CHAPTER - I

INTRODUCTION

1.1 Background of the Study

Inflation is defined as the decline of purchasing power of given currency over time reflecting the increase of an average price level of a basket of selected goods and services in an economy. The rise in general level of prices often expressed as a percentage means that a unit of currency effectively buys less than it did in prior periods.

Inflation is a persistent and appreciable rise in general price level or average of prices (Ackley). 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. 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, 1993). 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 hyper-inflation in 1980s on the contrary of structuralist belief inflation positively impact the economic growth. 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 2007/08 to 2014/15 but economic growth on the other hand shrunk to 4.3 percent in same period (MoF, 2015). Even though, various rigidities have been con-currently 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 macro-economic 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 causes 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 curve 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 resulting 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 and the relationship between 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 rate in Nepal.

a) What is the pattern of inflation and economic growth in Nepal?
b) Does long-run and short-run relationship between inflation and economic growth exist?
c) What is the threshold level of inflation existing in Nepal?

1.3 Objectives of the Study

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

a) To analyze the pattern of inflation and economic growth,
b) To examine the relationship between inflation and economic growth in short-run and long-run basis,
c) To estimate the threshold level of inflation for economic growth in Nepalese economy.

1.4 Hypothesis of the Study

Following hypothesis have been formulated in order to show the long-run relationship between inflation and economic growth for the study.

Null Hypothesis (H_0)=β_0=β_1=β_2=β_3=β_4=0, there is no significant long-run relationship between economic growth and inflation.

Alternative Hypothesis (H_1) = β_0=β_1=β_2=β_3=$\beta_4 \neq 0$, there is a significant long-run relationship between economic growth and inflation.

On the same way,for the estimation of threshold level of inflation following hypothesis have been formed.

H_0: = 0, there is no existence of the threshold point.

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

1.5 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 stable supported by empirical evidences.

1.6 Limitations of the Study

Each study has its own limitations due to the various constraints. The major limitations of the study period are:

a) Data has been extracted only of 35 years,
b) Mainly this study focused on the relationship between inflation and economic growth rather than other concerned variables,
c) It has been carried out with limited resources and information due to time and resources constraints.

1.7 Organization of the Study

This study has been carried out in five chapters. The first chapter is the introduction that includes background of the study, statement of the problem, objectives of the study, hypothesis of the study, significance of the study, limitations of the study and organization of the study.

Second chapter is the review of literature and it consists of theoretical review and empirical review. The empirical review is also divided into international and Nepalese context. Besides, research gap and additional contribution is also included in this chapter.

Third chapter is the research methodology that presents conceptual framework,research design,nature and sources of data,study period covered,tools and method of data collection,tools and method of data analysis,variables selection and its specification,model specification,hypothesis testing and diagnostic test for threshold level of inflation.

Fourth chapter is the presentation and analysis of the data which is the body part of the study.It shows the pattern of RGDP,CPI,inflation and economic growth rate,relationship

between inflation and economic growth in long and short-run basis and estimation of threshold level of inflation through different econometric models. Furthermore, the robustness of threshold level of inflation is elaborated in this chapter.

Major findings, conclusions and recommendations of the study are wellmentioned in the last chapter.

CHAPTER - II

REVIEW OF LITERATURE

Review of literature is an overview of the past studies, research reports and other published literature on a related topic. It is an important and mandatory part of research work which provides us the sense of what already happened and whether is a valley of knowledge still to discover. The review of literature shows the status of the study and research on the given issues and subject matter. It also shows the experience that the previous tracker undertakes and success.In order to analyze the relationship between inflation and economic growth, review of literature has been done on theoretical and empirical aspects in this study.

2.1 Theoretical / Conceptual Review

A number of theories have been put forward to examine the relationship between inflation and economic growth. Various historical evidences show that inflation has been 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 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, it deals with review of Mercantilist Theory, Classical Theory, Keynesian Theory, Monetarist Theory, Neo-Classical Growth Theory, New-Classical Theory and New-Keynesian Theory.

2.1.1 Mercantilist Concept

Mercantilist theory in economics made dominated from the period of 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 as 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 economic 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 rate. 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, 2014). For another mercantilist philosopher, Richard Cantillon, increase in gold bullion will not reduce the economic growth though 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, relationship between inflation and economic growth is quite controversial in mercantilist theory.

2.1.2 Classical Concept

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 competes with each other's even in the labor market which increases the labor wages thereby cost of production. This moreover leads in 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, 2000).

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 and sodevelopedthe model of production functionas;

$Y = f(L, K, T)$……2.1 (Smith,1776)

Where,

Y=Output

f=Function

L=Labor

K=Capital

T=Technology

In this way output growth was related to labor, capital and technology inputs.

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 a 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 asserted that money will not have real effects in real variables which has just price effects alone. Classical economists make assumptions of both V and T as constant. Therefore, increase in M directly affects to P. Moreover income version of quantity theory of money is expressed in functional form as;

MV=PT…….2.2 (Fisher, 1911)

Where,

M= Total money supply

V= Velocity of money

P= General price level and

T=Volume of transaction

Both V and T 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 level, its tax effects on profit level and output. However, relationship between two

variables have been implicitly suggested to be negative as indicated by the reduction in firms profit level due to higher cost.

2.1.3 Keynesian Concept

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 economic growth. Short run aggregate supply curve is upward sloped. In this situation, change in the demand side of economy positively influences both price level and economic growth rate. 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 factors 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 economic growth, however turns negative towards the latter part of adjustment path.

2.1.4 Monetarist Concept

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 economic growth.

2.1.5 Neo-Classical Growth Concept

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(1962) was another economist to examine the relationship between 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 saving means greater capital accumulation and thus faster output 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 which 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. Greenhood 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 economic growth. Tobin argued that an increase in inflation can result in higher output, lower output by Stockman and no change in output in Sidrauski model.

2.1.6 New Classical Concept

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 expectation. 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 variables 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.

Lucas (1973) argued that 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. 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 economic growth.

2.1.7 New Keynesian Concept

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 instability in the economy. Therefore, economic 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. Krause and Lubik(2003)pointed out that high and unstable prices affect productivity negatively.

Ambler (2008) found that 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. Inflation create 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.

2.2 Empirical Review

Significance of empirical 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.

2.2.1 International Context

Fisher and Gregorio (1993)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 channel in the process of effective decision making.

Barro (1995)has measured the relationship between inflation and economic growth by using the neo-classical methodology, in which inflation was used as major explanatory variable where as other variables was assumed constant. Findings provided that inflation has statistically positive significant with negative impact on economic growth.

Sarel(1995) conducted a study for existence of a threshold effect of inflation and economic growth. 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.

Bruno and Easterly (1996) have analyzed the effect of inflation on economic growth. They examined the inflation exhibited more than 40 percent before, after and during occurrence of crisis and found that higher level of inflation harms the economic 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.

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.

Dotsey and Sarte (2000)have analyzed the effect of inflation on economic growth for U.S. economy by including the money as an explanatory variable through neo-classical endogenous growth model. Their findings showed 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 economic growth in short run through precautionary 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 showed the negative effects of inflation exceed the positive impact of inflation supporting the views that higher inflation has negative impact on economic growth.

Gilman and Harris (2001)examined the relation of inflation and economic growth. 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 economic 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.

Mallik and Choudhary(2001) have conducted a study to establish relation between inflation and economic growth in four south Asian countries like India, Pakistan, Sri Lanka and Bangladesh. 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.

Gokaland and Hanif(2004)have analyzed the inflation and growth nexus to check the relation in Fiji economy by using 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 Dicky Fuller (ADF) and PhillpsPerron (PP) tests. The findings of analysis revealed 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.

Ahmed and Mortaza (2005) explored the relationship between inflation and economic growth in Bangladesh using Real Gross Domestic Product (RGDP) 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. Researcher 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. Researcher 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. It is also suggested to macro-economic policy makers in Pakistani economy to keep inflation below 9 percent.

Xiaojing (2008) examined the tradeoff between inflation and economic growth in china using the Phillip curve equation to see what the relationship would look like between two variables. It has been found that economic growth can be affected at different level

differently. He found that at the steady state of inflation for 5 percent gross domestic product (GDP) growth will be 9.39 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.

Cheung (2009)estimated the causal inter-relationship between inflation and economic growth by simultaneous equation framework. 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.

Mamo(2010)used Granger causality test using regression model to estimate growth and inflation relation by using economic growth as dependent variable and inflation, investment, population, initial GDP as independent variables. Empirical finding showed negative relationship between variables.

Bittencourt(2010) has examined how high growth of inflation affected the economic growth of Latin American countries (Bolivia, Peru, Argentina and Brazil) 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. Research concluded inflation was harmful for the economic growth of such countries and lower inflation rate was effective.

Hasanov (2011)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. It was found non- linear relation between inflation and economic growth concluding 13 percent of threshold level in Azerbaijani economy and below that level, inflation positively promotes the economic growth. After threshold point, increase in inflation deteriorates the real economic growth by 3 percent.

Bharumshan, Hamzah and Sarbi (2011)have 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.

Vinayagathasan (2013)has conducted a study on cross country basis of 32 Asian countries to examine the dynamic relation between inflation and economic growth by using 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. Through the observation non -linear nexus has been found with threshold point at 1 percent level of significance. Up to this threshold, growth is not deteriorated and beyond this point growth is hampered.

Manamba (2016)made a study to examine the nexus between inflation and economic growth in Namibia economy by observing the impact of inflation on growth and estimated the threshold level of inflation.He has found optimal level of inflation ranged between 3.25 percent and 3.75 percentby 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. Finding 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.

Shergill (2018)conducted inflation and growth relation in CIS countries. A non-linear least square technique has been employed and bootstrap approach has been used for estimation of inference. Empirical result showed 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.

2.2.2 Nepalese Context

Pant (1978)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.

Neupane (1992)had made exploration of continue appropriate model for Nepal byusing 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.

Khatiwada (1994)examined the inflation 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. Researcher made the long-run relationship and found 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 had used an expectation Augumented 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 coved 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. It showed no change in the explanatory power of the model including the public expenditure as well as real GDP and a supply side variable.

NRB (2006) found that Indian inflation to have significant and near unitary effect of inflation very quick using open economy monetary model. 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 lacked of long-run relationship and considerations for short-run adjustment process. This moreover shows no relation and causation between inflation and economic growth.

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 GDP, population, trade, investment, deposit and money for Nepal are the variables used. Data are taken through international financial institutions, IMF, school level statistics, department of education, Ministry of Education (MOE) and quarterly economic bulletin of NRB. In this empirical analysis, it was 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 using productive expenditure, capital expenditure indirect taxes and foreign grants as independent variables. This study

concluded 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.

Bhusal and Silpakar(2011) have estimated the threshold level of inflation in Nepalese economy showing 6 percent of 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 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. Analysis concluded 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 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. Researcher employed the auto-regressive 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, researcher 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. Analysis showed 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.

Gyanwaly(2014)has made the examination of relationship between the financial development and economic growth. It has been developed the financial index by taking the weighed the average of the different indicators of the financial development. For the analysis, researcher 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 by using variables as RGDP, CPI, real investment and gross fixed capital formation. 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.

Bista (2016) made an analysis to examine the relationship between inflation and economic growth rate by using linear regression model using GDP, CPI, import, consumption, population and investment as the variables. Analysis concluded in long-run inflation is not much harmful for economic growth however inflation negatively impacts economic growth in short-run. Analysis showed 4 percent of threshold level of inflation. Researcher has recommended tokeep 4 percent threshold level of inflation to promote economic growth rate of the economy.

NRB(2018)entitled inflation in Nepal made and analysis to identify the determinants of inflation using the both OLS and ECM model for determination of both short-run and long-run dynamics. Study included the variables money supply, velocity of money proxied by quantity theory of money, GDP, interest rates and external factors (Indian prices). It concluded Indian inflation was major rod to influence the Nepalese inflation. Real economic growth had no significant nexus with inflation.

2.3Research Gapand Additional Contribution

As this study is based on examining the short-run and long-run relationship between inflation and economic growth along with identifying the threshold level of inflation in Nepalese economy. Very few studies were carried out and there is no any standard criteria and specific variables to examine the relationship between inflation and economic growth.Different economic researchers used different variables in order to show the nexus between inflation and economic growth in Nepal. However, it is difficult to develop a universal criteria and index to join these aspects, the study tries to fill thevaccum in the previous economic literature conducted in this field of Nepal.Generally the study tries to examine impact of inflation over economic growth and estimation of threshold level of inflation including the variables CPI, investment, import and population by using the time series data from 1985 to 2019 i.e. after the economic liberalization.

CHAPTER - III

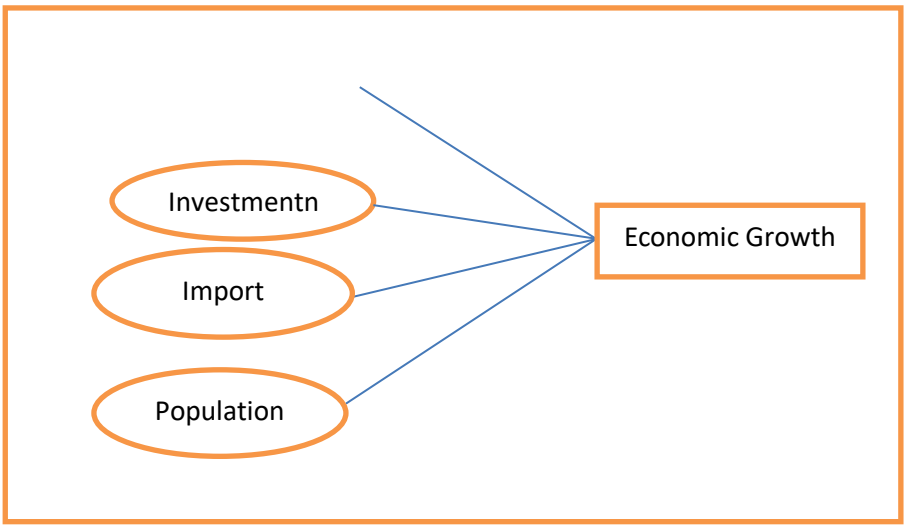
RESEARCH METHODOLOGY

Research methodology is taken as the major tool in research work. Research methodology is the systematic steps and procedure of inquiry seeking facts to get the answers of the given research questions, justifying the objectives and hypothesis testing. In order to examine appropriate relationship between inflation and economic growth following are the steps and procedure taken as the research methodology of the study.

3.1 Conceptual Framework

It is defined as the network or plane of linked concepts that together provide a comprehensive understanding of phenomenon. Economic growth is the increase in overall productivity that is measured by the GDP of the country either by the nominal or real GDP of the country. However, the exact economic performance is described by real GDP of the country. Economic growth of the country is influenced by several macro-economic variables. Different variables can be used to examine the relationship between inflation and economic growth, however this study has used economic growth as dependent variable and inflation along with investment, import and population as independent variables as shown below in the figure.

Figure 3.1:-Relationshipbetween Inflation and Economic Growth



3.2 Research Design

It is a master plan for executing a research project. The study is designed in accordance with getting answers of the given research questions and justifying objectives of the study related to the relationship between inflation and economic growth along with other variables. The study used deductive method by using both of qualitative and quantitative analysis. It is a micro level study fully based on secondary data using 35 years from 1985 to 2019. The major tools of data used in the study were simple mathematical and econometric techniques.

3.3 Nature and Sources of Data

The study is fully based on time series data. The required data and information were collected from published books, booklets, journals, research reports, magazines, seminar papers, articlesand newspapers etc. published by various national and international institutions like quartile economic bulletin of NRB, economic survey of MoF,Central Bureau of Statistics (CBS),The world Bank,IMF and UNDP. Similarly the required data and information were also collected from various libraries by visiting the researcher himself like Central library of Tribhuvan University, departmental library of the Central Department of Economics, library of CBS etc.

3.4Study Period Covered

The study covered 35 years of time series data from 1985 to 2019. Because, Nepal government started operation of economics liberalization. So, the study focuses on the scenario of the relationship between inflation and economic growth in Nepal.

3.5Tools and Method of Data Collection

As per the nature of the study,the required information and data were collected by research himself by visiting NRB, MoF and various libraries like central library of TU, departmental library of Central Departmental of Economics, library of CBS etc. by using various publications, laptop, internet, cell phone,friends etc.

3.6 Data Organization and Processing

The collected time series data and information were organizedin such a way that it could provide the answers of the given research questions and justified the desire objectives of the study.The collected data and information were in raw form by nature which was not possible to present and analyze them directly. Initially the collected data and information were edited, organized, classified and calculated as per the required units after then the raw data are put under process through the computer packages and converted into required form to obtain the appropriate result of the study.

3.7 Tools and Method of Data Analysis

Data analysis is the process of working on data with the purpose of arranging it correctly, explaining it, making it presentable and finding a conclusion from that data. It is done for finding useful information from data to make rational decisions. The major tools of data analysis are various tables, graphs, percentage, ratios, averages, other simple mathematical tools and various econometric tools like correlation analysis, multiple regression analysis, coefficient of determination, adjusted coefficient of determinants, t-test, F-test, D-W test, Unit root test, Augmented Dickey Fuller (ADF) test, Error Correction Model (ECM) model, Engle Granger Co-integration test,JB test,LM test,heteroscedasticity test, CUSUM test etc. Behinds both descriptive and analytical methods were used for data analysis and interpretation by using Micro-soft Word, Micro-soft Excel and E-views 10 computer software.

3.8 Model Specification

Based on the review of literature and availability of data, the study has used the multivariate regression model in order to examine the relationship between inflation and economic growth.The functional behavior of the study can be expressed as;

$GDP_t = f(CPI_t, INV_t, IMP_t, POPN_t)$…… 3.1

Converting the equation into real form it can be formulated as;

$$RGDP_t = f(CPI_t, RINV_t, RIMP_t, POPN_t) \text{……} 3.2$$

Applying the multiple linear regression in equation 3.2 it can be formulated as;

$RGDP_t = \beta_0 + \beta_1 CPI_t + \beta_2 RINV_t + \beta_3 RIMP_t + \beta_4 POPN_t + \mu t$ …… 3.3

Taking natural log on both sides, the multiple linear regression equation becomes;

$lnRGDP_t = \beta_0 + \beta_1 lnCPI_t + \beta_2 lnRINV_t + \beta_3 lnRIMP_t + \beta_4 lnPOPN_t + \mu t$ 3.4

Where,

GDP_t= Gross Domestic product as dependent variable.

CPI_t=Consumer Price Index as a core independent variable.

INV_t= Investment as a counter independent variable.

IMP_t= Import as a counter independent variable.

$POPN_t$= Population as another counter independent variable.

μt= Error term.

ln= Natural log.

$RGDP_t$=Real Gross Domestic product as dependent variable.

$RINV_t$= Real investment as a counter independent variable.

$RIMP_t$=Real import as a counter independent variable.

β_iWhere *i*= 0,1,2,3,4, are coefficients of respective variables.

3.9 Variables Selection and its Specification

Among the researchers it is highly debate and controversy for the selection of variables which affect the growth incorporating the inflation. Selection of variables is taken on the basis of some specific features of economic structure, theoretical aspect, level of development and socio-cultural aspects. The study used five variables, out of which GDP is taken as dependent variables and rest four CPI, investment, import and population as independent variables

a) **Economic Growth (GDP):-** Economic growth is the increase of market value of goods and services produced by an economy over time usually expressed in percentage form.Economic growth is measured by the GDP of the country.It measures the change in nation's GDP. It shows how a country is developing its economy, higher economic growth rate shows the higher level of development and vice-versa. As this study is based on showing the relationship between inflation and economic growth by including the real GDP rather than nominal GDP, because RGDP deals with inflation appropriately,expressed in base year prices or constant prices that are adjusted for inflation rather than current prices and is the best macroeconomic indicator for measuring the economic status of the country.Mathematically, RGDP is calculated as the ratio of

nominal GDP at producer's price to the GDP deflator and multiplied by 100 which is shown below in the table.

b) **Consumer Price Index (CPI):-** It is the instrument to measure inflation. It is used to estimate the average variation between two given periods in the price products consumed by households at a constant quality. It gives an idea about price changes in the economy and act as a guide in order to make informed decisions about the economy. Inflation rate is calculated by the help of CPI in the study.

c**) Investment (INV):-**An investment is an asset or item acquired with the goal of generating income or appreciation. It includes all spending on capital equipment, inventories and technology by firms. Investment is a component of aggregate demand. Therefore rise in investment will help to boost AD and therefore increase in investment increases the rate of economic growth. In order to examine the relationship real investment is considered into account which is calculated as the ratio of total volume of nominal investment to GDP deflator multiped by 100.

d) Import (IMP):-The process of bringing goods or services into home country from abroad for sale is known as import. Different economic analysis have shown the positive relationship between import and the economy's growth.

A high level of import indicates robust domestic demand and a growing economy. If the imports are mainly productive assets such as machinery and equipment this is even more favourable for a country. Since productive assets will improve the economy's productivity over the long-run. For examining the relationship between economic growth and inflation nominal import is converted into real import dividing the total volume of nominal import by GDP deflator and multiplied by 100.

e) **Population (POPN):-** Total number of all the people living in a particular country, area or place is known as population.In order to conduct the relationship between economic growth and population, it is still the matter of controversial. Many researches show that there is significant negative relationship between them which implies that if a country has raised in a proportion of dependent population per-capita income tender to be lower.

Table 3.1

Detail of Variables

Variables	Detail of variables
RGDP	RGDP stands for real GDP which is calculated as RGDP=$\frac{nominal\ GDP\ at\ producer's\ price}{GDP\ deflator}$*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
RINV	RINV stands for real investment which is calculated as RINV=$\frac{total\ voiume\ of\ nominal\ investment}{GDP\ deflator}$.*100
RIMP	RIMP represents real level of import which is calculated as RIMP=$\frac{nominal\ volume\ of\ total\ import}{GDP\ deflator}$*100
POPN	POPN stands annual population of Nepal.

3.10 Major Tools of Data Analysis

a) Engle Granger Approach to Co-integration Analysis:-Engle Granger approach analysis is used to analyze the existence of long-run relationship between the inflation and economic growth in the economy. In order to examine the long-run relationship between the concerned variables first of all the stationary of the time series data should be checked. Stationarity of the data can be checked by ADF test. If the variables are found non-stationary at the level form and stationary on the order form at 5 percent level of significance by using ADF test then the criteria for co-integration analysis developed by Engle Granger has been fulfilled. This method of analysis integrated the variables in such a way that they can't move away from some equilibrium in the long-run. 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.

For the long-run relation of the variables in model, data have been transformed to natural log. In the model log of dependent variable RGDP along with set of independent variables as log of CPI, log of real investment, log of real import and log of population have been $used. Thusmultivariateregressioncanbeexpressedas$;

$lnRGDP_t=\beta_0+\beta_1 lnCPI_t+\beta_2 lnRINV_t+\beta_3 lnRIMP_t+\beta_4 lnPOPN_t+\mu_t$ …… 3.5

After satisfying the necessary condition for Engle Granger Co-integration analysis "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 in the model can be expressed as

$\mu_t=lnRGDP_t-\beta_0-\beta_1 lnCPI_t-\beta_2 lnRINV_t-\beta_3 lnRIMP_t-\beta_4 lnPOPN_t$ ……..…… 3.6

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:

$\Delta\mu_t=\alpha+\pi\mu_{t-1}+\sum_{i=1}^{k} Y_i\,\Delta\mu_{t-1}+\vartheta_t$ ……3.7

Where

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

Under the estimation null hypothesis of no co-integration among the variables implies co integration in I(1). This unit root test is applied for a variable obtained from the derived form of regression and usual distribution by Augmented Dickey Fuller test. 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. 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.On the same way for analyzing the short-run relationship between inflation and economic growth Error Correction Model has been employed.

b) Error Correction Model to Short-run Analysis

Static equilibrium is shown by long-run equilibrium 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, Error Correction Model (ECM) is best alternative for assessing the short run dynamics structure of the model and hence it is used in the study. According to "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:

$$\Delta y_t=\beta_0+\sum \beta_i \Delta y_{t-1}+\Delta y_j \Delta X1_{t-j}+\sum \delta_k \Delta X2_{t-k}+\gamma EC_{t-1}+e_t \quad \text{..... 3.8}$$

$$\gamma EC_{t-1}=(y_{t-1}\text{-}a_0\text{-}a_1X1_{t-1}\text{-}a_2X2_{t-1}) \quad \text{..... 3.9}$$

Where,

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

EC_t= 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:

$$\Delta lnRGDP_t=\propto_0+\sum_{i=0}^{q} \beta_{1i} \Delta lnCPI_{t-i}+\sum_{i=0}^{q} \beta_{2i} \Delta lnRINV_{t-i}+\sum_{i=0}^{q} \beta_{3i} \Delta lnRIMP_{t-i}+ \sum_{i=0}^{q} \beta_{4i} \Delta lnPOPN_{t-i}+\gamma EC_{t-i}+e_t \quad \text{..... 3.10}$$

Where, β_i's are coefficients of the lagged first difference variables. γ reflects the rate at which variables adjust to the equilibrium state after structural or institutional shocks occurs. So, γshows the speed at which error is corrected after occurring the shocks (Engle and Granger, 1987). Moreover, inclusion of Error Correction Term (ECT) in the above equation makes change in all variables in ECM equation. γas 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.

Eventually the model purposed by Khan and Senhadji (2001) as a conditional least square method has been used to estimate the threshold level of inflation. 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. According to this model the threshold level of inflation is taken by maximizing R^2 or minimizing the sum of residuals or error terms by using conditional least square method of regression. The model for estimating the threshold level of inflation is expressed as;

$\Delta lnRGDP_t = \beta_0 + \beta_1 \Delta lnCPI_t + \beta_2 \Delta lnCPI2_t + \beta_3 D_t\ (INF - k) + \beta_4 \Delta lnRINV_t + \beta_5 \Delta lnRIMP_t + \beta_6 \Delta lnPOPN_t + U_i$ 3.11

Where,

$\Delta lnRGDP_t$= First order log of RGDP

$\Delta lnCPI_t$=First order log of CPI

$\Delta lnRINV_t$=First order log of RINV

$\Delta lnRIMP_t$ =First order log of RIMP

$\Delta lnPOPN_t$=First order log of POPN

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

3.11 Hypothesis Testing

a) Augumented Dickey Fuller (ADF) Test

ADF test is used to check the stationarity of the time series data.In order to check thestationary or the unit root of variables or order of integrationfollowing regression model has been operated.

$$\Delta x_t = \eta + \gamma_t + \alpha x_{t-1} + \sum_{j=1}^{k} \delta_j \Delta x_{t-j} + \varepsilon_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.12$$

Where,x_t is any variables likeRGDP,CPI,real investment, real import and population used in the study.Δindicates 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 3.12The null hypothesis is that x_t has a unit root, that is, H_0: $\alpha = 0$ and is rejected if the calculated ADF t-statistic is either negative or below the 5 percent level either at the level or the order form. This implies that x_t has no unit root or x_t is stationary (Gujarati,Porter&Gunasekar, 2012).

b)Engle Granger Test

In order to test out the existence of long-run relationship between economic growth and inflation, 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)=β_0=β_1=β_2=β_3=β_4=0, the long-run relationship does not exist.

Alternative Hypothesis (H_1) = β_0=β_1=β_2=β_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, if the p-value of the error correction term is less than 5 percent then null hypothesis cannot be accepted.Rejecting the null hypothesis implies the existence of the long-run relationship between economic growth and its determinants.

c) Khan and Senhadji Test

For estimation of threshold following hypothesis has been formed.

H_0: = 0, there is no existence of threshold point.

H_1: ≠ 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. For the rejection of null hypothesis and acceptance of alternative hypothesis the p-value of all the independent variables introduced in the study should be less than five percent. p-value can be obtained after conducting the multiple linear regression model. Khan and Senhadji (2001) argued that there will be the existence of the threshold level of inflation where R^2 is maximized and standard error (RSS) is minimized.

On the sameway,in order to check the reliability of the estimated threshold level of inflation different diagnostic tests are carried out. LM test is used to check the autocorrelation; problem of heteroscedasticity is checked by Bruesch Pagan Godfrey (BPG) test and normality by Jarque-Bera (JB) test. Eventually stability of the model is tested by Cumulative Sum of Recursive Residuals (CUSUM) test.

d) JB Test for Normality

The JB test for normality is an asymptotic or large scale test which is based on the OLS residuals. It is used whether the residuals or error terms are normally distributed or not.

Under the null hypothesis that the residuals are normally distributed, Jarque and Bera showed that asymptotically (i.e. in large samples) the JB statistic is given by test statistics which should be lied within 2 d.f. If the computed p-value of the JB statistic in an application is sufficiently low, one can reject the hypothesis, but if p-value is reasonably high i.e. p-value>0.05 we do not reject the normality assumption (Gujrati, Porter&Gunasekar,2012).

e) LM Test for Serial Correlation

One of the widely celebrated uses for LM serial test correlation is the Durbin-Watson (d-statistic) test which contain lagged values of the regressand. The Durbin-Watson test is often used implying that there is no first order autocorrelation. Thus, there is a bias

against discovering first order autocorrelation in this model. This does not mean that autoregressive models do not suffer from autocorrelation problem. To solve this problem, Breusch-Godfrey (BG)has developed LM test which is more powerful than Durbin-Watson test in statistical sense in order to solve the problem of serial autocorrelation. The LM test allows for the lagged values of the regressand, simple and higher order auto-regressive scheme and higher order moving averages of the white noise error term. Thus, BG test is employed to check the autocorrelation in the model. In this study the test assumes there is no autocorrelation within the variables as null hypothesis and there is presence of serial correlation as alternative hypothesis in the model. It argues that if the test statistics lies within range of 0 to 2 d.f. and p-value is high i.e. p-value > 0.05 then null hypothesis is accepted representing there is no presence of autocorrelation in the model.

f) Heteroscedasticity Test

Heterocedasticity arises due to different random error terms for different observations.It is the violations of OLS assumptions.It should be removed in order to examine the appropriate relationship between dependent and independent variables.Heteroscedasticity means not having the equal variance over the different observation. In order to avoid the presence of heteroscedasticity in the given model, null hypothesis assumes there is no heteroscedasticity and alternative hypothesis assumes there is heteroscedasticity. It argues that if the value of test statisticslies from 2 to 4d.f and the p-value is significantly high then null hypothesis is accepted.

g) Cumulative Sum of Recursive Residuals (CUSUM) Test

CUSUM test is applied to assess the parameter stability. CUSUM test identifies systematic change in the regression coefficients. It argues that there exists stability in the estimated coefficients over the sample period when test statistics of CUSUM test falls within the critical bands and p-value < 0.05. Test statistics of CUSUM lies within the band whenthe residuals terms are normally distributed and there is absence of heteroscedasticity and autocorrelation among the variables in the regression model.

CHAPTER - IV

DATA PRESENTATION AND ANALYSIS

Data presentation is defined as the process of using various graphical formats to visually represent the relationship between two or more data sets and the analysis of data refers to arranging, explaining and presentation of data through different econometric tools and models to find a strong conclusion related to the desire objectives of the study.The presentation and the analysis of data under this study are discussed under the following titles and sub-titles.

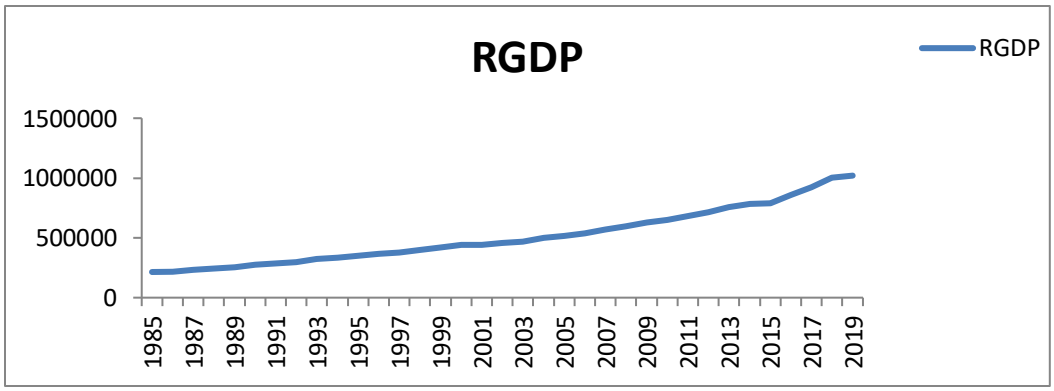
4.1 Pattern of Inflation and Economic Growth in Nepal

This heading provides the descriptive analysis of the macroeconomics variables under the study. For this data have been presented in line and graph to analyze the nature, pattern and growth of the concerned variables.

4.1.1 Pattern of RGDP Growth

RGDP is an inflation adjusted measure that reflects the value of all goods and services produced by an economy expressed in base year prices or constant prices. It makes comparing GDP from year to year and from different years more meaningful because it shows comparison for quantity and value of goods and services. It measures the country's total economic output, adjusted for price changes.The pattern of RGDP can be clearly seen in the graph below from 1985 to 2019.

Figure 4.1
Pattern of RGDP



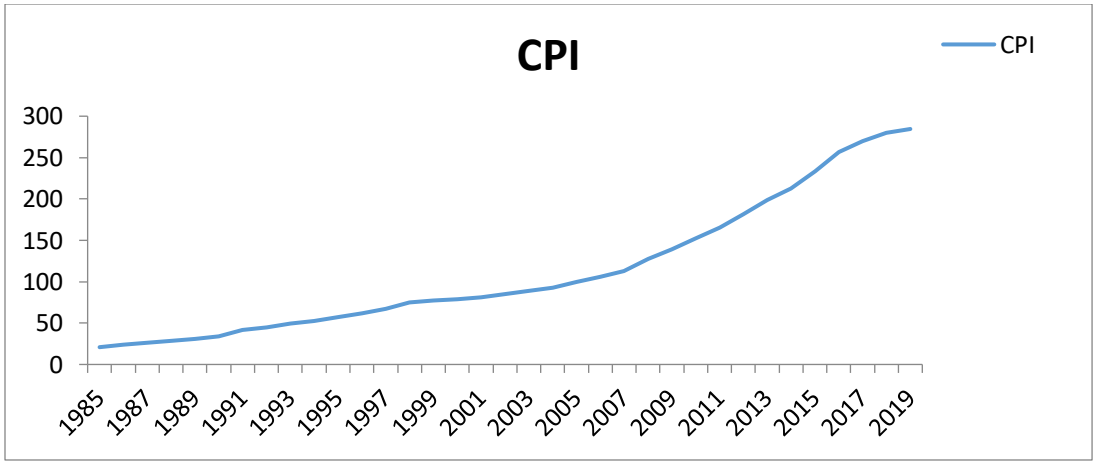
Source: Quarterly Economic Bulletin, 2019.

The figure 4.1 shows that the increase of real gross domestic product (RGDP). In fiscal year 1985/86, RGDP was NRs.214526.6 million, it reached to NRs.273568.2 million in fiscal year 1990/91 and NRs.1020050 million in fiscal year 2019/20. It shows RGDP is increasing at moderate level. From the period of fiscal year 1985 to 1995 RGDP seems increase at a constant. From the period of 1995 to the 2000, RGDP has increased. From onwards 2000 to 2003 RGDP has increased at slower rate. This may be due to civil war. At that time, civil war was reached to the peak stage and economy was facing massive turbulence. After taking place the comprehensive peace agreement, RGDP has increased. In fiscal year 2014 and 2015 RGDP seems constant. This may be due to obstacles in southern border of the economy and in the year 2018 and 2019 seems increasing which can be seen from the figure above.

4.1.2 Pattern of CPI

CPI is most widely used economic indicator of inflation which measures the average change in price over time that consumers pay for a basket of goods and services.It helps to locate inflation or deflation periods within the economy.Pattern of CPI can be viewed from the graph below.

Figure 4.2
Pattern of CPI



Source: Quarterly Economic Bulletin, 2019.

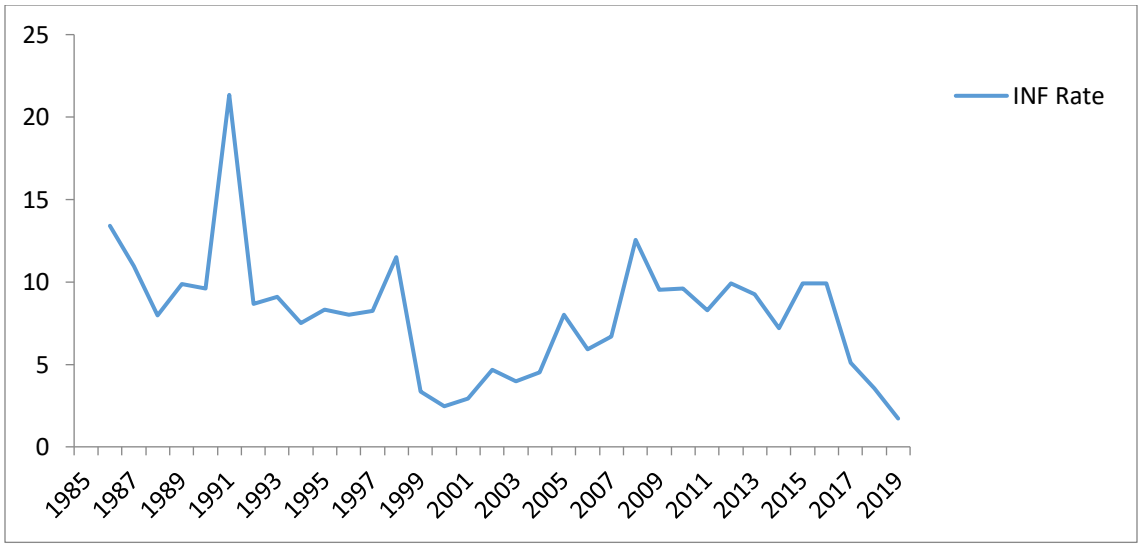
CPI in the figure 4.2 shows at increasing trend. Up to fiscal year 1991, CPI is raising at constant rate. From the period of 1991 to 2000, it increases at moderate rate. From fiscal year 2000, it has raised at rapid rate.

4.1.3 Pattern of Inflationary Rate

Inflation is a decrease in the purchasing power of money, reflected in a general in the price of goods and services. It is usually measured in percentage. Graphically the inflation rate of Nepal from 1985 to 2019 can be viewed from the figure below.

Figure 4.3

Pattern of Inflationary Rate



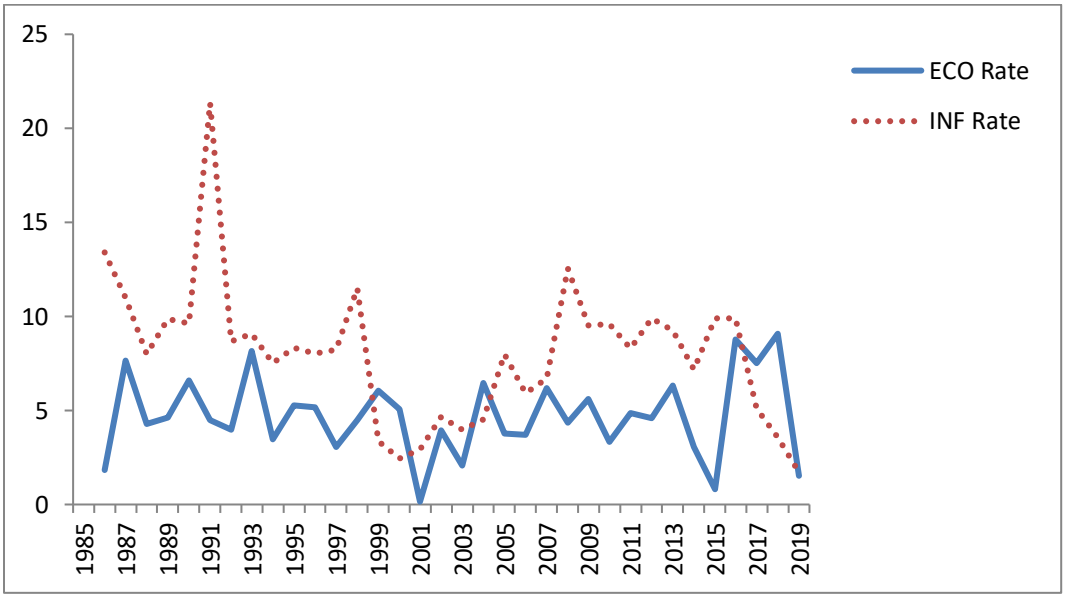
Source: Quarterly Economic Bulletin, 2019.

Figure 4.3 shows the inflation trend in Nepal from the period of fiscal year 1985 to 2019. Inflation is positive in every subsequent fiscal year. Inflation rate seems higher in fiscal year 1991. From the fiscal year 1991 to 2004, it has decreased. Again, from 2004 it has been increased in a slow rate and then increasing at high rate up to fiscal year 2009 as shown above in the figure. After that, it has been declined to fiscal year 2007 and again raised to fiscal year 2010 and after thefluctative situation can be viewed as shown above in the figure. Empirical studies show that higher causes of inflation includes the budget deficit, exchange rate, import and expected inflation (Neupane,1992)

4.1.4 Pattern of Economic Growth and Inflation Rate

Economic growth refers to the growth of potential output showing how a country is developing its economy.It is the increase of market value of goods and services produced by an economy over time. On the same way inflation is general rise in the price level decreasing the purchasing power of money.Simultaneously the graphical relationship between inflation and economic growth can be observed from the graph below.

Figure 4.4
Pattern of Inflation and Economic Growth Rate



Source: Quarterly Economic Bulletin, 2019.

Figure 4.4 shows the relationship between economic and inflation growth rate. Inflation is exceeding the economic growth rate in every fiscal year except some fiscal year like 1999, 2000 and 2004. Initially, at fiscal year 1985, economic growth rate seems higher than inflation rate. In fiscal year 1988 economic and inflation rate seems constant. In fiscal year 1991, inflation rate is higher. This shows more discrepancy between inflation and economic growth. This is because of the rise in prices of the importable raw materials, fuels, fertilizers, construction materials and consumer goods as well as the prices of administered goods and services such as milk, petroleum products, education fees, telephone charges, electricity charges and the devaluation of Nepalese currencies via US dollar and other convertible currencies. From the fiscal year 1991, inflation

started decreasing up to 1994. Again, it started raising up to fiscal year 1998. Then, it started falling. Economic growth rate at 2000 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.

4.2 Relationship between Inflation and Economic Growth

This title deals with the relationship of economic growth with other variables along with inflation introduced in the model to identify the impacts and responsiveness.In order to examine the long-run relationship between inflation and economic growth, initially the stationary of the variables should be checked which is examined by Augmented Dickey Fuller (ADF) test. Long-run relationship of the concerned variables has been established by Engle Granger Co-integration analysis. On the same way short-run relationship has been checked by Error Correction Model.

4.2.1 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 4.1
Unit Root Test of the Variables

UNIT ROOT TEST RESULTS TABLE (ADF)						
Null Hypothesis: Variable has a unit root						
	At Level					
		lnRGDP	lnRIMP	lnRINV	lnCPI	lnPOPN
With Constant	t-Statistic	0.04306	-1.4859	-0.0914	-0.1342	-1.9930
	Prob.	***0.9635***	***0.5285***	***0.9425***	***0.9373***	***0.2884***
		no	no	no	no	No
With Constant & Trend	t-Statistic	-2.2953	-0.2992	-2.6442	-1.8843	-0.9849
	Prob.	***0.4250***	***0.9874***	***0.2646***	***0.6399***	***0.9330***
		no	no	no	no	No
	At First Difference					
		d(lnRGDP)	d(lnRIMP)	d(lnRINV)	d(lnCPI)	d(lnPOPN)
With Constant	t-Statistic	0.03632	-5.9405	-7.6829	-1.7120	-4.4882
	Prob.	***0.0000***	***0.0003***	***0.0000***	***0.0010***	***0.021***
		*	**	*	*	**
With Constant & Trend	t-Statistic	-3.4648	-6.6760	-7.6784	-1.8283	-4.7306
	Prob.	***0.012***	***0.0007***	***0.031***	***0.0030***	***0.0032***
		**	**	**	**	**
Note:						
(*)Significant at the 1%; (**) Significant at the 5%, and (no) Not Significant						

Source: Author's calculation through Eviews-10.

As shown above in the table 4.1 variables are not stationary in the level form. After then, all the variables are integrated in first order I(1). These variables are found to be stationary at 5 percent level of significance. It is justified above in the table 4.1. 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 Co-integration test and short-run analysis will be carried out by Error Correction Model.

4.2.2Engle Granger Co-integration Test to Long-run Dynamics

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 using 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 4.2

Result of the Error Correction Term

Variable	Level		Remark
	Constant	Constant & Trend	
ECT	-0.622660 [0.000]	0.000838 [0.001]	I (0)

Source: Author's calculation through Eviews-10

From the table 4.2 residual term of regression is integrated for both constant (intercept), constant and trend at 5 percent level of significance in the level form. 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 4.3

Regression Result of Equation after Correcting the Autocorelation

Dependent Variable: lnRGDP				
Method: Least Squares				
Sample: 1985-2019				
Included observations: 35				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.498006	0.307038	24.42041	0.0000
lnRINV	0.00829	0.033058	4.788303	0.0000
lnCPI	0.003043	0.000739	4.117593	0.0003
lnRIMP	-0.006224	0.009892	0.629214	0.0434
lnPOPN	0.000458	0.093736	15.55615	0.0000
R-squared	0.856503	Log likehood		77.25364
Adjusted R-squared	0.906037	F-statistic		4.0802
S.E. of regression	0.038750	Prob(F-statistic)		0.000
Sum squared residual	0.024797	Durbin-Watson stat		1.226333

Source: Author's calculation through Eviews-10.

In the table 4.3, it has found p-values of independent variables are smaller close to zero except real import which means the regression coefficients are statistically significant both at 1 percent and five percent level. Adjusted R^2 is 0.906037 which is very high showing 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 method so far as there is no problem of heteroscedasticity and multicollinearity. Normality check is done by JB test showing that residuals are normally distributed. Residuals test of regression is stationary at level form with p-value (0.001) 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 independent variables in long-run is expressed as:

$lnRGDP_t$=7.4980 + 0.0030lnCPI_t+ 0.0083$lnRINV_t$- 0.0062$lnRIMP_t$+ 0.0004 $lnPOPN_t$…… 4.1

Positive coefficient of CPI with statistically significant indicates inflation positively influences the economic growth in the long-run. Moreover this finding is similar to the analysis of Keynesian theoretical analysis framework which indicates inflation before vertical AS positively influences the economic growth as in 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), Manamba (2016). Since, positive coefficient 0.003043 of CPI implies that one percent increase in inflation boosts up economic growth by 0.003043 percent. In similar way, real import volume negatively triggers the economic growth. Since, negative value of coefficient indicates that import reduces the economic growth thus, 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 of resources import can be

independent of economic growth. Investment in above table shows the positive impact on economic growth. This shows that 1 percent increase in investment influences the economic growth positively by 0.00829 percent. This is statistically significant at below 1 percent level. This is true since investment is assumed to be measuring rod of economic growth. Since Keynesian theory argues that AD generates the higher level of employment, output and economic growth. 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.

4.2.3 Error Correction Model (ECM) to Short-run Dynamics

Engle Granger test examines the long-run static equilibrium. Even if there exist 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.

Table 4.4
Estimation of the Result ofError Correction Model

Dependent Variable: D(lnRGDP)				
Method: Least Squares				
Sample : 1985-2019				
Included observations: 35				
Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	0.030021	0.008399	3.574232	0.0013
D(lnCPI)	-0.001481	0.001666	0.889203	0.3815
D(lnRIMP)	0.003771	0.008465	0.445436	0.6594
D(lnRINV)	0.050685	0.022903	2.213025	0.0352
D(lnPOPN)	0.462425	0.306578	1.508342	0.1427
ERROR(-1)	-0.372081	0.131645	-2.826388	0.0086
R-squared	0.751901	Log likelihood		90.55494
Adjusted R-squared	0.772403	F-statistic		2.421785
S.E. of regression	0.048588	Prob(F-statistic)		0.060481
Sum squared residual	0.009674	Durbin-Watson stat		1.902477

Source: Author's calculation through Eviews-10.

In the table 4.4 coefficient of ECM (γ) has negative sign which satisfies the theoretical expectation that indicates short-run equilibrium can be transformed into long-run equilibrium point. In other words, the negative coefficient of γcan 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 of the coefficient. Based on the table 4.4 the value of coefficient for the Error Correction term is 0.372081 implying that 37 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:

$$\Delta lnRGDP_t = 0.0030 - 0.0015\Delta lnCPI_t + 0.0507 \Delta lnRINV_t + 0.0038\Delta lnRIMP_t + 0.4624\Delta \text{lnPOPN}_t - 0.3721\text{ECT}_t \quad \ldots\ldots 4.2$$

In short-run, inflation negatively influences the economic growth. Negative coefficient 0.001481 implies that 1 percent increase in inflation decreases the economic growth rate

by 0.001481 percent. This is statistically significant at 1 percent level. 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 significant 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. Population growth rate also positively influences the economic growth. However, it is statistically insignificant.

Result in table 4.4 has been obtained after removing the serial autocorrelation by using robust least square method. Similarly, table 4.4 shows that adjusted R^2 is 0.772403. This means variations in the dependent variable in the model are explained by changes in independent variables. S.E. of regression is 0.048588 and value of D-W test 1.902477 near to 2 implies no presence of autocorrelation.Prob(F-statistic) 0.060481 implying the joint effect the of set of independent variables signified the economic growth properly. In conclusion, this shows economic growth is influenced by inflation negatively except other variables in short-run but in less significant way compared to long-run.

4.3 Estimation of the Threshold Level of Inflation and Checking its Robustness

Conditional Least Square technique developed by Khan and Senhadji is used to carry out the threshold level of inflation. On the same way different diagnostic test are carried out to examine the strength of threshold level of inflation.

4.3.1 Estimation of the Threshold level of Inflation

As stated in the chapter III 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 to 10 and above percent respectively. Moreover, threshold estimation is given below in table 4.5

Table 4.5

CLS Estimation of the Threshold Level of Inflation

Dependent variable: lnRGDP
Method: Ordinary least square
Number of observations: 35

K	Variables	Coefficient	Std.error	t-statistics	p-value	R^2
5	Constant	7.536	0.0209	24.364	0.413	$(0.841)^*$
	lnCPI	0.003	0.001	4.232	0.000	
	$lnCPI^2$	0.001	0.0261	3.145	0.033	
	D_5 (INF-5)	0.020	0.034	1.99	0.018	
	lnRINV	0.149	0.035	4.309	0.000	
	lnRIMP	0.006	0.010	0.553	0.584	
	lnPOPN	1.483	0.099	14.966	0.000	

Source: Author's calculation through Eviews-10.
Note: * represents existence of threshold level of inflation.

From the table 4.5 it has been found high R^2 as (0.841) at 5 percent level with lower standard errors (0.0209). In this situation, null hypothesis cannot be accepted. At 5 percent level, threshold of inflation exists in Nepalese economy in which it is statistically significant at less than five percent level of significance. At threshold level investment, import, population growth positively influences the growth. From above observation, higher inflation above the threshold level will jeopardize economic growth. Since, the coefficient value given by the dummy is lower. However economic growth will not be much affected below the threshold level. Since coefficient for D_4 is slightly lower

compared to coefficient of D_5 (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. Hence, lower level of economic growth will be attained above the threshold level of inflation. 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 4.5 shows 5 percent as optimum level of inflation that economy absorbs without affecting the economic growth.

4.3.2 Diagnostic Test

Diagnostic tests are carried out to check whether the model estimated is robust or not for threshold level of inflation at 5 percent level. As stated above in chapter III, 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.

Table 4.6
Diagnostic Test for Threshold Level of Inflation

Test	Test statistic	p-value	Conclusion
Normality test(JB test)	1.355	0.433	Residuals are normally distributed.
Autocorrelation (LM-test)	1.15	0.192	No autocorrelation
Heteroscedasticity test(BPG test)	2.99	0.561	No heterocedasticity
Stability (CUSUM test)	Within the bands	0.039	Stable

Source: Author's calculation through Eviews-10.

From the table 4.6 residuals are normally distributed which is checked by JB test. Autocorrelation is checked by LM test developed byBreusch-Godfrey (BG) and which gives no autocorrelation.Heteroscedasticity has been checkedBruesch Pagan Godfrey (BPG) showing p-value as 0.561 which is extremely high implying acceptance of null hypothesis showing the absence ofheteroscedasticity in the regression model and the conclusion drawn from the CUSUM test as stable represents that the estimated threshold level of inflation as 5 percent is appropriate in Nepalese economy during the study period.

Eventually, the estimation of threshold level of inflation shows at 5 percent level, inflation makes positive significant impact in an economy. This result is similar to the findings of Sattarov (2011) in Finland as 4 percent threshold, Mubarik(2005) in Pakistani economy suggested to be 9 percent as the threshold level, and Ahmed and Mortaza (2005) suggested 6 percent in Pakistan. Based upon the results of this chapter, final chapter provides major findings, conclusion and recommendations of the concerned research study.

CHAPTER - V

MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Major Findings of the Study

Economic growth of a country is the result of monetary, fiscal, and other economic policies undertaken by the policy makers. Economic growth is affected by a number of factors,one of which is inflation. The relationship between inflation and economic growth is complex one. 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 either of directly or indirectly have included the analysis of inflation. 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 aimed at keeping the inflation within the limited bands. Most of the economic researches have reached in the conclusion that the lower threshold level of inflation is more beneficial for the economic growth of the country.

The review of literature showed that there is negative relationship between inflation and economic growth both in international and Nepalese context in most of the analysis. However, some of the empirical studies showed neutral and positive relationship between inflation and economic growth in developing economies. Economic growth is not only affected by inflation but also by import, investment and by population in the study.Analysis showed that the positive relationship between economic growth,investment and import in the long-run.Most of the researches showed the inverse relationship between economic growth and population, rise in portion of dependent population decrease the per capita income of the individual.

The study showed RGDP is increasing in every fiscal year. In some year it increases at slow rate, in some year it increases at moderate rate and in some year it increases at a speedy rate. In fiscal year 1985 it was NRs. 214526.6 million, NRs. 273568.2 million in

fiscal year 1990, NRs. 441519 million in 2000, NRs. 6500001.9 million in 2010 and NRs. 1020050 million in the year 2019.

CPI seems increasing in every fiscal year like it was 20.9 in the year 1985, 77.2 in the year 1999, 152.67 in the year 2010 and on the same way it was 284.51 in the fiscal year 2019.Inflation rate seems positive in every subsequent fiscal year. Inflation rate seems higher in the fiscal year 1986,1991,1998,2008 and likewise it seems lower in the fiscal year 2000,2001 and 2019. In comparision to inflation and economic growth rate, inflation rate is exceeding the economic growth rate in most of the fiscal year except some years like 1999,2000 and 2004. Economic growth rate in the year 2000 was lowest reaching to zero.

Stationarity of all the variables are checked by ADF test and all the variables are found stationary in the first order I(1) either at 1 percent or 5 percent level of significance. For fulfilling the sufficient condition for Engle Granger, unit root test of the residual term was checked and it was found 0.000838 as p-value 0.001 showing stationary at the level form I(0). After conducting the regression among the selected variables it has been found the long run relationship between the economic growth and its determinants showing R^2 as 0.856503, standard error as 0.038750, F-statistics as 4.0802, Durbin-Watson stat as 1.226333 and 0.906037 as an adjusted R^2. R^2 as 0.856503 implied that the dependent variable is well explained by the explanatory variables. On the same way standard error founding as 0.038750 indicates there is very less chance only 3 percent of not explaining the economic growth by the selected variables in the long run.

Though there existed the long run relationship among the variables, sometimes the short run relationship may or may not exist. Short run relationship among the variables was examined by Error Correction Model showing 0.751901 as R^2,-0.372081 as error correction term which indicates the level of speed needed to move into the long run equilibrium from the short run, 0.772403 as adjusted R^2,2.421785 as F-statistics and 1.902477 as Durbin-Watson stat. R^2 as 0.751901 implied 75 percent of economic growth is explained by the selected independent variables. On the same way error correction term found as -0.372081 implying 37 percent of the speed of adjustment is required to come into the path of equilibrium in the long run from the short run.

Moreover, the study found 5 percent as threshold level inflation in Nepalese economy with maximum R^2 0.841 and lower standard error 0.0209. Inflation above threshold level provides lower economic growth. But keeping the inflation below the threshold level is desirable to get higher economic growth rate compared beyond the threshold level point. 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.

Diagnostic tests were conducted to examine the stability of threshold level of inflation. It includes normality test, autocorrelation test, heteroscedasticity test and CUSUM test. Normality test showed test statistics as 1.355, p-value as 0.433, autocorrelation test showed test statistics as 1.55 and 0.192 as p-value. On the same way heteroscedasticty test showed 2.99 as test statistics and p-value as 0.561 and finally test statistics within the bands and p-value as 0.039 shown by CUSUM test implied 5 percent as the threshold level of inflation is appropriate in the Nepalese economy during the study period.

5.2 Conclusions

In order to analyze the economic status of any country it is necessary to be known about the macro-economic indicators like GDP, inflation, import, investment, inflation, consumption, export,saving,consumption etc. Economic growth reflects whether the nation is under developed or developing or developed. Economic growth is affected by different indicators. As mine study mainly focusedon the impact of inflation over economic growth along with other variables like investment, import and population. Hence, this study is based on the response of inflation and other selected variables over economic growth of Nepal.

Overall, after observing the result in the fourth chapter study concluded that economic growth is positively influenced by inflation, investment and population and negatively influenced by import in the long-run. Positive sign of coefficient 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 relationship 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, major determinant of economic growth is inflation. Negative sign of coefficient of inflation indicates negative influences on the economic growth in short-run. This finding is similar to the theoretical framework of new classical and new Keynesian short-run analysis. However real investment, and population are independent of growth in short-run. Though, positive sign of coefficient of investment and population indicates that they positively influence 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.

5.3 Recommendations

From the empirical study, following recommendations have been provided.

a) 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.

b) Import has been found to deteriorate the economic growth in short-run and 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.

c) 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.

d) 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 5 percent level of threshold inflation in Nepalese economy. Thus inflation above the threshold level lowers the economic growth. Similarly, real investment and population growth positively influences the economic growth in long-run.

e) From the empirical evidence even if inflation and economic growth have positive relation in the long-run, it has been found 5 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.

f) 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. 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.

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APPENDIX – I

Data in Raw Form

GDP, INV, IMP, POPN (Rs. in million)

Year	GDP	INV	IMP	POPN	CPI	DFL
1985	55734	10599	9341.2	16.87	20.9	25.98
1986	63864	12898	10905.2	17.3	23.7	29.23
1987	76906	15237	13869.6	17.75	26.3	32.7
1988	89270	19415	16263.7	18.22	28.4	36.4
1989	103416	19076	18324.9	18.27	31.2	40.3
1990	120370	25074	23226.5	18.3	34.2	44
1991	149487	31619	31940	18.68	41.5	52.3
1992	171474	39653	39205.6	19.13	45.1	57.7
1993	199272	44644	51570.8	19.59	49.2	62
1994	219175	55231	63679.5	20.05	52.9	65.9
1995	248913	68017	74454.5	20.53	57.3	71.1
1996	280513	71084	93553.4	21.02	61.9	76.2
1997	300845	74728	89002	21.53	67	79.3
1998	342036	70061	87525.3	22.04	74.7	86.3
1999	379488	92272	108504.9	23.15	77.2	90.3
2000	441519	68649	115687.2	23.67	79.1	100
2001	459443	93019	107389	23.97	81.4	103.9
2002	492231	105383	124352.1	24.2	85.2	107.1
2003	536749	131671	136277.9	24.75	88.6	114.4
2004	589412	155907	149473.6	25.3	92.6	118
2005	654084	175633	173780.8	25.87	100	126.2
2006	727827	208779	194694.6	25.18	105.9	135.4
2007	815658	247272	221937.7	25.53	113	142.9
2008	988272	313029	284469.6	25.89	127.2	165.9
2009	1192744	456489	374335.2	26.25	139.3	189.6
2010	1366954	519268	396176	26.49	152.67	210.3
2011	1527344	526889	461668	26.85	165.34	224.1
2012	1695011	632601	556740	27.21	181.71	237.8
2013	1964540	808758	714366	27.58	198.52	259.2
2014	2130150	831983	774684	27.95	212.79	272.7
2015	2253163	763416	773599	28.33	233.86	286.11
2016	2674493	1252133	990113	28.71	257.01	312.24
2017	3044927	1641269	124510	29.1	270.11	330.62
2018	3458793	1956371	141850	29.49	279.71	344.3
2019	3767043	1889263	114840	29.89	284.51	369.3

Source: Economic Survey, various issues, MoF,CBS, Quarterly Economic Bulletin of NRB

APPENDIX – II

Data in Processed Form

RGDP, RINV, RIMP (Rs in million)

Year	RGDP	RINV	RIMP	Economic Growth Rate	Inflation Rate
1985	214526.6	40796.77	35955.35		
1986	218487.9	44125.9	37308.24	1.85	13.39
1987	235186.5	46596.33	42414.68	7.6	10.97
1988	245247.3	53337.91	44680.49	4.28	7.98
1989	256615.4	47334.99	45471.22	4.64	9.86
1990	273568.2	56986.36	52787.5	6.61	9.62
1991	285826	60456.98	61070.75	4.48	21.35
1992	297182	68722.7	67947.31	3.97	8.67
1993	321406.5	72006.45	83178.71	8.15	9.09
1994	332587.3	83810.32	96630.5	3.48	7.52
1995	350088.6	95663.85	104718	5.26	8.32
1996	368127.3	93286.09	122773.5	5.15	8.03
1997	379375.8	94234.55	112234.6	3.06	8.24
1998	396333.7	81183.08	101419.8	4.47	11.49
1999	420252.5	102183.8	120160.5	6.04	3.35
2000	441519	68649	115687.2	5.06	2.46
2001	442197.3	89527.43	103358	0.15	2.91
2002	459599.4	98396.83	116108.4	3.94	4.67
2003	469186.2	115097	119124	2.09	3.99
2004	499501.7	132124.6	126672.5	6.46	4.51
2005	518291.6	139170.4	137702.7	3.76	7.99
2006	537538.4	154194.2	143792.2	3.71	5.9
2007	570789.4	173038.5	155309.8	6.19	6.70
2008	595703.4	188685.4	171470.5	4.36	12.57
2009	629084.4	240764.2	197434.2	5.60	9.51
2010	650001.9	246917.7	188386.1	3.33	9.59
2011	681545.7	235113.3	206009.8	4.85	8.29
2012	712788.5	266022.3	234121.1	4.58	9.90
2013	757924.4	312020.8	275604.2	6.33	9.25
2014	781133.1	305090.9	284079.2	3.06	7.19
2015	787516.3	266826	270385.2	0.82	9.90
2016	856550.4	401016.2	317100	8.77	9.89
2017	920974.8	496421.6	37659.55	7.52	5.09
2018	1004587	568217	41199.54	9.08	3.55
2019	1020050	511579.5	31096.67	1.54	1.72

Source:Author’s calculation through Eviews-10

APPENDIX – III

Data in Log Form

Year	lnRGDP	lnRINV	LnRIMP	lnPOPN	lnCPI	$lnCPI^2$
1985	12.27619	10.61636	10.49003	2.825537	3.039749	9.240075
1986	12.29449	10.6948	10.52697	2.850707	3.165475	10.02023
1987	12.36813	10.74928	10.65525	2.876386	3.269569	10.69008
1988	12.41002	10.8844	10.70729	2.90252	3.346389	11.19832
1989	12.45533	10.765	10.72483	2.90526	3.440418	11.83648
1990	12.51931	10.95057	10.87403	2.906901	3.532226	12.47662
1991	12.56314	11.00969	11.01979	2.927453	3.725693	13.88079
1992	12.6021	11.13783	11.12649	2.951258	3.808882	14.50758
1993	12.68046	11.18451	11.32875	2.975019	3.895894	15.17799
1994	12.71466	11.33631	11.47865	2.998229	3.968403	15.74823
1995	12.76594	11.4686	11.55903	3.021887	4.048301	16.38874
1996	12.81618	11.44343	11.7181	3.045474	4.12552	17.01992
1997	12.84628	11.45354	11.62835	3.069447	4.204693	17.67944
1998	12.89001	11.30446	11.52702	3.092859	4.31348	18.60611
1999	12.94861	11.53453	11.69658	3.141995	4.346399	18.89119
2000	12.99798	11.13676	11.65865	3.164208	4.370713	19.10313
2001	12.99951	11.4023	11.54595	3.176803	4.399375	19.3545
2002	13.03811	11.49676	11.66228	3.186353	4.445001	19.75804
2003	13.05875	11.65353	11.68792	3.208825	4.484132	20.10744
2004	13.12137	11.7915	11.74936	3.230804	4.528289	20.5054
2005	13.15829	11.84345	11.83285	3.253084	4.60517	21.20759
2006	13.19476	11.94597	11.87612	3.22605	4.662495	21.73886
2007	13.25478	12.06127	11.95318	3.239854	4.727388	22.3482
2008	13.2975	12.14784	12.05217	3.253857	4.845761	23.4814
2009	13.35202	12.39157	12.19316	3.267666	4.93663	24.37031
2010	13.38473	12.41681	12.14625	3.276767	5.028279	25.28359
2011	13.43212	12.36782	12.23568	3.290266	5.108004	26.0917
2012	13.47694	12.49134	12.36359	3.303585	5.202412	27.06509
2013	13.53834	12.65083	12.52672	3.317091	5.29089	27.99352
2014	13.5685	12.62837	12.55701	3.330417	5.360306	28.73288
2015	13.57664	12.49435	12.5076	3.343921	5.454723	29.754
2016	13.66067	12.90176	12.66697	3.357245	5.549115	30.79268
2017	13.73319	13.11518	10.53634	3.370738	5.598829	31.34689
2018	13.82009	13.25026	10.62618	3.384051	5.633753	31.73918
2019	13.83536	13.14526	10.34486	3.397524	5.650768	31.93118

Source:Author's calculation through Eviews-10

APPENDIX - IV

CLS Estimation of the Inflation Threshold

Dependent Variable: lnRGDP

Method: Ordinary least square

Number of observations: 35

K	Variables	coefficient	Std. errors	T-statistic	Prob	R^2
3	C	7.540	0.314	24.005	0.512	
	lnRINV	0.156	0.033	4.651	0.000	
	lnRIMP	0.007	0.010	0.674	0.506	0.772
	lnPOPN	1.445	0.096	15.059	0.000	
	lnCPI	0.003	0.001	4.174	0.000	
	$lnCPI^2$	0.023	0.007	0.04	0.041	
	D3(INF-3)	0.022	0.032	0.701	0.489	
4	C	7.516	0.0305	24.613	0.0722	
	lnRINV	0.147	0.034	4.284	0.000	0.813
	lnRIMP	0.005	0.010	0.456	0.465	
	lnPOPN	1.50	0.102	14.711	0.000	
	lnCPI	0.003	0.001	4.186	0.000	
	$lnCPI^2$	0.017	0.045	2.234	0.013	
	D4(INF-4)	0.019	0.017	1.12	0.272	
5	C	7.536	0.0209	24.364	0.413	
	lnRINV	0.149	0.035	4.309	0.000	0.841*
	lnRIMP	0.006	0.010	0.553	0.584	
	lnPOPN	1.483	0.099	14.966	0.000	
	lnCPI	0.003	0.001	4.232	0.000	
	$lnCPI^2$	0.001	0.0261	3.145	0.033	
	D5(INF-5)	0.020	0.034	1.99	0.018	
6	C	7.515	0.108	24.360	0.051	
	lnRINV	0.152	0.034	4.492	0.000	0.681
	lnRIMP	0.006	0.010	0.539	0.594	
	lnPOPN	1.477	0.098	15.013	0.000	
	lnCPI	0.003	0.001	4.196	0.000	
	$lnCPI^2$	0.045	0.006	2.223	0.042	
	D6(INF-6)	0.009	0.011	0.824	0.417	
7	C	7.445	0.307	24.590	0.023	
	lnRINV	0.152	0.033	4.644	0.000	0.582
	lnRIMP	0.005	0.010	0.526	0.603	
	lnPOPN	1.504	0.098	15.340	0.000	
	lnCPI	0.003	0.001	4.192	0.000	
	$lnCPI^2$	0.066	0.009	2.65	0.004	

	D7(INF-7)	0.016	0.011	1.479	0.150	
8	C	7.484	0.323	23.185	0.414	0.620
	lnRINV	0.159	0.034	4.713	0.000	
	lnRIMP	0.007	0.011	0.623	0.538	
	lnPOPN	1.460	0.099	14.724	0.000	
	lnCPI	0.003	0.001	3.966	0.000	
	$lnCPI^2$	0.008	0.023	2.176	0.0047	
	D8(INF-8)	0.002	0.011	0.191	0.850	
9	C	7.521	0.0321	23.415	0.126	0.448
	lnRINV	0.158	0.034	4.701	0.000	
	lnRIMP	0.007	0.010	0.708	0.485	
	lnPOPN	1.448	0.099	14.654	0.000	
	lnCPI	0.003	0.001	4.079	0.000	
	$lnCPI^2$	0.0087	0.008	6.894	0.007	
	D9(INF-9)	-0.003	0.011	-0.261	0.796	
10	C	7.511	0.214	23.897	0.078	0.242
	lnRINV	0.158	0.034	4.713	0.000	
	lnRIMP	0.007	0.010	0.673	0.506	
	lnPOPN	1.452	0.096	15.096	0.000	
	lnCPI	0.003	0.001	4.085	0.000	
	$lnCPI^2$	0.083	0.053	8.345	0.007	
	D10(INF-10)	-0.003	0.012	-0.248	0.806	
11	C	7.512	0.3111	25.113	0.321	0.433
	lnRINV	0.166	0.033	5.096	0.000	
	lnRIMP	0.006	0.010	0.648	0.522	
	lnPOPN	1.422	0.094	15.107	0.000	
	lnCPI	0.003	0.001	4.084	0.000	
	$lnCPI^2$	0.102	0.033	8.432	0.006	
	D11(INF-11)	-0.021	0.014	-1.577	0.126	

Source: Author's calculation through Eviews-10