.000804		

Stationary at 2nd difference constant (Intercept) -Reject the null hypothesis

Null Hypothesis: D(GDP,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.058756	0.0016
Test critical values:	1% level	-4.004425	
	5% level	-3.098896	
	10% level	-2.690439	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,3)
Method: Least Squares
Sample (adjusted): 4 17
Included observations: 14 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1),2)	-1.381772	0.273145	-5.058756	0.0003
C	0.564145	1.667959	0.338225	0.7410

R-squared	0.680775	Mean dependent var	0.228571
Adjusted R-squared	0.654173	S.D. dependent var	10.60415
S.E. of regression	6.235993	Akaike info criterion	6.630116
Sum squared resid	466.6513	Schwarz criterion	6.721410
Log likelihood	-44.41081	Hannan-Quinn criter.	6.621665
F-statistic	25.59101	Durbin-Watson stat	1.669994
Prob(F-statistic)	0.000280		

Non Stationary at Level Constant(Intercept), Linear Trend -fail to reject null hypothesis

Null Hypothesis: GDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.520587	0.3151
Test critical values:	1% level	-4.667883	
	5% level	-3.733200	
	10% level	-3.310349	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 16
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Sample (adjusted): 2 17
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.656708	0.260538	-2.520587	0.0256
C	4.445607	2.562604	1.734801	0.1064
@TREND("1")	0.202745	0.216339	0.937163	0.3658

R-squared	0.328283	Mean dependent var	0.218750
Adjusted R-squared	0.224942	S.D. dependent var	4.203159
S.E. of regression	3.700352	Akaike info criterion	5.622094
Sum squared resid	178.0039	Schwarz criterion	5.766954
Log likelihood	-41.97675	Hannan-Quinn criter.	5.629512
F-statistic	3.176690	Durbin-Watson stat	1.574164
Prob(F-statistic)	0.075286		

Stationary Level, None- Reject null hypothesis

Null Hypothesis: GDP has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.616684	0.4343
Test critical values:	1% level	-2.717511	
	5% level	-1.964418	
	10% level	-1.605603	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 16
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Sample (adjusted): 2 17
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.065155	0.105654	-0.616684	0.5467

R-squared	0.021909	Mean dependent var	0.218750
Adjusted R-squared	0.021909	S.D. dependent var	4.203159
S.E. of regression	4.156861	Akaike info criterion	5.747859
Sum squared resid	259.1924	Schwarz criterion	5.796146
Log likelihood	-44.98287	Hannan-Quinn criter.	5.750332
Durbin-Watson stat	1.982100		

Stationary First Difference Constant (Intercept), Linear Trend -Reject null hypothesis

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.303544	0.0203
Test critical values:	1% level	-4.728363	
	5% level	-3.759743	
	10% level	-3.324976	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 15
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Sample (adjusted): 3 17
Included observations: 15 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.134849	0.263701	-4.303544	0.0010
C	2.277719	2.523026	0.902773	0.3844
@TREND("1")	-0.183592	0.252800	-0.726231	0.4816

R-squared	0.608658	Mean dependent var	0.580000
Adjusted R-squared	0.543434	S.D. dependent var	6.239823
S.E. of regression	4.216226	Akaike info criterion	5.892614
Sum squared resid	213.3187	Schwarz criterion	6.034224
Log likelihood	-41.19461	Hannan-Quinn criter.	5.891106
F-statistic	9.331858	Durbin-Watson stat	2.367600
Prob(F-statistic)	0.003592		

Stationary at First Difference none - Reject the null hypothesis

Null Hypothesis: D(GDP) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.438411	0.0002
Test critical values:	1% level	-2.728252	
	5% level	-1.966270	
	10% level	-1.605026	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 15
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Sample (adjusted): 3 17
Included observations: 15 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.117861	0.251861	-4.438411	0.0006

R-squared	0.580718	Mean dependent var	0.580000
Adjusted R-squared	0.580718	S.D. dependent var	6.239823
S.E. of regression	4.040411	Akaike info criterion	5.694910
Sum squared resid	228.5489	Schwarz criterion	5.742114
Log likelihood	-41.71183	Hannan-Quinn criter.	5.694407
Durbin-Watson stat	2.215960		

Stationary at Second difference Constant(Intercept), Linear Trend- Reject null hypothesis

Null Hypothesis: D(GDP,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.873012	0.0089
Test critical values:	1% level	-4.800080	
	5% level	-3.791172	
	10% level	-3.342253	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,3)
Method: Least Squares
Sample (adjusted): 4 17
Included observations: 14 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1),2)	-1.402887	0.287889	-4.873012	0.0005
C	2.252936	4.497988	0.500876	0.6263
@TREND("1")	-0.177228	0.435760	-0.406709	0.6920

R-squared	0.685504	Mean dependent var	0.228571
Adjusted R-squared	0.628323	S.D. dependent var	10.60415
S.E. of regression	6.464856	Akaike info criterion	6.758048
Sum squared resid	459.7380	Schwarz criterion	6.894989
Log likelihood	-44.30634	Hannan-Quinn criter.	6.745372
F-statistic	11.98830	Durbin-Watson stat	1.657430
Prob(F-statistic)	0.001725		

Stationary at Second Difference and none -Reject the null hypothesis

Null Hypothesis: D(GDP,2) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.230605	0.0001
Test critical values:	1% level	-2.740613	
	5% level	-1.968430	
	10% level	-1.604392	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observationsand may not be accurate for a sample size of 14
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,3)
Method: Least Squares
Sample (adjusted): 4 17
Included observations: 14 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1),2)	-1.378098	0.263468	-5.230605	0.0002

R-squared	0.677732	Mean dependent var	0.228571
Adjusted R-squared	0.677732	S.D. dependent var	10.60415
S.E. of regression	6.019838	Akaike info criterion	6.496747
Sum squared resid	471.0999	Schwarz criterion	6.542394
Log likelihood	-44.47723	Hannan-Quinn criter.	6.492522
Durbin-Watson stat	1.659204		