Determinants of Inflation in Nepal: An Empirical Assessment

Shoora B. Paudyal Ph.D.[*]

Abstract

This paper examines short term and long term effects of the macroeconomic variables on the inflation in Nepal during 1975-2011. The variables considered are budget deficits, Indian prices, broad money supply, exchange rate and real GDP. The regression results from Wickens-Breusch Single Equation Error Correction model suggest that all variables considered are significant in long run implying that these variables are the determinants of inflation in Nepal. However, only budget deficit, money supply and Indian prices cause inflation in the short run. The results are consistent with monetarists' hypothesis of money matters and inflationary gap theory of Keynesian as well as supply constraints approach to inflation.

Key Words: Inflation, Budget Deficits, Single Equation ECM, Imported Prices, Consumer Price Index, M2, GDP

JEL Classification: E31; C22

[*] *Dr. Paudyal is a faculty of economics, Tribhuvan University, Kathmandu.*
Email: paudyalsurbir@gmail.com

The author acknowledges the valuable comments from Editorial Board and external reviewers on the original version of this paper.

I. INTRODUCTION

A continuous rise in price level is termed as inflation (Parkin, et al, 1986: 367). Inflation is an ongoing process whereby prices are rising persistently year after year. Shapiro (1996:468) defines inflation as a rising price level. If such a rise in price level persist for long it is known as inflation. Consumer price index, gross domestic product deflator and other several indices measure the changes in price level. The use of these measures is purposely applied wherever appropriate. However, the rate of percentage change in consumer price index as a measure of inflation is widely used. We also here adopt this definition of inflation for our purpose.

Inflation is everywhere and is interestingly touchy issue in macroeconomics. All daily newspapers cover the news about inflation. There is no dearth of literature on inflation. It is the mostly discussed issue all over the world among policy makers and academia. It is because of the fact that its effects are widespread and severe and the impacts are far reaching. Inflation has been the major concern for the government since it has serious implication for the living of common peoples. Moreover, it affects several macroeconomic variables such as saving, investment, real interest, real wage, real income and level of employment. Inflation depreciates domestic currency and the imports become more expensive which further push up the domestic prices. In short, inflation is a burning issue in the macroeconomics and main objective and function of central bank is to control inflation.

Table 1: **Consumer price index**

Year	CPI	Year	CPI	Year	CPI	Year	CPI
1974/75	9.8	1984/85	20.8	1994/95	59.7	2004/05	100.0
1975/76	9.6	1985/86	24.7	1995/96	65.2	2005/06	107.6
1976/77	10.5	1986/87	27.4	1996/97	67.7	2006/07	114.1
1977/78	11.3	1987/88	29.9	1997/98	75.4	2007/08	126.6
1978/79	11.7	1988/89	32.5	1998/99	81.0	2008/09	141.3
1979/80	13.4	1989/90	35.2	1999/00	83.0	2009/10	155.4
1980/81	14.9	1990/91	40.7	2000/01	85.2	2010/11	170.2
1981/82	16.6	1991/92	47.6	2001/02	87.8		
1982/83	18.7	1992/93	51.2	2002/03	92.8		
1983/84	19.2	1993/94	55.5	2003/04	93.6		

Source: IMF, International Financial Statistics, various issues base year 2005=100

Table 1 shows that price index (base year 2005) has increased persistently over the years. It has increased by little over seventeen times (from 9.8 to 170.2) during 1975-2011. This means the purchasing power of the rupee has eroded by the same speed. Aforementioned, the impact of rising prices on the real sector is stylised fact. It constrains the rise of per capita real GDP and thereby reduces the standard of livings of the common people in the country. The stationary price level has thus been one of success parameters of the elected government. However, it has been a Herculean task to achieve in

developing countries. In case of Nepal, however, there appear some positive signals in slowing down the speed of price rise in the later years. For instance, CPI took ten years to double from 9.8 in 1975 to 20.8 in 1985; it doubled even faster within six years between 1985 and 1991 and within eight year period between 1991 to 1999. This has, however, turned upside down since the doubling period lengthened to twelve years between 1999 and 2011. This clearly indicates that prices have accelerated at slower motion especially after 1991's political change. One of the reasons for this might be relatively improved supply situation of the commodities during this period. Partly because Nepal's improved bilateral relation with India in the changing context and partly because of the sharply improved trade openness index due to trade liberalisation policy adopted by the government during early 1990s (Bowdler, et al; 2004)[1]. Some empirical studies substantiate that trade openness index has important bearing on the combating hyper inflation. This paper attempts to examine the relation between inflation and other related variables that influence the inflation in the country and suggest policy implications.

There may be a bunch of factors that may influence the inflation. In Nepal, price level, budget deficits, money supply, real GDP are continuously rising for many years. However, this does not prove that one causes other. We examine in this paper effects of a number of variables including budget deficits on prices dividing the paper into six sections: Section I is introduction, section II presents a literature review, and section III analytical framework, while section IV displays regression results and interpretation. The last section V concludes the paper.

II. REVIEWS OF LITERATURE

This section is divided into two parts: a) review of theoretical foundation and b) reviews of empirical studies. The theoretical review shape the relationship between inflation and other macroeconomic variables under classical/monetary hypothesis, Keynesian, New Keynesian and New Classical theories, while the empirical review examines both the short run and long run relationship between the variables under consideration.

The classical economists' famous quantity theory of money can be summarised in MV=PT, in which velocity of money in circulation (V) and quantity of goods (T) remain constant in the short run. So an increase in stock of money (M) brings a proportionate rise in price level (P). This equation became the foundation of monetarists economic thought. The monetarist economists opine that too much money chasing too few goods is the cause of inflation. As per the modern quantity theory of money, demand for money is given by 1/v* PQ. If the economy is at full employment, real income does not change and v being equals, there is a direct and proportionate relationship between changes in quantity of money and price level. The central bank prints more paper notes that directly causes inflation. But under the less than full employment economy, real income does not remain constant. So, v being constant if real income increases by 4% together with a 10% increase in money supply implies a 6% increase in inflation- a less than proportionate rise in price level.

[1] They claim that greater trade openness decreases the probability of inflation.

Historically, it is seen that if deficits are financed by money created by central bank that increases inflation directly (Friedman,1984). Friedman opines strongly that inflation is always and everywhere a monetary phenomenon. Monetarists including Friedman believe that money supply has direct effects on the inflation i.e., too much money to chase a few goods causes inflation. This implies that inflation is the function of money supply and real output. Friedman (1968) believed that central bank can control the inflation in the long run by controlling money supply. It is now well accepted that the primary goal of central bank is achieve a stable and low rate of inflation. However, the governments in many countries seem fail to support such contractionary monetary policy because of their temptation toward achieving higher economic growth and employment.

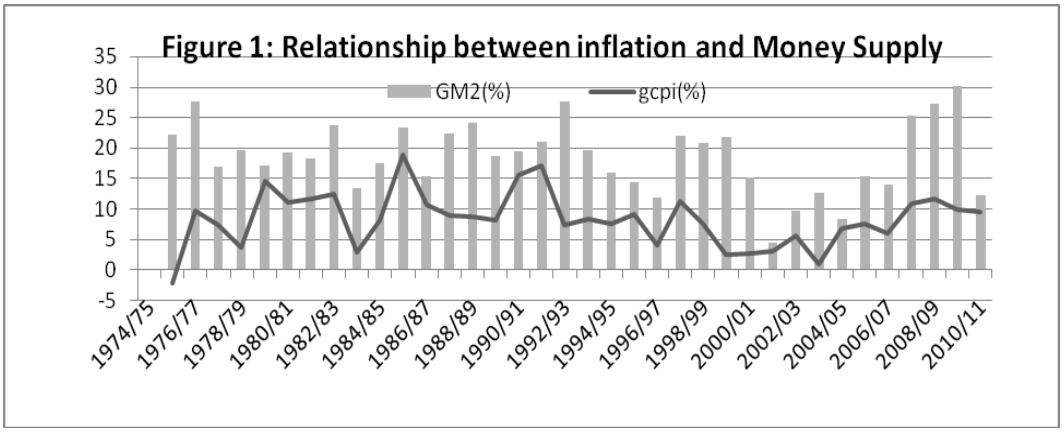


Figure 1 and Table A5 in appendices show the growth of money supply and that of prices in the country. Both move in the same direction but broad supply has alway been higher than inflation. High positive correlation between money supply and budget deficits (Appendices, Table A1) exhibits a very close association between these two variables.

Keynesian views of stimulating economy through aggregate demand often lead to a situation where government spending exceeds the mobilisation of taxes. It becomes thus a customary for the government from the developing economies to present deficit budget. However, it is widely believed that higher budget deficits have serious impacts on the macroeconomic variables. Among these most striking effect of budget deficits is on inflation. For this reason, budget deficit is largely considered as one of the major determinants of the inflation. Deficit compels the central bank to print new money to finance the budget deficit which led to an increase in money stock[2].

Deficits can be financed by other sources such as borrowing from the market which also indirectly affects inflation. Moreover, many believe that such effects of the budget deficits pass through interest rates to the major macroeconomic variables such as investment, employment, price level, consumption, exports and imports in an economy.

[2] See Malcolm Gillis, Dwight H Perkins, Michael Roemer and Donald R Snodgrass. 1983. Economics of Development, Second edition, p326. A country's money supply may be defined as the sum of all liquid assets in the financial system.

Because, the additional resources that are borrowed from the financial market by the government to finance the budget deficits which may crowd out the private investment. This increases the demand for credit, other things being equal; this will lead to a higher interest rate. Its immediate effects will be seen in the reduced private sector investment and consumption that implies lower aggregate demand, which virtually results in a lower income and employment. On the other hand, reduced private investment will result in lower aggregate supply. So, central bank generally attempts to monetise deficits to control the interest rate from rising. For this, it will purchase back the government securities pumping the new money in the market. This generally pushes up the price level through increase in money stock.

The monetary authority adopts thus the expansionary monetary policy that nullifies the rise in interest rate by increasing money supply but it causes inflation. So, deficits have indirect effects on the inflation through neutralised interest rate. This is consistence with a study that finds budget deficits in Nepal are interest rate neutral (Paudyal, 2013). However, the growth of budget deficits has been lower in later years but not the growth of money supply. This indicates that deficit is not only the cause of an increase in money supply.

The rise in budget deficits in the annual budget of the government of Nepal has been substantial over the years. The amount of budget deficits has increased to Rs 496 billion in 2010/11, which accounts for about 4% of GDP but this is lower than 5.5% in 2000/01 and about 10% in 1988/89 (NRB, 2010; MoF, 2012). This clearly indicates that budget deficits, though still at upper ladder, has substantially declined in recent years.

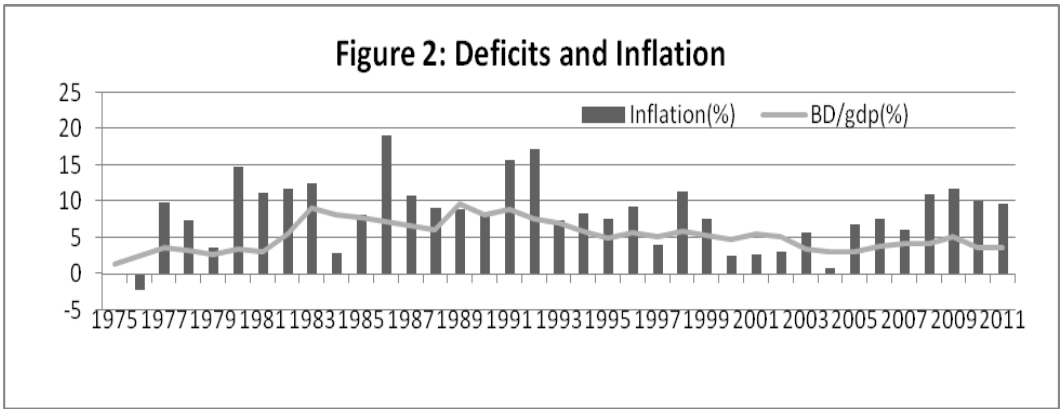


Figure 2 reveals that the relationship between inflation and deficits. The deficits as a percent of GDP almost coincided with inflation only for few years (1989/90, 1992/93 and others), but for the rest of years inflation departs either downwards or upwards of deficits. For instance, in 1979/80 deficit was little over 3% of GDP, but inflation rate was about 15%. This means inflation exceeds deficits by 12%. In 1982/83, deficits rose to 9% of GDP but inflation rate slipped to around 12% from the level of 1979/80 (see Table A2 in Appendices). The gap between two rates became only 3%. But interestingly they moved to opposite direction, that is, the increment in deficits appeared with reduction in inflation. Both declined in the next year (1983/84), but deficits decreased marginally by

one percent point (from 9% to 8%) while prices fell dramatically by over nine percentage point (from 12% to 2.8%). See Table A2 in Appendices. This indicates that deficits have not neck to neck relationship with inflation. However, two rates follow a similar positive trend for most of the years during the study period. To note, inflation rate exceeds deficits for the most of the years. It may be indicative that deficits are not only factors influencing inflation. However, the positive association between budget deficit and prices is high enough (Table A1). Some empirical studies such as Vuyyuri (2004) for developing economies suggest a strong influence of budget deficits on inflation rate. However, others such as Blanchard (1989) claim that budget deficits and inflation rate rarely show a positive association.

Figure 6 in Appendices also indicates that the growth rates of money supplies and domestic borrowing through securities to finance budget deficits are associated to each other. However, the government borrowing is highly fluctuating against the relatively stable money supply. The reason for the fluctuation might be explained in association to the disbursed amount of external loan and absorptive capacity of bureaucracy in the country. The growth curves of deficits and domestic borrowings reveal that they move concurrently.

The qualitative discussion clearly reveals that some variables seem to have very close link between them and others contain some distant relationship. But almost all of the variables mostly move in the same direction and exceptionally they move in opposite direction. Figures 7, 8, 9 and 10 in appendices show that the positive association between growth rates of broad money and budget deficits, that of borrowing and budget deficits, that of debt and deficits, and lastly relationship between three variables namely deficits, narrow money supply and inflation rate respectively.

Once Keynes says, "in the long run we all are dead." So, Keynesian economics focuses on the analysis of the short run behavior of the economic variables. For Keynesians, only aggregate demand matters. To them, in the short run, price level is determined by the aggregate demand and fixed aggregate supply. Any rise in aggregate demand in the short run thus causes inflation. For this reason, any pressure of the excess demand over fixed quantity of aggregate supply of goods and services causes inflationary gap. This leads to demand pull inflation (Shapiro, 1982).

Keynesian Philips curve comfortably explains tradeoff between inflation rate and unemployment rate, that is lower the unemployment rate higher the inflation. Keynesian aggregate demand (AD) policy to increase employment leads to a wider inflationary gap in the short run as aforementioned output cannot be increased immediately. Up to this point inflation was thus the resultant of demand shocks.

The oil shock of 1974 created a new problem of stagflation i.e. higher inflation appears with lower employment/real output (Shapiro, 1982). In other words, the world faced a new type of economic problem of hyper inflation and recession simultaneously that could not be explained by the old Keynesian Philips curve. Many countries faced double digit inflation rate in 1974 and 1979/80 due to supply shocks originated outside the country

(Shapiro, 1982). This suggested that supply shocks may have a dominant role in determination of inflation. The supply shocks generated outside the country cannot be controlled by the domestic policy. In addition, it is seen that past experiences on inflation may influence the future expected rate of inflation. This pushed the Keynesian economists to formulate new theory which is popularly known as New Keynesian economics that claims that inflation rate is determined by demand pull inflation, cost push and built-in-inflation (Gordon, 1988)[3].

The supply shocks from within and outside the domestic economy are accepted as one of the major causes of inflation. The economy wide shortages of goods and services cause the cost push inflation, that is, supply bottleneck causes this inflation. The cost push inflation may have many sources. One of these is the rising cost of production which causes inflation. The reasons behind such rise in cost may be either wage push, profit push or supply shock due to crop failure or lockouts or drought or foreign blockade, or war or supply shocks originated from outside country such as OPEC oil price rise in 1974 and 1979/80 (Shapiro, 1982). Supply shocks typically become rule, where domestic production shares small proportion of the total supply of the commodities in the market and agriculture largely depends on rain water in a small landlocked country like Nepal. Supply constraints, to some extent, might demonstrate higher domestic prices as compared to the international imported prices.

The built-in-inflation is another component of current inflation is the carryover from the past events and persists in the present time. The past events in the built in inflation may be persistence of either demand pull inflation or large cost push inflation or both in the past. Besides, inflationary expectations theory and conflict theory of inflation also contribute to the built in inflation. The past experiences of high inflation rate lead to the higher current inflation. The subjective judgments of workers and employers that current inflation will persist in future primarily push them to make an agreement to increase the prices of goods and money wages that causes built-in-inflation. The conflict theory of prices caused by wage-price spiral states that demand for higher money wages to protect real wages leads to built-in-inflation. This is also based on the subjective judgment of the workers. An increase in money wages pushes the prices upward and the purchasing power of the money again fall down. The built-in-inflation in New Keynesian seems to have largely influenced by the New Classical theory of rational expectation. The good thing is that this notion brings two major schools of thought-Keynesian and Monetarist-that differ for the century closer to each other.

[3] Gordon built triangle model of New Keynesian Theory of Inflation.

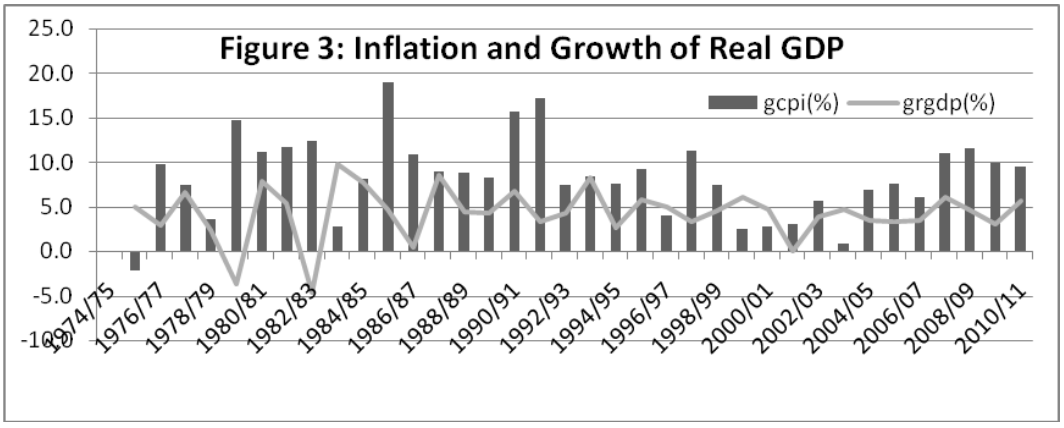


Figure 3 shows that growth in prices and real GDP move in the same direction. The growth of prices is higher for almost years and that of real output seems to be lower for almost all years. However, the high positive correlation coefficient between prices and real output (Table A1) demonstrates strong association between two variables.

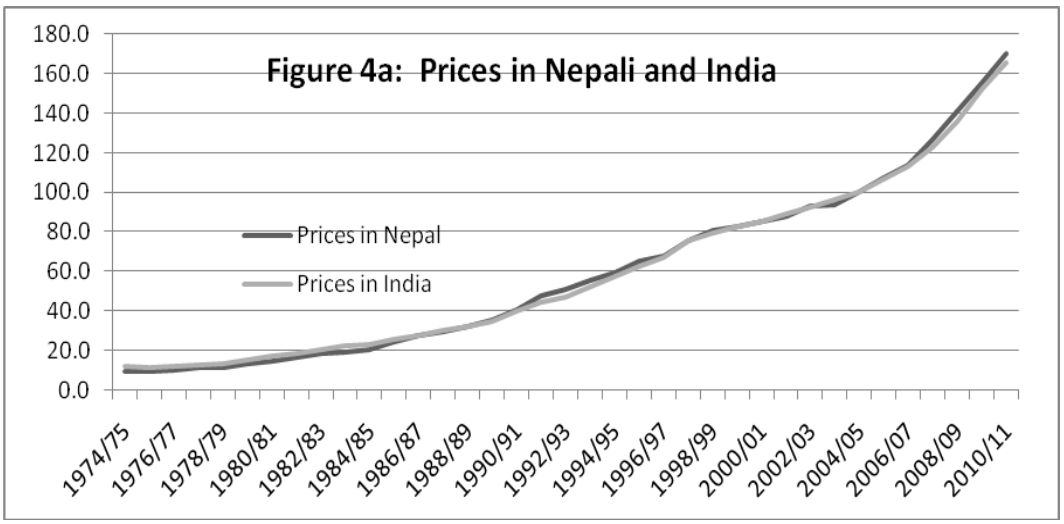
The Keynesian view that a modern capitalist system is not self-regulating and thus requires government intervention has given the rebirth of classical theory of economics (Cornwall, 1990:47). Among the advocates of New Classical theory of rational expectation, Lucas (1976) is in forefront. Lucas theory is very close to rational expectation in financial (stock) markets. This theory states that the predictions of economic agents about the future value of the variables are not systematically wrong in that all errors are random. This theory of inflation argues that rational expectation is the key cause of inflation. The actual price will only deviate from the expectation due to information shock caused by unforeseeable information at the time of expectation. So, actual price is the sum of expected price and error term. The control of inflation largely depends on the credibility, integrity and autonomy of the central bank. The economic actors look rationally into the future and try to maximize their well-being. They carefully watch the activities of the central bank and make their own perception about the decision of monetary authority and future expectations about the rate of inflation. Accordingly they frame their own strategies for maximization of benefits. They hardly believe the central bank which remained soft in the enforcement of its own decision in the past. In such backdrop, central bank policy to curb the inflation fails rather than succeed because market actors will hardly believe in the enforcement of the decision and so they expect higher inflation in future.

In short, Keynesian aggregate demand policy is considered as appropriate to reduce unemployment but inappropriate for regulating inflation (Cornwall, 1990:5). Rational expectation theory has some virtues and getting popularity explaining inflation. Modern macroeconomics theory posits that the output supplied depends on the unexpected movement in price level as well as on the actual and unexpected technological shocks (Blanchard, et. al, 1989: 519). So, inflation is not only the effect of demand and supply shocks but also is the cause of supply.

Some empirical studies such as Pahlavani (2009) find that even the international inflation and expected inflation have influential bearings on domestic inflation. Others such as Khan (2007) constructed econometric model to study inflation incorporating fiscal and monetary policies of the government. In reality, evident from empirical studies that several factors including money supply play roles in macro-economy (Kennedy, 2012: 189). McMillan (1986) finds that budget deficits cause inflation (Vuyyuri, et. al, 2004). In a study for Pakistan's inflation, Khan (2007) finds that the most important determinants of inflation in 2005-06 were adaptive expectations, private sector credit and rising import prices whereas, the fiscal policy's contribution to inflation was minimal. Bayo on the study for Nigeria reveals that fiscal deficits, money supply, interest and exchange rates are cause of inflation in Nigeria during the period under review. Pahlavani (2009) states that inflation in Iran is largely determined by money supply, exchange rate, GDP, expected inflation rate and imported inflation along with dummy variable. Kumar (2013) finds that money supply and imports index is the most important variables in explaining inflation in India while Laryea (2001) states that inflation in Tanzania is largely influenced by monetary factors both in the short run or the long run.

A study for NRB notes that Indian prices have a significant bearing on variation of domestic prices in the country (NRB, 1994:100). Besides, they find that an increase in money stock causes price rise and the gradual depreciation of the exchange rate of domestic currency has been partly responsible for the price rise in Nepal. Thapa (2010) attempts to study the determinants of inflation in Nepal. A study by Neupane (1992) finds that one year lagged money supply, cost of holding real balances, budget deficits, low output growth rates and import prices are the important determinants of price inflation in Nepal. NRB (2001) reveals that there is no structural shift in money price relationship in Nepal. This study finds that broad money has stronger relationship with inflation compared to narrow money. Mathema (1998) finds that a rise in wages in industrial sector causes national inflation while Koirala (2008) discloses a significant relationship between inflation and inflation expectations in Nepal. Koirala (2013) again finds non-constant time varying parameters of both the constant and autoregressive of order one AR(1) coefficient of inflation over the long run. He opines that the changes in the expectations of rational economic agents on macroeconomic policies due to the lack of policy commitment, credibility and dynamic consistency might have contributed for this.

Empirical studies in several other countries have shown that a set of explanatory variables such as real gross domestic product (RGDP), budget deficits (BD) or government expenditure, exchange rate (EXC), imported price (MP), broad money (M2) and expected inflation (P^e) explain the variation in price level (P). We examine these variables to explain the inflation in Nepal. In our case, CPI series is a measure of price level and among the independent variables the budget deficits after grants (BD), real GDP, the liquidity or money supply (M2) and the imported price is consumer price index of India (CPII) since Nepal's imports from India accounts about 66 per cent for 2013, which includes goods of daily consumption such as vegetables, clothes, medicines, transport equipments and petroleum products (MoF, 2014).



Two curves in Figure 4a shows that the movement of the price series in Nepal and India. The coincided curves to each other imply that they are very close mates and move together. They not only move to the same direction but also almost coincides each other. This implies that these two variables are perfectly co-related.

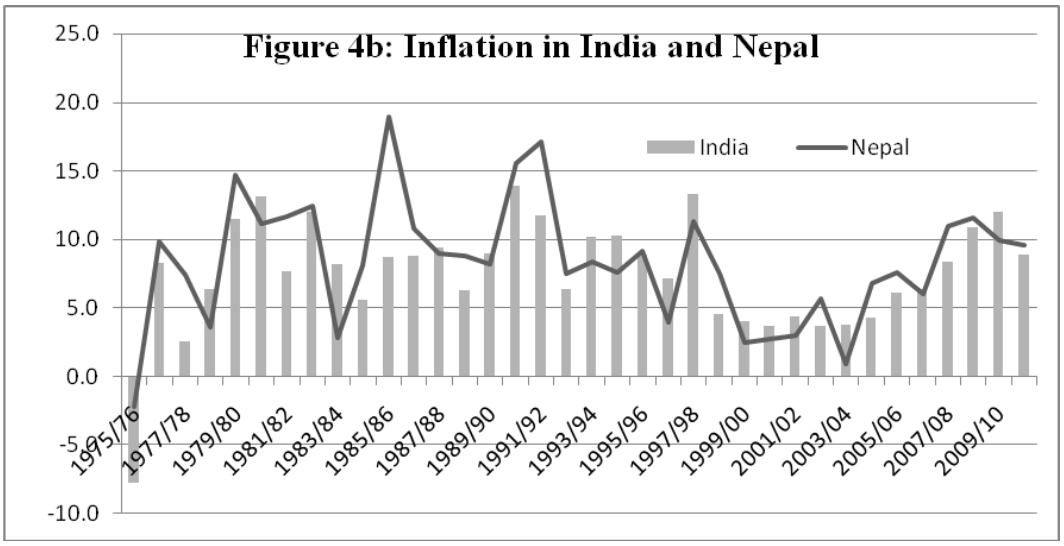
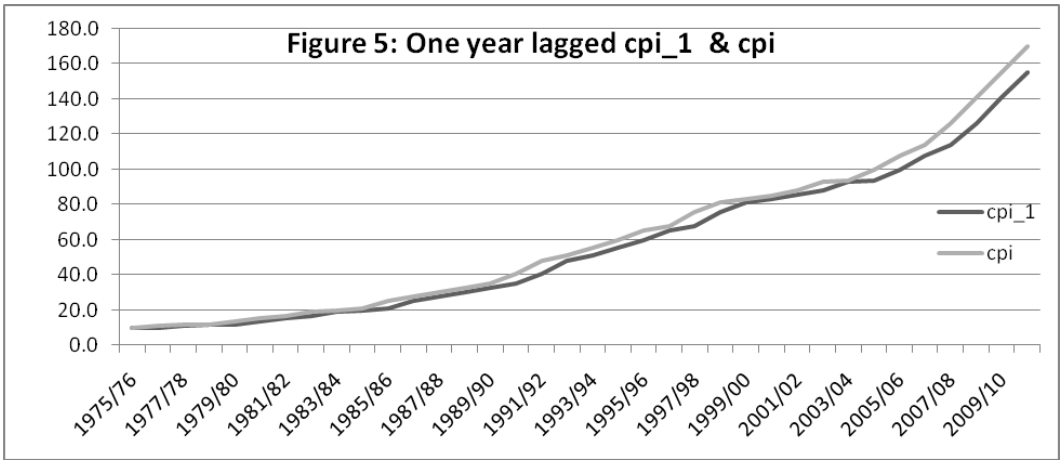


Figure 4b presents the inflation rates in Indian and Nepali economies. This clearly shows that inflation, with an exception for a few years, is always higher in Nepal compared to India. Table A1 in appendices shows a strong positive association between imported price and inflation. Besides, it also reflects the higher dominance of imported Indian goods in the domestic market.



Two curves in Figure 5 demonstrate that how closely last year price and current year price move together. The inflationary expectation in future is based on past inflation in built-in-inflation of new Keynesian economics that affects the current inflation. This may be examined with the help of the one year lagged cpi variable in the Nepali context. The lagged cpi will be interpreted as adoptive expectation.

III. ANALYTICAL FRAMEWORK

We discuss about the methodology in this section. This study covers time period 1975-2011. The data series on CPI for India and Nepal are retrieved from the international financial statistics of IMF. The rest data series are extracted from the quarterly economic bulletin of Nepal Rastra Bank and from various issues of Economic Survey published by Ministry of Finance of Nepal government. We use Wickens-Breusch Single Equation Error Correction model for the analysis of the data discussed somewhere in this section.

The regression of a non-stationary time series on a set of non-stationary time series can likely produce spurious results. But the difference of the non-stationary time series is individually stationary. However, the regression results from difference variables may results in loss of information about long run relationship between the variables. So it necessitates the regression of variables at level. Sometimes, the linear combination of the two or more non-stationary time series gives stationary results (Pindyck,et al, 1991, Enders, 2014, Gujarati, 2007). So, it is customary these days to test whether time series of economic variables are individually stationary followed by co-integration test of these variables at level. Dickey-Fuller or Augmented Dickey-Fuller test are generally apply to see whether such time series are individually stationary. The time series of economic variables are shown non-stationary or follow the random walk at level I(0) and stationary at first difference, I (1). The results from the augmented DF test at level and first difference are given by Table 2.

Table 2: **Augmented Dickey-Fuller tests at the level and at the first difference**

	Level	First Difference	1%	5%	10%	Order of Integration
CPI	-1.37555	-5.175140**	-4.243644	-3.54033	-3.20244	I(1)
rGDP	-3.012338	-7.498887**	-4.243644	-3.54033	-3.20244	I(1)
BD	-2.53712	-5.869865**	-4.243644	-3.54033	-3.20244	I(1)
EXC	0.217641	-4.87361**	4.243644	-3.544284	-3.204699	I(1)
CPII	-1.405367	-6.564345**	-4.243644	-3.54033	-3.20244	I(1)
M2	-1.98365	-3.872057*	-4.243644	-3.54033	-3.20244	I(1)

***, * significance at 1%, 5% level*

Augmented Dickey-Fuller tests (1979, 1981), shows that variables such as logarithm of CPI, RGDP, BD, EXC, CPII and M2 series are non-stationary at level but stationary at first difference as expected. So, we can regress difference of logarithm of prices (CPI) on the difference of logarithm series of budget deficits (BD), real gross domestic product (RGDP), exchange rate (EXC), Indian prices (CPII), and broad money supply (M2). Besides, Johansen co-integration test results presented in Table 2 suggest that these variables are co-integrated with dependent variable. It implies that there exist long run relation between inflation and other variables. This means that these variables can be regressed at level form also although individual series are stationary only at first difference. The coefficients from the regression of the variables at level measure the effects of independent variables on the dependent variable in the long run. Table 3 reveals that there are multiple cointegrating equations but we apply only one for the analysis of the data.

Table 3: **Johansen co-integration test at level**
[series CPI , GDP, BD, EXC, M2 and CPII]

Variables at level	Trace test statistics	Critical value 0.5%	Max-Eigenvalue statistics	Critical value 0.5%
None	129.4204*	95.75366	45.56497*	40.07757
At most 1	83.85546*	69.81889	33.09859	33.87687
At most 2	50.75687*	47.85613	23.18014	27.58434
At most 3	27.57673	29.79707	16.28424	21.13162
At most 4	11.29249	15.49471	8.732777	14.26460
At most 5	2.559717	3.841466	2.559717	3.841466

Note:*Trace test indicates 3 cointegrating equations while max-eigenvalue test indicates 1 cointegrating equation at the 0.05 level

Economic theories are based on the long run equilibrium relation between a set of variables. However, their relation can be disturbed by short term shocks and thus, disequilibrium occurs in short run. But the economists believe that if the variables are integrated, it implies that they have long run relation. So sooner or later, the disequilibrium in the short run returns to the long run equilibrium path. Such relation is stable and produces optimal results.

In this paper we examine the long run and short term effects of the related variables on inflation with the help of the W-B single error correction mechanism. So, this model is useful to examine the short run disturbances as well as long run equilibrium, which was first used by Sargon (1984; Cited in Gujarati, 2007) and later popularized by Engle and Granger (Cited in Gujarati, 2007) for the correction of disequilibrium between economic variables in the short run. The Engle and Granger method is two steps EC method. However, we estimate here error correction mechanism in a different way. The Wickens-Breusch approach (1988) is a single equation error correction model. This model evaluates the state of equilibrium between dependent and independent variables as well as estimates the speed at which a dependent variable returns to long run equilibrium path. So, this embodies a number of desirable properties which are as follows: a) it estimates the short and long term effects in one step; b) it provides easy interpretation of short and long term effects; c) applications to both integrated and stationary time series data; d) can be estimated with OLS; and e) model is built as per the theoretical relation between variables; f) useful for small sample data analysis; g) it assumes only one co-integration relationship among the variables in the equation and only one error correction model is formulated. So, this model is consistent with our economic theories. We can estimate long term effects of Xs on Y, short run effects of Xs on Y and measure the speed of Y variable moving toward the long run equilibrium level with the help of single equation error correction model.

As its name suggests, this is a multi-variables single equation model with first order difference and lag variables of both dependent and independent variables. However, we first begin our discussion with the specific error correction model which takes the following form:

$$\Delta Y = \alpha + \beta_0 \Delta X_t + \beta_1 (Y_{t-1} + \beta_2 X_{t-1}) + \varepsilon_t \quad \text{---- (i)}$$

Where $ß_1$ is error correction component, which measures the rate of return per time unit; or speed of rerun to the equilibrium path; $-1 < ß_1 < 0$, i.e. the value of $ß_1$ lies between -1 and 0; $ß_0$ is short term effects while $ß_2$ estimates long term effects of X on Y.

Where Y is a dependent variable and X is explanatory or independent variable, t-l is one year lag length, where $ß_1$ is the error correction component estimated from the equation, which is expected significant and to appear with negative sign. This model is based on the behavioural assumption that two or more time series exhibit an equilibrium relationship in the long run but short run disturbances push the dependent variable away from the equilibrium path. One of the important virtues of this model is that it estimates both short run effects and long run effects of right hand variables in the model. We extend model (i) by including aforementioned variables. Our single equation error correction model which makes the model in its full extent is as follows:

$$\Delta P_t = \alpha + \beta_{01} \Delta RGDP_t + ß_{02} \Delta BD_t + ß_{03} \Delta EXC_t + ß_{04} \Delta MP + ß_{05} \Delta M2_t + P^e - ß_1 (P_{t-1} - ß_{21} RGDP_{t-1} - ß_{22} BD_{t-1} - ß_{23} EXC_{t-1} + ß_{24} 0MPI_{t-1} + ß_{25} M2_{t-1} + ß_{25} P^e_{t-1} + \varepsilon_t \quad \text{---- (ii)}$$

Where Δ denotes first difference of log of variable and t-1 is one year lag of the variable. In the next section we present the regression results from this model.

IV. REGRESSION RESULTS AND INTERPRETATION

We already discussed about the movement and relationship between the time series of macroeconomic variables. We now are analysing the time series annual data of budget deficits and other macroeconomic variables to see their effects on price level of Nepal. Besides we tried to include the dummy variables for external supply shocks such as 1989 trade embargo imposed by India, 1979/80's oil price rise and policy change variable in 1991 onward. However, all these dummies appeared with insignificant t-statistics and for the reason we dropped them from the model. Aforementioned we use log form of all variables for the regression purpose.

Table 4: **Single equation ECM Model**

Dependent D(CPI)	Coefficient	Std. Error	t-Statistic	Prob.	Long run multiplier	Adj R^2=0.71; F=8.3**; SE=0.02; DW=1.93; AIC=-4.62; SIC=-4.08; N(0)=0.68; SC(1) = 2.33; HC(1)= 19.2; N=34
Intercept	-5.648542**	1.644366	-3.435089	0.0024		
D(rGDP)	0.159783	0.164301	0.972499	0.3414		
D(BD)	0.062471*	0.027578	2.265231	0.0337		
D(EXC)	0.036576	0.083414	0.438494	0.6653		
D(dCPII)	0.055639**	0.011400	4.880555	0.0001		
D(M2)	0.227992*	0.109064	2.090450	0.0483		
CPIt-1	-0.760707**	0.180061	-4.224709	0.0003		
rGDPt-1	0.433375*	0.160304	2.703459	0.0130	0.56*	
BDt-1	0.072413**	0.025298	2.862440	0.0091	0.10**	
EXCt-1	0.169250**	0.052021	3.253465	0.0036	0.22**	
dCPIIt-1	0.109898**	0.018445	5.958097	0.0000	0.14**	
M2	0.142841+	0.082091	1.740025	0.0958	0.19+	

**, * & + significant at 1%, 5% and 10% respectively, ns=not significant

Table 4 displays the regression results from the single equation ECM model which pass all diagnostic tests shown in the far right column of the table. As priori expectation, the error correction component in this model is highly significant at 1% and appears with negative sign. This shows that the system distracted temporarily out of long run equilibrium path but it will return soon. The speed of return to the equilibrium path is 0.76% next year and the remaining will be corrected following years.

All variables considered including real income are influencing inflation in long run while only variables such as budget deficits, change in imported prices and broad money are significant in both short run and long run. The exchange rate, budget deficits and change in imported prices are significant at 1% level whereas real income at 5% level and broad money supply at 10% in the long run. Similarly, in short run change in imported price is significant at 1% while budget deficits and broad money at 5% level. This clear shows that the change in import prices is the most important variable both in short run and long run. Obviously, in the short run, the change in import prices, budget deficits and broad money supply have critical role in determining the rise in prices in Nepal while in the long run almost all variables have influenced inflation. Among these budget deficits,

exchange rate and imported prices have played dominant role in determining the level of price in the country.

The estimated long run income elasticity of inflation is inelastic or less than one. In other words, long run multiplier is only 0.56, which implies that a 1% rise in real income leads to 0.56% increase in price level followed by exchange rate multiplier (0.22), broad money supply (0.19) and change in imported prices (0.14). However, broad money supply is significant at only 10% in long run as compared to at 5% in short run implies that the effect of this variable on price level slips low in long run.

Short run elasticity of the variables is lower than long run elasticity except in case of broad money. The elasticity for budget deficits and change in imported prices is estimated at 0.06 each while that of the broad money supply at 0.23. This implies that prices in Nepal are more sensitive to the change in broad money supply than the changes in imported prices which are the most influential variables in the short run. So, this can have important policy implication. The regression result that broad money supply is significant and real GDP is insignificant in the short run seems to obey the quantity theory of money that says only money supply matters to the inflation as real output and velocity of money remaining the equal. As regression results show that both money supply and real GDP are important variables in the long run, this further satiates the modern monetarists' approach to inflation theory under less than full equilibrium where real output changes and affects the price level. Furthermore, this result is consistent with the previous study which suggests interest neutrality in Nepal (Paudyal, 2013).

Nepal Rastra Bank seems to have monetised deficits to contain the interest rate. It might have taken expansionary monetary policy to offset the effect of deficits on interest rate. This led to increase in money supply causing inflation. On the other hand, budget deficit from the perspective of the Keynesian aggregate demand approach is the resultant of increase in aggregate demand. Such increase in aggregate demand due to excess government expenditure leading to budget deficits shows an excellent influence on inflation (inflationary gap theory) in both periods since this variable is significant at 5% and 1% in short run and long run. Moreover, highly significant effects of imported prices (cpii) variable at 1% both in short run and long run is consistent with the skyrocketing increase in imports which may be also the reflection of domestic supply constraints in the country. This is also comparable with the previous findings of NRB that finds Indian prices are the most important source of Nepali inflation (1994). However, the highly significant imported price variable implies that inflation is largely the function of external price discloses the difficulty of Nepal Rastra Bank which by law has to make attempts to keep the inflation rate low and stable. Still, policy variables such as money supply and budget deficits have important implications. Moreover, the empirical findings reveal that the growth of real GDP has an excellent influence on the inflation in the long run, through growth of real sector and increased supply.

In the sum, this study finds that the variations in inflation can be explained largely by imported price, exchange rate, budget deficits, real GDP and broad money in long run. However, in the short run, only the variables like budget deficit, broad money supply and imported prices can be considered as the major determinants of inflation in this country.

V. CONCLUSIONS

Controlling inflation is not easy task in a country like ours which shares open borders with neighbours and heavily dependent on the imported goods for the daily consumption and materials for other development purposes. In this backdrop, the dominant cause of domestic inflation becomes supply shock generated outside the country. In this context, the control of inflation typically becomes much more complicated and challenging for monetary authorities since the monetary and fiscal policies framed to tame the inflation seem to have lesser implications. However, it does not imply that there is no room for such policy implications at all. This empirical study suggests that prices in Nepal became highly dependent on Indian prices especially after 1991's political change. It is because of a weaker supply of domestic production supplemented by the increased imported goods from India. The movement of Nepali prices are very close to Indian prices after 1991/92. Because of liberalisation and privatisation policy, the existing limited domestic profit making import substituting enterprises like Basbari shoe factories were closed down partly because they were sold to the private sector. Besides, some of the domestic products could not compete with Indian goods in domestic market in the changing context of reduced import duties under preferential trade agreement with India. This led further rise in the imports from Indian goods and thereby the influence of Indian prices in Nepali prices. So, this has obviously increased the dominance of Indian prices in the domestic prices in the later years.

In short run following Keynesians, demand management is a major concern of the government to control the inflation. Well synchronized fiscal and monetary policies targeting the reduction in budget deficits through cutting down recurring expenditures and augmenting revenues of the government together with restrained money supply can be the effective measures to control inflation. Still, there remain some doubts about the effectiveness of the monetary and fiscal policies in the short run since this empirical study suggests the high domination of Indian prices. So far long run is concerned, an increase in domestic supply is the major step to control the inflation. The long run strategy thus to combat inflation is to increase the production of goods and services through the use of productive resources from money and capital markets. The government efforts to create conducive environment for foreign direct investment and ODA in the areas of energy and other infrastructure development along with investment in the productive sector thus can be the effective measures to improve the supply situation/real out and thereby control the inflation. Even so, as suggested by this empirical study, given the open border with India and liberalised trade regime, there exists higher prospect of Indian domination on the domestic prices in this country. Noting that there is a higher prospect of lower prices in India as revealed by its expected higher growth and prosperity, however, suggests that better connectivity with the Indian and Chinese economies will pave the road to deeper integration of Nepali economy with these Asian power houses help Nepal to control inflation. This along with other monetary and fiscal policy measures may be appropriate strategy to combat the inflation in Nepal.

*****

REFERENCES

Arestis, Philip. No date. "Keynesian Economics, New Keynesian/NCM schools of thought," Retrieved from http://finance5.net/Keynesian-Economics-and-the-New-Keynesian-NCM-Schools-of-Thought-download-w3462.htm.

Bashir, F., S. Nawaz, K. Ashim, U. Khursid, J. Khan and M. J. Qureshi. 2011. "Determinants of Inflation in Pakistan: An Econometric Model using Co-integration approach." Retrieved from http://www.ajbmr.com/articlepdf/ajbmrv01n0509.pdf

Bayo, F. No date. "Determinants of Inflation in Nigeria: An Empirical Analysis", *International Journal of Humanities and Social Sciences*, 1(18), Special Issue. Retrieved from http://ijhssnet.com/journals/Vol_1_No_18_Special_Issue/29.pdf

Best, R. 2008. "An Introduction to Error Correction Models." *Oxford Spring School for Quantitative Methods in Social Research.* London.

Blanchard, O. J. and G. Jordy. 2006. "A New Keynesian Model with Unemployment." CFS Working Paper, Retrieved from https:// www.ifk-cfs.de/ fileadmin/downloads/ publications/ wp/07_08.pdf

Blanchard, O. J. and F. Stanley. 1989. *Lecturers on Macroeconomics*, Massachusetts Institute of Technology, USA.

Blinder, A. No date. "Keeping Keynesian Faith." Retrieved from http://finance5.net/Keeping-the-Keynesian-Faith-download-w3459.html

Bowdler, C. and L. Nunziata. 2004. *A Note on the Determinants of Inflation Starts in OECD,* University of Oxford.

Carre, E. No date. "The New Keynesian Philips Curve: A Meta Analysis." Retrieved from http://finance5.net/THE-NEW-KEYNESIAN-PHILLIPS-CURVE-A-META-ANALYSIS-download-w3491.html

Chugh, S. K. 2014. *New Keynesian Economics*, Retrieved from http://finance5.net/ Chapter-12-New-Keynesian-Economics-download-w3456.html

Cornwall, J. 1990. *The Theory of Economic Breakdown*, Basil Backwell Inc. Cambridge, MA.

Cullis, J. and J. Philip. 2009. *Public Finance and Public Choice*, Oxford University Press, New York.

Cunningham_*New Keynesian Theory*, Retrieved from http://finance5.net/New-Keynesian-Theory-I-download-w3454.html

Deist, C. 2011. " The Role of Contractionary Monetary Policy in the Great Depression." retrieved from http://econ.berkeley.edu/sites/default/files/deist_charlie.pdf

Dennis, R. 2004. "New Keynesian Optimal Policy Model: An empirical Assessment." Retrieved from http://finance5.net/New-Keynesian-Optimal-Policy-Models-An-Empirical-Assessment-download-w3472.html.

Dixon, H. "Reflection on New Keynesian Economics and Role of Imperfect Competition." Retrieved fromhttp://finance5.net/Huw-Dixon-Reflections-on-New-Keynesian-Economics;-the-role-of-download- w3468.html.

Enders, W. 2014. *Applied Econometric Time Series*, Wiley India Pvt. Ltd., New Delhi.

Friedman, M. 1984. "Inflation is not Beaten." *New York Times*. April 3. Retrieved from http://0055d26.netsolhost.com/friedman/pdfs/nyt/NYT.04.03.1984.pdf

Friedman, M. 1983*."*Deficits and Inflation." *Bright Promises, Dismal Performance*. Harcourt Brace Jovanovich, New York.

Friedman, B. M. 1968. "The Role of Monetary Policy." *The American Economic Review*. LVIII, No 1. Retrieved from https://www.aeaweb.org/aer/top20/58.1.1-17.pdf

Greenwald, B. and J. E. Stizler. 1987. "Keynesian, New Keynesian and New Classical Economics." Retrieved from http://www.nber.org/papers/w2160.pdf.

Gordon, R. J. 1988, *Macroeconomics: Theory and Policy,* McGraw-Hill Inc.

Gujarati, D. and Sangeeta. 2007. *Basic Econometrics*, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Hiroshi, Y. 2012. *A New Micro Foundation of Keynesian Economics*, Oxford.

Kandi, et al. 2009. "Determinants of Inflation in GCC." Retrieved from http://www.imf.org/ external/pubs/ft/wp/2009/wp0982.pdf.

Keele, L. and Suzanna De Boef. 2004. "Not Just for Cointegration: Error Correction Models with Stationary Data." Retrieved from http://www.nuffield.ox.ac.uk/Politics/ papers/2005/ Keele%20DeBoef%20ECM%20041213.pdf

Khan, A. A., K. H. B. Syed and M. A. Qazi. 2007. "Determinants of Recent Inflation in Pakistan." Retrieved from http://mpra.ub.uni-muenchen.de/16254/1/determinants_of_recent_inflation_in_pakistanRR.pdf

Koirala, T. P. 2013. "Time Varying Parameters of Inflation in Nepal: A State Space Modelling." *NRB Economic Review*, 25(2) : 66-77.

Kumar, R. 2013. "A Study of Inflation Dynamics in India: A Cointegrated Autoregressive Approach." Retrieved from http://www.iosrjournals.org/iosr-jhss/papers/Vol8-issue1/J0816572.pdf.

Laryea, S. A. and R. S. Ussif. 2001. "Determinants of Inflation in Tanzania." Working Paper, Chr. Michelsen Institute, Norway.

Mathema, S. R. 1998. "Determinants of Inflation with special reference to wages in Nepal." *NRB Economic Review*, 10 : 1-18.

Menz, J. O. 2008. "Behavioural Macroeconomics and New Keynesian Mode." Retrieved from https://docs.google.com/gview?url=http://www.boeckler.de/pdf/ v200810_31 _menz.pdf & chrome = rue

Mossayeb, P. and R. Mohammad. 2009. "Sources of Inflation in Iran: An Application of the ARDL Approach." *International Journal of Applied Econometrics and Quantitative Studies*, 6(1) : 61-76.

MoF. 2014. *Economic Survey FY 2013/14*, Ministry of Finance. Kathmandu.

MoF. *Economic Survey*, various issues, Ministry of Finance, Kathmandu.

Neupane, G. 1992. "Causes of Inflation: A Quantitative Analysis." *NRB Economic Review*, 6 : 33-49. Retrieved from http://www.nrb.org.np/ecorev /pdffiles/ vol6_ art3. pdf

NRB. 2014. *Quarterly Economic Bulletin*, Nepal Rastra Bank, Kathmandu

NRB. 2010. *A Handbook of Government Statistics*, Nepal Rastra Bank. Kathmandu.

NRB. 2007. *Inflation in Nepal*, NRB Special Publication, Nepal Rastra Bank. Kathmandu.

NRB.1994. "Inflation in Nepal." *Economic Review. Occasional Paper*, No. 7, Nepal Rastra Bank, Kathmandu.

NRB Research Department. 2001. "Money and Price Relationship in Nepal: A Revisit." *NRB Economic Review*, 13 : 50-65.

Pahlavani, M. and R. Mohammad. 2009. "Sources of Inflation in Iran: Application of the ARDL Approach." *International Journal of Applied Econometrics and Quantitative Studies*, Vol. 6.

Parkin, M. and R. Bade. 1986. *Modern Macroeconomics*, Prentice-Hall Canada Inc. Ontario.

Paudyal, S. 2013."Do Budget Deficits Raise Interest Rates in Nepal?" *NRB Economic* Review, 25(1) : 51-66.

Pindyck, R. C., and L. R. Daniel. 1991. *Econometric Models and Economic Forecasts*, McGraw-Hill Inc, New York.

Shapiro, E. 1982. *Macroeconomic Analysis*, Harcourt Brace Jovanovich, Inc. New York

Song, H. A., F. W. Stephen and L. Gang. 2003. "Modelling and forecasting the demand for Thai tourism." in *Journal of Tourism Economics*, 9(4) : 363-387. Retrieved from http://epubs.surrey.ac.uk/1125/1/fulltext.pdf.

Thapa, R. 2010. "Determinants of Inflation in Nepal." *Nepal Journal of Management*, Public Youth Campus, Kathmandu.

Vuyyuri, S. and S. V. Sethaiah. 2004. "Budget deficits and other macroeconomic variables in India." *Applied Econometrics and International Journal*, 4(1).

APPENDICES

Table A1: Correlation Among Variables

	LOG(CPI)	LOG(GDP)	LOG(BD)	LOG(EXC)	LOG(CPII)	LOG(M2)
LOG(CPI)	1	0.998	0.972	0.975	0.999	0.997
LOG(rGDP)	0.992	1	0.943	0.967	0.995	0.996
LOG(BD)	0.972	0.962	1	0.945	0.965	0.959
LOG(EXC)	0.975	0.971	0.945	1	0.971	0.965
LOG(CPII)	0.999	0.999	0.965	0.971	1	0.999
LOG(M2)	0.997	0.999	0.959	0.965	0.999	1

Source: Author's Calculation

Table A2: Budget Deficits and Inflation

Year	BD/GDP	Inflation rate	Year	BD/GDP	Inflation rate
1975/76	2.5	-2.2	1993/94	5.8	8.4
1976/77	3.6	9.8	1994/95	4.8	7.6
1977/78	3.2	7.4	1995/96	5.6	9.2
1978/79	2.7	3.6	1996/97	5.1	3.9
1979/80	3.4	14.7	1997/98	5.9	11.3
1980/81	2.9	11.1	1998/99	5.3	7.5
1981/82	5.4	11.7	1999/00	4.7	2.5
1982/83	9.0	12.4	2000/01	5.5	2.7
1983/84	8.0	2.8	2001/02	5.0	3.0
1984/85	7.6	8.1	2002/03	3.3	5.7
1985/86	7.1	19.0	2003/04	2.9	0.9
1986/87	6.7	10.8	2004/05	3.1	6.8
1987/88	6.1	9.0	2005/06	3.8	7.6
1988/89	9.6	8.8	2006/07	4.1	6.0
1989/90	8.1	8.2	2007/08	4.1	11.0
1990/91	8.9	15.6	2008/09	5.0	11.6
1991/92	7.5	17.1	2009/10	3.5	9.9
1992/93	7.0	7.5	2010/11	3.6	9.6

Source: MoF/GoN, Economic Survey

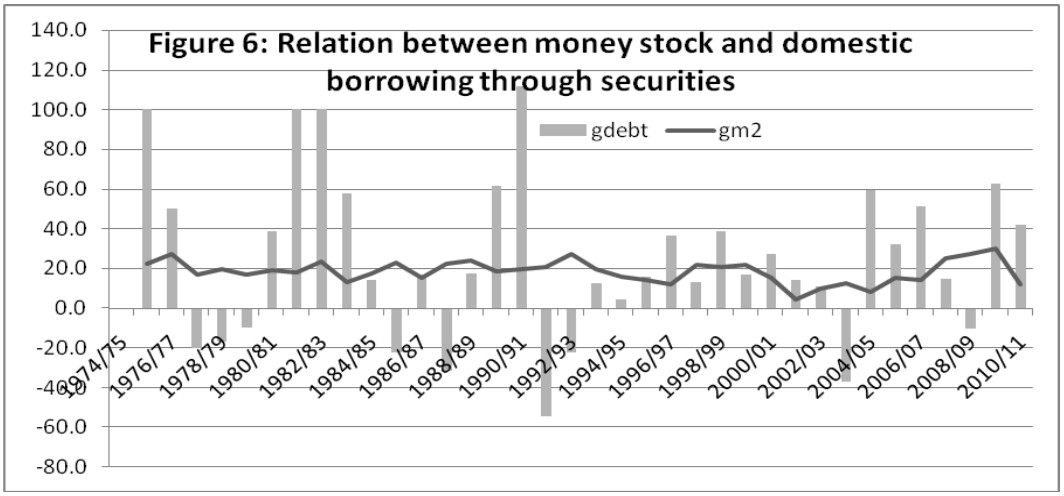


Figure 6: Relation between money stock and domestic borrowing through securities
gdebt
gm2
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
-40.0
-60.0
-80.0
1974/75
1976/77
1978/79
1980/81
1982/83
1984/85
1986/87
1988/89
1990/91
1992/93
1994/95
1996/97
1998/99
2000/01
2002/03
2004/05
2006/07
2008/09
2010/11

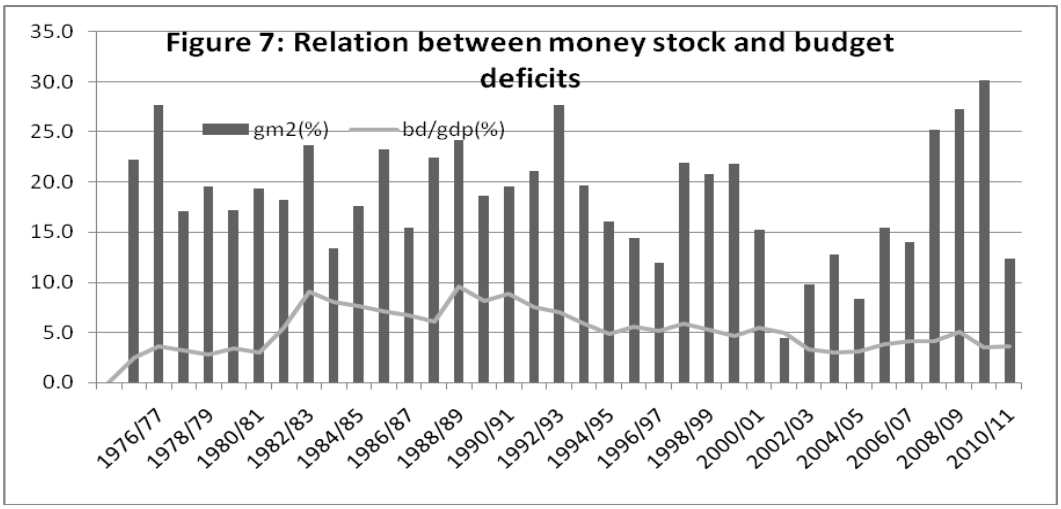


Figure 7: Relation between money stock and budget deficits
gm2(%)
bd/gdp(%)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1976/77
1978/79
1980/81
1982/83
1984/85
1986/87
1988/89
1990/91
1992/93
1994/95
1996/97
1998/99
2000/01
2002/03
2004/05
2006/07
2008/09
2010/11

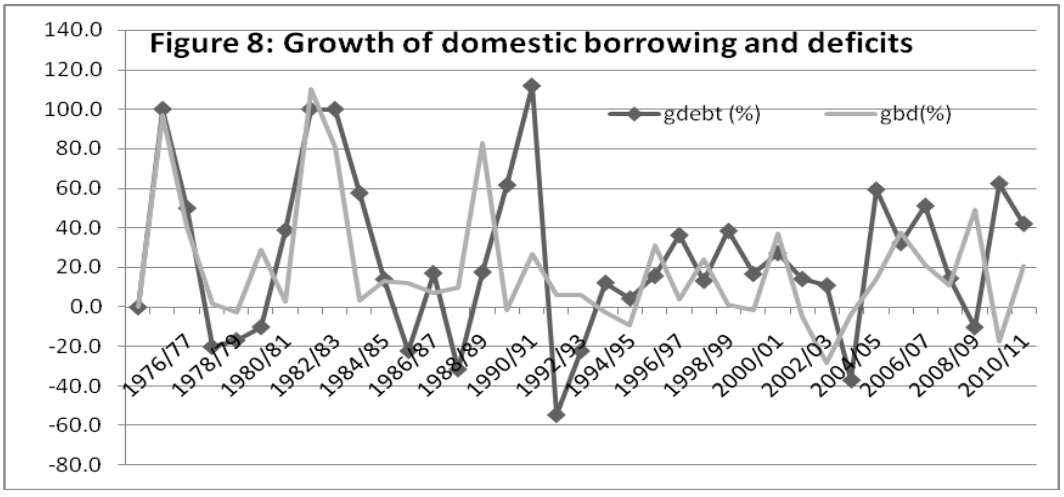


Figure 8: Growth of domestic borrowing and deficits
gdebt (%)
gbd(%)
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
-40.0
-60.0
-80.0
1976/77
1978/79
1980/81
1982/83
1984/85
1986/87
1988/89
1990/91
1992/93
1994/95
1996/97
1998/99
2000/01
2002/03
2004/05
2006/07
2008/09
2010/11

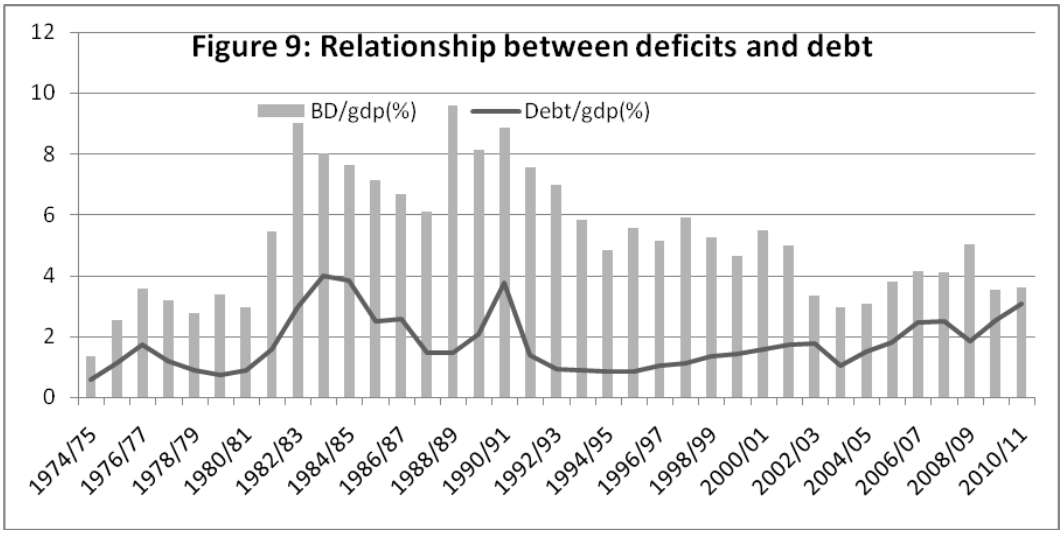


Figure 9: Relationship between deficits and debt
BD/gdp(%)
Debt/gdp(%)
12
10
8
6
4
2
0
1974/75
1976/77
1978/79
1980/81
1982/83
1984/85
1986/87
1988/89
1990/91
1992/93
1994/95
1996/97
1998/99
2000/01
2002/03
2004/05
2006/07
2008/09
2010/11

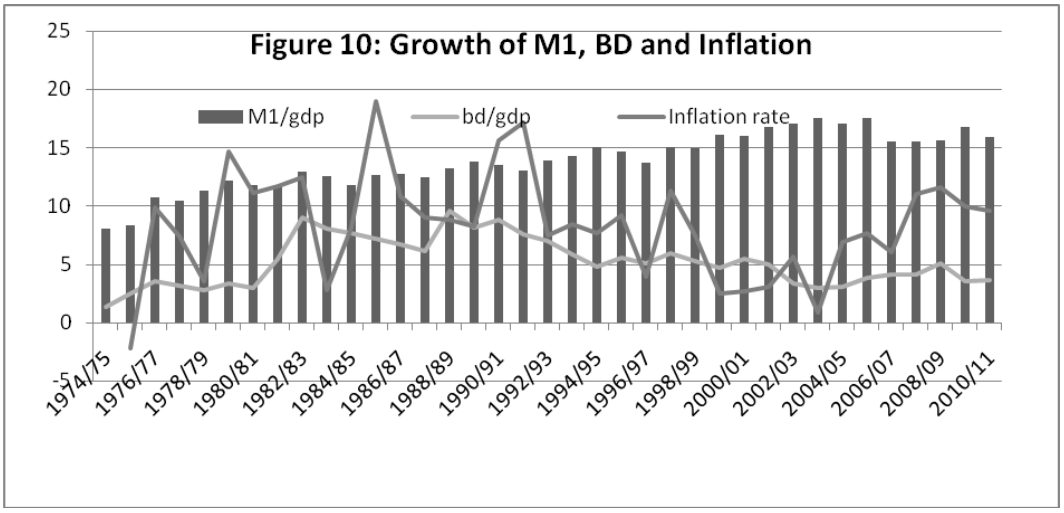


Figure 10: Growth of M1, BD and Inflation
M1/gdp
bd/gdp
Inflation rate
25
20
15
10
5
0
-5
1974/75
1976/77
1978/79
1980/81
1982/83
1984/85
1986/87
1988/89
1990/91
1992/93
1994/95
1996/97
1998/99
2000/01
2002/03
2004/05
2006/07
2008/09
2010/11