Macro-Financial Link and Monetary Policy Management: Insight from the Case of Nepal

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Abstract

Increasing financial sector development and globalization have significantly changed the nature of macro-financial link. The paper aims to obtain insight on how these changes have impacted on the effectiveness of monetary policy management, by undergoing a case study of Nepal. The empirical results over the thirty five year period spanning FY 1975 to FY 2009, find that the elasticity of the real interest rate is not economically and statistically significant in relation to the output gap. This result is further explored by examining sequentially the contributions of direct financing, domestic financial sector development and external integration. The results suggest that while their respective contribution to the elasticity of the real interest rate is now statistically significant, however it remains economically insignificant. Further the direction of effect is ***opposite*** *to that of the theoretically predicted sign; this contrary result implies that the residual is driving the regression results. The results further suggest that the economic regime shift in early-1990s, had contributed to weaken the elasticity of the real interest rate. The general insight from the Nepalese case study is that countries have to re-examine on a regular basis the nature of macro-financial link to ensure optimal monetary policy management.*

JEL Classification: E5

Key Words: Macro-Financial Link, Monetary Policy Management, Nepal

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Acknowledgement: This paper had originally been produced in the NRB Working Paper Series (NRB-WP-7, 2010) and is based on a SEACEN research project entitled "Macro-Financial Link and Monetary Policy Management" where Dr. Maskay was the Project Leader and Mr. Pandit was the Nepal country economist.

Remarks: Our thanks to Mr. Alex Pitt for providing precious feedback and valuable suggestions as well to comments from a number of anonymous referees and to a NRB knowledge sharing program, all of which contributed to significantly enhance the quality of the paper. However, any error which occur in the paper are ours alone, with the views expressed being personal and are not representative of the official stance of the Nepal Rastra Bank or any other author associated institutions.

I. BACKGROUND

The macroeconomy and the financial environment are closely linked. At a fundamental and basic level the financial markets efficiently allocate resources and risks to facilitate wealth accumulation; this leads to overall economic development and growth. One way

this link can be characterized via the textbook IS-LM analysis, where changes in the interest rate, i.e. the cost of funds, leads to an opposite change in national income by allocating resources. Thus the link connecting the real sector with the financial markets can be portrayed via the efficient allocation of scarce resources and risks.

Monetary policy is formulated to take advantage of the above-mentioned macro-financial link. As most of the sources of financing in the past had come from one part of the financial system - the banking and non-bank financial intermediaries sector which is described as the monetary system - focus of monetary policy was accordingly made to this area. This narrow focus on the monetary system, versus the financial system, allows the respective monetary authorities to simplify and highlight the various channels of monetary policy.[1] This simplification allows the respective monetary authorities to fine-tune their monetary policy management.[2]

However, the basis of understanding of the macro-financial link is formulated on the understanding of the real economy. As the economy is dynamic, this necessarily implies that the nature of the macro-financial link is also changing. The episode of global financial crisis is a case in point which suggests that there is a need to update the understanding of the macro-financial link. The primary objective of the paper is thus to garner insight in this regard by examining how these changes have impacted on the effectiveness of monetary policy management. The paper aims to achieve the stated objective by looking at the case of the Federal Democratic Republic of Nepal (onwards simply Nepal).

The paper is structured into four additional parts: the following section provides review of Monetary Policy Management in Nepal; the third section focuses on literature review of the conceptual model and identification of the working model; the fourth section provides data analysis and estimation results with the last section ending with summary, insight and concluding observations.

II. REVIEW OF MONETARY POLICY MANAGEMENT IN NEPAL

Based on the discussion of monetary policy management provided in Annex 1, formulation and implementation in Nepal of those activities center on the Nepal Rastra Bank (NRB). NRB was established on 26 April1956 by the Act of 1955, to act as an apex institution of the banking and deposit taking institutions in Nepal. Since its establishment, there has been significant development of the monetary system as well as there being a substantial increment in the number of banks and financial institutions phases shown in the below table. With a view to respond to the fast growing Nepalese economy and the development in the financial sector, the new NRB Act was brought out in 2002 by replacing the previous Act of 1955.

1 These are namely narrow credit channel; broad credit channel; wealth channel; interest rate channel; and exchange rate channel. A good description is in Kuttner and Mosser (2002)

2 The configuration used by monetary policy makers is reflected in the well known monetary framework, which moves from instruments in the "arsenal" of the monetary authorities, such as the policy rate, to the goals and ultimate target, such as economic growth, price stability etc.

Both acts, the Act of 1955 and the present act of 2002, permit the following discussion to be divided into two periods: the first period of 1956 - 2002 and the second period of 2003 - present. Also, the first period can be further divided into two sub-periods: the sub-period of pre-liberalization of 1956 - 1989 and the sub-period of post-liberalization of 1990 - 2001. The domestic financial sector development indicators highlight the above-mentioned categorization, and are provided below:

Table 2.1: Financial Sector Development Indicator

	1st Period				2nd Period	
	1st Sub-Period		2nd Sub-Period			
	1956	1989	1990	2002	2003	2010
No of Banks and Financial institutions	1	7	7	92	96	203
Broad money GDP Ratio	11.1 (1970)	29.8	30.5	48.7	49.96	61.4
Financial sector Assets to GDP ratio	16.8	37.4	38.9	89.0	101.77	113.3
Stock market capitalization to GDP ratio	-	-	6.9 (1994)	7.6	7.16	32.16
Banks Deposits to GDP ratio	5.6 (1970)	22.6	22.9	48.4	50.51	66.4
Private Sector Loan to GDP ratio	3.1 (1970)	14.2	14.0	36.9	39.33	55.5
Source: Quarterly Economic Bulletin, 2010 July, Annual Report, 2009/10 Nepal Rastra Bank and Central Bureau of Statistics, GON						

In both the examined periods, the apex body for designing monetary policy is the Board of Directors (BOD) of NRB. However, in the first period while there was no clear choice of targeting framework there was clarity of the goals which were explicitly expressed in the NRB Act of 1955.[3] In contrast to this situation, there was clarity in the implementation tools of monetary policy (both operating targets and instruments). In the first sub-period, the monetary tools of NRB, which was initiated from 1966 with the elimination of the dual currency period (NRB, 1996) and reflected the under-developed financial environment, was limited to direct measures; these are namely administered interest rates regimes, directed credit, and mandatory guidelines to banks.[4] In the late 1980s, the instrument of controlled interest rates was liberalized and in 1989 interest rates determination was fully deregulated with primary issuance of treasury bills started in November 1988 through an auction basis. This event took place in the broader atmosphere of economic liberalization in early-1990s. In the second sub-period of the first period, there was massive growth of banks and financial institution however there was no significant change in the framework of monetary policy management.

3 The goals in the NRB Act of 1955 were to end the dual currency system of the country, stabilize the exchange rate and promote the banking services throughout the country

4 Some of the monetary instruments introduced in the period are the (1) Cash Reserve Ratio; (2) Statutory Liquidity Ration (on and off introduction); (3) Refinance Rate/Bank Rate; and (4) Interest Rate.

In the second period starting in 2003 and consistent with the prior period, there is transparency[5] in terms of monetary policy formulation with the goals clearly spelt out as maintaining domestic price stability and a reasonable level of surplus in the balance of payments in order to facilitate a sustainable economic growth and financial sector stability. However, contrary to the first period NRB has adopted monetary targeting for facilitating the formulation of monetary policy management. Similarly to the first period, the operating targets and tools of implementing monetary policy management during both periods has remained the same, however the emphasis has changed. NRB has adopted the indirect measures of monetary control with more reliance on the use of market-based instruments, such as, Open Market Operations,[6] complemented by reserve requirements. Additionally, NRB presently monitors inter-bank transaction while taking monetary policy decisions.

In sum, the formulation, targeting regime and goals of monetary policy in Nepal has attained greater clarity, as well as there being enhancement of the existing operating monetary policy targets and their instruments. The above discussion suggests that there are two important regime shifts: (1) the regime shift of interest rate liberalization in 1989; which can be generalized as economic liberalization in 1990; (2) the regime shift on monetary policy in 2003 reflected in the enactment of the new NRB Act of 2002.[7]

III. WORKING MODEL

While the literature provides different methodologies to examine the relationship between the macro-financial link and monetary policy management, the paper uses the methodology of SEACEN (2010) which is based on the model initially developed by Rudenbush and Svenson (1999; now RS, 1999).[8] RS (1999) looks at the macro-financial link and specifies the marginal (contractionary) influence of the real interest rate on the output gap of the macroeconomy as:

$$y_t = \alpha(w_t) + \sum_{j=1}^{p} \beta_j y_{t-j} + \beta_3(w_t)\left(\bar{i}_{t-1} - \bar{\pi}_{t-1}\right) + \varepsilon_t ; \qquad \text{..... (3.1)}$$

Where: $\alpha(w_t) = \alpha$ and $\beta_3(w_t) = \beta < 0$

With:

- y_t = the percentage gap between actual real GDP and potential GDP
- $\bar{i}_{t-1}$ = interest rate (quarterly average federal funds rate at an annual rate)
- $\bar{\pi}_{t-1}$ = inflation rate (four quarter inflation in the GDP chain-weighted price index)

5 This if reflected in the requirement that NRB publish its annual monetary policy statements and its mid-term review.

6 As mentioned above, primary issuance of treasury bills started in 1998 but OMO actually started with effect from June 1994, NRB has begun to operate secondary OMO to meet the monetary policy objectives

7 While there has been greater clarity in terms of formulation of goals and targeting mechanism, the process by which this moves from formulation to implementation results is still being developed – this aspect is touched more fully in Maskay and Pandit (2010).

8 Which is an extension of Johansen and Juselius (1994)

As stated by RS (1999, p. 207) "The third term (e.g. β_3) is a simple representation of the monetary transmission mechanism, which, in the view of many central banks, likely involves nominal interest rates (e.g., mortgage rates), ex ante real short and long rates, exchange rates, and possibly direct credit quantities as well." They conclude that this equation appears to be a workable approximation of these various intermediate transmission mechanisms, which suggest that it can represent the macro-financial link. The authors use US data from 1961:1 - 1996:2 and run a dynamic regression (e.g. an OLS-AR2) on the above-mentioned representation. The empirical exercise suggests that β_3 is (0.10), which is statistically significant at the 5% level of confidence. This suggests that there is presence of a macro-financial link in the US and that monetary management has been effective in influencing the output gap.

But, the aforementioned changes in the macroeconomic and financial environment, namely globalization and financial sector development, suggest that the channels connecting the macroeconomy with the financial markets, i.e. the nature of the macro-financial link, has changed. This has been further highlighted with the global crisis which has originated in the US housing market. Mangal Goswami, Andreas Jobst, and Xin Long (2009; now as GJL, 2009) test this and find that securitization has indeed contributed to weaken monetary policy in the US. In this regard GLJ (2009) examine whether securitization, a direct source of financing, has impacted the strength of the macro-financial link and therefore condition both the intercept term and β_3 in (3.1), on the ratio of securtization S_t, defined as the home mortgage rate to the value of all home mortgages (in percent). Conditioning the intercept term and β_3 in (3.1) results in:

$$\alpha(w_t) = \alpha_1 + \alpha_2 S_t \text{ and } \beta_3(w_t) = \beta_{3,1} + \beta_{3,2} S_t \qquad \text{..... (3.2)}$$

GJL (2009) also introduce additional control variables (CV) which attempt to control for variability and allow for interest elasticity and its interaction effects. The alternative models introduce S_t and adjust the base model by introducing CVs which affect both the intercept and slope of the regression. The two CVs used by GJL (2009) are the financing ratio F_t^9 and credit growth. They define the later as $K_t = \ln\left(\frac{\kappa_t}{GDP_t} \Big/ \frac{\kappa_{t-1}}{GDP_{t-1}}\right)$ where, κ is private sector credit and which controls for the relative importance of the credit channel to the growth of aggregate demand. GLJ (2009) then test for the stochastic properties of the above mentioned time series.[10]

9 This reflects the changing level of direct financing (i.e., equity, bonds, commercial paper or other capital-market based sources of external funding, with securitized issuance excluded) relative to indirect (or intermediated) financing (i.e., bank loans to the non-financial private sector, with household loans excluded)

10 All the time series are found to be stationary, however S_t is found to be integrated of order one. To address this, the authors introduce a time trend t to control for the "continuously increasing securitization on the relation between changes in output gap and monetary policy."

The authors run (3.1) modified by (3.2) as an OLS-AR2 and find that securitization activity dampens the interest rate elasticity of output in the US. GLJ (2009) use US data covering the span of 1970:3 - 2006:4 and show that the coefficient of the interaction between securitization and the real interest rate has a consistently positive and significant contribution. This implies that controlling for the relative share of securitized mortgages reduces the traditionally negative relation between output gap and real interest rates; this result is robust when controlling for other variability as mentioned above. The same methodology is also applied to the emerging market of South Africa. While GLJ (2009) use the same base regression, they modify their alternative model by replacing the securitization ratio S_t, with a dummy variable $S_t^{'}$, which registers the existence of securitized issuance at time *t*, so that:

$$\alpha(w_t) = \alpha_1 + \alpha_2 S_t^{'} \text{ and } \beta_3(w_t) = \beta_{3,1} + \beta_{3,2} S_t^{'} \quad \text{..... (3.3)}$$

The authors also find that the growing use of mortgage securitization in South Africa has, to some extent, eroded the general sensitivity of real output to monetary policy.

Given the above discussion, this study applies the methodology of GLJ (2009) on Nepal to assess the macro-financial link. Due to the absence of a securtization market, the study looks at the presence and effect of direct financing, which is an alternative source of financing. In Nepal, this source of financing is carried through the stock market (there is no active and developed market for private sector bonds) and in this regard, the Equity Financing variable (*EF)* is constructed as the ratio of the sum of equity [marketcap] to nominal GDP; so that:

$$EF_t = \ln\left(Equity[marketcap]_t \Big/ GDP \right) \quad \text{..... (3.4)}$$

Based on the discussion above, two versions are estimated: the first is the base case (below labeled as Model 1); with the second being alternative cases (below Model 2 but modified using EF). Analysis is done in both cases to determine if there is a significant effect of EF on the strength of monetary policy (i.e. the elasticity of the real interest rate).

Model 1: the base case as expressed in (3.1) where $\alpha(w_t) = \alpha_1$ and $\beta_3(w_t) = \beta_{3,1}$. Thus $\alpha(w_t) = \alpha_1$ is simply the intercept and $\beta_3(w_t) = \beta_{3,1}$ is simply the coefficient of the interest rate. Dummies are also included to take into account regime shift in 1990, which signaled economic and financial liberalization in Nepal, as well as in 2003, with the enactment of NRB Act 2003, and the 1984 Nepal-specific shocks.. This is represented schematically as:

$$y_t = \alpha + \beta_1 y_{t-1} + \beta_{t-2} y_{t-2} + \beta_3 (i_{t-1} - \bar{\pi}_{t-1}) + \beta_4 DUMMY\,(1990) + \beta_5 DUMMY\,(2003) + \beta_6 DUMMY\,(1984) + \varepsilon_t \quad \text{..... (3.5)}$$

Model 2: Elasticity varying with EF ratio where (3.1) is enhanced such that $\alpha(w_t) = \alpha_1 + \beta_4 EF_t + \sum_{n=5} \beta_n CV_t$ and $\beta_3(w_t) = \beta_{3,1} + \beta_{3,2} EF_t + \sum \beta_{3,n} \text{CV}$; the first

term represents the intercept and the EF variable (3.4) while β_3 is the coefficient of the interest rate, conditioned by the term EF and the CVs. The CVs represent both financial sector development (FSD) and greater trade integration (e.g globalization). For FSD, the standard variables as per GLJ (2009) above is utilized, but is labeled as Credit Growth (CG). Greater trade integration is proxied by openness in trade sectors. As above, dummies are also included. Both representations are similar to that used by GLJ (2009). This is represented schematically as[11]:

$$y_t = \alpha + \beta_1 y_{t-1} + \beta_2 y_{t-2} + (\beta_{3,1} + \beta_{3,2} EF_t + \beta_{3,3} CG_t + \beta_{3,4} OP_t + \beta_{3,5} EF_t CG_t + \beta_{3,6} EF_t OP_t + \beta_{3,7} EF_t CG_t OP_t)(i_{t-1} - \bar{\pi}_{t-1})_t + \beta_4 EF_t + \beta_5 CG_t + \beta_6 OP_t + \beta_7 EF_t CG_t + \beta_8 EF_t OP_t + \beta_9 EF_t CG_t OP_t + \beta_{10} DUMMY(1990) + \beta_{11} DUMMY(2003) + \beta_{12} DUMMY(1984) + \varepsilon \quad \text{..... (3.6)}$$

IV. DATA ANALYSIS AND ESTIMATION RESULTS

4.1 Data span and instrument of time trend: The data series of the study covers annual observation over the time period from FY 1974/1975 to FY 2008/2009, thus there are 35 observations in the full sample. In total, there are six categories of ten time series[12]:

- Output gap (YGAP): YGAP is taken as the logarithmic difference of real GDP at basic price (base year 2001) with that of potential output. The potential output is calculated by smoothing real GDP using a Hodrik Prescott filter. In addition to estimating this representation, as a test of robustness, alternative estimates for potential output are used. That is, in addition to the standard measure of potential output using linear trend approach, Hodrick-Prescott filter; estimates from production function approach are used which are derived from production function approach and whose series is provided in Bhandari (2010).
- Real Policy Interest Rate (RIR): The calculation of RIR is provided schematically as $RIR = i_t - \pi_t$. i_t the policy rate, where in Nepal NRB uses the bank rate.[13] Likewise, inflation data (π) is taken to be represented by the annual average consumer price index.
- Equity Financing (EF): EF is introduced as a proxy for the capital market indicator or alternative financing and is represented schematically in (3.4).
- Credit growth (CG): CG is used as the proxy of financial development. It is calculated as GJL (2009) under K, the terminology is simply renamed as CG. The paper also uses alternative proxies for financial development, which are utilized to

11 This representation differs from Pandit (2010) in three significant ways: (1) EF is a continuous term, whereas previously it was only a dummy representing the establishment of NEPSE; (2) inclusion of more variables leading to an increase from 4 equations to 7 present estimating equations; and (3) inclusion of three dummy variables. The first two representing regime shifts in 1990 and 2003 and an economic stress viariable in 1984.

12 The full time series are provided in appendix 2.

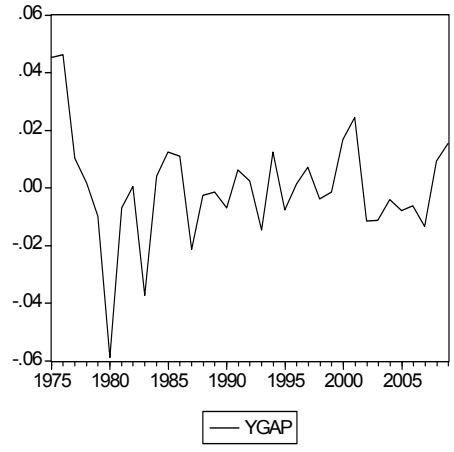
13 This is the rate charged by the NRB to banks and financial institutions when they resort to the bank fund i.e. as lender of last resort or for refinance facility. The bank rate is used to indicate NRB's monetary policy stance.

examine for robustness such as $DEPT_t = \ln\left(\frac{M_{2t}}{GDP_t} \Big/ \frac{M_{2t-1}}{GDP_{t-1}}\right)$; in the equation M_2 is broad money and GDP is taken in nominal terms. These have been used in numerous studies in this regard such as Maskay and Subedi (2009).

- Trade Integration (OP): OP is an indicator for trade openness and is taken as total trade to nominal GDP. This is represented schematically as $OP_t = \ln\left(\frac{(X+M)_t}{GDP_t} \Big/ \frac{(X+M)_{t-1}}{GDP_{t-1}}\right)$ where X is exports of goods and services and M is imports of goods and services and GDP is taken in nominal terms.
- Dummy Variables: The results are tested for three major events that occurred in the Nepalese financial system as discussed in the second section: these are namely dummies for 1990, 2003 and 1984. The prior two represents the regime shifts namely of the period of economic liberalization in the early-1990s and the enactment of the NRB Act of 2002. While the last one represents a period of economic stress. Therefore, three dummies (D1990, D1984 and D2003) are created to see the effect of these events.

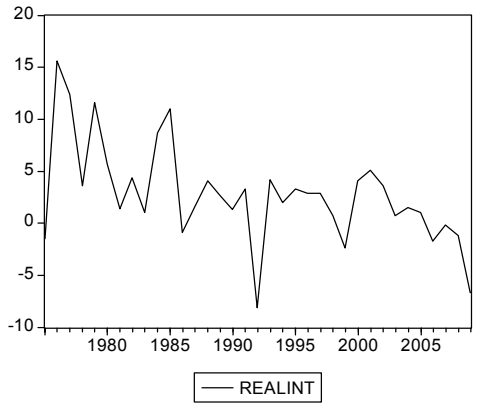
Graphical Presentation of Time Trend: The calculated time trends are presented graphically below.

Figure 1: Output Gap



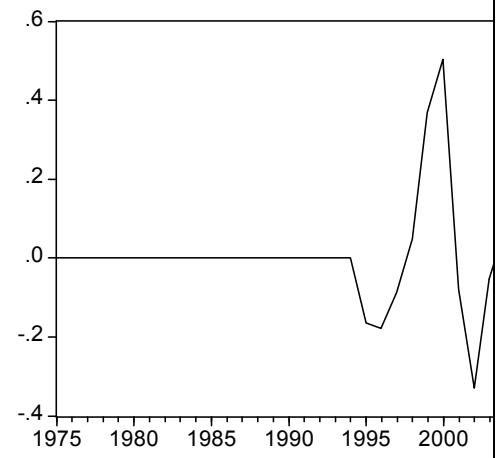
Source: CBS, and authors calculation

Figure 2: Real Interest Rate



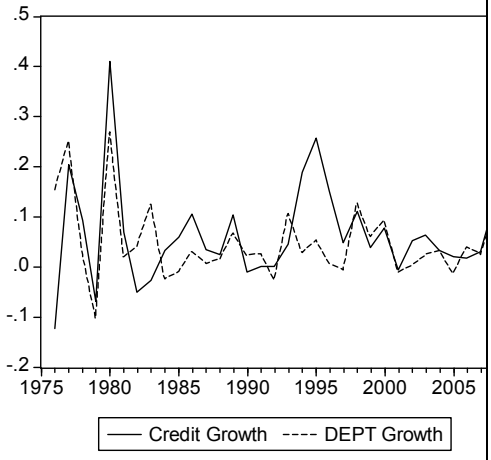
Source: NRB and authors calculation

Figure 3: Growth of Stock Market Capitalization



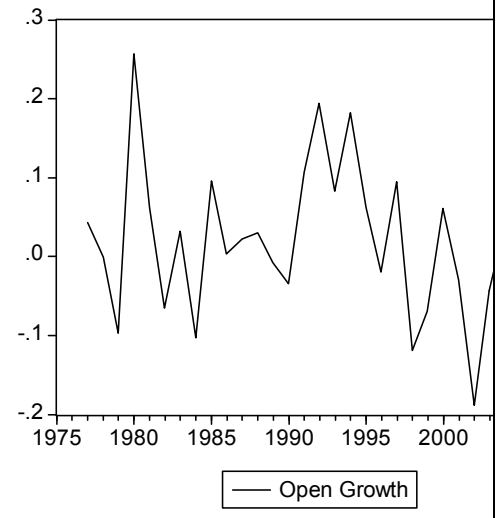
Source: QEB, Nepal Rastra Bank

Fig 4: Credit Growth and Financial Dept Growth



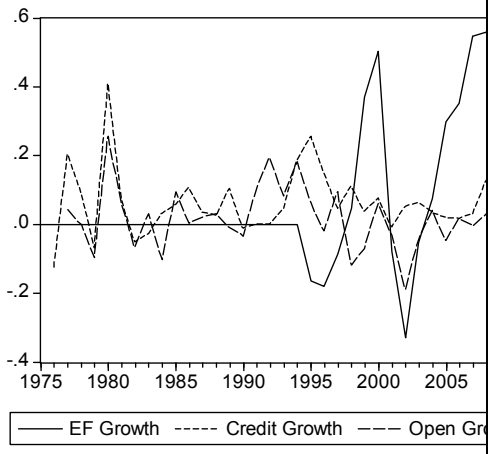
Source: QEB, Nepal Rastra Bank

Figure 5: Openness Growth



Source: QEB, NRB and CBS

Fig 6: EF, CG, OP Growth



Source: QEB, NRB and CBS

4.2 Data Analysis: Eye-balling the trends suggest that there are no outliers and they do not have a discernable trend. The next step is to verify statistically whether the time series have long-term memory, i.e. if they are stationary, as their presence makes the regression spurious. In this regard, the Augmented Dicky-Fuller (ADF) is carried out to analyze the stochastic properties of each variable in the sample. The ADF statistics show that all the time series reject the null of serial correlation at the 5% level of confidence except for EF. The same result had occurred with GLF (2009). To address the growth rate of the EF variable is taken, which now becomes stationary. Having ascertained that the variables

are now stationary, the relationship of the variables to each other is assessed. In this regard, the below table provides correlation coefficients and their respective significance.[14]

Table 4:1: Correlation Matrix

	YGAP	RIR	EF	CG	OP
YGAP	1.00				
RIR	-0.01	1.00			
EF	-0.07	0.00	1.00		
CG	-0.25	0.11	-0.04	1.00	
OP	-0.14	-0.11	0.10	0.47*	1.00

Source: Author calculations from data in appendix 2
Note: * is significance at the 1% level

The correlation suggests that only one of the statistics is significant at the 1% level. This is the relation between OP and CG.

4.3 Estimation Result: Prior to running regressions, it is important to determine the representation of the base model. In this regard and as a first step, the first and base model uses as foundation (3.1). The initial step in this regard is to determine the optimal lag length. For determining this, the Akaike Information Criteria (AIC) and Schwarz Information Criteria (SIC) are used. Gradually increasing the number of lags lead to a decreasing trend of both AIC and SIC statistic, which bottoms out then reverses to follow an increasing trend. The lags are determined to be the optimal lag lengths where the AIC and SIC statistics are minimized. Additionally, the recursive estimates of the base equation are examines for structural breaks. Except for a spike in 1984, none is found. Using standard Chow Test, 1984 is found to be significant at the 5% level, which coincides with period of economic turbulence. While doing such for both period of regime shift (i.e. 1990 and 2003) do not find any significant result, it is observed that during the period of economic liberalization, the p-value reduces to being slightly statistically significant which contrasts with that of the regime shift in 2003 with the new NRB act, where there is no discernable effect on statistical significance. It is suggested that the period of economic liberalization had a near significant effect on policy, however there is no such suggestion for significant effect with NRB act, 2003 (e.g. Maskay and Pandit, 2010). In this regard and on the above-mentioned basis, it is felt that the regime

14 The formula $Z = \frac{1}{2}\sqrt{N-3}\{\ln[(1+r)(1-\rho)/(1-r)(1+\rho]\}$, is utilized from Romano (1977, pp.156-160) with $H_0: \rho = 0$ versus $H_A: \rho \neq 0$ and using $\alpha = 0.05, 0.01$ thus the rejection region is $Z = |\frac{1}{2}\sqrt{N-3}\{\ln[(1+r)/(1-r)]\}| > 1.96, 2.58$; by inputting the produced coefficients of correlation (r) with an N of 80 for the full sample and N of 30 for the sub-sample statistics of greater than 0.30 and 0.45 respectively are required for significance at the 1 % level of confidence.

shift of economic liberalization is utilized along with the dummy representing the year 1984, while the regime shift with the new NRB act is not significant and thus not utilized.

The results of running the second model (3.2), which is based on the above representation, whereby the intercept and the elasticity with respect to RIR(-1) are allowed to vary with inclusion of different variables namely EF, CG, OP and their pair-wise interaction (i.e. EF and CG as well as EF and OP) in a step wise manner, is provided below:

OLS Estimation Results:

	YGAP						
	MODEL 1		MODEL 2				
	EQ1	**EQ2**	**EQ3**	**EQ4**	**EQ5**	**EQ6**	**EQ7**
A	-0.0019	-0.0126	-0.0135	-0.0163	-0.0223	-0.0160	-0.0223
p-value	0.61	0.09	0.09	0.02	0.00	0.02	0.00
β_1	0.1672	0.1733	0.1904	0.2231	0.0704	0.2291	0.0644
p-value	0.35	0.36	0.34	0.20	0.65	0.19	0.67
β_2	-0.0863	-0.1525	-0.1525	-0.0935	-0.3172	-0.1082	-0.3046
p-value	0.60	0.36	0.37	0.52	0.02	0.45	0.03
$\beta_{3,1}$ (RIR(-1))	**-0.0002**	**0.0006**	**0.0008**	**0.0030**	**0.0034**	**0.0029**	**0.0034**
p-value	**0.77**	**0.44**	**0.38**	**0.01**	**0.00**	**0.01**	**0.00**
$\beta_{3,2}$ (EF)			-0.0003	0.0009	0.0009	0.0055	-0.0022
p-value			0.96	0.89	0.88	0.67	0.79
$\beta_{3,3}$ (CG)				-0.0184		-0.0172	
p-value				0.01		0.03	
$\beta_{3,4}$ (OP)					-0.0343		-0.0317
p-value					0.00		0.00
$\beta_{3,5}$ (EF*CG)						-0.0683	
p-value						0.74	
$\beta_{3,6}$ (EF*OP)							-0.1188
p-value							0.12
β_4 (EF)			0.0107	0.0186	0.0243	-0.0097	0.0112
p-value			0.50	0.18	0.06	0.69	0.44
β_5 (CG)				0.0634		0.0546	
p-value				0.25		0.42	
β_6 (OP)					0.1387		0.1038
p-value					0.00		0.05
β_7 (EF*CG)						0.3854	
p-value						0.17	
β_8 (EF*OP)							0.1740
p-value							0.59
β_9 (D1984)		0.0226	0.0240	0.0242	0.0365	0.0246	0.0329
p-value		0.22	0.21	0.14	0.02	0.13	0.04
β_{10} (D1990)		0.0121	0.0116	0.0087	0.0121	0.0100	0.0139
p-value		0.11	0.14	0.22	0.05	0.16	0.03
R2	0.04	0.15	0.16	0.45	0.56	0.5	0.62
Adj R2	-0.06	-0.01	-0.07	0.24	0.39	0.24	0.42
F-Prob	0.78	0.48	0.68	0.07	0.01	0.09	0.01

Prior to analyzing the regression equations, their diagnostic statistics are examined. The nature of the regression shows a common pattern: the inclusion of control variables at the

intercept and the elasticity with respect to RIR, lead to more significant results up to Eq. 7. For serial correlation, the statistic for Breusch-Godfrey (BG) Serial Correlation LM Test is used since the inclusion of lagged dependent variables in a regression make the DW test no longer valid. The BG statistic suggests that there is absence of serial correlation (e.g. fail to reject the null of no serial correlation). The Adj R2, the goodness of fit, suggest that moving from Eq. 1 to Eq. 7 leads to a higher Adj R2 statistic - from the base regression with a statistic of about zero to being statistically significant at 0.42 in the final equation, Eq. 7.[15] The same pattern is found with F-Prob statistic, which examine the joint test that all the coefficient are zero; the significance of the F-statistic increases up to Eq. 7, where it is significant at the 1%. The trend of the significance of the two statistics, suggests that the regressions in model 2, especially the final equation (Eq. 7), are acceptable for analysis.

Looking at the result of $\beta_{3,1}$ in model 1, suggest that there exists both economically weak and statistically insignificant relation. The results suggest that the bank rate has an insignificant economic and statistical effect on the real domestic economic activities. The apparent ineffectiveness of the policy rate is also suggested by the interest rate pass through exercise, elaborated in Maskay and Pandit (2010). This result is further explored by adding dummies for economic shock and regime shifts - these add slightly to the analysis. In Eq. 7 both the dummy for 1984 and 1990 are found to significant at the 5% level with positive coefficient. This is suggestive evidence that both the shock and the regime shift had affected the nature of the macroeconomic and financial linkage, which had contributed to a weakening of the traditional monetary policy management. For the later, this may be due to the more than twelve times growth in the formal bank and financial institutions over the twelve years of the second phase of the first period, and reflects significant development of the domestic financial system.

The above elasticity coefficient, $\beta_{3,1}$, is further explored in model 2 through inclusion of additional variables (namely EF, CG and OP). As mentioned earlier, these transform the equation in both the intercept and the elasticity with respect to RIR(-1); in all cases (Eq. 3 – 7) while the real interest rate coefficient is still economically weak but is now statistically significant. This result is however, contrary to theory, which suggests that there is a negative relation between the real policy interest rate and the output gap. The results thus suggest that RIR(-1) has a positive relation with the output gap.[16] The inclusion of control variables focus on highlighting the effect of RIR(-1) with the output gap; the results show:

- That the slope of EF and the elasticity statistic of EF in relation to RIR (-1) is insignificant. This suggests that the introduction of EF, which is reflective of direct financing, did not have any statistically significant effect on the elasticity of RIR(-1).

15 It is important to note that this statistic penalizes for inclusion of additional variables without contributing to the explanatory power of the regress.

16 Specifically, for the final equation (Eq. 7), the coefficient is significant at the 1% level however in the final equation in Pandit (2010), the coefficient is insignificant.

- That development of CG and OP contributed significantly, to the efficacy of monetary policy with respect to RIR(-1) (reflected in the negative sign of their respective coefficients) however the intercept in both cases is insignificant. This prior result suggests that the development of the financial sector has been enhanced by the contribution of the elasticity of RIR(-1) on the output gap (interaction of CG and RIR(-1)). Similarly economic integration has also been enhanced by the contribution of the elasticity of RIR(-1) with respect to output gap (interaction of OP and RIR(-1)). Interestingly, the magnitude of contribution of the elasticity of RIR(-1) of CG and OP is different by less than magnitude of two times. This suggests that external sector integration has contributed more to strengthen monetary policy efficacy that financial sector development; nonetheless both contribute in this regard.
- The intercept and the elasticity of the interaction of both EF with both CG and OP and RIR(-1) is insignificant. The later suggests that the interaction of EF does not contribute to the strength of either CG and OP with respect to RIR(-1). This highlights that the there is insignificant contribution of EF seen in this result as well as the individual result of EF.

The above results suggests that known variables, which are included to determine their contribution to understanding the elasticity of $\beta_{3,1}$, and their interaction is either negative or insignificant, thus that they can be eliminated and implies that the elasticity coefficient of RIR (-1) appears to be driven by the residual.

The question is now thus, what is contributing to the residual? The above empirical results suggest that this is not contributed by EF, CG and OP. One clue to this is from the interpreting of the dummy variable for economic liberalization, since the coefficient is both economically and statistically significant. In the final equations, the coefficient of the dummy is significant at the 5% level with p-value being equal to 0.03. Likewise, the magnitude is generally ten times greater than the coefficient of RIR (-1). *This suggests that with the start of the phase of economic liberalization – which had a broad impact on the financial system - there has been a weakening of the traditional relationship of monetary policy with the real economy.* The result of the empirical exercise suggests that the traditional formulation and implementation of monetary policy in Nepal during the examined period has not been so effective at affecting output.

V. SUMMARY, INSIGHT AND CLOSING REMARKS

The paper aimed to obtain insight on how changes in the Nepalese economic environment have impacted on the effectiveness of monetary policy management. The empirical results find that the elasticity of the real interest is not economically and statistically significant in relation to the output gap. However, when taking into account the contribution of direct financing, domestic financial development and external integration, in the above-mentioned relationship, the elasticity of real interest rate now becomes statistically significant (although it remains economically insignificant); however the direction of effect is opposite to that of the theoretically predicted sign! The result thus suggests that the residual of the regression is driving the results. However, what factors account for this residual? The empirical regression suggests that regime shift which

resulted in economic liberalization of 1990, had contributed to weaken the elasticity of interest rate. This may reflect the ensuing massive growth in the monetary and financial system with economic and financial liberalization, suggesting that existing traditional monetary management has not been able to adjust to the development in the domestic financial system.

The paper thus highlights the insight that there should be a regular process to review the macro-financial link and monetary policy management process to optimally fine-tune monetary policy. This conclusion follows Maskay (2010), where looking at the empirical result from eight countries, suggests that the understanding of monetary policy limited to the monetary system is incomplete; this may be attributed to the respective growth of financial sector development. Based on this insight from Nepal, it is suggested that the formulation of domestic monetary policy should be targeted to the whole financial system (beyond that of the monetary system), which necessary implies initiating the formulation of domestic financial policy; this implies initiating greater coordination between stakeholders with development of more effective instruments.

By closing a number of limitations and caveats are pointed out: (1) first, there are data quality problems, less so for monetary statistics relative to for real statistics, in the developing country of Nepal; (2) there are some caveats on the economic indicators; for example the use of the policy rate has been found to be less effective (Maskay and Pandit, 20010), there are alternative measures existing beyond the standard measure used in this study; (3) there are also some technical limitations due to the level of financial development which have a direct impact on the use of techniques that allow for addressing problems such as simultaneity. These caveats point to areas of further research in this important area of monetary policy management.

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Appendix 1: Discussion on monetary policy management

Monetary policy management aims to provide a sound and stable financial environment that is conducive for the attainment of both macroeconomic stability and growth. In this regard and to optimize monetary policy management, the general framework used by policy makers is provided below:

Table 2.1: General Monetary Framework

Instruments (1st stage)	**Operating target (2nd stage)**	Intermediate Target (3rd stage)	**Goals (4th stage)**
• Cash Reserve Ratio • Policy rate • Open Market Operatons (OMOs) • Direct control (SLR, interest setting and credit ceiling) • Moral Suasion	• Short-term interest rate • Monetary Base • Excess reserve of commercial banks • Domestic credit	• Monetary Aggregate • Interest rate • Exchange rate • Inflation	• Price stability • Economic growth • Employment • Exchange rate stability • BOP surplus
----> Implementation of monetary policy		Formulation of monetary policy <----	

Based on the assessment of specific country situation's, policy makers determine their specific targeting framework, e.g. these are generally categorized into monetary interest rate, exchange rate or inflation targeting frameworks, to help facilitate and guide monetary policy management to achieve their goals.

While doing this exercise in regard to determining the optimal monetary framework, it is important to keep in mind that the strength and appropriateness of this transmission mechanism will vary by countries with different levels of financial development and/or levels of external integration. An example of how results vary by country is provided by Patat (2007, p.1). He states "the wealth effect is less important in the Euro-area than in the US as the equities market is less developed and the role of institutional and non resident investors more decisive". This observation suggests that while the flow of funds is important, the factor which influences varies; thus in the US, where it is suggested that the wealth rather than the income effect predominates, the interest channel is less effective due to financial innovation, esp. securitization.

The above-mentioned framework provides four stages in the process of monetary management, but this is generally broken down into two groups: first formulation (4th and 3rd stage); and second implementation (2nd and 1st stage).

Appendix 2

Year	YGAP	RIR	EF	CG	OP
1975	0.05	-1.50	0	NA	NA
1976	0.05	15.60	0	-0.12	NA
1977	0.01	12.40	0	0.20	0.04
1978	0.00	3.60	0	0.09	0.00
1979	-0.01	11.60	0	-0.07	-0.10
1980	-0.06	5.70	0	0.41	0.26
1981	-0.01	1.40	0	0.07	0.06
1982	0.00	4.40	0	-0.05	-0.07
1983	-0.04	1.00	0	-0.03	0.03
1984	0.00	8.70	0	0.03	-0.10
1985	0.01	11.00	0	0.06	0.10
1986	0.01	-0.90	0	0.11	0.00
1987	-0.02	1.60	0	0.03	0.02
1988	0.00	4.10	0	0.03	0.03
1989	0.00	2.70	0	0.10	-0.01
1990	-0.01	1.30	0	-0.01	-0.03
1991	0.01	3.30	0	0.00	0.11
1992	0.00	-8.10	0	0.00	0.19
1993	-0.01	4.20	0	0.05	0.08
1994	0.01	2.00	0	0.19	0.18
1995	-0.01	3.30	-0.16	0.26	0.06
1996	0.00	2.90	-0.18	0.15	-0.02
1997	0.01	2.90	-0.09	0.05	0.09
1998	0.00	0.70	0.05	0.11	-0.12
1999	0.00	-2.40	0.37	0.04	-0.07
2000	0.02	4.10	0.50	0.08	0.06
2001	0.02	5.10	-0.08	-0.01	-0.03
2002	-0.01	3.60	-0.33	0.05	-0.19
2003	-0.01	0.70	-0.05	0.06	-0.04
2004	0.00	1.50	0.08	0.03	0.04
2005	-0.01	1.00	0.30	0.02	-0.05
2006	-0.01	-1.75	0.35	0.02	0.02
2007	-0.01	-0.15	0.55	0.03	0.00
2008	0.01	-1.20	0.56	0.13	0.03
2009	0.02	-6.70	0.18	0.09	0.02
Source	Author calculations as mentioned in 4.1				