THE IMPACT OF THE INDIAN MONETARY POLICY AND THE OFFICIAL EXCHANGE RATE ON NEPALESE MONETARY POLICY

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Abstract

Hypothesis testing identifies a set of significant variables that appear to influence Nepal's monetary policy. After finding a structural break in 1989 (in line with the political regime shift), lagged Indian monetary base and the official exchange rate have respective negative and positive effects on Nepalese monetary base growth. This supports earlier results which indicate that the Nepalese monetary authority plays a stabilizing role given that both countries do not face symmetric shocks and have a well behaved (hard) pegged exchange rate, and is consistent with the policy of the Nepalese monetary authority.

1. Introduction

The paper asks : "What are the impacts of Indian economic variables on Nepalese monetary policy?"[1] Nepal and India are developing countries in Asia who share a common

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1 This paper is taken from a chapter of the author's dissertation at Claremont, which was produced while he was a visiting reasercher at the Center for Economic Development and Administration (CEDA), Tribhuvan University, Nepal. The author is the Ph.D. candidate at the School of Politics and Economics, Claremont Graduate University, Claremont, California, U.S.A.

culture and heritage as well as having a contiguous border with no restrictions on labor and capital mobility[2] (guaranteed by the 1950 Treaty of Trade and Transit). Nepal's geographical situation, bordered on the south, west and east by India and to the north by Tibet, autonomous region of the People's Republic of China and the Himalayan mountain range, as well as the magnitude of the Indian economy, would imply that Indian economic variables have a significant effect on Nepal's domestic policy. There have been many discussions concerning this topic in Nepal (for example see Sharma (1991) and Khatiwada (1994)) as well as an indication from an earlier study, albeit indirectly from initial data analysis, through a positive coefficient of correlation on the lagged output growth and inflation for both countries. Also, Bohara and McNown (1989) show a uni-directional transmission of inflation from India to Nepal through the channels of price arbitrage and the balance of payments from a VAR analysis.

Two factors should be considered, however. First, the shift in policy stances of both India and Nepal, from a closed inward focused regime to an open liberalized economy, may have affected the magnitude of influence (i.e. there may be a gradual shift in parameters) with India's influence somewhat diminishing as Nepal has diversified towards the influence of world economies (i.e. 80% of total trade with India in 1975 versus only 30% in 1993 – Economic Survey, 1995/1996). Also, this movement was enhanced by a regime shift in February 1990 from a guided democracy to the present post democracy assisted by a trade embargo by India on March 1989. Secondly, empirical evidence, as put forward in a previous study, shows that Nepal and India do not face symmetric output shocks (specifically the coefficient of correlation for real shocks is negative but insignificant). In other words, Nepal and India, by facing dissimilar shocks, may be forced to take conflicting domestic monetary stances even though this is not reflected in the exchange rate which has maintained a surprising level of stability during a thirty six year period.[3] Thus, during the analysis we should keep in mind whether liberalization has caused a shift in parameters and we should see how Nepal's monetary policy has responded to Indian economic variables in a way that allows the observed stability in the exchange rate system. Looking ahead it is found that Nepalese monetary authority does play some role in stabilization as well as evidence of a structural break in 1989.

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2 Legally there are some restrictions on capital mobility between both countries although not practical.

3 The average and standard deviation of the official buying rate of the Indian Currency for the Nepalese Currency, for the thirty six year period of 1960 to 1996 from the Quarterly Economic Bulletin of the Nepal Rastra Bank, is 1.529167 and 0.162999 respectively. However if we exclude the years 1966 and 1967, the years of the Bretton Woods turmoil, the statistics change to 1.559556 and 0.118664 respectively.

The outline of the chapter is as follows : the next section discusses the data, the third section discusses the methodology along with some empirical results, the fourth section gives an analysis of the empirical results while the last section concludes.

2. Data[4]

Unfortunately, the data of developing countries play a large part in determining an estimation strategy. Data quality[5] and availability for Nepal and India are problematic further constraining the choice of variables (for example of Nepal's cases see Sharma (1989) and Pant (1995)). With these constraints in mind variables were arbitrarily chosen along the line of Burdekin and Burkett (1992) which capture fiscal and monetary policy interactions as well as the foreign policy goals, although the GNP GAP measure was not included since data was unavailable. The monetary base was chosen as the monetary policy variable (as with B&B (1992)) since high-powered money is the most stable across countries (Lothian, 1976).[6] The full set of nine variables comprises :

ZMB	=	Nepalese monetary base growth
ZDEF	=	Nepalese Budget deficit as a proportion of Nepalese GDP
ZDP	=	Nepalese Inflation
ZLR	=	Change in Nepalese discount rate
ZIMB	=	Indian monetary base growth
ZIDEF	=	Indian Budget deficit as a proportion of Indian GDP
ZIDP	=	Indian Inflation
ZILR	=	Change in Indian discount rate
ZEX	=	Change in the Nepali Rupee / Indian Currency exchange rate
ZBP	=	Nepalese balance of payment deficit on current account as a proportion of Nepalese GDP

For details of data computation please see the appendix at the end of this paper.[7] Also, the use of annual data and limited sample size, 1976 - 1994, reflect data constraints.

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4 The data are available from the International Financial Statistics (IFS) of the International Monetary Fund, the Quarterly Economic Bulletin from the Nepal Rastra Bank and the Economic Survey of HMG Ministry of Finance.

5 For example Summers and Heston (1991) give a quality rating for the data ranging from A (best) to D- (worst) with Nepal having D+ and India enjoying a C quality rating.

6 Studies on the money supply have shown that the monetary base is a good predictor of the money supply in Nepal (Khatiwada, 1994) and India (Rani and Ramachandran, 1994) although the NRB does not have great control over high powered money due to the component of net foreign assets and claims on government (Poudyal, 1991).

7 The "Z" preceding each variable indicates variables which are "processed"; for example ZMB = log(MB/MB(-1)), or the growth of the monetary base, is "processed data", while MB , or the monetary base, is "raw" data.

3. Methodology, Initial Empirical Results along with some Specification Tests[8]

The first step taken was to determine if the variables had a unit root since its presence would lead to spurious results. Consider the general relationship :

$$(1)\ y_t = \alpha y_{t-1} + \varepsilon_t$$

If $|\alpha| < 1$ then y is I (0) i.e. stationary, but if $\alpha = 1$ then y is I (1), i.e. non stationary and has a unit root. There are different tests for unit roots looking at the value of α. The Dickey Fuller (DF) test is utilized, from Dickey and Fuller (1979), and the Weighted Symmetric (WS) test, from Pantula, Gonzales-Farias and Fuller (PG-FF, 1994) against the null of a unit root (i.e. $H_0 : \alpha = 1$). Critical values are given in Davidson and Mackinnon (1993) and PG-FF (1994) where, in this case, we limit the lag length to one since we were using data with annual frequency. Since the power of the WS statistic is greater that the DF statistic (PG-FF, 1994) the p-value given the null of a unit root of WS is put forward; they are :

Lag 1

Variable	p-value
ZMB	0.010696
ZDEF	0.042190
ZNDP	0.012110
ZLR	0.055563
ZIMB	0.088383
ZIDEF	0.032829
ZIDP	0.014343
ZILR	0.023059
ZEX	0.093116
ZBP	0.059462

All variables reject the null of a unit root at the 10% level and half at the 5% level of significance. A greater confidence level is taken given the quality of the data and the developing nature of the countries. Also, serial correlation is determined in the unit root

8 For a nice discussion see Godfrey (1988) and McAleer (1994)

regressions by looking at the Durbin *h* and the Durbin *m* statistic (Durbin (1970)).[9] The statistics, which are normally distributed, are given below :

Variable	Statistics
ZMB	0.988170
ZDEF	0.417350
ZNDP	-0.798465
ZLR	-0.463624
ZIMB	-0.228807
ZDEF	-0.373721
ZIDP	-1.07855
ZILR	-0.528990
ZEX	-0.90830
ZBP[10]	-0.288786

All the statistics fail to reject the null of no serial correlation at even the 10% level of significance. In general, the data had been shown to be fairly well behaved and thus proceeded to the estimation.

3a. General Methodology

Running the full model with all variables included fails due to insufficient degrees of freedom. Therefore, a sequential testing procedure was adopted to test the significance of different sub-sets of the right hand side variables. Initially three regressions were run to determine the significance of either ZMB(-1), ZIMB, or ZIMB(-1) since empirical evidence (from an earlier study and from Bohara and McNown(1989)) suggests some monetary relationship between both countries. ZIMB(-1) was selected, since it was significant at the 5% level with a p-value of 0.044, and include it in all subsequent regressions. Four pairs of variables were run in three combinations, with ZIMB(-1), thus running twelve regressions in all; the combinations are :

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9 The Durbin *h* is calculated as $h = \hat{\rho}\sqrt{\frac{T}{1 - TV(\hat{ab_1})}}$ where $V(\hat{b_1})$ is the ordinary least squares estimator of the variance of b_1 and $\hat{\rho}$ is the least squares estimate of ρ. The Durbin m (*h* alternative) is a two-step procedure which is applicable when 1-TV(b^1) is negative and is asymptotically equivalent to the *h*-test, based on a two-step procedure. Both are asymptotically normally distributed against the null of no serial correlation.

10 The statistic for ZBP is robust to different data sets such as the World Tables and Economic Survey.

	ZDEF–ZIDEF	ZNDP–ZINDP	ZLR–ZILR	ZEX–ZBP
Current Values (2)	ZDEF–ZIDEF	ZNDP–ZINDP	ZLR–ZILR	ZEX–ZBP
Legged Values (2)	ZDEF (–1)–ZIDEF (–1)	ZNDP (–1)–ZINDP (–1)	ZLR (–1)–ZILR (–1)	ZEX (–1)–ZBP (–1)
Current and Lagged	ZDEF–ZIDEF–ZDEF (–1)–	ZNDP–ZINDP–ZNDP(–1)–	ZLR–ZILR–ZLR (–1)–	ZEX–ZBP–ZEX (–1)–
Values (4)	ZIDEF (–1)	ZINDP (–1)	ZILR (–1)	ZBP (–1)

After testing for serial correlation by the Durbin Watson statistic and correcting using Maximum Likelihood (ML) the groups of variables significant at the 5% level or better were chosen in the initial pair-wise regression. From this set regression testing was run for parameter stability then commenced trimming variables by Likelihood Ratio (LR) test given the null of zero coefficient restrictions. This process was repeated until the important variables remained. As a final step Hausman tests were run on the remaining variables for exogeneity as well as RESET test for omitted variables on the final equation.

3b. Initial Empirical Results

The regressions with contemporaneous variables showed some level of serial correlation although corrected for by using the Cochrane Orcutt technique. The Durbin Watson statistics for the regressions that also include ZIMB(-1) are :

	Current/R = 2	Lagged/R = 2	Current and Lagged/R = 4
ZDEF–ZIDEF	1.97261	2.05683	1.56355
ZNDP–ZINDP	–1.56350	1.89001	1.22756
ZLR–ZILR	1.87847	1.88645	1.87651
ZEX–ZBP	0.916861	1.97968	1.10808

In general, the null of no serial correlation is rejected and the null of serial correlation is accepted. The data is corrected using ML and the statistics of the variables are viewed to determine if they are to be included.[11] The significant variables are ZNDP (p=0.015), ZLR (p=0.051) and ZEX (p=0.010). The new full equation is thus written as :

$$(2)\quad ZMB = b_{0i} + b_{1I}ZIMB(-1) + b_{2I}ZNDP + b_{3I}ZLR + b_{4I}ZEX + \mu_i$$

Equation (2) is estimated and it is found that the F statistic of zero slopes is significant at the 5% level (p=0.015) and the Chow statistic of a structural break is significant at the 10% level (p=0.066). The later is in line with the regime shift beginning

[11] Surprisingly these regression results do not differ significantly if we do not correct for serial correlation.

in 1989 with the transit embargo and the present post democracy. The equation is adjusted as follows :

$$(3)\ ZMB = b_{0i} + b_{1I}ZIMB(-1) + b_{2I}ZNDP + b_{3I}ZLR + b_{4I}ZEX + b_{5I}D1989 + \mu_i$$

Where D1989 is a dummy variable which is 0 from 1976 till 1988 and 1 from 1989 till 1994. Equation (3) is estimated with the significance of coefficients given in parenthesis below their respective variables :

$$(4)\ ZMB = b_{0i} + b_{1I}ZNDP + b_{2I}ZLR + b_{3I}ZIMB(-1) + b_{4I}ZEX + b_{5I}D1989 + \mu_i$$
$$(0.000)\quad (0.150)\quad (0.470)\quad (0.000)\quad (0.001)\quad (0.002)$$

As the Durbin Watson statistic (1.62163) is in the indeterminate range, equation (3) was run correcting for serial correlation by using ML. Similar results emerge :

$$(5)\ ZMB = b_{0i} + b_{1I}ZNDP + b_{2I}ZLR + b_{3I}ZIMB(-1) + b_{4I}ZEX + b_{5I}D1989 + \mu_i$$
$$(0.000)\quad (0.064)\quad (0.696)\quad (0.000)\quad (0.000)\quad (0.001)$$

In both (4) and (5) the F statistic of zero slopes is rejected at the 1% level of significance (p=0.000). The LR tests is then run against the null of each coefficient in (4) and (5) being zero since the Durbin Watson statistic for the unrestricted regression falls in the indeterminate range. The results are :

	OLS	ML
ZNDP	X	0.4005
ZLR	0.3583	0.6642
ZIMB (–1)	X	0.0000
ZEX	0.0000	0.0000

The variables ZNDP and ZLR were eliminated since they are shown to be insignificant. The last equation is limited to the variables of ZEX and ZMB(-1) which were chosen by LR. This equation is written as :

$$(6)\ ZMB = b_{0i} + b_{1I}ZIMB(-1) + b_{2I}ZEX + b_{5I}D1989 + u_i$$

The LR statistic is once again used to determine the validity of the variables in equation (6). Since the Durbin Watson statistic (1.79701) for (6) is in the ambiguous range both OLSQ and ML are used for hypothesis testing :

	OLSQ	ML
ZEX	0.0000	0.0000
ZIMB (–1)	0.0001	0.0001

The final OLS and ML results follow with the p value of the coefficients given in parenthesis below their respective coefficients :

$$\underset{(0.000)}{\text{ZMB} = 0.345022} - \underset{(0.000)}{(1.29557)\text{ZIMB}(-1)} + \underset{(0.000)}{(1.13921)\text{ZEX}} + \underset{(0.000)}{(0.53750)\text{D1989}} + \mu_i \quad (7)$$

$$\underset{(0.000)}{\text{ZMB} = 0.347194} - \underset{(0.000)}{(1.30875)\text{ZIMB}(-1)} + \underset{(0.000)}{(1.14136)\text{ZEX}} + \underset{(0.000)}{(0.53318)\text{D1989}} + \mu_i \quad (8)$$

In both cases the F statistic of zero slopes are rejected at the 1% level of significance.[12] Also, it is noteworthy that the signs of the coefficients are similar between both estimates.

The importance of each variable is analyzed through Beta coefficients. Beta coefficients (Goldberger, 1964, pp. 197-198),[13] which "measure the importance of the individual repressors by their individual contributions to...y," are presented in parenthesis below the coefficients of the repressors keeping in mind that the p-value of all the coefficients are p=0.000; the equations are :

$$\underset{[0.2310980]}{\text{ZMB} = 0.345022} - \underset{[-5.5060516]}{(1.29557)\text{ZIMB}(-1)} + \underset{[4.8415362]}{(1.13921)\text{ZEX}} + \underset{[0.0141656]}{(0.053750)\text{D1989}} + \mu_i \quad (9)$$

$$\underset{[0.2305347]}{\text{ZMB} = 0.347194} - \underset{[-5.5001743]}{(1.30875)\text{ZIMB}(-1)} + \underset{[4.5694352]}{(1.14136)\text{ZEX}} + \underset{[0.0142637]}{(0.53318)\text{D1989}} + \mu_i \quad (10)$$

The beta coefficients for (9) and (10) for ZIMB(-1) and ZEX are fairly similar in absolute magnitude and outweigh the effects of the dummy.

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[12] Unfortunately for the ML estimation, although convergence was achieved the p-value for rho was not significant (p=0.920).

[13] Since variation in the sample provides an objective measure of typical changes in the form of the sample deviation, the Beta coefficients are calculated by : Since variation in the sample provides an objective measure of typical changes in the form of the sample deviation, the Beta coefficients are calculated by : $\beta_i = b_i = \frac{S_{ji}}{S_{yy}}$ where $S_{ij} = \sqrt{\Sigma(X_{ij} - \overline{X_{ij}})} = \sqrt{T}$ times the standard deviation of x_j, and similarly for s_{yy}.

Hausman exogeneity[14] tests are run on the variables. If a variable is exogenous then it should not be correlated with the error terms. The results for each variable are :

Variable	p-values
XEX	0.98939
ZIMB (–1)	0.67221

Both variables fail to reject the null of exogeneity. This is understandable since the first variable is an official rate determined by the government while the latter is determined by the Indian government.

Lastly, Ramsey's (1969) RESET procedure was utilized to test for the possible omission of relevant explanatory variables in which the final equation (7) was augmented by additional test variables. If these additional test variables are found to be jointly insignificant then we fail to reject the null hypothesis of no specification error. Following Thursby and Schmidt (1977), squares, cubes and fourth powers of the right-hand-side variables are included in (7) which are used to form the test variables. Since serial correlation was detected by Durbin Watson in the indeterminate range the OLSQ and the ML estimation is put forward :

	OLSQ	ML
χ^2 (2)	0.86267	0.6088
χ^2 (4)	0.4492	0.3404
χ^2 (6)	0.0156	0.0122

The data fail to reject the null of no specification error even at the 30% level for adding squared and cubed powers however we reject the hypothesis for fourth powers of the right hand side variables at the 5% level of significance. Less weight should be put for the variables of the fourth power due to low power of the statistic brought about by the degree of freedom problem.

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[14] The Hausman exogeneity test looks at the statistic $\frac{B^{IV} - B^{OLS}}{\sqrt{\hat{V}B^{IV} - \hat{V}B^{OLS}}}$ which is distributed as a t statistic with n-2 degrees of freed on where for IV we use lagged variables and the null is that the error are uncorrelated or that we have a null of exogeneity.

3c. The Derived Black Market Rate : A Consideration

The derived Black Market Rate (BMR) for Nepal and India[15] was also considered by adding it in equation (6), although it decreases the sample size and adds to the degree of freedom problem, as an additional specification check :

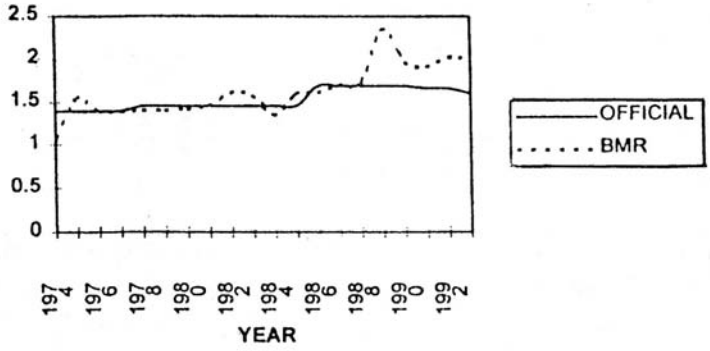
$$(11)\ ZMB = b_{0i} + b_{1I}ZIMB(-1) + b_{2I}ZEX + b_{5I}ZBMR + b_{4I}D1989 + \mu_i$$

Running this equation, given a smaller sample size, results in no significant coefficient for ZBMR; the equation is given below with respective p-values under the variables after correcting for serial correlation along with finding ZBMR well behaved[16]:

$$(12)\ ZMB = b_{0i} + b_{1I}ZIMB(-1) + b_{2I}ZEX + b_{5I}ZBMR + b_{4I}D1989 + \mu_i$$
$$(0.000)\quad (0.000)\quad (0.602)\quad (0.000)$$

The insignificant result may be due to low power from a smaller sample size however it happens that the information which is added by ZBMR only occur near the tail end of the sample. This can be seen in the graph with the official exchange rate :

Plots of the Official Exchange Rate and the Black Market Rate of the Nepalese Rupee to the Indian Rupee



Prior to 1989, the guided democracy period, the ratio of the official exchange rate to BMR was 1.004. Information was conveyed after the democracy period where BMR was

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[15] Where the BMR is measured indirectly as a ratio of the Nepalese BMR to the USD and the Indian BMR to the USD.

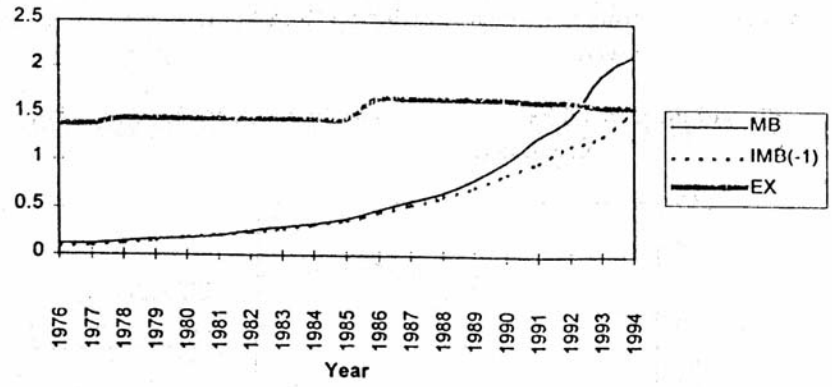
[16] ZBMR rejected the null of a unit root (p=0.010723) and found no serial correlation (m-statistic=-1.2169)

over 40% greater than the official exchange rate and stabilized after 1990 to the end of the sample at 20% average "discount" for the NC against the IC (1.2025). In other words, there is evidence of a structural break. Also, it appears that market confidence in democracy was lacking where people were willing to pay more to hold the IC. Thus, the results are consistent with our finding of an insignificant relationship between MB and BMR.

3d. Properties of the selected variables

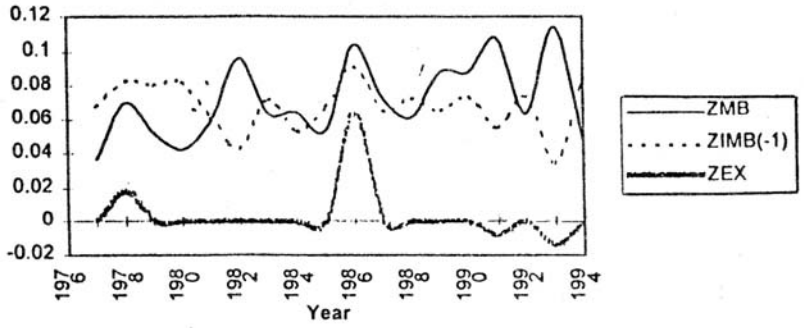
The plots of the "raw" data and the "processed" data of some variables are put forward which were determined to be significant during the course of the testing although plots of all the data are also available on request. Also, the variables are given with base 1990, where appropriate, for ease of comparison. The raw data for the monetary base, lagged Indian monetary base, and the exchange rate are :

Plot for MB, IMB (–1) and EX



It is difficult to observe a relationship between MB and EX, since the latter is government controlled with minimal changes, although MB and IMB(-1) show distinct breaks in 1989. Prior to democracy both variables appear to share a common trend, after democracy they appear to have different trends with the level of MB end at a higher level that IMB(-1). This is consistent with the empirical evidence of a structural break noted above. Plots of the growth rates are then given :

Plot of ZMB, ZIMB (–1) and ZEX



Looking at the growth rates, the movement of both ZMB and ZIMB(-1) tend upward; also there is more negative movement in ZEX after the advent of democracy although there are large (positive) spike at 1978 and 1986[17] although they are incorporated by ZEX.

The correlation tables are also calculated from the relevant data and their calculated significance,[18] where *,**,*** represent significance at the 1%,5%,10% level :

Variable Relationship :: Coefficient of Correlation

MB–IMB (–1)	0.99042*
MB–EX	0.60766*
ZMB–ZIMB (–1)	–0.49472**
ZMB–ZEX	0.19110

The coefficients of correlation for the raw data on MB vs. IMB(-1) and MB vs. EX are highly significant at the 1% level and shows a positive relationship. The relationship for ZMB and ZEX has the same sign as the level data but is insignificant. Surprisingly the

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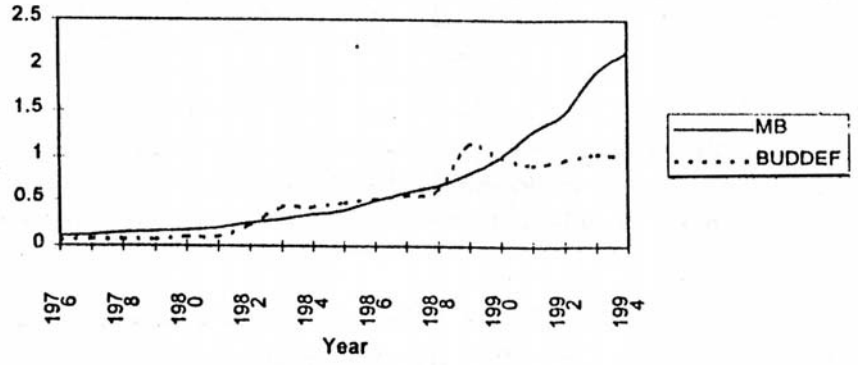
[17] The changes in the exchange rate refelct adjustments along the lines of policy objectives (i.e.,"fine tuning"). For example, in 1986 India revalued against all major currencies; Nepal followed suit but revalued to a larger extent due to Balance of Payments considerations.

[18] The formula $Z = \frac{1}{2}\sqrt{N-3}\,[\ln\{1+r)\,(1-\rho)\,(1-r)(1+\rho)\}]$, is utilized to determine the significance of the coefficient of correlation (see Romano (1977, pp.156-160)) with $Ho : \rho = 0$ versus $H_A : \neq 0$ and using $\alpha = 0.05, 0.01$ thus the rejection region is $Z = |\frac{1}{2}\sqrt{N-3}\,[\ln\{(1+r)/(1-r)\}]| > 1.96, 2.58$.

relationship between ZMB and ZIMB(-1) changes sign and shows a negative coefficient of correlation which is significant at the 5% level. This result is consistent with the negative sign of the coefficient for ZIMB(-1). Both significant results may be accounted for as stabilizing flow to maintain a trend where the flows are minuscule.

Finally, the Nepalese budget deficit and monetary base may have a positive relationship, due to its monetization, thus the plots of their "raw" and "processed" data are viewed. The plot of their "raw" data are :

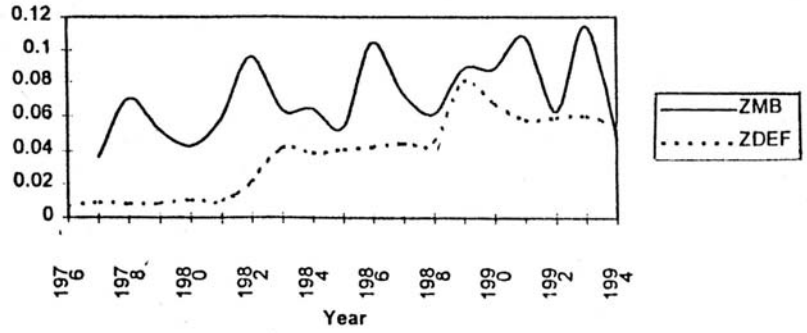
Plot of MB and BUDDEF



Once again the BUDDEF series shows evidence of a break occurring at about 1989. Prior to the democracy period both BUDDEF and MB appear to share a common trend. Surprisingly enough, the level of BUDDEF after democracy appears to stabilize; this observation suggests that the new democracy did not increase BUDDEF to maintain popularity of the constituents.[19] The plots of the growth data are :

[19] Indeed Economic Survey (p. 76) shows the last budgets receipt growth to be larger than expenditure growth and this is in line with financial discipline imposed externally by organizations such as the IMF during Nepal's inital majority government.

Plot of ZMB and ZDEF



The plots of ZMB and ZDEF show little obvious patter between the two variables. This observation is consistent with an insignificant coefficient of correlation :

Variable Relationship ::	Coefficient of Correlation
MB–BUDDEF	–0.88758*
ZMB–ZDEF	–0.14039

The finding is consistent with the result of the regression which do not find a significant relationship between ZMB and ZDEF.[20]

4. Analysis

Based on the signs of the coefficient estimates from equations (6) and (7), the Nepalese monetary authority seems to react negatively to lagged Indian monetary policy and react positively to the contemporaneous exchange rate. The latter relationship[21] appears to be a coordination problem since the exchange rate corrects for a misalignment while the monetary base increases the misalignment leading into a depreciation-inflation cycle. However, this scenario does not hold up given the stability of the exchange rate over a thirty six year period. Rather, it appears that the authority is simultaneously using both tools in its arsenal to correct for a misalignment and achieve stability. On the

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[20] There is suggestive evidence that the monetary base is more correlated with net foreign exchange reserves (i.e. aid) than with government monetary operations (see Sharma (1984) and Poudyal (1991)).

[21] The results are in line with those obtained by Bohara and McNown (1989) although the earlier study uses narrow money, as the policy variable, instead of the monetary base as above.

one hand the Nepalese depreciation of the exchange rate can be interpreted as an adjustment to a perceived permanent misalignment of both economies by the domestic authorities by virtue of the stability of the exchange rate over the observed period (that is, "fine-tuning" the exchange rate and allow both the economies to once again share a common trend). On the other hand the monetary base can be interpreted as adjusting to a perceived temporary misalignment since both countries do not face symmetrical real shocks. Thus the positive relationship can reflect a simultaneous adjustment to misalignment, using both the exchange rate and the monetary base tools by the domestic authority and this is consistent with the policy of the Nepalese monetary authority.

The sign of the coefficient on Indian monetary base growth is, at first instance, somewhat paradoxical since our prior, given the contiguous border and the stability of the exchange rate, would be of a positive relationship between Nepal and (lagged) Indian monetary base. However the negative relationship between ZMB and ZIMB(-1) is found perhaps because the Nepalese monetary authority may well be responding to real shocks with stabilizing monetary policy.[22] This is in line with the empirical results from earlier studies which show that Nepal and India do not face symmetric real shocks (attributable to their agricultural economies being held hostage to the vicissitudes of the weather and explicitly explored for Nepal in Bajracharya and Maskay (1997) and also generalizeable to the Indian economy) and that contemporaneous monetary base conditional on output shocks was cointegrated at the first lag for annual data given similar inflation targets. Consider an example where Nepal faces a negative output shock. If this happened in a world of flexible exchange rates then Nepal's currency would depreciate vis-a-vis the Indian currency. Since Nepal has a hard pegged exchange rate with India the Nepalese monetary authority must increase the monetary base to maintain this exchange rate regime. In other words, by virtue of not facing symmetric shocks while maintaining a fixed exchange rate regime, non-symmetric monetary policy between both countries is required. This result is consistent with the policy response of the Nepalese monetary authority to unexpected real shocks with stabilizing policy (such as an accommodative stance if there is a negative agricultural shock etc.).

Another interesting point is the apparent dichotomy between the real and the monetary sector (also seen in earlier studies). A striking example is that of the budget deficit which is monetization and thus expected a positive relation between ZMB and ZDEF (or MB and BUDDEF). No such a relationship is found in the data however.

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[22] The results of Bohara and McNown (1989, p.50) are generalized, where they found strong seasonality in the data which "...may be a source of monetary instability which is correctable through counter seasonal policies..." thus allowing for the observed stabilizing policy of the monetary authority and the resulting well behaved exchange rate.

Rather, a leveling of for the BUDDEF was found after the advent of democracy. This is contrary to anecdotal evidence since the democracy period of Nepal has been marked by great political uncertainty and thus that expenditures are fast outpacing revenues. In part this non-relationship may be due to missing numbers since governments in developing countries tend to different accounting techniques. Also, since the advent of democracy in Nepal there has been a confusion about the validity of deficit figures given by each government. However, it appears that democracy has improved discipline due to higher accountability and through external discipline and this is consistent with the data as well as government policy.

5. Conclusion

The paper provides a simple equation for Nepalese monetary base growth showing a positive relationship with the exchange rate and a negative relationship with lagged Indian monetary base. There is also empirical support for a regime shift after 1989. The results for the negative Nepalese response to lagged Indian money supply growth appear to be consistent with the earlier studies finding that the two countries do not face symmetric shocks. Also, the stabilizing policy of the Nepalese monetary authority is consistent with empirical results of the regression analysis.

DATA APPENDIX

1. ZMB = log (MB / MB (-1)),
   IFS # = f14a ; 1957 - 1994
   MB is the Nepalese reserve money which is the sum of currency outside bank; frequently referred to as high-powered money and monetary base.

2. ZDEF = (-1 X BUDDEF)/GDP
   IFS # = f80a ; 1957–1995
   BUDDEF is the Nepalese Government deficit which is the difference between revenue, and if applicable, grants received on one hand and expenditure and lending minus repayments
   IFS # = f99ba ; 1964–1994
   GDP is the Nepalese Gross Domestic Product which is the sum of household consumption expenditure, government consumption expenditure, gross fixed capital formation, changes in inventories, exports of goods and services and imports of goods and services

3. ZDP = log (CPI / CPI (-1))
IFS # = f64a ; 1964 - 1994
DP is the Nepalese inflation rate which is measured by the changes in CPI, the cost of acquiring a fixed basket of goods and services by the average consumer.

4. ZLR = LR-LR(-1)
IFS # = f60a ; 1976–1994
LR is the Central Bank Discount rate which is the rate at which the monetary authority lend or discount eligible paper for deposit money banks.

5. ZIMB = Indian monetary base growth
Same as for MB where IMB (1957–1994)

6. ZIDEF = Indian Government deficit as a proportion of Indian GDP
Same as for NDEF where IDEF (1950–1994) and IGDP (1950–1994) are defined as above.

7. ZIDP = Indian Inflation
Same as for NDP where IDP (1963–1994) is defined as above.

8. ZILR = Indian Lending Rate
Same as for LR where ILR (1963–1994) is defined as above.

9. ZEX = log (EX/EX(-1))
EX = Official exchange rate from Nepal Rastra Bank Quarterly Economic Bulletin for 1960–1996.

10. ZBP = log (NBP/GDP)
IFS # = f78al_da; 1976–1995
NBP is the credit minus the debit of goods, services, income and current transfers.
GDP is same as above.

11. ZBMR = log (BMR/BMR(-1))
BMR = ratio of Nepal BMR to USD against Indian BMR to USD from various issues of World Currency Yearbook.

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