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Inflation in Nepal

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INTRODUCTION

Economic theory suggests that prices are determined by the money market. However, domestic prices can also be affected by the world prices in a small open economy like Nepal which is highly dependent on imports. The purpose of this paper is to consider the causative factors of both internal and external origin and estimate their relationship with inflation in Nepal.

THEORETICAL BASIS AND MODEL

Price clears the money market equating money supply with money demand

$$M = P * L (Y, R) \quad (1)$$

Where, M is the amount of money supply, P the level of prices and L (Y, R) the demand for real money balance expressed as a function of real income Y and the nominal interest rate R. L (Y, R) remaining the same, this equation provides a proportionate relationship of prices P with the money supply M, say P=d*M where d is a constant. But whenever the government introduces new money, there is a time lag in this money reaching into the market and the market making necessary adjustments to respond in terms of price increase. Yang (1990) has referred to literature suggesting a lag averaging six to nine months and in certain cases even a lag of eight quarters. We are using annual data and hence, money supply over period of two years i.e., 24 months may be considered enough to capture any such lags.

We assume prices to adjust logarithmically to the gap caused by increase in money supply from M_{t-1} in year (t-1) to new level M_t in year (t); that is,

$$\log P_t - P_{t-1} = a [\log (P_t^*) - \log (p_{t-1})] \quad (2)$$

Where, P_t and P_{t-1} are the actual prices prevailing at the respective periods, P_t^* is the equilibrium level of prices commensurate with the money supply M_t (i.e., $P_t^*=d M_t$) and a is adjustment coefficient. Let P_{t-1} be only equal to c M_{t-1} (c<d) assuming that prices where in the process of adjusting top the equilibrium level in response to the money supply in period (t-1) and before this level was attained, money supply increased to M_t and the prices have to adjust now top a new equilibrium level P_t^*. Solving equation (2) for log P_t in terms of log M_t and log M_{t-1} and then taking antilog, we have:

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$$P_t = \gamma * M_t^a * M_{t-1}^{(1-a)} \quad (3)$$

Incorporating (3) into (1), we have

$$P_t = \gamma * M_t^a * M_{t-1}^{(1-a)} / L(Y, R) \quad (4)$$

Generally, the money demand takes a form given in (5)

$$L(Y, R) = K * Y^m * R^{-n} \quad (5)$$

Barro (1990) presents the well-known Baumol - Tobin model for demand for real money balance; $L(Y, R) = K\ Y^{1/2}\ R^{1/2}$. K in this model is related to the cost of transacting money. Cost of transaction has drastically gone down in developed countries owing to large scale computerization of banking operations and implementation of financial innovations like electronic fund transfers. Nepal has however, not yet caught up much in this directions. So, we can consider K as a constant here. Though the Baumol–Tobin model takes the transactions view, other analyses of the demand for money emphasizing speculative, precautionary, or transitive considerations in addition to the utility motive are also broadly consistent with the general from of equation (5) (Goldfeld, 1973)

Bairam (1990) has examined the role of world prices also in determining the domestic inflation of western developed countries. He concluded that the world rate of inflation, not attributable to the world money supply increases, plays a very important role in determining the domestic rate of inflation and found the foreign price elasticity coefficient to be positive.

Wallace and McNown (1981) have evaluated the relative impact of monetary and foreign price influences on inflation in Nepal taking Indian prices because of dominant share of India in the international trade of Nepal. Bohara and McNown (1989), while examining monetary and inflationary linkages between India and Nepal, have concluded that Indian inflation is transmitted to Nepal directly through price arbitrage effects and through the balance of payments.

World prices is an exogenous variable impinging in domestic money market as an external shock. If such prices fall, consumers feel an increase in their real income with respect to the imported goods. Similarly, and increase in world prices is equivalent to erosion of real income. Therefore, the real income in equation (5) is taken as (Y/Pind) to capture the impact of this external variable, where Pind denotes the Indian prices representing world prices for Nepal.

Money demand then, takes the form of following equation

$$L(Y, R) = K * (Y/Pind)^m * R^{-n} \quad (6)$$

Substituting (6) in (4) and inserting a random disturbance term, we have the final expression for the prices:

$$P_t = (\gamma/K) * M_t^{a} * M_{t-1}^{(1-a)} * Y_t^{-m} * Pind_t^{m} * R_t^{n} * \exp\{\varepsilon_t\} \quad (7)$$

where, $\eta_t = \exp\{\varepsilon_t\}$ is the random term with ε meeting all the classical assumptions.

Prices (P) may then be presented as a log-linear function of the variables, M, Y, R and Pind as expressed in equation (8)

$$\log P_t = \log(\gamma/K) + a \log M_t + (1-a) \log M_{t-1} + m \log Pind_t + n \log R_t - m \log Y_t + \varepsilon_t \quad (8)$$

Differentiating with respect to time, we can present growth rates of prices (i.e., inflation rate) as a linear function of the growth rates of the given explanatory variables.

$$P_t = \beta_1 + \beta_2 * m_t + \beta_3 * m_{t-1} + \beta_4 * Y_t + \beta_5 * r_t + \beta_6 * pind_t + (\varepsilon_t - \varepsilon_{t-1}) \quad (9)$$

Lower case letters in equation (9) denote growth rates of upper case letters and $\beta_1, \beta_2, \ldots\ldots\ldots \beta_6$ are the parameters.

In formulation of the above relationships, there is an implicit assumption that the nominal interest rate is freely and competitively determined by the market. This is, however, not true for Nepal where it is generally regulated and prescribed by the central monetary authority. Therefor, we propose to use last period's inflation rate as a proxy because people form expectations of market nominal interest rate and also of the upcoming inflation rate based on their recent experience of inflation. This assumption is consistent with the Fisher's relation.

Substituting growth rate of inflation from period (t-2) to (t-1) for r_t in equation (9) and estimating the relationship by least squares method, we found its coefficient insignificant suggesting a poor representation of nominal interest rate. Therefore, we excluded this variable and letting $u_t = (\varepsilon_t - \varepsilon_{t-1})$, adopted the model in equation (10) as the final version. (+) or (-) below the parameters in equation (10) indicate the expected signs of these coefficients.

$$P_t = \beta_1 + \underset{(+)}{\beta_2} * m_t + \underset{(+)}{\beta_3} * m_{t-1} + \underset{(-)}{\beta_4} * Y_t + \underset{(+)}{\beta_5} * pind_t + u_t \quad (10)$$

Because $U_t = (\varepsilon t - \varepsilon t - 1)$, equation (10) may have first order autoregression. This equation, however when estimated by Cochrane- Orcutt method, showed a very low coefficient of autocorrelation (0.06) and an insignificant t-statistics (0.315) for this coefficient, implying random walk for εt, so that u_t also meets the classical assumptions. Equation (10) can, therefore, be estimated by ordinary least squares method also. Durban - Watson test confirms absence of autocorrelation in this model.

Equation (7) implies that the coefficients of the explanatory variables in equation (10) are the individual elasticities and the elasticities of the two money variables add to 1 and the elasticities of income and Indian prices add to 0.

DATA AND METHODOLOGY

The above model is estimated by the ordinary least squares method using annual data from International Financial Statistics Yearbook of 1991 for the period 1964 to 1990. We take narrow money (M1) as money supply (in millions of Rupees), gross domestic product (GDP) at constant prices for income (in millions of Rupees), consumer price indices of the respective countries for inflation in Nepal and India. We test the validity of the model and the significance of the different explanatory variables in determining inflation in Nepal.

For the purpose of testing the significance of the external cause of domestic inflation, we also estimate the same regression with pind omitted from the model and test the hypothesis that the coefficient of this variable is zero. We also test that the sum of the elasticities of the two money variables is unity and that of income and Indian prices is zero.

Though there is no evident sign, we test the data and the model for multicollinearity, heteroskedasticity and autocorrelation. We compute coefficients of correlation among the explanatory variables. Because the number of explanatory variables exceeds two, we also regress each of the explanatory variables with the rest of them and compute individual coefficients of determination to evaluate any indication of multicollinearity.

We employ the Durbin - Watson test for non-autocorrelation and in absence of any obvious possible source of heteroskedasticity, the white test for homoskedasticity.

RESULTS

The estimated equation for inflation is:

$$\mathbf{P_t = - 0.018145 + 0.087452\ m_t + 0.49485\ m_{t-1} - 0.21422\ Y_t}$$

(s = 0.02496) (s = 0. 11806) (s = 0. 14752) (s = 0.29015)

(t = - 0.72698) (t = - 0.74077) (t = 3.3546) (t = - 0.73830)

$$\mathbf{+ 0.32288\ pind_t}$$

(s = 0. 15736)

(t = 2.0518)

$\mathbf{R^2 = 0.610025}$

F-stat (4,20) = 7.82132

DW-stat = 1.9376

The numbers in the parentheses are the respective standard errors (s) and the t-statistics (t) of the coefficients. All the coefficients have the expected signs. The coefficients of m_{t-1} and $pind_t$ are significant and those of m_t and Y_t are not. It seems

the effect of money supply instead of the current one. The insignificance of in come may probably be attributed to the practical problems associated with reasonably precise measurement of series of GDP in less - developed countries.

The coefficient of determination suggests that 61 percent of the change in inflation rate in Nepal is explained by the changes in the given explanatory variables the independent variables together. The model can therefore, be judged reasonably successful in explaining inflation in Nepal

Among the explanatory variables, pind is a variable of external origin (originating in India). Comparing the original model with an alternative model restricting the coefficient of pind to be zero and using the F-test, we find calculated value of F to be 4.21 against the tabulated value of 4.35 at 5 percent level of significance. The two values are very close and yet calculated value being smaller, this demands acceptance of the restriction placed. But at a higher, level of significance, we may reject the restriction (e.g. at 10 percent tabulated value of F is 2.97 only).

Acceptance of the restriction when it is not true introduces Type II error and implies omission of a relevant variable. On the other hand, rejection of the restriction when it is true introduces Type I error implying inclusion of an irrelevant variable. Committing Type II error it this case then, may lead to biased and not consistent estimates of the coefficients and impairment of the validity of the significance tests, whereas Type I error retains unbiasedness of the estimates and their variances (but looses efficiency) and the validity of tests of significance of coefficients is maintained. Obviously, Type II therefore, reject the hypothesis that the coefficient of pind is zero. Thereby, we do not reject the significance of the role of Indian prices in influencing inflation in Nepal. Based on discussions above, money supply with a lag stands out as a prominent cause of inflation.

Examination of coefficients of correlation among explanatory variables (maximum 0.46422 between Y_t and m_{t-1}) and the individual coefficients of determination of each explanatory variable regressed with the rest of them (maximum 0.426829 for m_{t-1}) dose not suggest any high degree of multicollinearity. The Durbin - Watson statistic of 1.9376 is greater than the upper limit (d_u) of 1.767 for 5 percent significance, 25 observations and 4 regressors. Therefore autocorrelation is not doubted. The white test yields nR^2 to be 5.39 against the tabulated value 15.5 of Chi - Square for 5 percent level of significance i.e., no heteroskedasticity. These findings endorse the conclusions on appropriateness of the adopted model.

Comparing the unrestricted model (10) with a model restricting the sum of coefficients of the two money variables by use of F-test at 5 percent level of significance shown that the restriction cannot be rejected. This can be interpreted to mean that prices adjust within two periods of any increase in money supply. Similarly, a different F-test dose not reject the hypothesis that the sum of the coefficients of income and Indian prices add to zero. The latter result, however, may be debated in view of the problem associated with the estimation of the coefficient of the income variable. If accepted, this means that Indian prices impinge on Nepalese money market through direct effect on income.

FINDINGS OF THE STUDY

The findings of the study may be summarized as follows

- Money supply including the lagged level of supply, income and world prices affected inflation in Nepal.
- The justification of inclusion of Indian prices as an explanatory variable and thereby its role in causing inflation in Nepal could not be rejected.
- The coefficient of income was found insignificant in the model which may probably be owing to imprecise measurements of income.
- Money supply is a prominent cause of inflation in Nepal and prices take time to respond to money supply.

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