

CHAPTER ONE

INTRODUCTION

1.1 General Background

Inflation is a persistent and appreciable rise in general price level or average of prices. Most of the countries make the policy to sustain economic growth with low level of inflation as their main objective of the macroeconomic policy. A widely accepted concept in macroeconomic analysis is low level of inflation for high level of economic growth. However, there is an open debate in between the relation of economic growth and inflation among the economists. So, question of the existence and nature of link has been subject of considerable debate (Munir and Mansur, 2009). Different economic schools of thought offer different theoretical linkage in between inflation and economic growth. For example, Classical economists argue that inflation deteriorates the economic growth. Keynesian school believes that to raise the economic growth, mild inflation is necessary prior to the full employment. But, according to the monetarists' view, inflation is harmful to economic growth.

Higher economic growth had been attained in 1960s through the portfolio substitution mechanism (Fischer, 1994). However, economic growth started decreasing in 1970s in the countries where there was relatively higher inflation rate. Most of the Latin American countries faced the severe negative impact on the economic growth by high inflation and hype- inflation in 1980s on the contrary of structuralists belief inflation positively impact the economic growth (Vbaykal and Okuyan,2008). High inflation associated with different time periods leads to hamper resource allocation through the change in relative prices and thereby towards economic growth. On the contrary, lower level of inflation associated with different time periods makes prices and wages more flexible promoting economic growth (Fischer, 1993). Therefore, it is necessary to link the relationship between economic growth and inflation as optimal one when high inflation disturbs the economic growth and low inflation promotes (Lucas, 1973). It is also required to identify the threshold level of inflation to observe the impact of inflation on real economic growth.

Nepal, as least developed country is substantially facing the higher level of inflation over the longer period of time. Average inflation faced by the economy stands 9.12 percent in latest decade from the fiscal year 2007/8 to 2014/15. Economic growth on the other hand shrunk to 4.3 percent in same period (Economic survey 2015/16). Even though, various rigidities have been concurrently faced by the economy, inflation has been one of the main concerns to the economy. Nepal Rastra Bank (NRB) launches the monetary policy after the release of budgetary policy to support objectives and policy of government aiming to keep inflation in controlled situation. Every plan in Nepal makes main macroeconomic objective to address the issue of inflation. However, inflation relatively exists at higher level. Living standard of people falls to costly and to be sustained well becomes challengeable in both city and urban area due to higher inflation. If cost of living is too high, people become frustrated with the rising level of price. It moreover can cause for economic, social and political instability.

Inflation can lead to the uncertainty to the future profitability of the investment projects. This leads to more conservative investment strategies than otherwise case is, ultimately leading to the lower level of investment and economic growth (Stockman, 1981). Inflation may reduce the country international competitiveness by making the export relatively more expensive and which impacts the balance of payments (BOP). Moreover, inflation can interact with the tax system to distort borrowing and lending decisions. Firms may have to deal with more resources in dealing with the effects of inflation. In modern macroeconomic analysis, inflation has broadly classified in two categories as demand pull and cost push inflation. General rise in demand side components eventually brings to raise the level of both output and employment in the economy. However, supply side is harmful which brings the both employment and output down. This is divergence and galloping in nature. It moreover occurs through supply shocks problems in any economy.

Some group of economists argues that inflation positively influences the economic growth. This is especially Keynesian group of economics. For example, in a stable economy, an expansionary fiscal policy increases the output, employment and income. It therefore raises the productivity and which in turn increases the general price level. Analysis of Phillip and its conclusion supported by empirical evidence

was one of the supporting points for inflation promotes the economic growth. Phillip, however made his analysis based on the labor market data of Britain economy explained by money wage and unemployment providing negative relation. Later on, Richard Lipsey provided it as theoretical background in which money wage has been transformed to inflation. This left the issues to both policy makers and macro economists to consider the existence of Phillip analysis. In early 1980s, Latin American and American economy substantially faced the inflation and unemployment simultaneously. Over the existence of Phillip curve, monetarists questioned. They believed that existence was mere in short run. But in long run, there was not existence of Phillip curve but there was just price effect. It was just supportive to the short run. New classical economists moreover rejected the existence of Phillip curve in both short run and long run. Classical economists argued that growth depends upon the joint combination of labor, land, capital and over- all productivity. Moreover, saving and investment accelerates the pace of economic growth. So, through the capital formation, division of the labor, and increase in over-all productivity, growth could be maintained in any economy. Various empirical analyses have shown that inflation up to certain threshold point is desirable which is positively correlated with economic growth. However, it is undoubtedly true cost of inflation is severe. It affects severely in social, political and economic sphere. The basic question is what level of inflation is desirable to the economy and what effects will be faced when it crosses the threshold level.

1.2 Statement of the Problem

Various empirical studies have been conducted to examine the nature and relation of inflation with economic growth. These studies have been carried out in both cross country and individual country basis. Most of the studies have concluded the negative relation in between inflation and economic growth in long run. However, up to certain point as threshold, it has positive impact and economic growth was not affected. Moreover, threshold measurement differs country to country depending upon economic condition, socio economic structure and different time periods of the country. In cross country analysis, threshold measurement for developed and developing countries varies. In some studies, it has been found no long run relation in between these variables. It has been constructed the various model to show the

inflation sensitivity of variables in relation with economic growth. In the context of Nepal, it has been argued mismatch in between monetary policy and other number of structural factors are resulted lower economic growth coupled with higher inflation (Shrestha, 2003). Therefore, such mismatch has resulted in poor performance of the economy with high level of inflation and lower economic growth. Nepalese economy needs higher rate of economic growth to be promoted to developing country by efficient allocation and productive mobilization of resources. High living standard by transferring the socio economic structure of the economy is necessary for forwardness of country. Thus, it is essential to be mobilized available resources efficiently in the economy. It must be required to investigate the factors which hinder the economic growth by policy makers, economists and academicians. Therefore, it requires identifying the threshold level of inflation in the economy and relation in between the inflation and real economic growth in long run and short run basis. If threshold level exists, it should require finding elasticity of inflation for real economic growth. In this context, this research study has been designed to address the following questions related to the relationship between inflation and economic growth in Nepal.

1. What are the nature, trend and growth of economic growth and inflation in Nepal?
2. Does long run and short run relationship between inflation and economic growth exist?
3. Does threshold level of inflation exist in Nepal?

1.3 Objectives of the Study

The general objective of this study is to examine the relation between inflation and economic growth in Nepal. The specific objectives are:

- To examine the trend and structure of inflation and economic growth from the period of 1975 to 2015.
- To examine the short run and long run relationship between inflation and economic growth by time series econometric analysis.
- To find the threshold level of inflation in Nepalese economy.

1.4 Significance of the Study

In literature, it has intense debate in the relation of economic growth and inflation. Through empirical analysis, it has been found mixed results in the sense that up to threshold level, inflation positively affects the economic growth. However, after threshold level it negatively affects the economic growth. Moreover, responsive and impact including relation varies depending upon structure of the economy and different time periods. In long run, in almost all economics, it has been found negative impact. In the context of Nepal, very few studies have been carried out and which are sharply differentiated in terms of threshold result and association of long run. These studies require further improvement in existing study and support to identify the threshold level of inflation and long run relationship of variables. It will be helpful to identify responsiveness to economic growth by level of inflation. Moreover, it will be supportive to find impact of inflation on economic growth and further policy implications. Thus, it will contribute to identify what level of inflation is desirable in economy to keep economic growth higher and stables upported by empirical evidence.

1.5 Limitation of the Study

Each study has its own limitations due to the various constraints. This study has been carried out to identify the impact of inflation on the economic growth in the economy. It has been carried out in secondary data and information from Nepal Rastra Bank (NRB), Economic survey including Ministry of Finance (MOF), journals, research papers etc. Data have been taken from the period of 1975 to 2015. This study has been carried out within certain limit of time with limited resources and information due to time and resource constraints.

1.6 Organization of the Study

This study has been carried out in six chapters. First chapter includes the introduction chapter. There are six sub sections within first chapter such as general background, statement of the problem, objectives, significance of the study, limitations and organization of the study. Second chapter includes the literature review and it moreover consists of sub sections as theoretical literature review, empirical literature review, growth and inflation including central bank nexus and conclusions. Third

chapter involves the research methodology and it consists of sub section as selection of variables, sources of data, sample period covered, empirical linear model, econometric modeling, diagnostic tests and other criterion for applying model. Fourth chapter includes the trend, nature and growth of GDP and inflation. Fifth chapter includes the analysis of data through econometric models. Summary of findings, conclusion and recommendations are well mentioned in the last chapter.

CHAPTER TWO

LITERATURE REVIEW

This chapter deals with the literature review. It provides the basis of the study by reviewing both theoretical and empirical literature. This includes the review of theories, researches, magazines, articles, working papers and journals as well.

2.1 Theoretical Literature Review

A number of theories have been put forward to examine the relationship between inflation and economic growth. Various historical evidences show that inflation was discussed earlier in mercantilism. Even though, it has not been made direct association between inflation and economic growth prior to classical era, indirect association had been made. For example, increase in inflow of gold triggers price level. It moreover increases the price level in domestic economy reducing international competitiveness. Eventually, it reduces economic growth by negative impact in investment. For theoretical perspective, this study provides review of Mercantilist Theory, Classical Theory, Keynesian Theory, Neo Classical Theory, New Classical Theory, New Keynesian theory and proximate growth theories like Harrod -Domar Growth Theory, Slow Swan Growth Theory and Endogenous Growth Theory.

2.1.1 Mercantilist Theory

Mercantilist theory in economics made dominated from the period of the 1650 to the prior of economics synthesized by Adam Smith scientifically in 1776. Economic growth of any country was widely believed to have been determined by export. So, export surplus was assumed to remain the major rod of economic growth. Deficit in Balance of payment (BOP) was assumed to be negative factor for economic growth. Relation of inflation with growth is debatable. Some mercantilists argue that growth will not be affected by inflation. For example, William Pitty, one of the mercantilist philosophers argued the negative relationship between inflation and economic growth. Increase in price level is followed by inflow of gold in any economy. Further, increase in price level reduces the international competitiveness. So, domestically produced goods will be expensive. This will moreover reduce the overseas demand of goods

produced. Thus, export level falls which is followed by reduction in economic growth (Makuria). For another mercantilist philosopher, Richard Cantillon, increase in gold bullion will not reduce the economic growth through rise in general price level if real output in an economy increases. Therefore, inflation will not seriously harm the economic growth. This belief is similar to the ideas of modern monetarists. Thus, inflation and growth relation is quite controversial in mercantilist theory.

2.1.2 Classical Theory

Doctrine of classical theory began after existence of economics and made dominant until 1930s in mainstream economics. Keynes challenged this doctrine after publication of “General Theory of Employment, Output and Interest”. Classical economists Adam Smith, David Ricardo adopted the Richard Quensay’s social class analysis and revised these classes as landlords, capitalists and workers. Based upon the self-interest assumption of classical economists, capitalists compete with each other’s even in the labor market which increases the labor wages thereby cost of production. This moreover leads to reducing profit of capitalists benefiting the workers and landlords. Therefore, fall in profit discourages the capitalist who is the source of wealth creation which makes negative impact on productivity of capital leading to reduction in economic growth (Pentecost).

Number of classical growth theory has been propounded by various economists to study the variables which determine growth. Founding father of economics Adam Smith had laid down the model driven by the supply side model and so developed model of production function is given by

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

Where

Y=output

F=function

L=labour

K=capital

L= land

In this way output growth was related to labor capital and land inputs. Moreover, output growth g_Y was driven by population growth g_l , investment g_k land growth g_t and increase in overall productivity g_t . This is functionally shown by

$$G_y=f(g_f, g_k, g_l, g_t)$$

Smith opined growth was assumed to be self -correcting with increasing return to scale. Saving was considered as major engine of investment and there by economic growth. Moreover, he focused income distribution as major indicator to determine how fast a nation could grow. He argued that reduction in profit is not due to decrease in marginal productivity but because of intense competition among the capitalists for workers of bidding of wages.

Classical economists assert that money will not have real effects in real variables which has just price effects alone and more precisely Cambridge equation has stated as

$$M=kPY \dots\dots\dots 2.1$$

Where

M= money supply

K= fraction of national income

P= price level and

Y=total national income.

Classical economists make assumption of both k and Y is constant. Therefore, increase in M directly affects to P. Moreover, income version of quantity theory of money is expressed by

$$MV=PY \dots\dots\dots 2.2$$

Where

M= total money supply

V= velocity of money

P= general price level and

Y= total national income

Both V and Y are constant under the assumption of full employment. Therefore, increase in money supply affects price level directly and proportionately. Hence, classical economists implicitly stated inverse relationship in between these two variables.

Thus, in classical growth theories, it has not been specifically shown the link between change in price levels, its tax effects on profit levels and output. However, relationship between two variables have been implicitly suggested to be negative as indicated by the reduction in firms profit levels due to higher costs.

2.1.3 Keynesian Theory

Keynes was the pioneer of this doctrine which came after the great global depression of 1930s. Keynesian theory dropped the assumption of full employment. They argue an expansionary fiscal policy increases the output, income and employment when an economy remains in zero inflation and stable situation. Such productivity will be supportive to raise the price level, and growth. So, inflation is positively related with growth. They also argued that there is no visible short run relationship due to sticky wage and price relationship.

Keynesian model comprises of aggregate demand (AD) and aggregate supply (AS) model which elucidates the inflation and growth. Short run aggregate supply curve is upward sloped. In this situation, change in the demand side of economy positively influences the both price levels and economic growth. This holds fact that when price raises in the short run output also raises. It argues many factors drive inflation rate and rate of economic growth in short run. These factors include change in expectations, labor force, prices of other factor of production, fiscal and monetary policies. In long run, aggregate supply curve is vertical. Change in demand side negatively influences the economic growth. In moving from short run to the hypothetical long run above mentioned factors and its shocks on the steady state of economy are assumed to be balance out.

Through the empirical evidence, Phillip has found the tradeoff between money wage and unemployment in long run. This argued that when money wage increases in an economy, unemployment falls. So, inflation positively influences to the growth in economy. Richard Lipsey was the first Keynesian economist who gave the theoretical

framework to this relationship transforming money wage to inflation. Thus, Keynesian economists argued long run tradeoffs relationship in between inflation and unemployment.

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

2.1.4 Monetarist Theory

Monetarists argued that money is not cause to the fluctuation of the activities and rather consequences. Monetarist doctrine of economic analysis focuses on long run supply side properties of economy as opposed to short run dynamics. Milton Friedman coined the monetarism and developed so many doctrines including quantity theory of money and neutrality of money. Quantity theory of money linked inflation with economic growth by equating the total amount of spending in the economy to the existence of amount of money. Inflation was product of greater velocity or supply of money than the rate of growth in economy. On the ground of neutrality of money, it holds true if the equilibrium values of real variables including the level of GDP are the independent of the level of money supply in the long run. Through the capital accumulation, investment and exports, inflation can adversely impact on economic growth. Similarly, existence of Phillip curve is rejected in long run. In other words, inflation has no impact over economic growth in long run. This just operates in short run. This is because, in long run economic agents make themselves adjusted by learning the error from past. if authorities want to reduce the unemployment by raising the aggregate demand through increase in money supply, then worker considers the associated wage increases as real one. So, workers will increase their supply and productivity of workers also rises. However, this situation alone exists in short run. Once workers consider that wage has not increased in real term but alone in nominal term, they start reducing their supply. Therefore, in short run productivity growth and employment can be increased through expansionary monetary policy. However, in long run expectations are adjusted and economic growth will not be affected; only price will be changed (Friedman 1976).

In nutshell, monetarism suggests that in the long run prices are mainly affected by growth rate in money which has no real effect on growth.

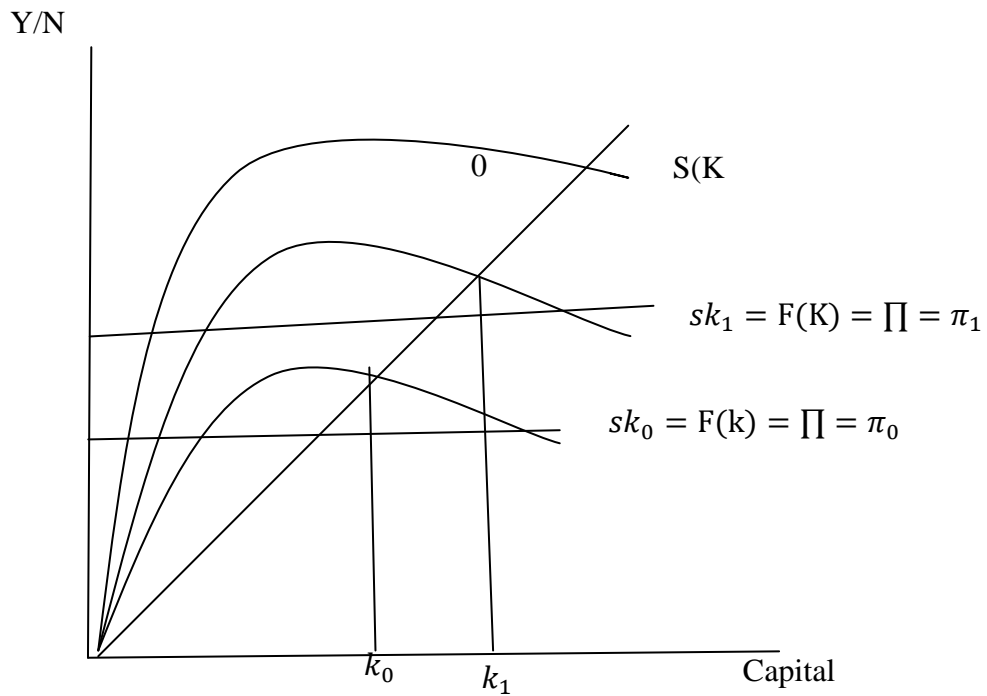
2.1.5 Neo- Classical Growth Theory

The model of economic growth was developed by Slow and Swan separately in 1956 is considered as one of the important neo classical economic growth model. Model has exhibited the diminishing return to scale of labor and capital separately and constant return to scale jointly. Technology growth has been assumed to be primary factor to promote the long term growth and it was assumed to be determined exogenously. It has been assumed to be determined independently including inflation (Todaro, 2000).

Mundell's (1936) was another model to examine the inflation and economic growth separated from excess demand for commodities. According to Mundell's model, an increase in inflation or inflation expectations immediately reduces people's wealth. This works on the premise that the rate of return on individual's real money balances falls. So that, to accumulate the desired wealth, people save more and more by switching to assets, increasing their price, thus driving down the real interest rate. Thus, Greater savings means greater capital accumulation and thus faster output growth.

Tobin effect is widely celebrated model as neo-classical model showing inflation and growth nexus. Tobin as neoclassical economist in 1965 developed the model by including Slow Swan model and improving Mundell model by including the concept of store value of money. Under this model, individual makes the substitution either by holding money or acquiring the money. In this model, people make precautionary motive in spite of offering higher rate of return.

FIGURE 2.1. (Tobin effect)



Tobin portfolio mechanism has been explained in above figure. This figure shows that if inflation rate increases from π_0 to π_1 , return to money falls, since ($\pi_1 > \pi_0$). According to Tobin portfolio mechanism, people will substitute more with its lower return more towards its capital. Therefore, this substitution is given by line sk_0 to sk_1 . Portfolio mechanism results higher steady state of capital stock to k_1 . So, Tobin framework eventually suggests that higher inflation permanently raises the level of output. However, the output growth is viewed as temporary occurring during the transition from steady state capital stock sk_0 to the new steady stock of capital stock sk_1 . The impact of inflation can be viewed as having a “lazy dog effect”. Thus, it induces greater capital accumulation and higher growth only until return to capital falls. Therefore, higher investment ceases and steady growth starts. Growth in neo classical model is eventually determined by exogenous technological advancement shifting upward in $f(k)$ curve. Simply, Tobin effect suggests that inflation causes individuals to substitute out of money into interest bearing assets leading greater capital intensity there by economic growth. Moreover, Tobin (1972) also argued that because of individual rigidity of prices, the adjustment relative prices during economic growth could be better achieved by the upward price movement of some individual prices. In nutshell, inflation exhibits a positive relation to economic growth.

Stockman(1981), developed another model claiming that increase in inflation rate lowers the steady state level of output and people welfare declines. In this model, money is compliment to capital having a negative relation between steady state of output and inflation rate. This model is justified by that firms put up some cash in financing their investment projects. Sometimes, cash is directly part of the financing package whereas in other times, banks require compensating balances. This cash investment as a cash in advance makes restriction on both consumption and capital purchase. Thus, people reduce their both purchase of capital and cash goods due to rise in inflation and such inflation adversely affect the purchasing power of money balances. Stockman effect can be operated through the effects of the labor leisure decision. Greenwood and Huffman (1987) developed the basic leisure mechanism identifying the implication for the capital accumulation. In their research, people hold money to purchase consumption goods which provide the utility from both consumption and leisure.in this model, fiat money is used because there is a cash in advance constraint on consumption goods. Thus, return to labor falls as inflation rises and hence people substitute away consumption to leisure because return to labor falls.

At this juncture Sidrauski(1967) proposed the next major development on his seminal work on the context of an infinitely lived representative agent model where money was considered as supernatural. Real variables, growth of output are independent of the growth in the money supply in the long run. Ultimately, his findings are that an increase in the rate of inflation does not affect the steady state of capital stock and neither of output nor economic growth is affected.

In neo classical model, theoretical literature reveals mixed interpretation to identify relation between inflation and growth relation. An increase in inflation can result in higher output (Tobin effect), lower output by stockman effect and no change in output in Sidrauski model.

2.1.6 New Classical Theory

New classical theory was evolved after the 1960s supply side shocks in world economy initially advocated by Chicago based on Nobel laureate economist Robert Lucas. Basic pillar of this doctrine is rational expectations. Therefore, all economic agents are rational in decision making through all available past and present

information in any economy. In both short run and long run, real variable will not be affected by inflationary pressure in an economy. So, monetary policy will not be able to raise the real variable like income, employment and output in an economy. It just makes nominal impact raising the general price level in an economy. Thus, this theory has emphasized the supply side to raise the level of economic growth in an economy.

Based on the rational expectations and continuous market clearing approach, the relationship between inflation and economic growth is explained by the inter-temporal substitution approach and the surprise model in the New Classical economics (Lucas 1996). According to the inter-temporal substitution approach, rational workers supply more labor when real wage increases and they take more leisure when real wage falls. When workers supply more labor, productivity is expected to move up leading to economic growth. An increase in nominal wage however will not have an impact on real economic variables such as employment and growth (Lucas and Rapping 1969).

2.1.7. New Keynesian Theory

New Keynesian economics is also based on the main orthodox Keynesian assumption of wage and price rigidity. It moreover explains that economic shocks are due to either of demand and supply side shocks. More restrictive monetary policy will reduce the aggregate demand in an economy and thereby economic growth will be severely affected. Increase in money supply will not make increased the price level if a firm makes increase in the productivity. This theory argues that when loose monetary policy is released and output cannot be increased it is due to non-increase in the productivity of firms. Up to certain point, increase in the production level will not affect the price level. But, beyond certain level of production, there will not be further demand for product and growth will be jeopardized. New Keynesian economists argue that higher level of inflation brings the instability in the economy. Therefore, growth will be badly affected. So, mild level of inflation is desirable in the economy which promotes the growth positively. Furthermore, the New Keynesians claim that even if prices and wages are flexible, output still varies due to the uncertainty that exists with prices. During a period of recession, risk avoiding firms prefer to reduce their output rather than dealing with the fluctuation of prices and the associated uncertainties. This implies that high and unstable prices affect productivity negatively (Krause and Lubik 2003).

For New Keynesians, high inflation has a negative impact on economic stability and hence growth. To achieve rapid economic growth and to have fair distribution of income, there must be low and stable inflation. For them, if money supply is decreased for reducing inflation it leads recession due to price rigidities. Thus, in order to set monetary policy, there has to be prior information about future values of inflation and output. In inflation targeting monetary policies, credibility of the policy is very important and hence the Central Bank's independence plays a crucial role in this case (Ambler 2008). Inflation creates costs in the economy. These costs can be seen as costs of anticipated inflation and costs of unanticipated inflation. Costs of anticipated inflation include shoe leather costs, menu costs and costs created by distortions in the non-indexed tax system. Costs of unanticipated inflation include distortions in the distribution of income, distortions in the price mechanism, and losses due to uncertainty. According to New Keynesians, inflation whether anticipated or unanticipated, has an overall negative impact on economic growth (Ambler 2008).

2.2 Proximate Growth Theories

To examine the inflation and growth, it is also quite necessary to examine some of the growth theories. Though, there are number of growth theories developed and most of them do not make direct connection of growth with inflation. They consider the different variables to determine growth in an economy. Out of which Harrod-Domar, Solow -Swan and new endogenous growth are well celebrated model in growth theory.

2.2.1. Harrod-Domar Growth Theory

Domar model of economic growth assumes that investment in an economy is determined by the saving in that economy. Though, it has not been made any linkage between inflation and growth, reduction in saving will reduce the capital accumulation, investment and thereby economic growth. So, unemployment and economic growth walks in hand in hand. This reduction will fall the output and trigger the inflation in economy.

Harrod growth model is the extension of short run Keynesian analysis to long run. It is dynamic analysis concluding economy is often volatile. It has been observed three sort of growth in an economy like warranted, actual and natural growth rate. Growth

will be exogenously determined by the investment and labor force. If economy is operating under production with surplus resources, there will be inflationary pressure in an economy. Thus, growth will be determined by saving, labor force and capital output ratio. In under-utilized resources, shortage of goods and services triggers the price level which means more profit to the business man and more economic growth and vice versa. This growth model links positive association between inflation and economic growth so they walk in hand in hand in positive direction.

2.2.2 Solow-Swan Growth Theory

Solow- swan model is also known as neo-classical growth model which uses short run production function using two factors such as labor and capital in varying proportion. Growth will eventually follow the stable time path. It has been assumed that marginal productivity of both factor remains at diminishing rate. It also argues that technology innovation is crucial to raise the growth in an economy. Technological innovation contributes to raise the productivity of each factor. So, unlike Harrod and Domar growth model, capital accumulation is not much necessary to have higher economic growth. This model assumes the constant price level which is quite unrealistic to real situation. More productivity associated with technological advance means more profit and reducing cost of production. This encourages the producers to produce more goods and services. So, this theory also makes positive association between inflation and economic growth rate.

2.2.3 Endogenous Growth Theory

Endogenous growth theory evolved in 1970s, developed by economists like Romer, Lucas, Robelo etc. This model argues that growth does not depend on external factors. So, growth depends upon the factors like technology, knowledge, human capital etc which all are considered as endogenous factors. Economic growth is assumed to be generated by factors within the process. Moreover, growth depends upon the variable like rate of return on capital. Variables like inflation reduces the rate of return which in turn reduces capital accumulation and there by growth rate. In simple version of endogenous model, per capita output continues to grow because the capital does not fall below positive lower bound. This models of growth permits increasing return to scale in aggregate products and focuses on the role of externalities in determining the

rate of return on capital. It further explains with human capital thereby implying growth rate also depends upon the rate of return on human capital as well as physical capital. A tax on either form of capital triggers lower return. For example, a tax on income directly reduces the growth rate while a tax on human capital would cause labor to leisure substitution that lowers the rate of human capital and can also lower the growth rate. This growth models are set within a monetary exchange framework of Lucas(1980), Lucas and Stokey (1987), Mccallum and Goodfried (1987). Thus, this theory argues that law of diminishing return does not operate in production due to technological advancement in the process of capital accumulation. Therefore, this theory has synthesized both Harrod-Domar and Solow- Swan growth models. In conclusion, the inflation rate lowers both the return on capital and economic growth justifying inverse relation.

Theoretically, it seems quite debatable to link the relationship between inflation and economic growth. This debate starts from the mercantilists to the New Keynesian economists. Proximate growth theories however do not directly make the relation of growth with inflation. They make the analysis to examine the determinants of growth. Their indirect associations again show same interpretation of theoretical base with debate.

2.2.4 Central Bank, Growth and Inflation

Monetary behavior was traditionally assumed to be exogenous variables by policy makers. It is now widely believed that sustained growth of money supply is associated with the rise in price level. Desirable and moderate level of money supply leads to long term economic stability by limiting the price level and maintaining sustained economic growth. So, in the view of policy makers, researchers, academicians and theorists, inflation is associated with monetary phenomena. Monetary authorities have been allowed to excess supply of monetary growth in excess of real growth. The dominant trend of monetary policy since last few decades is for price stability coupled with higher economic growth. In theory and both practice, it is highly focused. Major and primary focus of central banks and bankers is inflation has primarily negative impacts on economic growth and on overall economic activities. Like most debate in theoretical aspect of inflation, output tradeoffs, for stability and dynamism of economy, empirically results shows paradoxical and contradictory results. However, it

is prime objective of monetary institutions to keep inflation in desirable rate. Today, issue is not to minimize the inflation alone, rather to maintain reasonable rate. It has been found empirically both above and below the threshold, inflation harms the economic growth. This moreover depends upon the structure of economy and so many exogenous and endogenous variables. Authority of money supply is given to Nepal Rastra Bank (NRB) in Nepal as autonomous and independent body. Through monetary policy, every year central bank tries to keep inflation at moderate rate supporting the economic growth laid by government of Nepal after release of budgetary policy. By balancing money supply in economy, Nepal Rastra Bank (NRB) aims at stabilizing both external and internal stability avoiding negative consequences of higher sustained price level in economy.

2.3 Empirical Literature Review

Significance of empirical literature review is being increased day by day due to importance of both perspective from policy analysis and experiment of theoretical facts. Thus, various empirical studies have been conducted in terms of both cross country and individual basis. In their analysis, they have examined in both short run and long run basis including threshold level.

2.3.1 Empirical literature Review on International Context

By using the panel data of 100 countries over the period of 1960-1990, Barro (1925) has measured the relationship of inflation and economic growth. He used the neo classical methodology in which inflation was used as major explanatory variable where as other variables was assumed constant. His findings provided that inflation has statistically positive significant with negative impact on economic growth.

Through the panel data of 26 countries over the period of (1961-1992), Bruno and Easterly (1996) have analyzed the effect of inflation on economic growth. They examined the inflation exhibited more than 40 percent rate and inflation before, after and during occurrence of crisis and found that higher level of inflation harms the growth and so long as lower level of inflation had low cost on the economy. They found that inflation of 70s and 80s has temporarily affected the economic growth in the countries.

Bittencourt (2010) has examined how high growth of inflation affected the growth of Latin American countries (Bolivia, Peru, Argentina and Brazil). He has used the panel data for the period of (1970-2007) obtained from central bureau of four countries, world bank, world development indicators(WDI) and pen world trade(PWT).He constructed the model by using the explanatory variables such as inflation, government expenditure, openness, investment, money supply, political regime and interaction between education and urbanization. Among all of the explanatory variables inflation was most influencing variable to impact the economic growth. He concluded inflation was harmful to the growth of such countries and lower inflation was effective.

Ahmed and Mortaza (2005) explored the relationship between inflation and economic growth in Bangladesh using the annual data of period (1980-2005) with real Gross Domestic Product (GDP) and consumer price index (CPI). In their study, long run and short run dynamics relationship of two variables was assessed by using Engle Granger co- integration test and Error learning model. They further used the model developed by Khan and Senhadji (2001) to estimate the threshold level of inflation. It has been found the significant relationship between CPI and real GDP. Estimated threshold level of inflation was suggested 6 percent for Bangladeshi economy. They have suggested to macroeconomic policy makers to keep inflation under threshold point.

Mubarik (2005) has studied the threshold level of inflation for Pakistan by using the annual time series data of period (1973-2000). He employed the method used by Khan and Senhadji (2001) where variables CPI real GDP at constant factor cost, population, and total investment obtained through the economic survey of Pakistani economy. He also transformed the model by taking log to get rid of asymmetry in inflation distribution. The result of the study shows 9 percent threshold level of inflation in Pakistani economy. Mubarak also suggested macroeconomic policy makers in Pakistani economy to keep inflation below 9 percent.

Dotsey and Sarte(2000) studied the effects of inflation on economic growth for U.S. economy. By including the money as an explanatory variable through neo classical endogenous growth model they have examined their analysis. Their findings show that higher average inflation has a negative impact on the steady economic growth. On the other hand, they argued that inflation has positive impact on growth in short

run through pre cautionary savings. During the inflation volatility, precautionary savings rise and that is positively related to growth and negatively to the welfare. In over all, their finding is the negative effects of inflation exceed the positive impact of inflation supporting the views that higher inflation has negative impact on growth.

Xiaojing (2008) examined the tradeoffs between inflation and economic growth in china using the annual time series data from the period of (1978-2007). He had used the Phillip curve equation to see what the relationship would look like between two variables. It has been found that growth can be affected at different level by differently. He found that at the steady state of inflation 5 percent gross domestic product (GDP) growth will be 9.3 percent. However, a rising inflation above this steady state will have a negative impact on growth and tight monetary and fiscal policies are recommended in these cases. Nonetheless, tight policies can harm the economic growth of the country if they are still adopted when the rate of inflation is below the steady state.

Hasanov(2010) has employed the real economic growth, consumer price index(CPI) and growth rate of gross capital formation to examine the relation between inflation and economic growth in Azerbaijani economy by using the data of the period 2001-2009. He found non- linear relation between inflation and economic growth concluding 13 percent threshold level in Azerbaijani economy and below that level, inflation positively promotes the growth. After threshold point, increase in inflation deteriorates the real economic growth by 3 percent.

Gilman and Harris(2001) examined the relation of inflation and growth nexus for transition 13 countries by taking the panel data from the period of 1990-2000 in which data have been taken from the World Bank Development Indicator(WBDI). They have used three equations such as growth inflation and money demand. It has found very similar result to the OCED countries that inflation has strong negative impact to growth and growth is similar to that of developed countries having convergent time path. It suggests that monetary policy to be inflation targeting and fiscal policies to keep budget deficit with acceptable range.

Gokaland and Hanif (2004) have analyzed the inflation and growth nexus to check the relation in Fiji economy. They have used of 34 years data from the period of 1970-

2003 for variables of real GDP, annual average CPI and year CPI inflation rate. To test the relationship, Granger causality test has been employed. Before, it has been used time series property such as Augmented Dickey Fuller (ADF) and PhillipsPerron (pp) tests. The findings of analysis reveal that both inflation measures (annual average CPI, and year and year CPI) have negative weak relation with GDP growth. Granger causality test shows the one way relation of growth to inflation. Fiji economy inflation is largely influenced by international factors so that they provide the policy recommendation that fiscal and monetary policy aims to reduce inflation and inflation expectations to promote economic growth.

Malla (1997) has carried out a study to examine how inflation affects the economic growth in OCED and ASIAN countries by using the small sample size. The Study has been carried out separately for both OCED and ASEAN countries using different equation explained by capital accumulation and labor force. Finding for OCED countries shows no relation between these variable which is contrary to the theoretical aspect. But, for ASEAN countries, growth is negatively influenced by inflation

Bharumshan, Hamzah and Sarbi(2011)has analyzed the inflation uncertainty and economic growth in ASEAN countries (Association of East Asian Countries) namely for Malaysia, Singapore, Thailand, Indonesia and Philippines. To examine the relation and uncertainty they have employed the L-ARCH autoregressive conditional heteroscedasticity model. It has been found negative relation between inflation and growth and uncertainty. So, it has focused on strategy to reduce inflation for overall economic growth in economy. However, it has not been carried out full analysis since it just makes analysis the inflation growth and uncertainty relation exiting the determinants of inflation.

Mallik and Choudhary (2001), conducted a study to establish relation between inflation and economic growth in four south Asian countries like India, Pakistan, Sri Lanka and Bangladesh. They have used Johansen and Juselius (1990), co integration and Engle Granger test (1987) including Error Correction Model to observe short run and long run relationship. It has been found positive long run relationship between variables for all four countries. Moreover, they do not provide whether higher inflation than existing impacts sustainable growth. They rather suggest it as knife edge claiming inflation above this level may lead recession.

Erbaykal and Okulan (2008) have made study to examine the relation between inflation and growth by using the quarterly time series data from 1987Q1-2006Q2 of Turkish economy. They have used co-integration and causality test to test the relation between variables. It has also been used bound test for co-integration developed by Pearson, Skin and Smith (2001). This approach is carried out to co-integration test if variables are not found to be stationary of the same order. They have also used ARDL method to examine short term and long term relation between variables. For study of the variables, it has been used WALD test developed by Toda and Yamamoto (1995) to see the causal relation. They found no long term relation between these two macro-economic variables. However, there was statistically significant negative short term relationship and for causality analysis, a unidirectional causal relationship from inflation to economic growth is observed

Vinayagathan (2013), has conducted a study on cross country basis of 32 Asian countries taking the data from 1980-2009 to examine the dynamic relation between inflation and economic growth. He has used the dynamic panel of threshold model to examine the inflation, growth nexus to identify the threshold level of inflation. It has been also used endogenous growth model which allows including indigenous regresses proposed by Kremer (27). Through the observation non -linear nexus has been found with threshold point 5.43 percent at 1 percent level of significance. Up to this threshold, growth is not deteriorated and beyond this point growth is hampered.

Jayathilake and Rathnayake (2013) have conducted a study to examine the dynamic relation between inflation and economic growth in three Asian countries namely China, India and Sri Lanka using the data from the period of 1980-2010. To observe the relation, they have employed methodology as co-integration, causality test and bound test. It has been also carried out bound test to check stationary in order to examine co-integration with Augmented Dickey Fuller and PhillipsPerron test. Similarly vector error correction and granger causality test has been adopted to examine short run dynamics of variables. In Sri Lanka, it has been found statistically significant negative relation but no long run relation has been found in India and China. Short run negative statistically significant relation has been found in China. Unidirectional causal relation from economic growth to inflation has been found in china.

Li, (2005) made a study to examine the relationship between inflation and economic growth observing the impact by transmission mechanism at cross country basis. For this he has taken data of 90 developing countries and 28 developed countries from the period of 1961-2004 from the world development indicators (WDI). He made analysis by grouping developed and developing countries differently using linear regression model and non- linear model for observing impact of inflation and threshold estimation respectively. For developing countries, he found the presence of two thresholds. His conclusion finds non -linear mechanism which works as:

1. The effects of inflation to economic growth is positive and with statistically insignificant for rates of inflation lower than those of the first threshold.
2. The effects of inflation to growth are significant and negative for moderate levels which lie between two threshold levels.
3. At extremely high level of inflation, marginal impact of additional inflation on economic growth diminishes rapidly but is still significantly negative.

For developed countries one threshold is detected and found to be statistically significant. The working mechanism of nonlinear model is as the magnitude of the negative impact of inflation on growth declines when the rate of inflation increases.

Manamba (2016) made a study to examine the nexus between inflation and economic growth in Namibia economy by taking the quadratic data from the period of 1967 to 2015. He observed the impact of inflation on growth and estimated the threshold level using standard growth model used by Barro 1991 Levine and Renelt 1992 and sala-i-martin, (1997). He found optimal level of inflation ranged between 3.25 percent and 3.75 percent by minimizing the residual sum of squares and maximizing the adjusted R- squared. Estimated coefficient of linear form of inflation was negative and estimated coefficient of square form of inflation was positive suggesting a u-shaped effect as opposed to inverted u-shaped relationship found in various countries. His findings showed the existence of Tobin effect for higher inflation in which at higher level of inflation people realizes the importance of substituting money for interest bearing assets. This reflects capital investment increases and which raises the economic growth rate with higher level of inflation.

Sarel (1996) conducted a study for existence of a threshold effect of inflation and economic growth using panel data of 87 countries from the period of 1970-1990. For estimation, OLS regression was used to growth rate of inflation, dummies as dependent variables and choose independent variables such as population growth rate, initial income per person, government expenditure to GDP ratio, rate in change in trade. So, he asserted that function relating to economic growth contains a structural break point of an annual inflation rate of percentage. From his empirical study, he found 8 percent of inflation as threshold inflation under which it does not significantly impact the economic growth. However, after that estimated level inflation will have negative impact on growth.

Non-existence of long run relationship between inflation and economic growth is supported by Moishuri and Sphri (2004). This study has been carried out for industrial and developing countries. Empirical evidence reveals that turning point varies significantly. For lower middle income countries, it is 15 percent for lower middle income countries 11 percent and 5 percent has been estimated for upper middle income countries. It has found no significant long run relationship between inflation and economic growth for countries.

Faria and Carnelro (2001) made a study by applying a bivariate vector auto regression to find nexus between inflation and economic growth in Brazilian economy. In long term, it found no relationship between variables. But, in short run the result suggests that the existence of relation is negative.

Kremer (2009), by expanding the scope of Khan and Senhadji (2001) estimated threshold level of inflation modeling a large scale panel data set of 124 industrialized and non -industrialized countries over the period of 1950-2004 period. A dynamic panel threshold model is employed in the analysis for the growth equation. Threshold level for non -industrialized countries has been estimated 17 percent whereas it is 2.5 percent for industrialized economies. Effect of inflation below the threshold level is significantly positive for developed economics so far as impact of inflation on growth remains insignificant in developing economics when inflation is below 17percent. This study fails to support growth enhancing effects of inflation on growth in developing countries.

Rousseau and Wachtel(2012), examined a study to find growth and inflation nexus by introducing financial development. It has been incorporated financial development as intermediary to inflation and growth for cross country analysis taking the data of 84 countries from the period of 1960 to 1995 by world development indicators (WDI). A series of rolling panel regression model used by Barro(1991), Levine and Renelt(1992) has been employed. Inflation threshold for the finance growth relationship found to be lied between 13 percent to percent. When inflation exceeds the threshold finance, it ceases to increase the economic growth. Moreover, level of financial depth varies inversely with inflation in low inflation environment and that disinflation is associated with a positive effect of financial depth on growth.

Sergill (2009) conducted inflation growth relation in CIS countries by taking the data from the period of 2001 to 2008. A non- linear least square technique has been employed and bootstrap approach has been used for estimation of inference. Empirical result shows the relation of strictly concave with some level of inflation. Inflation higher than 8 percent has been estimated threshold and up to that level growth is slower down, above that level growth will be harmful and below that growth will be promoted.

Fisher(1992) and Gregorio, DE (1992, 1994), have investigated the link between inflation and economic growth in time series cross section and panel data for a large number of countries .It has been found over all negative impact of inflation over economic growth. Fisher argued that inflation hampers the efficient allocation of resources due to harmful changes of relative prices. At the same times, relative prices appear to be one of the most important channels in the process of effective decision making.

Christoffersen and Doyle (1998), by taking data of 22 transitional economics from the period of 1990 to 1997 made a study for inflation and growth analysis. They used Sarrel(1995) approach to modeling the kinked interaction between inflation and economic growth. It has been found threshold level to be 3 percent. They concluded that there was no any evidence that below the threshold level of inflation there was no country which got rapid output growth. They suggested that for the favorable impact on growth performance as highest level, policymakers should keep inflation at threshold level.

Mamo(2010), used granger causality test using regression model to estimate growth and inflation relation in 13 SSA countries. Data has been taken from the period of 1969 to 2009 in which economic growth has been taken as dependent variables and independent other variables considered are as inflation, investment, population, initial GDP. Empirical finding shows negative relationship between variables. This finds except Zimbabwe, Congo, granger causality in samples can be used to predict growth.

Chuan (2009) estimated the causal interrelationship between inflation and economic growth by simultaneous equation framework. Cross section data of 140 countries has been considered from the period of 1970 to 2005. Bilateral causal relationship between inflation and economic growth has been observed. For the study, data has been analyzed by grouping in developed and developing country data. Inflation has been harmful to growth but growth is found to be beneficial for inflation. Effect of inflation to growth was higher in low income economics than developing and high income economics.

2.3.2 Empirical Review on National Context

Bhusal and Silpakar(2011) has estimated the threshold level of inflation in Nepalese economy by using the data for the period of 1975-2010 showing 6 percent threshold with conclusion below and above the threshold point, growth will be jeopardized. For the estimation, they have used the non- linear approach adopted by Mubarik (2005) with application of granger causality test to check the causation in between inflation and economic growth.

Adhikari, (2014) has estimated the inflation growth nexus to examine the impact of inflation over economic growth by using the data from the period of 1975-2012 employing the distributed lag model with consumer price index (CPI) as proxy variable transferring nominal gross domestic product (GDP) to real GDP by taking base year for fiscal year 2006. His analysis concludes that impact of previous inflation to current economic growth is positive but current year inflation to current year growth is negative. In sum, total effect of inflation over economic growth is not too harmful and mild inflation is often desirable to promote the economic growth in economy.

Bhattarai (2014) has examined the inflation and economic growth in case of Nepal by using the data from 1975-2011 concluding with no significant relation between inflation and economic growth in long run finding no threshold point, sharply contrasted with conclusion of Bhusal and Silpakar and recommending to expansionary monetary policy. She has employed the autoregressive distributed lag model (ARDL) with error correction model and co integration model to investigate the short run and long run relationship of economic growth and its determinants. For threshold estimation, she has used Khan and Senhadji model. For determinants of short run and long run economic growth, she has used explanatory variables such as consumption to GDP ratio, investment to GDP ratio, broad money supply to GDP ratio, total trade volume to GDP ratio and annual population growth rate. She found significant determinants of economic growth are consumption to GDP ratio related to negatively, investment to GDP ratio related to positively, and total trade volume to GDP ratio negatively. Similarly, inflation rate, broad money supply to GDP and annual population growth were related to positively with statistically insignificant relation implying no long run relation.

Earlier explanation in closed economy has been made by Fry(1974), Pant(1977) and Pant (1978) to examine the inflation and its determinants. These studies make weak association between money and prices using basic statistical analysis. Pant (1977) showed inflation in Nepal is not much explained by the monetary aggregates and economic growth rather due to the structural changes in the economy. This conclusion contrasts with the observations of Sharma (1987) who identifies the influencing factor of Indian economy showing empirically significant and by Khatiwada as well (1981).

Neupane (1992), had made exploration of continue appropriate model for Nepal examining the both monetarist (closed economy and structuralists) approach by taking the data from the period of 1965 to 1988 by OLS technique. Author used the CPI as dependent variable and percentage change in current money supply lagged by one and two years, percentage change in GDP, expected cost of holding money, percentage change in commodity, percentage change in import price index lagged by one year and percentage change in government budget deficit as explanatory variables. This concludes increase in money supply in line with the growth of per capita GDP could help to control inflation showing the inflation growth nexus.

Subsequently, Neupane (1992), the institute for sustainable development (ISD: 1994) in a study conducted for NRB used an eclectic approach of structuralists and monetarists view approach. This study included the external variables of an open economy model of regression analysis taking variables such as Indian economy whose price exchange rate, lagged effect of money supply, government expenditure as additional explanatory variables. It showed 10 percent increase in Indian inflation triggers the 8 percent rise in domestic price level. This moreover shows the indirect association between inflation and economic growth in Nepal.

In this line, Khatiwada (1994) examined the inflation prices in Nepal utilizing the basis as quantity theory of money. Study included the structural variables such as per capita output, government expenditure and open economy variables such as Indian inflation and exchange rate. He made the long run relationship and finds the inflation consistently significant thereby inflation significantly affected by open economy factors. In general, relation between inflation and economic growth exists significantly.

Mathema (1998) in this juncture has used an expectation Augmented Phillip curve approach to examine the relation showing whether nominal wage increase are most significant sources of the cost push inflation. In this model ,CPI inflation, real GDP growth, changes in money supply, changes in money supply, change in wage(W), change in imported price(PI) and change in expectation price(PE) are considered as variables where excess demand were given proxies for unemployment. Study period covered the data from 1978 to 1995 using OLS and unit root test for stationary check of chosen variables. it finds only unilateral causation from the rate of inflation to wages of agricultural and masonry labor and industrial wages causes the inflation in Nepal by employing the granger bivariate causality test. It shows no causal relation between inflation and economic growth in economy.

Pandey (2005) utilized an excess demand model of inflation applied OLS stationary test, co-integration technique and Error Correction Model (ECM) to study the determinants of inflation. Study included the variables money supply, real GDP, government expenditure, Indian inflation and exchange rate using the data from the period of 1973 to 2004. It finds no change in the explanatory power of the model including the public expenditure as well as real GDP and a supply side variable.

In the study of Nepal Rastra Bank (NRB), Price Division and Economic Analysis (PDEA,2006), a very quick and simple study using open economy monetary model found Indian inflation to have significant and near unitary effect of inflation. This analysis has been made by using the empirical regression utilizing the ordinary Least Square (OLS) on annual time series data over 1975 to 2006 including the explanatory variables like growth rate of real GDP, money supply, interest rate on fixed deposit and Indian inflation. However, it had lack of long run relationship and considerations for short run adjustment process. This moreover shows no relation and causation between inflation and economic growth.

Nepal Rastra Bank (NRB), research department (2016), entitled inflation in Nepal made and analysis to identify the determinates of inflation using the both OLS and ECM model for determination of both short run and long run dynamics. This study included the variables money supply, velocity of money proxied by quantity theory of money, GDP, interest rates and external factors (Indian prices). This study concluded Indian inflation was major rod to influence the Nepalese inflation. Real economic growth had no significant nexus with inflation.

Regmi (2010) has made the assessment of financial development on the impact of economic growth by using the neo classical growth model used by Ram (1999).In this model, variables used are GDP, population, trade, investment, deposit and money for Nepal covering the data from the period of 1987 to 2006. Data are taken through international financial institutions, IMF, school level statistics, d department of education, Ministry of Education (MOE) and quarterly economic bulletin of NRB. In this empirical analysis, he found insignificant contribution of financial development to economic growth due to pervasive inefficiencies in credit allocation mechanism, poor quality of institutions, weak infrastructures, and general shift of resources from productive investment to consumption.

Koirala (2010) conducted a study to examine the impact of fiscal policy over economic growth under Endogenous Growth Framework (EGF) by taking the time series data from the period of 1975 to 2009.He used independent variables such as productive expenditure, capital expenditure and indirect taxes and foreign grants. This study concludes that productive expenditure such as capital and recurrent of government expenditure positively influences on growth via productivity

enhancement effect of human capital and capital stock. Moreover, indirect taxes and foreign grants respectively have positive and negative impact on growth.

Regmi (2010) in this line makes analysis the impact of foreign aid to economic growth by using the time series data of 1975-2003. He has used the unit root test, vector error correction and concludes foreign aid has significantly contributed on economic growth in Nepal by supplementing domestic savings, investment and by purchasing of essential imports required for industrial growth. So, openness of trade positively influences on economic growth.

Gyanwaly (2014) has made the examination of relationship between the financial development and economic growth by using the data from the period of 1975 to 2014. It has been developed the financial index by taking the weighed the average of the different indicators of the financial development. For the analysis, he has used the variables such as financial development, real stock of capital, real per capita of capital, labor force, real export, government expenditure and inflation. After using stationary test, it has been used co- integration test and Johansson co -integration technique including Error Correction Model (ECM). Except inflation and economic growth, all of the other variables affects significantly in negative way.

Acharya (2014) made an analysis to examine the determinants of economic growth. He has used the variables such as real GDP, CPI, real investment and gross fixed capital formation. It has been used the time series data from the period of 1975 to 2011. To conduct the study after examining the time series properties, ARDL model has been employed. It has been found the co-integration among the variables. Capital formation and gross domestic investment have positive and significant impact on economic growth.

2.4 Research Gap.

International literature review on inflation and economic growth nexus by Ahmed & Mortza (2005), Mambab(2016) shows the positive association of inflation over economic growth in long run and short run. Barro (1925), Bittencourt (2010), Doesty and Sarte (2000) Gilman and Harris (2001) studies conducted on cross country basis shows the negative impact of economic growth in long run. Mubarik (2005), Xiaojing (2008) Hansav (2010) have found threshold level of inflation. They have suggested

keeping inflation at threshold level for stable and desirable level of economic growth. But, Finding of threshold level given by empirical study varies country to country. In general, most of the studies find negative impact of inflation over economic growth in long run. In national context, literature review by Bhataarai (2014), Bhusal and Silpakar (2011) and Adhikari (2014) find the empirical results. Bhattraai (2014) in this context finds no threshold level of inflation and no existence of long run relation between inflation and economic growth. Bhusal and silpakar (2011) finds 6 percent of threshold level of inflation in Nepal suggesting above below that level inflation harms the economic growth. Adhikari (2014) concludes previous year of inflation positively influences the economic growth but current year of inflation hurts economic growth suggesting keep in mild level of inflation. Despite, few studies have been carried out to observe the nexus between inflation and growth, various studies have been conducted to identify the determinates of inflation and economic growth in which either of variables have been kept showing inflation and growth nexus as independent and dependent variable. Acharya (2014) includes the inflation as independent variables as one of the determinant of the economic growth. He finds inflation is not statistically significant variable to influence the economic growth in Nepal. Review of literature shows that limited number of studies has been carried out for inflation growth nexus in Nepal. This study aims at finding the short run and long run relationship between variables. In last some fiscal years, inflation is higher and economic growth rate is lower. Nepalese economy should require getting higher rate of economic growth to be upgraded to developing country. Every planning, budgetary policy, monetary policy primarily concerns to keep inflation within the limited level. But, they hardly keep within the limitation. Moreover, it requires identifying the desirable level of inflation which promotes the economic growth. Since, higher inflation distorts the resources and lower drives to economic depression. Thus, this study examines the short run and long run relation between inflation and economic growth identifying the threshold level of inflation in Nepalese economy by taking the data from the period of 1975 to 2015.

2.5 Conclusions

Like debate in theoretical matter, whether inflation is harmful to economic growth or not, empirical evidences reveal both paradoxical results in both single country basis

and cross country basis. In long run most of the studies find negative impact of inflation over economic growth. For the estimation of threshold points, it has been found different threshold. In some country no threshold point has been also found. Bhattari(2014) in Nepal has suggested to be found no threshold level of inflation recommending expansionary monetary policy. However, Bhusal and Silpakar (2011) have found 6 percent level of threshold. Below and above that threshold inflation point, inflation will be harmful to economic growth.

Burno (1925) found negative impact of inflation on economic growth. He has used neo classical model for the data of 100 countries in cross border scale. Similarly, Fisher (1992) concluded the similar conclusion by using the data of larger number of countries. He found that inflation destroys the efficient allocation of resources and which eventually harms the economic growth. Sarel (1996) conclusion is different. He finds 8 percent of threshold in which study has been conducted for cross country basis of 87 countries using panel data. He suggests above that inflation, growth will be negatively influenced. However, below that inflation does not harm growth. Vinayagathsan (2013) found threshold of 5.43 percent for 32 Asian countries by using non-linear model.

Moreover, in the estimation of threshold, Khan and Shenhadji model (2001) used in IMF working paper to show inflation growth nexus at cross country basis is turning point to observe inflation impact over economic growth. Difference in the result of threshold estimation in cross country basis and single country basis is due to differences in methodology, data, structural rigidities, variables selection and so on. However, this study is being interesting and popular for policy makers', researchers and academicians due to its wide popularity for economic stability coupled with sustained economic growth rate. Empirical findings of threshold and above, below threshold adversely affect the growth has provided interesting platform to study this nexus.

CHAPTER THREE

RESEARCH- METHODOLOGY

This chapter deals with the research methodology used in this study. It elucidates the issues of inflation, its determinants, and relationship with growth, specification of model, estimation of threshold model, data selection, sample period and econometric technique applied.

Firstly, estimation of growth with inflation model has been estimated and threshold model has been developed.

3.1. Estimation of Growth Equation with Inflation

Among the studies and researchers there is wide range of variability for the selection of variables to estimate growth by incorporating the inflation. It depends upon the composition of structure, availability of data, methodology used, socio economic situations, model used for the analysis. Barro (1991) has introduced standard framework to examine the rate of economic growth. Fischer (1992) and Gregorio and DE (1992, 1994) moreover provided sound empirical framework for study. King and Levine (1993) have incorporated the ideas of financial depth in the model.

For the single country analysis of inflation growth relation (Sing, and Kalirajan, 2003) has proposed the variables like level of income, investment rate, various measure of education, population growth rate, terms of trade, policy indicators such as inflation, black market premium, fiscal surplus and other many variables. So, following model has been proposed:

$GDP_t = f$ (level of income, investment rate, measure of education, population growth, inflation, black market premium, fiscal surplus)

Several variables included in the right hand side including inflation has been used to explain GDP growth systematically in above model.

Ayyoub, Chaudhary, and Farooq (2011) in order to examine the impact of inflation on growth in single country basis have used two econometric equations. These equations have been estimated by employing the method of Ordinary Least Square (OLS).

Regression errors in equations of these models have been tested for autocorrelation with the help of Durwin- Watson (DW) test.

$$GDP_t = \beta_0 + \beta_1 CIN F_t + \beta_2 OPNS_t + \beta_3 INVG_t + \beta_4 LFPR_t + \beta_5 LPOPM_t + \epsilon_t$$

And

$$GDP_t = \gamma_0 + \gamma_1 CIN F_t + \gamma_2 OPNS_t + \gamma_3 INVG_t + \gamma_4 LFPR_t + \gamma_5 LPOPM_t + \gamma_6 INF7_t + \mu_t$$

Where

GDP_t = Gross domestic product growth

$CINF$ = CPI inflation

$OPNS$ = Trade openness

$INVG$ = Investment growth rate

$LFPR$ = Labor force participation rate

$LPOPM$ = Log of population in millions

$INF7$ = inflation level ≤ 7 percent as dummy variable

(1 = inflation level ≤ 7 percent, 0 = otherwise)

ϵ, μ = error terms

$$\beta_2, \beta_3, \beta_4, \gamma_2, \gamma_3, \gamma_4, \gamma_6 > 0 \quad \beta_0, \beta_1, \beta_5, \gamma_0, \gamma_1, \gamma_5 < 0$$

In Nepal, Pandey (2005) has used money supply, real GDP, government expenditure, Indian inflation and exchange rate to examine determinants of inflation showing nexus between inflation and growth. Gyanwaly(2014) has used financial development, real stock of capital, real per capita of capital, labor force, inflation, real government expenditure to identify the impact of financial development on growth. Similarly, Bhattarai(2014) used CPI, total trade, population growth rate, consumption expenditure, investment expenditure and broad money supply to conduct relation between inflation and growth.

3.2 Selections of Variables and Estimation of Econometrical Model

Among the researchers, it is highly debate and controversy for the selection of variables which affects the growth incorporating the inflation. Consideration of variables is taken on the basis of some specific features of economic structure,

theoretical aspect, level of development, socio cultural aspects. However, it should be included the variables suggested by macroeconomic theory, monetary economics theory, international trade theory and financial economic theory. Since, today economy is interdependent and globalization has played dominant role in growth of national economy. So, we should consider both external and internal variables which influence the domestic economy. Macroeconomic theory suggests that saving, investment, capital accumulation, technological advance, government policy are major determinants of economic growth. International trade theory argues that diversification of trade, specification of labor, openness of trade shape the economic growth. Monetary theory suggests that financial stability, money supply, interest rate, inflation, expected return of investment plays major role in growth. Financial economics focuses on financial depth in country, new financial innovation, deepening of labor and capital market as source of economic growth.

In empirical literature, in particular, Cass (1965) and Koopmans (1965) finds increase in investment together with reduction in population growth triggers the economic growth by using neo classical model. Melitz (2003) has concluded that greater openness of the economy leads to higher economic growth. The empirical Literatures on growth on the work of the King and Levine (1993), Levine and Rennet (1992) and Sala I martin (1997) have extended the concept of model by incorporating the financial development as explanatory variables of economic growth. In this model, inflation, investment, population growth, tax system, theory of black market premium, terms of trade, total trade volume, no of schooling children, employment rate, and financial development are considered as major explanatory variables.

Though, empirical variables considered show the effects depending upon the scale and depth of development, peculiarity of social and economic development of the economy, availability of data and earlier studies in which variables are carried out by researchers, following explanatory variables have been selected. These variables are consistent with khan and Senhadji (2001), Hussian (2005), Singh and Kalirajan (2003), Bhattarai (2014), Pandey (2005) and Gyanwaly (2014).

- Investment
- Total import
- Consumer price index

- Annual population growth

After selection of the variables to examine the relationship between inflation and economic growth following empirical model has been constructed;

$$LGDP_t = \beta_0 + \beta_1 LCPI_t + \beta_2 LINV_t + \beta_3 LIMP_t + \beta_4 LPOP_t + \mu_t \quad 3.1.$$

Where

$LGDP_t$ = Log of Gross Domestic product

$LCPI_t$ = log of Consumer price index

$LINV_t$ = Log of Investment

$LIMP_t$ = Log of import.

$LPOP_t$ = Log of annual population

μ_t = Error term

β_i Where $i = 0, 1, 2, 3, 4$, are coefficients of respective variables.

For estimation of threshold level of inflation, it has been used the model proposed by Khan and Senhadji (2001) as conditional least square method initially developed by Hansen (1996, 2000). This model is gaining popularity among the researchers and policy makers to estimate the existence of threshold in both cross country and single country basis. Fischer (1993) and Barro (1996) have used cross country panel data to estimate threshold level of inflation by using least square method. After Hansen initially proposed and later advanced by Khan and Senhadji, conditional least square has been used by almost all researchers for estimation of threshold level of inflation by arbitrary selection of value of threshold minimizing square of residual sum of errors. This model has been further used by Mubarik (2005), Hussian (2005), for Pakistan, Sweidan (2004) for Jordan, Munir and Munsar (2009) in Malaysian economy. In this model, different arbitrary value of unknown say threshold k is taken maximizing the R^2 or minimizing the sum of error of residuals by conditional regression values. To find the threshold point, it is chosen in a way in which value of R^2 is maximized that satisfies statistically significant relation. In this model, value of threshold as k ranges from 3 to 11 in which coefficients of values are chosen arbitrarily by considering minimization of error terms of residual sums or maximization of value of R^2 . To examine the threshold model, same following model has been employed:

$$\Delta LGDP_t = \beta_0 + \beta_1 \Delta LCPI_t + \beta_2 D_t (INF - k) + \beta_3 \Delta LINV_t + \beta_4 \Delta LIMP_t + \beta_5 \Delta LPOP_t + U_i \dots \dots (3.2.)$$

Where

$\Delta LGDP_t$ = GDP growth rate

INF = inflation rate

K = threshold level of inflation (it is defined as rate of inflation at which structural break occurs)

U_i = Random error terms, which represents the measurement of error in the explanatory variables

D = Dummy variables.

$D_t = 1$ If $INF > 1$ and $D_t = 0$ if $INF \leq 0$

Details of variables

Table 3.1

variables	Variable details
RGDP	RGDP stands for real GDP which is calculated as $RGDP = \frac{\text{nominal GDP at produce's price}}{GDP \text{ deflator}} * 100$
RINV	RINV stands for real investment which is calculate as $RINV = \frac{\text{total volume of nominal investment}}{GDP \text{ deflator}} * 100$
RIMP	RIMP represents real level of import which is calculated as $RIMP = \frac{\text{nominal volume of total import}}{GDP \text{ deflator}} * 100$
CPI	This stands for consumer price index of Nepal.
INF	INF stands for annual inflation growth rate of Nepal which is calculated as $INF = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} * 100$
POP_t	POP_t stands annual population of Nepal.

3.3. The Data

This study has been carried out by using secondary data. Sources of data have been extracted from quarterly bulletin published by Nepal Rastra Bank (NRB) various Economic surveys by Ministry of Finance (MOF) and population growth from Central Bureau of Statistics (CBS). GDP, investment, total import volume and GDP deflator are taken from economic survey. Population growth is extracted from Central Bureau of Statistics and consumer price index is from the quarterly bulletin published by Nepal Rastra Bank (NRB).

3.4. Hypothesis Test

In order to carry out the test of long run relationship of introduced variables in the model whether long run relation between variable economic growth and inflation exists or not, co integration test of Engle Granger (1987) has been employed. To test the long run relationship of the variables, following hypothesis is proposed:

Null Hypothesis (H_0)= $\beta_0=\beta_1=\beta_2=\beta_3=\beta_4=0$, the long run relationship does not exist.

Alternative Hypothesis (H_1) = $\beta_0=\beta_1=\beta_2=\beta_3=\beta_4 \neq 0$, there exists long run relationship between GDP growth and its determinants.

For this, it will be firstly checked the stationary of concerned variables by using the co integration test. After conducting the regression, error terms are checked to avoid the spurious of the model. For stationary check of residual terms at level form, Engle Granger (1987) τ values are compared with critical values. If τ value is greater than critical value, null hypothesis cannot be accepted.

For estimation of threshold following hypothesis has been formed.

H_0 : =0, there is no threshold point

H_1 : $\neq 0$, there exists threshold point

Classical t-test and F- test have non- standard distribution. The asymptotic distribution is non- standard and strictly dominants the distribution. Distribution of Z depends upon general moments of samples. Therefore critical values cannot be tabulated. In

order to test of significance of threshold, Hanson (1996, 2000) has proposed following bootstrap technique to stimulate asymptotic distribution of likelihood ratio.

$$Z = \frac{0-1}{2}$$

Where, 0 and 1 are residuals sum of squares. Under null hypothesis of no threshold effect and alternative hypothesis of presence of threshold effect, this above ratio is used to estimate the residual variance under alternative hypothesis. It is used to compute p-values which are asymptotically distributed. The null hypothesis will be rejected if p- value is less than some critical value.

3.5 Estimation Methodology

Various techniques for conducting the Co-integration analysis on impact of inflation on economic growth have been proposed in literature. Most popular and the well-known approaches are residual-based approach proposed by Engle and Granger (1987) and the maximum likelihood-based approach proposed by Johansen and Julius (1990) and Johansen (1991). If more than two I(1) variables in the system operates, the maximum likelihood approach of Johansen and Julius are more advantageous than residual-based approach of Engle and Granger. For this, both of the approaches should require same order of integration for variables. Heterogeneity of order of integration for variables causes the difficulties to estimate the model for researchers. To overcome this problem, Pesaran et al. (1996, 2001) proposed a new approach known as Autoregressive Distributed Lag (ARDL) to test co-integration which does not require the classification of variables into I(0) or I(1).

To conduct this nexus, this study follows the co integration model of integration developed by Granger (1987). It is used if variables are found stationary in same order of first difference I (1). So, it is possible to continue the regression. After the regression takes place, if the error terms are found to be stationary at levels I(0), then the linear combination of the individually non- stationary I(1) is stationary at I(0). In this condition, the two variables are integrated and economic interpretation of co integrated variables shows the long term relationship between variables under study of (Engle and Yoo, 1987). Therefore, in this study, co integration test will be carried

out by Engle Granger (1987) approach for long run relation and Error Correction Model (ECM) will be carried out for short run dynamics.

3.5.1. Engle-Granger Approach to Co-integration Analysis

Regression of inflation and growth equation (3.1.) takes place even in the presence of unit root test when relevant variables are checked for stationary using the unit root test. It stills provides the combined effect of two non- stationary variables. But, in this situation, spurious regression is estimated. So, unit root test on the residuals (μ_t) is applied to check the stationary. For the estimation of the error terms, Engle and Granger (1987) calculated critical values are used to estimate the stationary of the error terms. For the estimation of the error terms assuming the variables are non-stationary individually, the Engle Granger approach checks for the combined effects by examining the stationary of error terms. If the error terms are found to be stationary I (0) at their levels using Engle- Granger (1987) critical values, then the regression equation will not be spurious. Co- integration relationship between the two variables can be interpreted as a static long run equilibrium relationship and the co - integrating coefficients are interpreted as long run coefficients (Cambell and Shiller, 1988).

For the long run relation of the variables in model, data have been transformed to natural log. In the model, dependent variable log of GDP along with set of independent variables log of CPI, log of real investment, log of real import and log of population have used. Thus multivariate regression can be expressed as

$$LGDP_t = \beta_0 + \beta_1 LCPI_t + \beta_2 LINV_t + \beta_3 LIMP_t + \beta_4 LPOP_t + \mu_t \quad 3.3$$

After satisfying the necessary condition for Engle Granger co-integration in which variables should be non -stationary in the level form and should be stationary at first difference, sufficient condition follows the stationary of the residuals term of regression. Residual term of regression model can be expressed as

$$\mu_t = LGDP_t - \beta_0 - \beta_1 LCPI_t - \beta_2 LINV_t - \beta_3 LIMP_t - \beta_4 LPOP_t + \mu \quad 3.4$$

This equilibrium represents the steady state of equilibrium among the variables. co integration among the variables show the common trend forming the stable relation in

long run. Estimated parameter can be observed as correct estimates for long run parameters as steady state of equilibrium due to the convergence nature of parameter. Then, residual term series can be used as error correction term in an Error Correction Model (ECM). In next step, unit root test of residual series is employed by using following ADF test:

$$\Delta\mu_t = \alpha + \pi\mu_{t-1} + \sum_{i=1}^k Y_i \Delta\mu_{t-1} + \vartheta_t \quad 3.5$$

Where

α = constant term, which is used to improve the efficiency of the estimate results.

Under the estimation, null hypothesis no co-integration among the variables implies co integration in I(1). This unit root test is applied for a variable obtained through derived form of regression and usual t distribution by Augmented Dickey Fuller test is not followed. Therefore, critical value must be tabulated through simulation. Significant value of π in above equation follows the co integration among the variables. Null hypothesis in above equation follows the no co-integration among the variables. Alternative hypothesis provides the co integration among the variables. If the dependent variable is co integrated, at least one regressor is integrated of same order. Co integration in the model leads to stationary I(0) to residuals. But, test does not provide variables are co integrating either all some or only one. Lack of co integration implies the residuals have the same stochastic as dependent variable possesses. The test is independent irrespective of which variable occurs in the left hand side of co-integration equation asymptotically. So, by choosing the one variable on the left side, co integration vector are said to be normalized around the variable. it assumes that normalization corresponds to some long run meaningful relation. But, it may not be corrected in limited samples. Therefore, sample matter for normalization process, (Perron, 1995). If the variables in the co integration vectors have larger differences in variances, it might be approximately integrated. Thus, such factors may affect the outcome of co integration test.

3.5.2. Error Correction Model (ECM) and Short Run Dynamics

Static equilibrium is shown by long run equilibrium by co-integration test. When structural and institutional changes occur in economy in short run, it is difficult to

explain long run dynamics. Therefore, it must be checked the short run relationship and short run dynamics. To study this, “the Error Correction Mechanism (ECM) is best alternative for assessing the short run dynamics structure of the model and hence it is used in the study (Compbell and Shiller, 1988). According to the” Granger Representation Theorem” if two time series variables are co-integrated then relationship between two variables can be examined as an Error Correction Model(ECM).After examining the co integration of long run relationship usual ECM can be expressed as:

$$\Delta y_t = \beta_0 + \sum \beta_i \Delta y_{t-1} + \Delta y_j \Delta X1_{t-j} + \sum \delta_k \Delta X2_{t-k} + \gamma EC_{t-1} + e_t \quad 3.6$$

$$\gamma EC_{t-1} = (y_{t-1} - a_0 - a_1 X1_{t-1} - a_2 X2_{t-1})$$

Where

a's are the OLS estimates of the long run equilibrium equation.

E_c = Error correction term

γ = error correction term or speed of adjustment parameter.

ECM can be estimated under the framework of co integrating relationship. Therefore, ECM used in this study can be specified as:

$$\begin{aligned} \Delta LGDP_t = & \alpha_0 + \sum_{i=0}^q \beta_{1i} \Delta LCPI_{t-i} + \sum_{i=0}^q \beta_{2i} \Delta LINV_{t-i} + \sum_{i=0}^q \beta_{3i} \Delta LIMP_{t-i} + \sum_{i=0}^q \beta_{4i} \Delta LPOP_{t-i} + \\ & \gamma ECT_{t-i} + e_t \end{aligned} \quad 3.7$$

Where, β_i 's are coefficients of the lagged first difference variables. γ Reflects to the rate at which variables adjust to the equilibrium state after structural or institutional shocks occurs. So, γ shows the speed at which error is corrected after occurring the shocks (Engle and Yoo, 1987). Moreover, inclusion of Error Correction Term (ECT) in above equation 3.7. Makes change in all variables in ECM equation. γ As speed of adjustment parameter of ECT shows convergence and divergence towards the long run equilibrium. Value of γ is expected to be negative such that system converges to equilibrium. The ECM is moreover based on assumption of Classical Linear Regression Model (CLRM) in which residuals are normally distributed, no autocorrelation of residuals and absence of correlation among the explanatory variables (Jarque and Bera, 1980).

3.6. Diagnostic Tests and Other Tests

3.6.1 Augmented Dickey Fuller (ADF test)

To check the stationary of the time series variable, Augmented Dickey Fuller (ADF test) statistic is used. Following regression model is run in (ADF test) in order to check unit root of variables or order of integration.

$$\Delta x_t = \eta + \gamma_t + \alpha x_{t-1} + \sum_{j=1}^k \delta_j \Delta x_{t-j} + \varepsilon_{1t} \dots\dots\dots (3.8.)$$

Where x_t is any variable used in this study, that is, GDP, Consumption, investment, CPI, population growth, total import. Δ Indicates the first difference operator and k is the length of lag which ensures residuals to have white noise empirically. The ADF statistic is simply the t-value of the coefficient α in equation (3.5). The null hypothesis is that x has a unit root, that is, $H_0: \alpha = 0$ and is rejected if the calculated ADF statistic is above the critical value implying that x_t has no unit root or x is stationary (Gujarati, Sangeetha & Peter 2011).

3.6.2 Residual Diagnostic Tests

- **JB Test For Normality**

The JB test for normality is an asymptotic or large scale test which is based on the OLS residuals. This test first computes the skewness and kurtosis measures the residuals which use the following statistic:

$$JB = n \left[\frac{S^2}{6} + \frac{(K-3)^2}{24} \right]$$

Where

N = sample size, S = skewness coefficient and K = kurtosis coefficient. For a normally distributed variable, $S=0$ and $K=3$. Therefore, the JB test of normality is a test of joint hypothesis that S and k are 0 and 3 respectively. In that case, the value of JB statistic is expected to be zero. Under the null hypothesis that the residuals are normally distributed, Jarque and Bera showed that asymptotically (i.e. in large samples) the JB statistic given follows the chi square distribution with 2 d.f. If the computed p value of the JB statistic in an application is sufficiently low, one can reject the hypothesis

that the residuals are normally distributed. But if p- value is reasonably high we do not reject the normality assumption (Gujrati,Sangeeta and Porter,2011).

- **LM Test for Serial Correlation**

One of the widely celebrated uses for LM serial test correlation is the Durbin- Watson d-statistic. In the models which contain lagged values of the regressand. The Durbin- Watson d-statistic is often around 2 implying that there is no first order autocorrelation. Thus, there is a bias against discovering first order autocorrelation in such models. This does not mean that autoregressive models do not suffer from autocorrelation problem. To solve this problem, Durbin has developed Durbin h-test but it is less powerful in statistical sense than the Breusch-Godfrey test popularly known as the LM test for serial correlation. The LM test allows for the lagged values of the regressand, higher order autoregressive scheme and simple or higher order moving averages• of the white noise error term. Thus, BG test is employed to check the serial autocorrelation in the model.

- **Heteroscedasticity Test**

Heterocedasticity arises due to different random error terms for different observations. In the violations of no heterocedasticity, variance of OLS estimates will be incorrect and thereby estimates will be inefficient. Under the assumption of no heterocedasticity in the given model, null hypothesis is there is no heterocedasticity and alternative hypothesis assumes there is heterocedasticity. In the model, heterocedasticity will be checked by BPG test.

3.6.3 Estimation Method of Threshold

Estimation method is carried out by the arbitrarily selection of k by OLS procedure. In the model, k is unknown and it is estimated along with other parameters. If K enters in the regression in a non- linear and non -differentiable manner so both OLS and non- linear least square are inappropriate. To avoid such difficulties, Khan and Senhadji has proposed conditional least square method initially developed by Hansen (1996,2000).For any k, model is estimated by OLS in which sum of square of residuals is considered as a function of k. The least square estimates of k are founded

by selecting the values of k which minimizes the sum of squared of residuals. Moreover it is given by

$$\bar{K} = [S_1(k)k = \underline{k} \dots \bar{k}]$$

Where $()$ is residual sum of squares for different values of threshold parameter -

In below refers to the lower value of threshold parameter and \bar{k} in upper refers to the upper value of threshold of parameter.

3.6.4 Confidence interval for threshold

In order to test null hypothesis of $Z=0$, the LR statistic is computed as follows:

$$1[\blacksquare] = \frac{1(0) - 1(\blacksquare)}{2}$$

Say \blacksquare be threshold

Where $1(0)$ is a likelihood ratio (LR) as function of threshold level, $1(0)$ is so residual sum of squares for given threshold (0) . And $1(\blacksquare)$ is residual sum of squares for threshold. Hansan (1999) has proposed that asymptotic distribution LR statistic having an inverse form which is defined by

$$() = -2 \log (1 - \sqrt{1 - ()})$$

Where, $()$ is a critical value $(1 -)$ is confidence interval test.

If $() \leq () \blacksquare$ then the null hypothesis of $H_0 = 0$ cannot be rejected

3.6.5 Diagnostic Tests for Threshold

In order to check the reliability of the estimation, different diagnostic tests are carried out in which R^2 is maximized and the RSS is minimized. LM test is used to check the autocorrelation; problem of heterocedasticity is checked by Bruesch Pagan Godfrey (BPG) test and normality by Jarque-Bera (J-B) test. Eventually, stability of the model is tested by Cumulative Sum of Recursive Residuals (CUSUM) test.

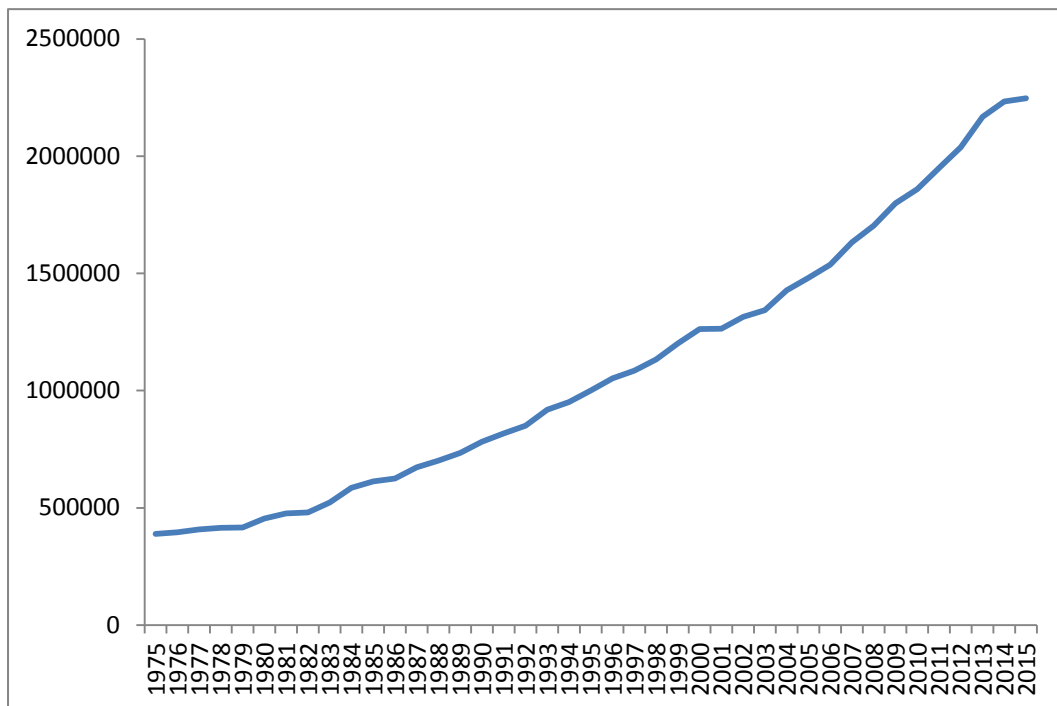
CHAPTER 4

ECONOMIC GROWTH AND INFLATION IN NEPAL

This chapter deals with the nature, trend and growth of GDP and inflation in Nepal. It provides the descriptive analysis of the macroeconomic variables under the study. For this, data has been presented in line, graph to analyze the nature trend and growth of the concerned variables.

4.1 GDP Growth in Nepal

Figure 4.1



Source: Quarterly economic bulletin, 2017

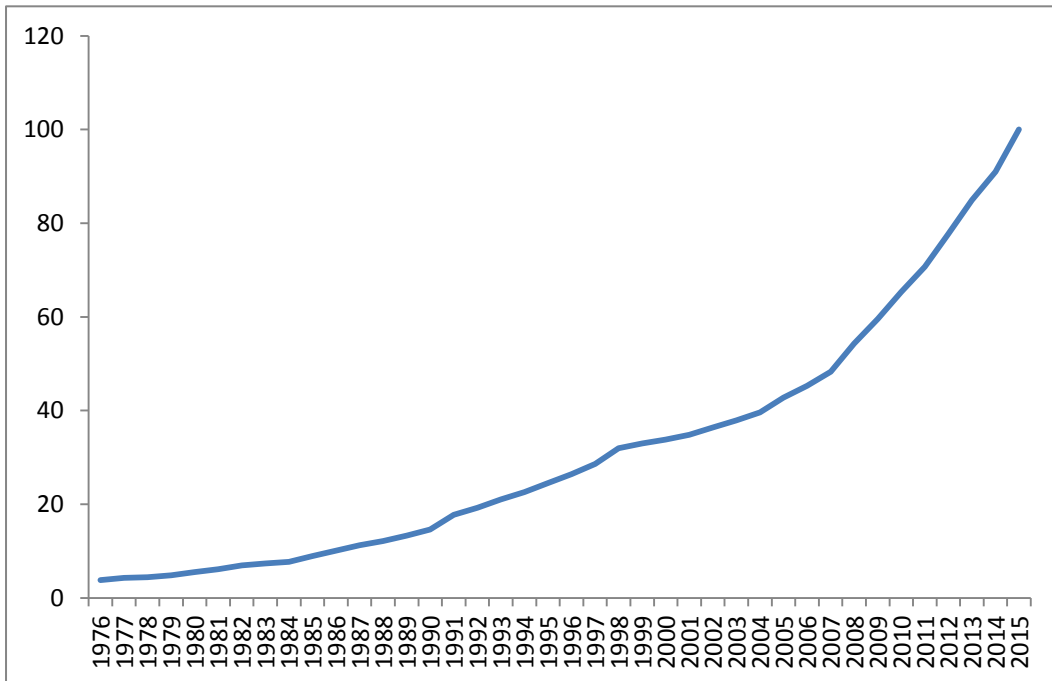
This above figure 4.1 explains the increase of real gross domestic product (RGDP). In fiscal year 1975/76, GDP was Nrs 389160.1 million, it reached to Nrs 782213.5 million in fiscal year 1990/91 and Nrs 2247427 million in fiscal year 2015/16. It shows real GDP is increasing at moderate level. From the period of fiscal year 1975 to 1980 increase in GDP seems constant. From the period of 1980 to the 2000, GDP has increased. This shows after the economic liberalization, GDP has increased. From the onwards 2000 to 2003, again GDP has increased at slower rate. This may be due to civil war. At that time, civil war has reached to the peak stage and economy was facing massive turbulence. After taking place the

comprehensive peace agreement, GDP has increased. In fiscal year 2014 and 2015, GDP seems constant. This may be due to obstacles in southern border of economy.

4.2 Inflation in Nepal

4.2.1 CPI Trend in Nepal

Figure 4.2

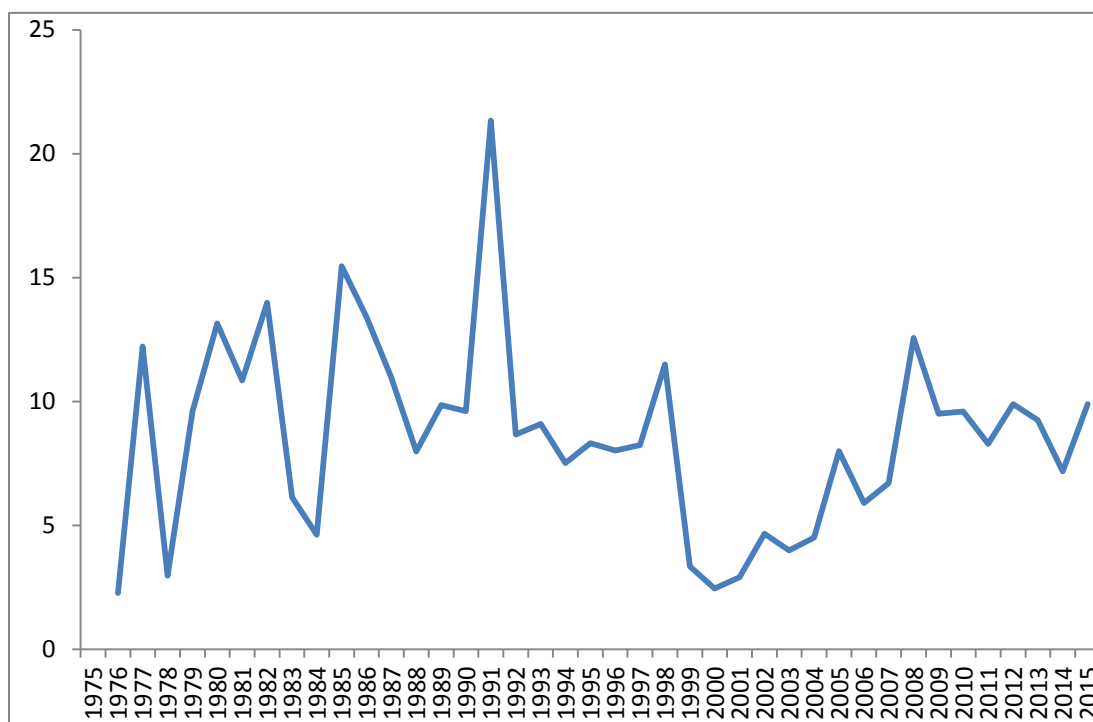


Source: quarterly economic bulletin, 2017

CPI in above figure 4.2 shows at increasing trend. Up to fiscal year 1988, CPI is raising at constant rate. From the period of 1980 to 2008, it increases at moderate rate. From fiscal year 2008, it has raised at rapid rate.

4.2.2 Over -all Inflation in Nepal

Figure 4.3

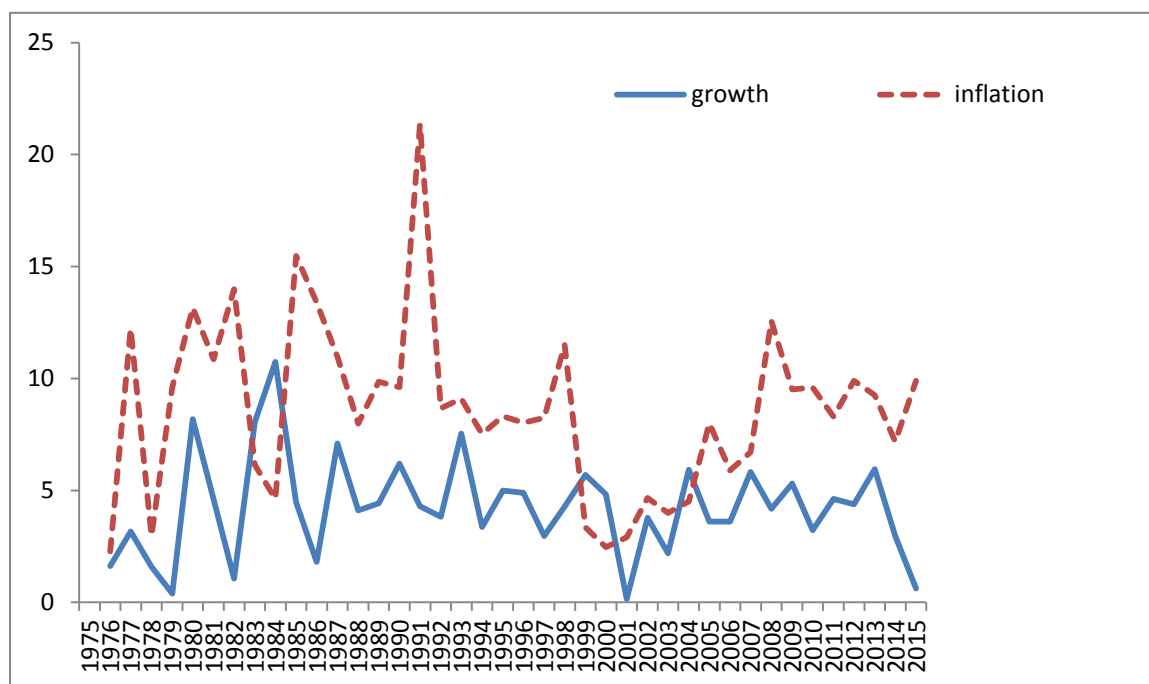


Source: Quarterly economic bulletin 2017

This above figure 4.3 shows the inflation trend in Nepal from the period of fiscal year 1975 to 2015. Inflation is positive in every subsequent fiscal year. Inflation rate seems higher at fiscal year in 1991. From the fiscal year 1991 to 2000, it has decreased. Again, from 2000 up to fiscal year 2009, it has raised. After that, it has declined to fiscal year 2011 and again rose. Empirical studies show that higher causes of inflation includes the budget deficit, exchange rate, import and expected inflation (Neupane, 1992)

4.3 GDP Growth and Inflation in Nepal

Figure 4.4

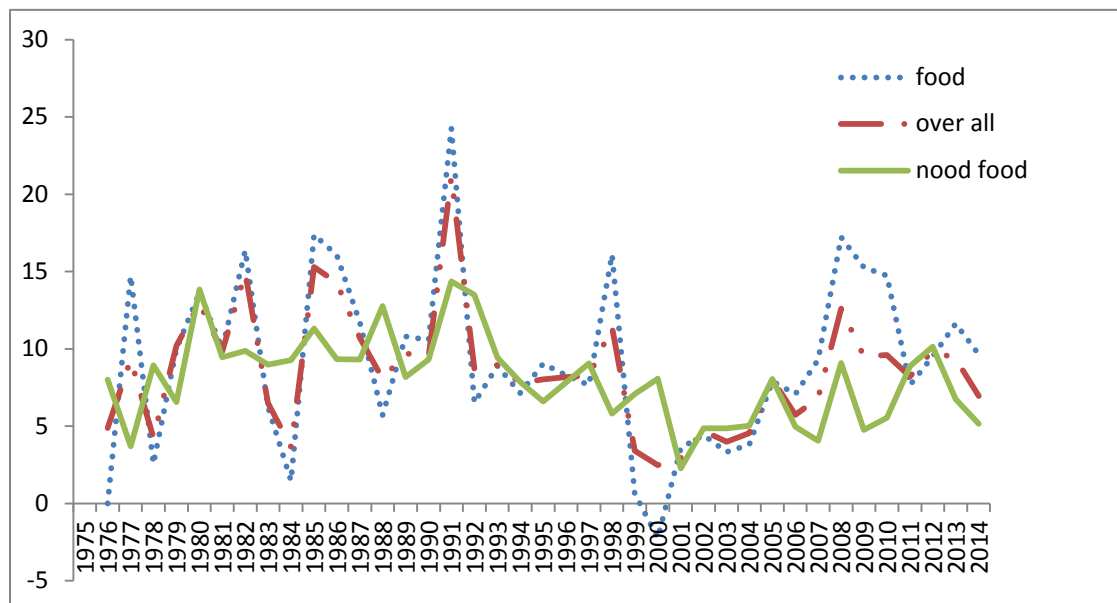


Source: Quarterly economic bulletin, 2017

Above figure 4.4 shows the relationship between GDP and inflation growth rate. Inflation is exceeding the economic growth rate in every fiscal year except some fiscal year like 1984, 2000 and 2004. Initially, at fiscal year 1976, economic growth rate and inflation were same. After that, both have increased but rate of increase of inflation is higher compared to economic growth. In fiscal year 1991, inflation rate is higher. This shows more discrepancy between inflation and economic growth. From the fiscal year 1991, inflation started decreasing up to 2000. Again, it started raising up to fiscal year 2009. Then, it started falling. Economic growth rate at 2001 is lowest reaching to zero. This may be due to civil insurgency. At that time civil war has reached to peak situation. After taking place comprehensive peace agreement, economic growth rate started increasing. This may be due to investment friendly environment. Entrepreneurs may be induced towards investment. After 2013, economic growth rate has decreased. This may be due to uncertainty of constitution promulgation and political transition. At fiscal year 2015, economic growth rate is near to zero percent. This may be due to obstacles in southern border of the country. This graph has moreover shown the positive correlation between inflation and economic growth in Nepal when inflation rate is lower. But, at higher inflation rate negative correlation between inflation and economic growth have been observed.

4.4 Food, Non -Food and Overall Inflation in Nepal

Figure 4.5

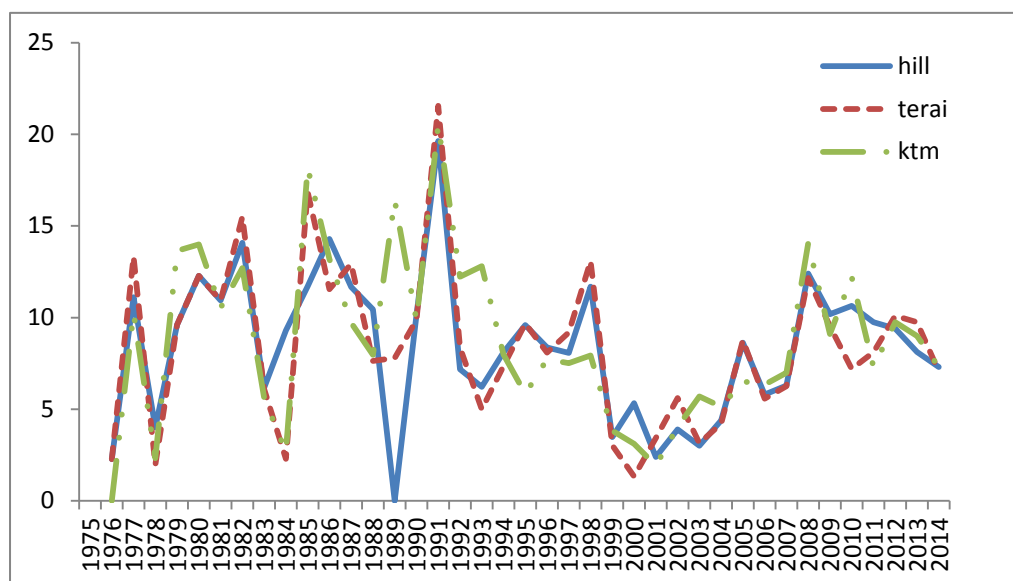


Source: Quarterly economic bulletin, 2017

This above figure 4.5 shows the food, non- food and over- all inflation from the period of 1975 to 2015. From the figure, it shows share of food inflation seems higher compared to non- food inflation. Food inflation has higher in fiscal year 1991 and reached to negative in fiscal year 2000. Higher rate of food inflation in 1991 may be due to structural change of economy from state led economy to market oriented economy. Again, negative rate in 2000 may be due to higher demand on arms weapons due to massive civil war. Nepal food production largely depends upon on agricultural productivity. Its production moreover depends on monsoon. Favorable monsoon raises the food production and vice versa. Thus, fluctuation in food inflation can be interpreted by production level of food determined by monsoon.

4.5 Distribution of Inflation in Nepal

Figure 4.6



Source: Quarterly economic bulletin 2017

From the above figure 4.6, inflation distribution has been shown in Terai, Kathmandu valley and Hill region. From the graph, it shows inflation distribution is highly associated with Kathmandu valley then Terai region and Hill region respectively. More inflation in Kathmandu valley than Terai region may be due to higher demand in this region due to high density and population. Since, approximately half of the population resides in Terai region. Kathmandu valley is highly populated place. It seems that inflation in such regions is driven due to higher demand of food. More fluctuation of inflation in hill region may be due to agricultural production. The more production in the year in hill region the less inflation may have and vice versa.

CHAPTER FIVE

ANALYSIS OF DATA

This chapter deals with the relationship of inflation and other variables introduced in model with economic growth to identify impacts and responsiveness. Long run relation of concerned variables developed in the model have been established by co-integration test and short run dynamics has been carried out by Error Correction Model (ECM). Moreover, threshold level of inflation has been estimated by maximizing R^2 by Khan and Senhadji model (2001). Thus, Conditional Least Square Technique (CLST) has been discussed to identify the threshold level of inflation. Time series properties of the variables have been carried out by Augmented Dickey Fuller (ADF) test for unit root. Similarly, other diagnostic tests have been carried out for the robustness of the model. For the stability test of the threshold level, CUSUM test has been employed.

5.1 Time Series Properties of the Variables

The underlying assumption to use the co-integration developed by Engle and Granger (1987) by using the conditional least square should be stationary for the variables in first order. Residuals after running the ordinary least square must be stationary at the level form to exist the long run relation between inflation and economic growth and other variables in the model. Any variables non stationary in the first difference violates the basic criteria to carry out this model. Again stationary in the level form violates the assumption. Thus, concerned variables must be stationary at first difference $I(1)$. Before conducting the unit root test, trend of variables are plotted below.

Fig 5.1

Time series plot of $LRGDP_t$ and $LRIMP_t$

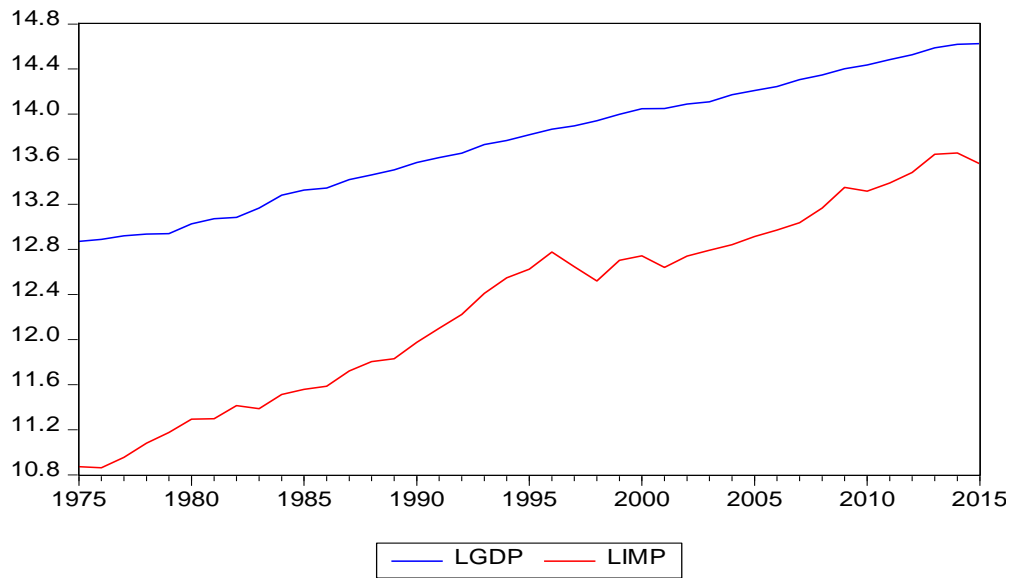


Fig 5.2

Time series plot of $LRINV_t$ and $LRIMP_t$

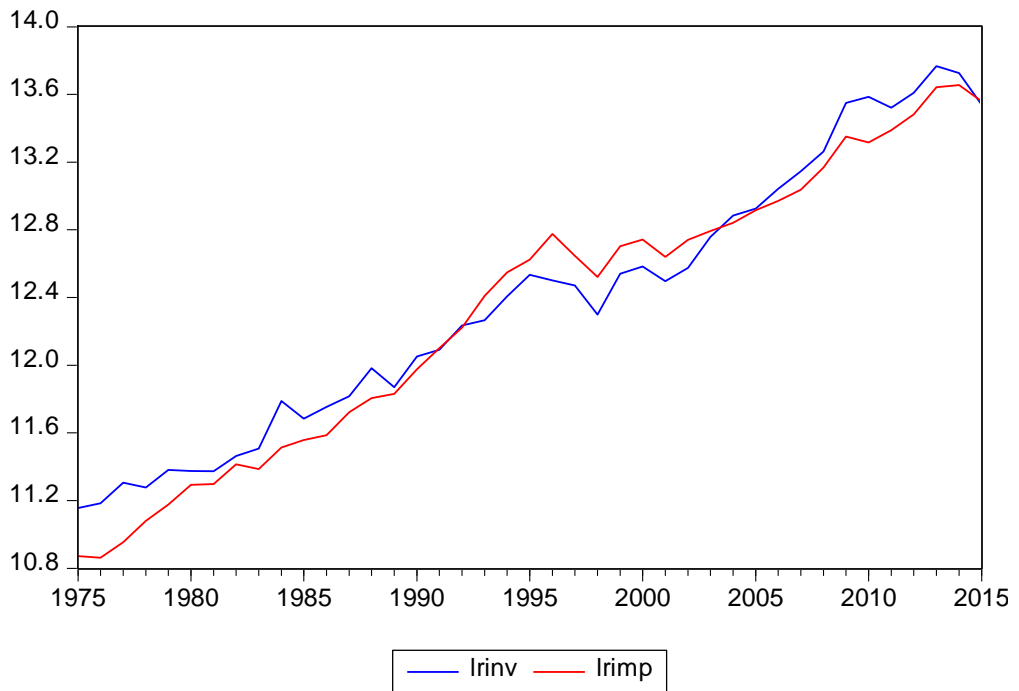
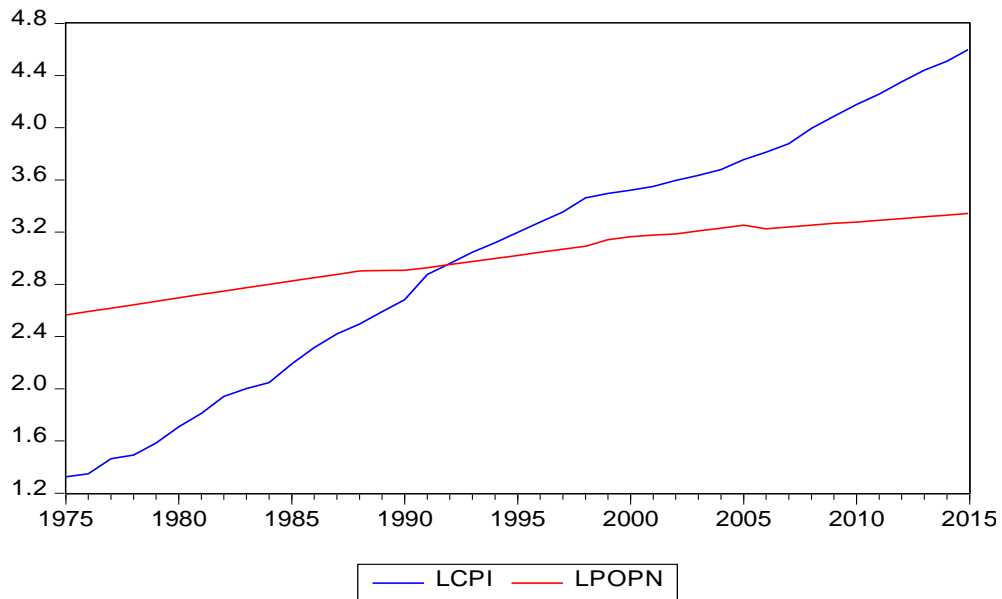


Fig 5.3
Time series plot of $LRCPI_t$ and $LPOPN_t$



5.2 Unit Root Test Result of the Variables

Unit root test of the variables is examined by the Augmented Dickey Fuller (ADF) test and result is shown below in table.

Table 5.1

Variables	Level		First difference		Remarks
	Intercept only	Intercept and trend	Intercept only	Intercept and trend	
Log(GDP)	-0.4956 [0.88]	-1.718 [0.72]	-6.0135 [0.0000]*	-5.4997 [0.0003]	I(1)
Log(CPI)	-1.06 [0.88]	-1.54 [0.7970]	-5.11691 [0.0001]*	-5.3178 [0.0005]	I(1)
Log(IMP)	-0.976 [0.75]	-1.89 [0.638]	-5.8408 [0.0000]*	-5.8655 [0.0001]	I(1)
Log(INV)	-0.55 [0.87]	-2.918 [0.16]	-6.8937 [0.0000]*	-6.7659 [0.000]	I(1)
Log(POPN)	-4.15 [0.325]	-0.67 [0.9687]	-4.4484 [0.00016]*	-5.19588 [0.0007]	I(1)

Note: * represents the less than 1 percent level of significance of the concerned variables and numeric value between [] express corresponding p- values.

Source: Author's calculation through eviews-9.

All the variables after converting into logarithm are integrated in first order I(0). These variables are integrated at 5 percent level of significance. It is justified in above table 5.1. So, necessary criteria for using the Engle Granger test for co integration have been fulfilled. For the long run dynamics of the variables, we will carry out Engle Granger test to co- integration and short run analysis will be carried out by error correction model.

5.3 Long run relationships and short run dynamics

For this, we use Engle Granger co- integration test and Error Correction Model (ECM) respectively.

5.3.1 Engle Granger co-Integration Test

This test is based on the run of Ordinary Least Square method of regression (OLS) as suggested by Engle and Granger (1987). Long run dynamics of the variables exist between inflation and economic growth including the concerned variables in the model if residuals term after regression is stationary in level form. Moreover, interpretation of the model is usual as regression analysis given by the coefficients. After run of the model, there is presence of auto correlation. So, to avoid this robust least square is applied. Since, it automatically avoids the problem of autocorrelation giving robustness of the model. It follows the normal distribution which is checked by the JB test. Sufficient condition for the EG test is checked by the unit root test of residual term of regression. Result of residual term for unit root test is given below.

Table 5.2

Variable	Level		Remark
	Intercept	Intercept & trend	
ECT	-0.5971 [0.0001]	-0.6086 [0.0002]	I (0)

Source: Author's calculation from evIEWS-9

From the above table 5.2.residual term of regression is integrated in level form both in intercept and trend and intercept at 5 percent level of significance. Therefore, it shows that co integration between variables exists in the model. This provides us guideline to use the OLS for long run relation among the variables in the model. Regression result is shown below in the table.

Table 5.3

Regression result of equation after correcting the autocorrelation

Dependent variable: Log(GDP)				
Method: Robust least square				
Number of observation: (41) after adjustment.				
variable	coefficient	Std.error	z-statistic	prob
C	3.1782	0.45182	7.03431	0.000
Log(CPI)	0.01901	0.01426	1.8232	0.0483
Log(INV)	0.40068	0.00489	8.1840	0.000
Log(IMP)	-0.15164	0.0959	-1.5809	0.1139
Log(POPN)	0.727248	0.24073	3.020895	0.0025
R-squared: 0.8209				
Adjusted R-squared : 0.8010				
Prob F (stat): 0.000				
Durbin Watson statistic: 1.173124				

Source: author's calculation through eviews-9.

In above table, it has been found p- values of independent values smaller close to zero except real import which means the regression coefficients are statistically significant at five percent level. Adjusted R^2 is 0.8010 which is very high showing the meaning that variations in GDP are well explained by changes in the explanatory variables introduced in the model. Presence of autocorrelation in the model has been removed by using the robust least square so far as there is no problem of heteroscedasticity and multicollinearity. Normality check by JB test shows that residuals are normally distributed. Residuals test of regression is stationary at level form with p- value

(0.0019) having statistically significant at below 1 percent level. By ADF test of residuals term which is stationary at level form shows the existence of long run relation between inflation and economic growth in Nepal. The estimated long run function of economic growth explained by set of dependent variables in long run is expressed as:

$$LGDP_t = 3.1782 + 0.0190LCPI_t + 0.4006LINV_t - 0.1516IMP_t + 0.7272POP_t$$

Positive coefficient of CPI with statistically significant indicates that in long run inflation positively influences the economic growth. Moreover, this finding is similar to the analysis of Keynesian theoretical analysis framework inflation before vertical AS positively influences the economic growth and Phillip curve analysis. This conclusion is similar to Tobin substitution effect, Mundell effect of new classical growth theory inducing the entrepreneurs to dose more and more investment implying the capital accumulation and thereby effective resource mobilization and economic growth. This conclusion is similar with the empirical study of Mortza (2005), Mamamb (2016). Expression of CPI in log form interprets inflation significantly impacts economic growth in positive way. Increase in inflation by 1 percent increase the economic growth by 0.019 percent. In similar way, real import volume negatively triggers the economic growth. Since, negative value of coefficient indicates that import reduces the economic growth. But, this result is statistically insignificant. This may be true in Nepal that share of import seems higher as compared to export in economy through the reduction in capital formation and deficit in BOP. Higher level of import may deteriorate the service sector, manufacturing sector and domestic investment of goods and services. Thus, in long run, in condition of fully utilization resources, import can be independent of economic growth. Investment in above table shows the positive impact on economic growth. This is statistically significant at below 1 percent level. This is true since investment is assumed to be measuring rod of economic growth. In economic literature, every theory from the classical to new Keynesian in time line and proximate theories like Harrod –Domar, Endogenous growth theory accept this validity. Positive coefficient of population tells that population growth rate raises the economic growth. This is similar to the classical theory of growth that population is one of the major rods of economic growth.

Through the access of labor in the labor market, cheap and easy supply of labor and intense competition in labor market, it may trigger the economic growth.

5.3.2 Error Correction Model (ECM) to Short Run Dynamics

Engle Granger test examines the long run static equilibrium. Even if there exists long run dynamics of the variables introduced in the model, there may be disequilibrium in the relation in short run due to the structural and institutional changes. Therefore, it is observed by ECM model. For this, firstly regression equation in difference form is run incorporating the residual term of regression. Then, residual term of such run regression is checked for stationary. After checking the stationary of residual, it has been found stationary in level form. This shows the existence of short run dynamics. Moreover, if disequilibrium exists at what speed it converges to the equilibrium is measured by the value of adjustment parameter. Result of ECM is given below in table 5.4

Table 5.4

The estimation result of the Error Correction Model

Dependent variable: $\Delta L(\text{GDP})$				
Method: Robust least square				
Number of observation : 40 after observation				
variable	coefficient	Std. error	z-static	probability
C	0.0189	0.0076	2.5929	0.0095
$\Delta L(\text{CPI})$	-0.022337	0.1671	-1.336	0.0181
$\Delta L(\text{INV})$	0.0629	0.0070	0.8977	0.36
$\Delta L(\text{IMP})$	0.1721	0.0991	1.850	0.064
$\Delta L(\text{POP})$	-0.0874	0.50413	-0.17402	0.8618
EC_{t-1}	-0.755202	0.158164	-4.7747	0.000
R-squared : 0.4270				
Adjusted R-squared : 0.322				
S.E. of regression: 0.0174				
Durbin-Watson statistic : 1.512				
F- statistic : 0.0001				

Source: Author's calculation from eviews-9.

In above table 5.4, coefficient of ECM (γ) has negative sign which satisfies the theoretical expectation that short run inflation converges to the long run equilibrium point. In other words, the negative coefficient of γ can be interpreted in case of any disequilibrium, it will be back towards its long run equilibrium path. The speed of adjustment is determined by the magnitude coefficient. Based on the above table 5.4, the value of coefficient for the Error Correction term is 0.755 implying that 75 percent of the speed of adjustment operates to come to path of equilibrium in long run from short run due to the institutional and structural shocks in short run. Estimated short run function of real economic growth explained by independent variables is expressed as follows:

$$\Delta LGDP_t = 0.0189 - 0.02237 \Delta LCPI_t + 0.06291 \Delta INV_t + 0.1726 \Delta LIMP_t - 0.0874 \Delta LPON_t - 0.7552 ECT_{t-1}$$

In short run, inflation negatively influences the economic growth. This is statistically significant at 1 percent level. This result is similar to theoretical framework of classical economics that inflation negatively impacts the economic growth by tax distortion, reduction in the profitability of firms and monetarist's argument negative relation between inflation and growth. This is also similar to the conclusion of monetarist long run Phillip curve analysis. This conclusion is similar to the empirical findings of Erbaykal and Okulan (2008), Faria and Carnelro (2001). Through the diversification of resources, disincentive in productive investment and reduction in aggregate demand of goods and services, inflation may negatively impact over economic growth in short run. Increase in inflation by 1 percent reduces the economic growth by 0.0223 percent. Investment in short run positively influences the economic growth. However, this is statistically insignificant at 5 percent level of significance. This may be due to non-productive investment in real estate and interest bearing assets. It may suggest us to invest in capital accumulation. Import has positive impact on growth, but this is statistically insignificant at 5 percent level of significance. This may be due to higher capital outflow and imbalances between import and export. More capital outflow may adversely affect in capital accumulation and depreciation of domestic currency. It moreover affects in import of capital goods. Import of more consumption goods reduces the economic growth. Population growth rate negatively influences the economic growth. However, it is statistically insignificant. This may be due to higher outflow of labor forces to foreign employment, brain drain, lack of production of efficient, productive and qualitative manpower, lower level of investment in human resources, low focus on human capital formation. In short, inflation negatively influences the economic growth in short run and other variables seem independent.

This above result in table 5.4 been obtained after removing the serial correlation by using robust least square. Moreover, heteroscedasticity, normality are tested and all are significant. Similarly, above table 5.4 shows that adjusted R^2 is 0.322. This means variations in the dependent variable in the model are explained by changes in independent variables. S.E. of regression is 0.017 and value of D-W test 1.512 near to 2 implies no presence of autocorrelation. F statistic is 0.0001 implying the joint effects of set of independent variables significantly. In conclusion, it shows economic growth is negatively influenced by inflation in short run.

5.4 Estimation of Threshold level of Inflation

This part deals with the empirical analysis of threshold level of inflation.

5.4.1 Estimation of threshold level

As stated in the chapter three, conditional least square (CLS) technique is used to carry out the threshold level of inflation. The criteria of the OLS technique is to identify the desirable level of inflation that maximizes the R^2 or one that minimizes the residual sum of squares (RSS) among the different ascending values kept as a threshold. Variables used to estimate the threshold level of inflation are transferred into log and taken difference. For the inference of threshold level estimation, following hypothesis is constructed:

$H_0 = 0$, there is no existence of threshold.

$H_1 = 1$, there is existence of threshold.

For existence of threshold, along with the high R^2 of corresponding variables using the dummy, there should be simultaneously significant value given for dummy. Other usual properties are same as that of Classical Linear Regression Model (CLRM). In estimation of threshold level of inflation, value of threshold as dummy is chosen arbitrarily in ascending order from 3 percent to 11 percent respectively. Moreover, threshold estimation is given below in table 5.5.

Table 5.5.

CLS Estimation of the inflation threshold

Dependent variable: $\Delta L(\text{GDP})$

Method: Ordinary least square

Number of observation: 40 after adjustments

k	Variable	coefficient	Std.error	t-statistics	p-value	R ²
4	C	-0.0040	0.0112	-0.3628	0.7190	(0.549)*
	ΔLCPI	-0.0984	0.1131	-0.8695	0.3908	
	D ₄ (INF-4)	0.034	0.0105	3.3256	0.0028	
	ΔLINV	0.0495	0.0361	1.3712	0.1796	
	ΔLIMP	0.0185	0.0491	0.3774	0.7083	
	ΔLPOP	0.5090	0.2669	1.906	0.0563	

Source: Author's calculation from eviews-9

Note: * represents existence of threshold level of inflation.

From above table 5.5, it has been found high R² as (0.549) at 4 percent level with lower standard errors (S.E.) (0.0171). In this situation, above null hypothesis no threshold exist can not be accepted. At 4 percent level, threshold of inflation exists in Nepalese economy in which it is statistically significant at less than one percent level of significance. At threshold level, consumption positively affects the economic growth which is statistically significant. In similar way, investment, import, population growth positively influences the growth. However, they are statistically insignificant. From above observation, higher inflation above the threshold level will jeopardize economic growth. Since, the coefficient value given by the dummy is lower. However, growth will not be much affected below the threshold level. Since, coefficient for D₃ is slightly lower compared to coefficient of D₄ (details of estimation of threshold is given in appendix). At the threshold level, inflation positively promotes the economic growth. Inflation below threshold level also positively promotes the economic growth, but lower than threshold level. Hence, lower level of economic growth will be attained below and above the threshold level of inflation. Positive economic growth can be attained up to 6 percent level of inflation. When inflation reaches to 7 percent, inflation negatively impacts over economic growth. Therefore, beyond the 7 percent level of inflation, economic growth will be reduced. This conclusion is similar to the theoretical analysis of new Keynesian theory mild level of inflation is desirable to promote the economic growth. Thus,

above table 4.6 shows 4 percent optimum level of inflation that economy absorbs without affecting the economic growth.

5.4.2 Diagnostic Tests

Diagnostic tests are carried out to check whether the model estimated is robust or not for threshold level of inflation at 4 percent level. As stated above in chapter 3, diagnostic tests include normality test, serial correlation test, heteroscedasticity test and cumulative sum (CUSUM) test of Recursive Residuals. Result of the diagnostic tests is shown below in table 5.7

Table 5.6

Diagnostic tests for threshold level of inflation

Test	Test statistic	P-value	Conclusion
Normality test (JB test)	1.896	0.387	Residuals are normally distributed.
Serial correlation (LM-test)	63.64	0.21	No serial correlation
Heteroscedasticity test(Breusch-Godfrey test)	2.99	0.8094	No heteroscedasticity
Stability (CUSUM test)	Within the bands		stable

Source: Author's calculation from eviews-9.

From above table 5.7.residuals are normally distributed. It is checked by JB test. Autocorrelation is checked by LM serial (BPG) test and which gives no auto correlation. By using Breusch-Godfrey test, heteroscedasticity has been checked. So, chi-square value (0.8094) shows acceptance of null hypothesis implying no heteroscedasticity.

Eventually, the estimation of threshold level of inflation shows at 4 percent level, inflation makes positive significant impact in economy. This result is similar to the findings of satarov (2011) in Finland (4 percent) threshold, Mubarik (2005) in Pakistani economy suggested to be 9 percent threshold, and Ahmed and Mortazan(2005) 6 percent level in Pakistan. Based upon the results of this chapter, next chapter provides a conclusion and recommendations.

CHAPTER: SIX

SUMMARY CONCLUSION AND RECOMMENDATION

Higher economic growth rate coupled with the lower level of inflation is always preferred by the policy makers in every economy. Inflation and growth theories make the center place for their analysis in macro-economic literature. Moreover, various growth theories have either directly and indirectly included the analysis of inflation. Inflation is associated with the both demand side and supply side phenomena as well as structural and circumstantial aspects. However, it is most significantly associated with the money supply exogenous variable. Despite of excessively discussed subject of relation between inflation and economic growth in literature, very few empirical studies have been carried out in Nepalese context. Monetary institutions aim at keeping the inflation within the limited bands. This study examines the relation between inflation and economic growth along with other concerned variables incorporated in the model. Other relevant variables like real investment, real import and population growth have been incorporated to conduct this nexus. Long run relation has been estimated by using the Engle -Granger co - integration test (1987) and short run dynamics has been made by Error Correction Model (ECM). Threshold level of inflation has been estimated by using the Khan and Senhadji (2001) model of Conditional Least Square (CLS) method

6.1 Summary of the Findings and Conclusions

Since, this study has aimed at establishing the nexus between inflation and economic growth and other variables included in the model are real investment, real import, and population growth. After employing the Engle Granger co-integration test and Error Correction model for long run and short run dynamics respectively, threshold level of inflation has been estimated. The major findings and conclusions of the study are:

- Inflation growth rate is higher compared to economic growth rate in study period. Inflation distribution in Kathmandu valley followed to terai seems higher compared to hill region. Inflation of food is higher compared to non food.

- Co-integration between economic growth, inflation and other concerned variables in the model exists.
- In long run, most significant determinants of economic growth include the inflation, real investment, and population growth. These all variables are statistically significant at 5 percent level of significance. However, import is independent showing statistically insignificant with negative impact.
- Positive sign of coefficients of inflation, real investment and population shows these variables positively influence the economic growth in long run.
- Statistically insignificant and negative relation of import to economic growth shows no long run relation in between two variables. It can be due to the reason of higher import compared to lower export through massive outflow of capital, foreign exchange instability (depreciation of domestic currency), adverse impact in domestic service, manufacturing and small infant industries.
- In short run, economic growth is negatively influenced by inflation. Negative sign of coefficients of inflation indicates it negatively influences the economic growth in short run. This finding is similar to the theoretical framework of classical and monetarist short run analysis. However, real investment, real import and population are independent of growth in short run. Though, positive sign of coefficient of investment and import indicates that they positively influence and negative sign of population implies population growth inversely influences the economic growth. This may be due to the massive unproductive investment, lack of investment in human capital formation, capital goods, larger ratio of export and import, raising level of consumption on luxurious goods and investment in interest bearing non-productive assets.
- Error correction coefficient provides the negative sign implying that at 75 percent of speed of adjustment, economy converges to the long run equilibrium due to previous shocks in short run in economy.
- This study finds 4 percent level of threshold inflation in Nepalese economy. Inflation above threshold level provides lower economic growth. But, to keep

the inflation below the threshold level is desirable to get higher economic growth rate compared to above the threshold level. Beyond 7 percent level of inflation, economic growth will be negatively affected. This finding of threshold level of inflation is sharply contrasted with the conclusion of Bhattarai (2014) no existence of threshold level of inflation and somehow similar to the finding of Bhusal and Silpakar (2011) 6 percent level of inflation.

6.2. Recommendations

From the empirical study, following recommendations have been provided.

- This study shows the higher rate of inflation in Kathmandu valley then terai region and in food item. It shows the more distribution of inflation is in populated place. So, it may indicate Nepal's inflation as demand pull inflation. It may be influenced by massive import, expected inflation and more population in such region. It should be kept within limited band by compensating the demand of people. It should be kept in controlled situation by raising the investment and output. Graphical visualization between inflation and economic growth shows that lower investment has positively correlated with economic growth and vice versa. Thus, inflation should be kept at lower level.
- This study found the long run relationship between inflation and economic growth. In long run, economic growth is positively influenced by the inflation. So, growth is inflation responsive. Through the empirical study, it has been found the 4 percent level of threshold inflation in Nepalese economy. Thus, inflation above the threshold level lowers the economic growth. Similarly, real investment, real consumption and population growth positively influences the economic growth in long run.
- From the empirical evidence, even if inflation and economic growth have positive relation in long run, it has been found 4 percent level of threshold inflation. If inflation crosses the threshold level, economic growth will be reduced. So, by keeping the inflation at threshold level, more economic growth could be attained. Fourteen plan has aimed to keep inflation at 7.5

percent level. If it is kept within the expected bands, real economic growth will be reduced during plan period. Thus, if inflation will be kept within the threshold level, more real economic growth could be generated.

- Monetary policy is released by NRB in every fiscal year .it aims at keeping the money supply at targeted rate after releasing the budgetary policy by Government of Nepal (GON) supporting to meet the economic growth laid by GON. Existence of threshold level of inflation as 4 percent suggests that monetary institution should try to release the tight monetary policy desirable in economy. High inflation may diverse the resources towards unproductive expenditure and speculative behaviors. This moreover distorts the economic growth. Thus, by adopting the inflation control measures, inflation should be kept at moderate level in threshold. Monetary institution, Ministry of Finance (MOF) and other administrative bodies including concerned stakeholders should work together to keep inflation at threshold level. Monetary institution should work by well liquidity management and MOF should adopt the fiscal measures to keep inflation at threshold level so that more economic growth could be attained.
- Real investment has statistically positive influence to boost up economic growth in long run. Therefore, more investment should be made through productive mechanism. By efficient allocation of available resources substituting the import and raising export, more growth could be generated. For sound, sustainable self- reliant, and broad based economy, investment friendly environment should be made by GON through various investment attractive schemes, policy consistency including political and economic stability.
- Import has been found to deteriorate the economic growth in long run in Nepalese economy with statistically insignificant relation. Policy makers should follow the import substitution strategies by mobilizing the domestic resources. Thus, excessive import should be controlled either of raising export

or producing more goods and services in domestic economy through productive investment.

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APPENDIX-A

(RAW DATA)

In RS 10 millions

Year	Gdp	Cpi	Investment	Import	Population	Gdp deflator
1975	17394	3.762935	2632	1981.7	13	12.78
1976	17280	3.848456	2768	2008	13.35	12.49
1977	19732	4.318823	3507	2469.6	13.7	13.81
1978	22215	4.447105	3514	2884.7	14.07	15.3
1979	23351	4.874711	4270	3480.1	14.44	16.02
1980	27307	5.516121	4808	4428.2	14.83	17.2
1981	30988	6.11477	5314	4930.3	15.22	18.62
1982	33761	6.969982	6628	6314	15.62	20.07
1983	39390	7.397588	7351	6514.3	16.03	21.53
1984	46587	7.739673	10184	7742.1	16.45	22.73
1985	55734	8.936971	10599	9341.2	16.87	25.98
1986	63864	10.13427	12898	10905.2	17.3	29.23
1987	76906	11.24604	15237	13869.6	17.75	32.7
1988	89270	12.14402	19415	16263.7	18.22	36.4
1989	103416	13.34132	19076	18324.9	18.27	40.3
1990	120370	14.62413	25074	23226.5	18.3	44
1991	149487	17.74566	31619	31940	18.68	52.3
1992	171474	19.28504	39653	39205.6	19.13	57.7
1993	199272	21.03823	44644	51570.8	19.59	62
1994	219175	22.62037	55231	63679.5	20.05	65.9
1995	248913	24.50184	68017	74454.5	20.53	71.1
1996	280513	26.46883	71084	93553.4	21.02	76.2
1997	300845	28.64962	74728	89002	21.53	79.3
1998	342036	31.94219	70061	87525.3	22.04	86.3

1999	379488	33.0112	92272	108504.9	23.15	90.3
2000	441519	33.82366	98649	115687.2	23.67	100
2001	459443	34.80715	93019	107389	23.97	103.9
2002	492231	36.43205	105383	124352.1	24.2	107.1
2003	536749	37.88591	131671	136277.9	24.75	114.4
2004	589412	39.59634	155907	149473.6	25.3	118
2005	654084	42.76063	175633	173780.8	25.87	126.2
2006	727827	45.2835	208779	194694.6	25.18	135.4
2007	815658	48.31951	247272	221937.7	25.53	142.9
2008	988272	54.39152	313029	284469.6	25.89	165.9
2009	1192744	59.56555	456489	374335.2	26.25	189.6
2010	1366954	65.28265	519268	396176	26.49	210.3
2011	1527344	70.70042	526889	461668	26.85	224.1
2012	1695011	77.70033	632601	556740	27.21	237.8
2013	1964540	84.88839	808758	714366	27.58	259.2
2014	2130150	90.99034	831983	774684	27.95	272.7
2015	2247427	100	757680	773599	28.33	285.93

Source : Economic survey, various issues, MOF

Quarterly Economic Bulletin, NRB

APPENDIX-B

PROCESSED DATA

year	lrgdp	lrcpi	lrinv	lrimp	lpopn
1975	12.87175	1.325199	11.15547	10.87168	2.564949
1976	12.88812	1.347672	11.18338	10.86239	2.591516
1977	12.92035	1.462983	11.3047	10.954	2.617396
1978	12.93642	1.492253	11.27743	11.08009	2.644045
1979	12.9403	1.584061	11.38048	11.17593	2.670002
1980	13.02574	1.707675	11.37553	11.29324	2.696652
1981	13.07287	1.810707	11.37256	11.29762	2.72261
1982	13.08358	1.941613	11.46262	11.41408	2.748552
1983	13.16757	2.001154	11.50661	11.38577	2.774462
1984	13.28114	2.046359	11.78738	11.51324	2.800325
1985	13.32677	2.190197	11.68349	11.55716	2.825537
1986	13.34506	2.315923	11.75408	11.58624	2.850707
1987	13.41871	2.420016	11.81664	11.72261	2.876386
1988	13.4606	2.496837	11.98213	11.80502	2.90252
1989	13.50591	2.590866	11.87049	11.83032	2.90526
1990	13.56988	2.682673	12.05208	11.97555	2.906901
1991	13.61372	2.876141	12.09054	12.10064	2.927453
1992	13.65268	2.95933	12.23376	12.22242	2.951258
1993	13.73104	3.046341	12.2653	12.40954	2.975019
1994	13.76523	3.118851	12.4056	12.54794	2.998229
1995	13.81652	3.198748	12.53393	12.62437	3.021887
1996	13.86676	3.275968	12.50082	12.77549	3.045474
1997	13.89686	3.35514	12.47164	12.64644	3.069447
1998	13.94059	3.463928	12.29836	12.52093	3.092859
1999	13.99919	3.496847	12.54082	12.70287	3.141995
2000	14.04855	3.52116	12.58333	12.74266	3.164208
2001	14.05009	3.549823	12.49591	12.63956	3.176803

2002	14.08869	3.595449	12.57508	12.74059	3.186353
2003	14.10933	3.634579	12.75865	12.79304	3.208825
2004	14.17194	3.678737	12.88345	12.84131	3.230804
2005	14.20887	3.755618	12.9257	12.9151	3.253084
2006	14.24533	3.812943	13.04126	12.97141	3.22605
2007	14.30535	3.877835	13.14558	13.03749	3.239854
2008	14.34808	3.996208	13.26301	13.16734	3.253857
2009	14.4026	4.087077	13.54941	13.351	3.267666
2010	14.43531	4.178726	13.58662	13.31606	3.276767
2011	14.4827	4.258452	13.52146	13.38932	3.290266
2012	14.52752	4.35286	13.60991	13.48216	3.303585
2013	14.58892	4.441337	13.76709	13.64298	3.317091
2014	14.61908	4.510753	13.72598	13.65463	3.330417
2015	14.6253	4.60517	13.53802	13.55881	3.343921

Source : Economic survey, various issues, MOF, CBS

Quarterly Economic Bulletin NRB

APPENDIX-C

PROCESSED DATA FOR THE EXISTENCE OF THRESHOLD INFLATION

Year	Lrgdp	Lrcpi	Inflation	D_4	Lrinv	Lrimp	Lpopn
1975	12.871	1.3251		0	11.15	10.871	2.56
1976	12.888	1.3476	2.272	0	11.183	10.862	2.591
1977	12.920	1.4629	12.22	1	11.304	10.954	2.617
1978	12.936	1.4922	2.97	0	11.277	11.080	2.644
1979	12.940	1.5840	9.61	1	11.380	11.175	2.670
1980	13.025	1.7076	13.15	1	11.375	11.293	2.699
1981	13.072	1.8107	10.85	1	11.372	11.297	2.722
1982	13.083	1.9416	13.98	1	11.462	11.414	2.748
1983	13.167	2.0011	6.13	1	11.506	11.385	2.774
1984	13.281	2.0463	4.62	1	11.787	11.513	2.800
1985	13.326	2.1901	15.46	1	11.683	11.557	2.825
1986	13.345	2.3159	13.39	1	11.754	11.586	2.850
1987	13.418	2.42001	10.97	1	11.816	11.722	2.876
1988	13.460	2.4968	7.98	1	11.982	11.805	2.907
1989	13.505	2.5908	9.85	1	11.870	11.830	2.902
1990	13.569	2.6825	9.61	1	12.052	11.975	2.906
1991	13.613	2.8761	21.34	1	12.090	12.10	2.927
1992	13.652	2.9593	8.67	1	12.235	12.222	2.951
1993	13.731	3.0463	9.09	1	12.265	12.409	2.975
1994	13.765	3.1188	7.52	1	12.405	12.547	2.998
1995	13.816	3.198	8.31	1	12.533	12.624	3.021
1996	13.866	3.2759	8.02	1	12.500	12.775	3.045
1997	13.896	3.3551	8.23	1	12.471	12.646	3.069
1998	13.940	3.4639	11.49	1	12.298	12.520	3.092
1999	13.999	3.49683	3.34	0	12.540	12.702	3.141
2000	14.048	3.5211	2.46	0	12.583	12.742	3.164

2001	14.050	3.5498	2.90	0	12.495	12.639	3.176
2002	14.088	3.5954	4.66	1	12.575	12.740	3.186
2003	14.609	3.6345	3.99	0	12.758	12.793	3.208
2004	14.171	3.6787	4.51	1	12.883	12.841	3.230
2005	14.208	3.7556	7.99	1	12.925	12.915	3.253
2006	14.245	3.8129	5.9	1	13.041	12.971	3.226
2007	14.305	3.8778	6.7	1	13.145	13.037	3.239
2008	14.348	3.9962	12.56	1	13.263	13.167	3.253
2009	14.402	4.0870	9.51	1	13.549	13.351	3.267
2010	14.4353	4.1787	9.59	1	13.586	13.316	3.276
2011	14.4827	4.2584	8.29	1	13.521	13.389	3.290
2012	14.5275	4.3528	9.9	1	13.609	13.482	3.303
2013	14.5889	4.4413	9.25	1	13.767	13.642	3.317
2014	14.6190	4.5107	7.18	1	13.725	13.654	3.330
2015	14.625	4.6051	9.90	1	13.538	13.558	3.343

Source: Economic survey, various issues, MOF, CBS, Quarterly Economic Bulletin NRB

APPENDIX-D

(CLS ESTIMATION OF THRESHOLD INFLATION)

Dependent variable: $\Delta L(\text{GDP})$

Method: Ordinary least square

Number of observation: 40 after adjustments

k	variable	coefficient	Std.error	t-statist	prob	R²
3	C	-0.058	0.0123	-0.4728	0.6394	(0.515)
	ΔLCPI	-0.032	0.1094	-0.295	0.76	
	$D_3 (\text{INF-3})$	0.0328	0.012	2.7177	0.0104	
	ΔLIN	0.034	0.039	0.8732	0.38	
	ΔLIMP	0.0185	0.0509	0.3632	0.7187	
	ΔLPOP	0.2953	0.2608	1.1320	0.2658	
4	C	-0.0040	0.0112	-0.3628	0.7190	(0.549)*
	ΔLCPI	-0.0984	0.1131	-0.8695	0.3908	
	$D_4 (\text{INF-4})$	0.034	0.0105	3.2356	0.0028	
	ΔLINV	0.0495	0.0361	1.3712	0.1796	
	ΔLIMP	0.0185	0.0491	0.3774	0.7083	
	ΔLPOP	0.5090	0.2669	1.906	0.0653	
5	C	0.0061	0.0129	0.4789	0.6351	(0.420)
	ΔLCPI	-0.1132	0.1020	1.1096	0.27	
	$D_5 (\text{INF-5})$	0.0075	0.0086	0.8726	0.38	
	ΔLINV	0.0702	0.0405	1.734	0.0922	
	ΔLIMP	-0.0063	0.0589	-0.1076	0.9149	
	ΔLPOP	0.2614	0.2916	0.896	0.3765	
6	C	0.0074	0.0106	0.7027	0.4872	(0.415)
	ΔLCPI	0.0659	0.1381	0.4700	0.6365	
	$D_6 (\text{INF-6})$	0.0074	0.0106	0.7027	0.4872	
	ΔLINV	0.0702	0.0407	1.7258	0.0937	
	ΔLIMP	0.0110	0.0559	0.1982	0.8441	
	ΔLPOP	0.1893	0.2841	0.6663	0.5098	
7	C	0.0109	0.0117	0.9386	0.35	
	ΔLCPI	0.1872	0.1379	1.3577	0.1837	

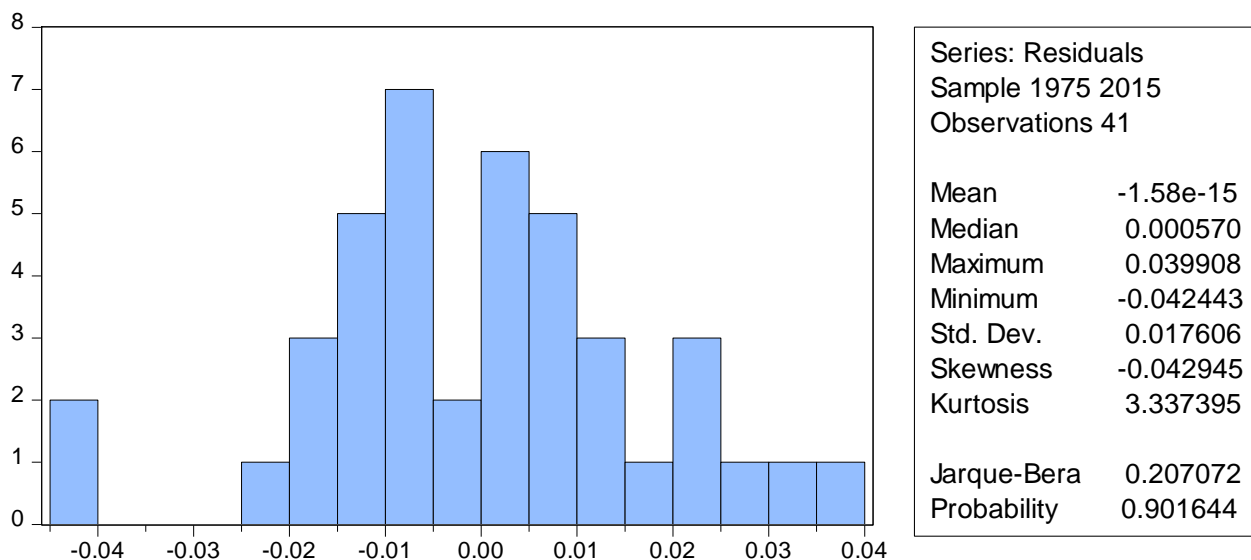
	D ₇ (INF-7)	-0.0060	0.01057	-0.5716	0.5714	
	ΔLINV	0.0639	0.0414	1.5442	0.1321	(0.412)
	ΔLIMP	0.01553	0.0567	0.2738	0.7859	
	ΔLPOP	0.2018	0.2845	0.7091	0.4832	
8	C	0.0117	0.0118	0.989	0.3298	
	ΔLCPI	0.0940	0.1383	0.6799	0.5013	
	D ₈ (INF-8)	0.0040	0.0098	0.4089	0.6852	(0.406)
	ΔLINV	0.0713	0.0414	1.7207	0.0947	
	ΔLIMP	0.0077	0.0565	0.1375	0.8914	
	ΔLPOP	0.2020	0.2853	0.7089	0.4838	
9	C	0.0110	0.0129	0.9025	0.3733	
	ΔLCPI	0.1366	0.1425	0.9584	0.3448	
	D ₉ (INF-9)	-0.0003	0.0096	-0.0357	0.9717	(0.406)
	ΔLINV	0.0683	0.0409	1.6680	0.1048	
	ΔLIMP	0.0106	0.0563	0.1888	0.8514	
	ΔPOP	0.1978	0.2874	0.6880	0.4962	
10	C	0.0078	0.0144	0.5450	0.5894	
	ΔLCPI	0.1752	0.1495	1.1717	0.2497	
	D ₁₀ (INF-10)	-0.0043	0.0115	-0.3805	0.7060	(0.409)
	ΔLINV	0.0687	0.0408	1.6822	0.1020	
	ΔLIMP	0.0067	0.0570	0.1181	0.9066	
	ΔLPOP	0.2424	0.3074	0.7886	0.4359	
11	C	0.6058	0.0134	0.4319	0.6686	
	ΔLCPI	0.2084	0.1387	1.5028	0.1424	
	D ₁₁ (INF-11)	-0.009	0.0115	-0.7819	0.4398	(0.417)
	ΔLINV	0.0689	0.0405	1.6995	0.0987	
	ΔLIMP	0.0048	0.0562	0.0859	0.9320	
	ΔLPOP	0.2613	0.2943	0.8877	0.3811	

Source: Author's calculation from eviews-

APPENDIX-E

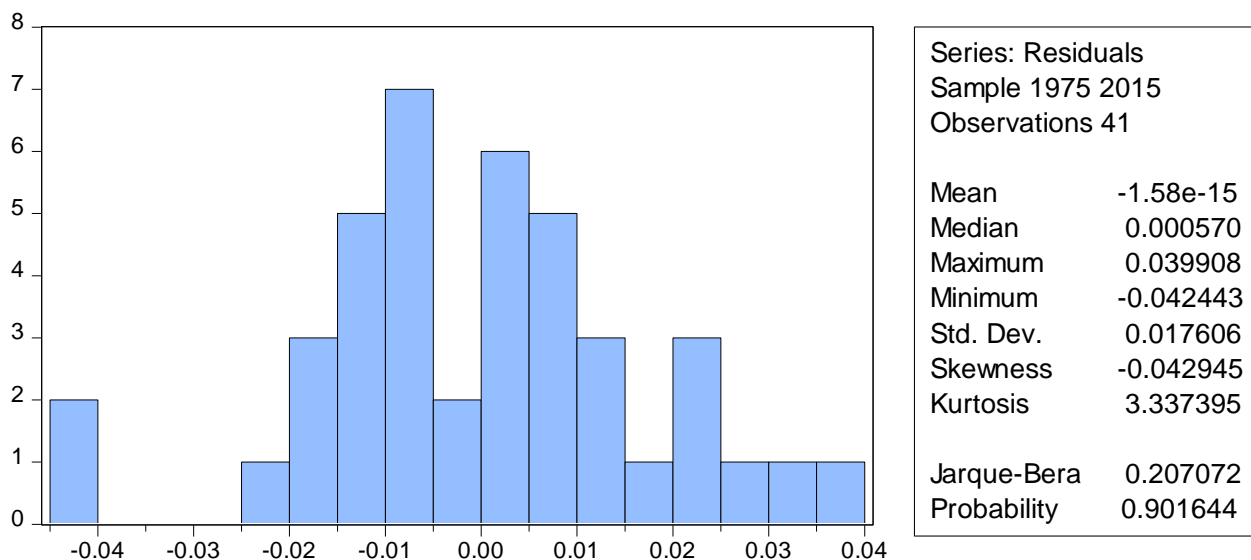
DIAGNOSTIC TEST RESULTS

Normality Test : JB Test For (long run co- integration)



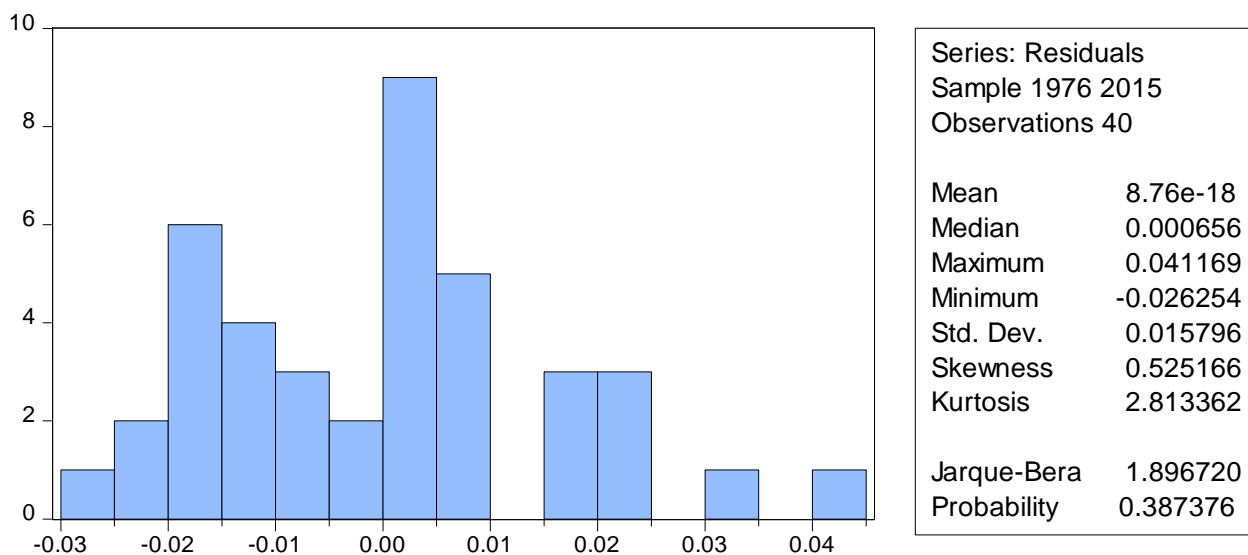
Source: author's calculation from views-9.

Normality Test: JB Test for (Error Correction Model)



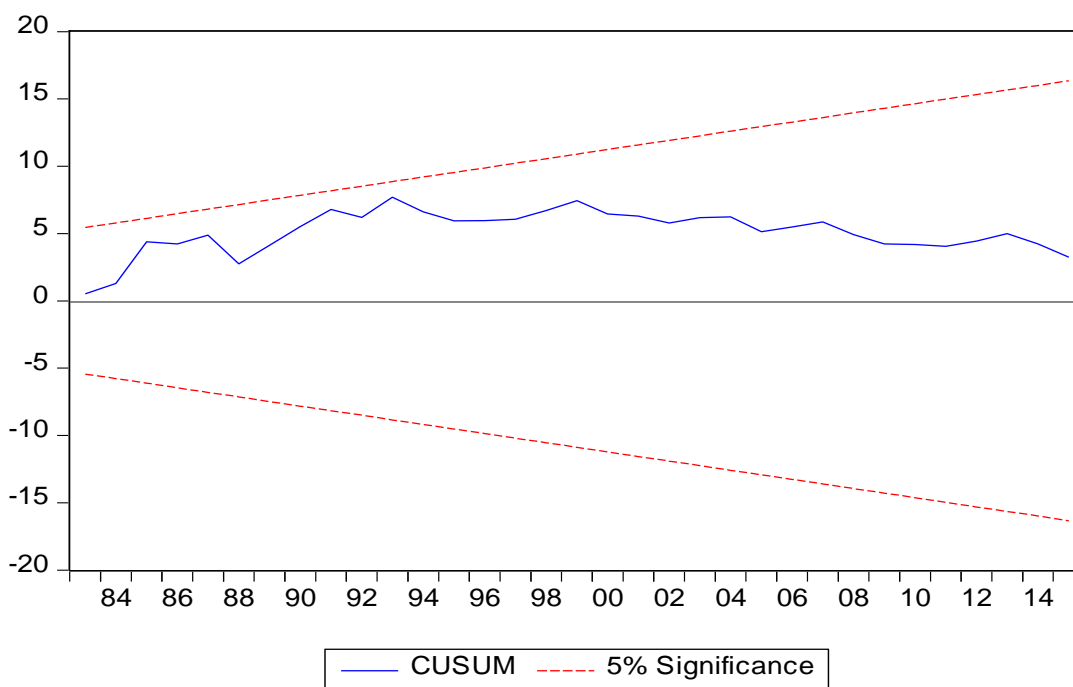
Source: Author's calculation from views-9.

Normality Test: JB Test for optimum threshold level of inflation



Source : Author's calculation from evIEWS-9.

CUSUM Test of optimum threshold level of inflation



Source : Author's calculation from evIEWS-9.