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Macro-Financial Link and Monetary Policy Management: The Case of Nepal

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Abstract

Macro-financial link is closely intertwined with monetary policy management since it contributes to its fine-tuning and optimization. However, it is felt that increasing financial development and globalization have significantly changed the nature of this 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 a thirty-five year period (FY 1975 to FY 2009), suggest that the elasticity of the real interest is economically and statistically insignificant in relation to the output gap. Examining this result further by taking into account the contribution of direct financing, domestic financial development and external integration, finds that while the elasticity of real interest rate remains economically insignificant, its contribution is now statistically significant; however the direction of effect is opposite to that of the theoretically predicted sign. Surprisingly, the interaction contribution of both domestic financial sector development along with external integration, suggests that their contribution significantly enhances the effectiveness of monetary policy. The result implies that the residual of the regression is driving the results and suggests revision of the traditional monetary policy management in Nepal. The paper ends by highlighting that there should be a regular process to review the macro-financial link to ensure optimal fine-tuning of monetary policy.

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Acknowledgement: Thanks to Mr. Alex Pitt for providing valuable suggestions as well as to comments from anonymous referees – these have helped enhance the final output. This paper is based on the 2010 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. Standard disclaimer's apply, with any errors in the paper are the responsibility of the authors', with the views expressed are personal and do not represent the official stance of the Nepal Rastra Bank or any other authors' associated institutions.

Contents

I. Introduction

1.1 Macro-financial link and monetary policy management: 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, which leads to overall development and growth. One way the link can be characterized is 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 via allocation of investment. 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 bank and non-bank financial intermediaries sector, i.e. 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 allows the respective monetary authorities to fine-tune their monetary policy management. 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. To optimize monetary policy management, the formulation and choice of monetary framework, is based on the nature of the macro-financial link.

However, the basis of understanding of the macro-financial link is formulated on the understanding of the real economy. As the economy is not static; it is dynamic, this necessarily implies that the nature of the macro-financial link is also changing. The recent 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.

1.2 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 Nepal and providing necessary recommendations.

1.3 Stylized Facts of Nepal's Financial System: The Federal Democratic Republic of Nepal is a landlocked Least Developed Country of 27 million people (CBS 2010), and occupies an area of 147, 181 square kilometers. The nation lies on the southern slope of the Himalayas, bordering only two countries: Tibet Autonomous Region of the People's Republic of China to the north and Republic of India in the remaining directions of east, south and west.

The geographical situation has resulted in greater activity with the southern neighbor. This is reflected in the pegged exchange rate regime which had commenced in 1960 where the last of the seven adjustments, having occurred in 1993, back to the same level in which it started. This is also seen in the significant share by India of total Nepalese merchandise trade – about 56.0 percent of formal merchandise trade in 2010.

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)

The country has an embryonic financial system which is gradually developing. The development of the formal financial system, which for simplicity has been taken as the banking and non-bank financial intermediaries sector, commenced from the establishment of the Nepal Rastra Bank (NRB) in 1956 (from NRB Act of 1955). There have been three developing trends in Nepal's financial system:

- *First, there is accelerated development in the monetary system:* This is seen in the rapid increase in both the breadth and depth of financial intermediaries especially with the commencement of economic liberalization in the early 1990's.
- *Second, there is growing development of the non-monetary system:* This sector provides a source of alternative formal financing vis-à-vis that of the traditional source of indirect financing mentioned above. The salient case in this regard is with reference to the stock market, which was formally established in 1994.
- *Lastly, there is steady integration with the external economy:* This is reflected in greater participation in globalization. This external orientation is reflected in participation in numerous multi-lateral trade organizations, saliently seen in Nepal's 2004 membership in the World Trade Organization.[2]

1.4 The paper's structure is aimed to attain the above-mentioned objective, and is organized into four 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

2.1 Discussion of Monetary Policy Management: As mentioned earlier, 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	Operating target	Intermediate Target	Goals
• Cash Reserve Ratio • Policy rate • Direct control (interest setting and credit ceiling) • OMO • 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 the country situation, policy makers determine their specific targeting framework, e.g. generally categorized into four broad categories of monetary aggregate, interest, exchange rate or inflation targeting, to facilitate guiding monetary

[2] While the country has not fully opened up the capital account; the contribution of the external sector is growing, with the country in 2010 allowing the opening of foreign (wholesale) bank branches.

policy management to achieve their goals.[3] The above-mentioned framework can be broken down into two groups: first formulation; and second implementation. In this regard, the discussion of monetary policy management in Nepal focuses on those two aspects.

2.2 Monetary Policy Management in Nepal is the responsibility of the Nepal Rastra Bank (NRB) – the country's Central Bank. NRB was established in 1956 by the act of 1955, as an apex body of the banking and deposit taking institutions in Nepal – this year can be taken as the start of the formal monetary system in Nepal. Since 1956, the Nepalese monetary system has grown incrementally; however this steady trend had significantly accelerated after the start of economic liberalization in 1990 - this is shown in the table below. The changing indicators of financial sector development reflect transformation of the Nepalese economy. **With a view to respond to the fast growing Nepalese economy and the financial sector, the NRB Act of 1955 was replaced in 2002 with a reformulated and upgraded NRB Act.** The time of both acts thus permit the era of Nepal's formal monetary history to be broken down into two periods; the first period spanning the years of 1956 - 2002 and the second period spanning the years of 2003 - present. The first period can be further divided into two phases: the phase of pre-liberalization of 1956 - 1989 and the phase of post-liberalization of 1990 - 2001. These divisions are shown in the table below:

Table 2.1: Financial Sector Development Indicator

	1st Period				2nd Period	
	1st Phase		2nd Phase			
	1956	1989	1990	2002	2003	2009
No of Banks and Financial institutions	1	7	7	92	96	181
Broad money to GDP Ratio	11.1 (1970)	29.8	30.5	48.7	49.96	65.9
Financial sector Assets to GDP ratio	16.8	37.4	38.9	89.0	101.77	131.5
Stock market capitalization to GDP ratio	-	-	6.9 (1994)	7.6	7.16	53.4
Bank 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	54.1

Source: Quarterly Economic Bulletin, Nepal Rastra Bank and Central Bureau of Statistics, GON

2.3 Monetary Management in Nepal is examined in the two periods. In both cases, the apex body for designing monetary policies is the Board of Directors (BOD) of NRB. While in the first period there was vagueness in the formulation of monetary policy, there was clarity in the implementing tools of monetary policy (both operating targets

[3] 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) who 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.

and instruments). The monetary tools used by NRB was initiated from 1966, with the elimination of the dual currency period (NRB, 1996), and reflected the under-developed financial environment; the tools were blunt and limited to direct measures, such as 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 commencing in November 1988 through an auction basis. This event took place in the broader atmosphere of economic liberalization in 1990.

In the second period starting in 2003 the formulation the monetary policy became more systematic, with the monetary targeting regime having been presently chosen. Likewise while the operating targets and tools of implementing monetary policy have been constant, their emphasis has changed. That is, NRB has now adopted the indirect techniques of monetary control with more reliance on the use of market-based instruments, such as, Open Market Operations,[5] complemented by reserve requirements. Additionally, NRB is presently monitoring inter-bank transaction while executing monetary policy decisions.

In sum, the formulation of goals and the targeting regime of monetary policy in Nepal is changing – over time it has attained greater clarity, as well as there being enhancement of the existing operating monetary policy targets and their instruments. The review highlights two dates as being significant for monetary policy in Nepal: (1) 1990, since this represents the start of economic liberalization; which was signaled by interest rate liberalization in 1989; and (2) 2003, which is the first year of enactment of the new NRB Act of 2002.[6] Both years will be taken as dates which auger periods of regime shift.

III. Literature Review and Working Model

3.1 Literature Review: There is a vast literature on examining the macro-financial link (most recently in SEACEN, 2010). The paper focuses on the standard model initially developed by Rudenbush and Svenson (1999; now RS, 1999)[7]. RS (1999) looks at the macro-financial link and specifies the relation as the marginal (contractionary) influence of the real interest rate on the output gap of the macroeconomy; this is provided algebraically as:

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

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.

5 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

6 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).

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

Where: $\alpha(w_t) = \alpha$ and $\beta_3(w_t) = \beta < 1$

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)
- β_3 = the authors suggest that this coefficient that should conceptually have a negative sign.

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 shows that β_3 is negative 0.10, which is statistically significant at the 5% level of confidence. This significant result 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.

Over the last decade since RS (1999), the international economic enviornment has witnessed significant change - namely accelerated globalisation and higher and more complex financial sector development - which suggest that the channels connecting the macroeconomy with the financial markets, i.e. the nature of the macro-financial link, has changed. In this regard, Estrella (2002) extend RS (1999) and look at the degree of securitization and how this has affected the transmission mechanism of monetary policy. The author examine this by conditioning the intercept term and β_3 in (3.1) by S_t, securitized home mortgages to the value of all, home mortgages (in percent); this modification results in:

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

The issue of direct financing has been further examined by Mangal Goswami, Andreas Jobst, and Xin Long (2009; now as GJL, 2009) who test this relationship and find that securitization has indeed contributed to weaken monetary policy in the US. Using (3.2) the authors 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[8] and credit growth. They define the later as $K_t = \ln\left(\frac{\kappa_t}{GDP_t} \Big/ \frac{\kappa_{t-1}}{GDP_{t-1}}\right)$

[8] 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)

where K is private sector credit and which controls for the relative importance of the credit channel to growth of aggregate demand. GLJ (2009) then test for the stochastic properties of the above mentioned time series.[9]

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. The authors 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 by the authors to the emerging market of South Africa. While GLJ (2009) use the same base regression, the authors 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:

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

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.

3.2 Working Model: Given the above discussion, where presence of securitization dampens the elasticity of real interest rate, this study applies the methodology of GLJ (2009) on Nepal to asses the macro-financial link. Due to the absence of a securtization market, the study focuses on the presence and effect of direct financing, which is a source of alternative financing. In Nepal, this source of financing is through the stock market (there is no active and developed market for private sector bonds) and in this regard, the variable EF is constructed as the ratio of equity [marketcap] to nominal GDP; so that:

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

Along the lines of MJL (2009), two versions are estimated: the first is the base case (below labeled as Model 1); with the second being modified cases (below labeled as Model 2). 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 included, as necessary, to take into account for country regime shifts and specific shocks.

This is represented schematically as:

$$y_t = \alpha + \beta_1 y_{t-1} + \beta_{t-2} + \beta_3 (i_{t-1} - \bar{\pi}_{t-1}) + dummy1 + dummy2 + \varepsilon_t \tag{3.5}$$

[9] GLJ (2009) find all the time series 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."

Model 2: Elasticity varying with EF ratio where the base equation in (3.1) is modified 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, the EF variable and CVs 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, namely K, the growth of private sector credit κ to GDP. Greater trade integration is proxied by openness in trade sectors. Both representations are similar to that used by GLJ (2009). This is represented schematically as:

$$y_t = \alpha + (\beta_{3,1} + \beta_{3,2} EF_t + \beta_{3,3} CG_t + \beta_{3,4} OP_t + \beta_{3,5} EF_t CG_t + \beta_{3,6} EF_t OP_t + \beta_{3,7} EF_t CG_t OP_t)(i_{t-1} - \bar{\pi}_{t-1})_t$$

$$+ \beta_4 EF_t + \beta_5 CG_t + \beta_6 OP_t + \beta_7 EF_t CG_t + \beta_8 EF_t OP_t + \beta_9 EF_t CG_t OP_t + \beta_{10} DUMMY + \beta_{11} DUMMY + + \varepsilon \quad (3.6)$$

IV. Data Analysis and Estimation Results

4.1 Data span and instrument of time trend: The data series of the study covers 35 annual observations over the time period from FY 1975 to FY 2009. They can be grouped into the following six categories[10]:

- Output gap (YGAP): The real GDP at basic price (base year 2001) is taken and its logarithm difference to potential output is calculated to derive the output gap. 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.

- Real Policy Interest Rate (RIR): In Nepal, the policy interest rate of Nepal Rastra Bank is taken as the bank rate. The bank rate 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. This also indicates monetary policy stance of the bank. (NRB, Statement of the Monetary Policy, 2007). Likewise, inflation data, represented by the annual average consumer price index (CPI) is taken and is represented by $RIR = i_t - \pi$. Thus RIR is the real policy interest rate.

- Equity Financing (EF): This is introduced as a proxy for the capital market indicator or alternative financing and represented algebraically in (3.4).

- Financial Sector Development: Credit growth (CG) is used as the proxy of financial development. However, there are alternative proxies which are tested for to examine robustness such $DEPT_t = \ln\left(\frac{M_{2t}}{GDP_t} \Big/ \frac{M_{2t-1}}{GDP_{t-1}}\right)$ with M_2 being broad money and GDP

[10] The full time series are provided in the first appendix.

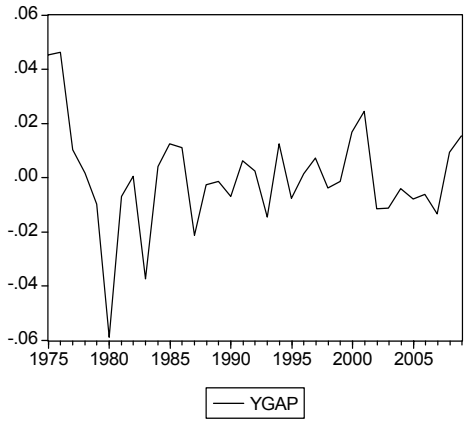
is taken in nominal terms. These have been used in numerous studies in this regard such as Maskay and Subedi (2009).

- Trade Integration (OP): The indicator for trade openness is taken as total trade to nominal GDP. This is represented schematically as $OP_t = \ln\left(\frac{\frac{(X+M)_t}{GDP_t}}{\frac{(X+M)_{t-1}}{GDP_{t-1}}}\right)$ 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 two major regime shifts that occurred in the Nepalese financial system as discussed in the second section: these are namely dummies for 1990 and 2003. The prior represents the regime shift as a result of economic liberalization. While the later represents the enactment of the NRB Act of 2002. Therefore, two dummies (dum_ir and dum_nrb) are created to see the effect of these events on monetary policy.

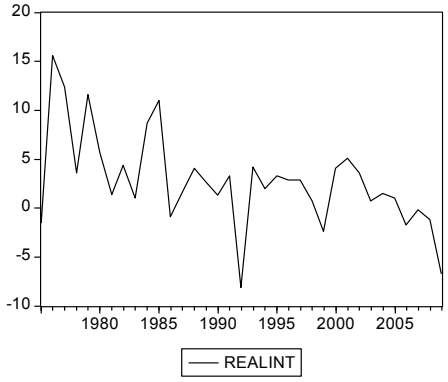
Graphical Presentation of Time Trend: The calculated time trends are presented graphically below.

Figure 1: Output Gap



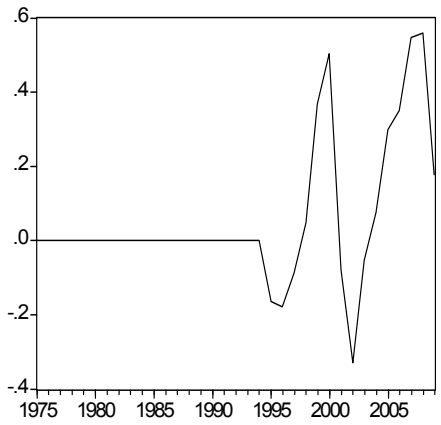
Source: CBS, and authors calculation

Figure 2: Real Interest Rate



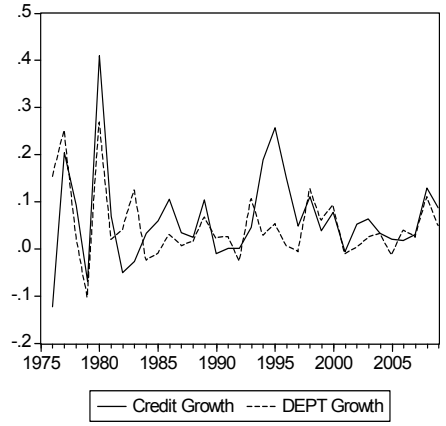
Source: NRB and authors calculation

Figure 3: Growth of Stock Market Capitalization



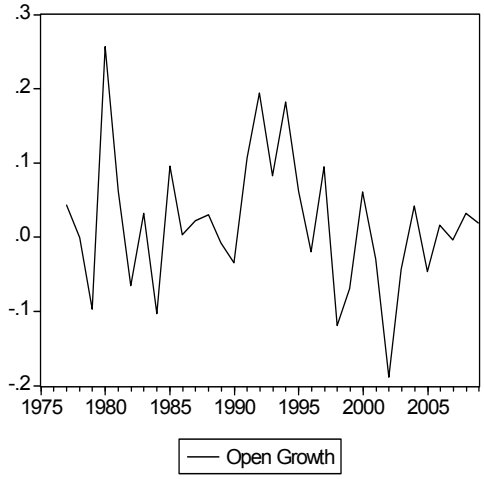
Source: QEB, Nepal Rastra Bank

Figure 4: Credit Growth and Financial Dept Growth



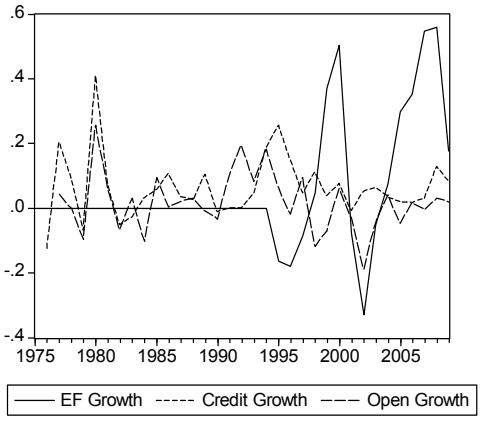
Source: QEB, Nepal Rastra Bank

Figure 5: Openness Growth



Source: QEB, NRB and CBS

Figure 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 determine their stochastic properties, i.e are the time series stationary or do they have some long-term memory. In this regard, the Augmented Dicky-Fuller (ADF) test is carried out on each of the above-mentioned times series. The ADF statistics show that all the time series reject the null of serial correlation at the 5% level of confidence except for the EF time series. The same result had occurred in GLF (2009). To address this, the growth of the EF variable is taken, where the time series is now made 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.[11]

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 10% 5%, and 1% respectively					

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 first model used (3.1) as foundation.

The initial step in this regard is to determine the optimal lag length. For this, the Akaike Information Criteria (AIC) and Schwarz Information Criteria (SIC) are used. The determination of optimal lag lengths is the minimization of AIC and SIC statistics, from this exercise it is determined that two lags are optimal. Additionally, the recursive estimates of the base equation are examineed 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 do not find any significant result, it is observed that the p-value of the coefficient associated with the period of economic liberalization, is slightly significant which contrasts with that of the regime shift in 2003 where the coefficient is not statistically significance. It is thus suggested that the period of economic liberalization had a significant effect on policy, however there is no such suggestion for significant effect with the NRB Act, 2003; this consistent with earlier works by the author in Maskay and Pandit (2010). In this regard and on the basis of the above-mentioned result, the regime shift of economic liberalization is only utilized.

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 the inclusion of CVs 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.

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[11] 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.

The result of running both models by OLS is provided in the below table.

OLS Estimation Results:

	LGAP						
	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} **(DL1990)**		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
Ad 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

Note:

EQ1: YGAP = C(1) + C(2)*YGAP(-1) + C(3)*YGAP(-2) + C(4)*RIR(-1); EQ2: YGAP = C(1) + C(2)*YGAP(-1) + C(3)*YGAP(-2) + C(4)*RIR(-1) + C(5)*DUM_84 + C(6)*DUM_IR; EQ3: YGAP = C(1) + C(2)*YGAP(-1) + C(3)*YGAP(-2) + C(4)*RIR(-1) + C(5)*EF + C(6)*(RIR(-1)*EF) + C(7)*DUM_84 + C(8)*DUM_IR; EQ4: YGAP = C(1) + C(2)*YGAP(-1) + C(3)*YGAP(-2) + C(4)*RIR(-1) + C(5)*EF + C(6)*CG + C(7)*(RIR(-1)*EF) + C(8)*(RIR(-1)*CG) + C(9)*DUM_84 + C(10)*DUM_IR; EQ5: YGAP = C(1) + C(2)*YGAP(-1) + C(3)*YGAP(-2) + C(4)*RIR(-1) + C(5)*EF + C(6)*OP + C(7)*(RIR(-1)*EF) + C(8)*(RIR(-1)*OP) + C(9)*DUM_84 + C(10)*DUM_IR; EQ6: YGAP = C(1) + C(2)*YGAP(-1) + C(3)*YGAP(-2) + C(4)*RIR(-1) + C(5)*EF + C(6)*CG + C(7)*(EF*CG) + C(8)*(RIR(-1)*EF) + C(9)*(RIR(-1)*CG) + C(10)*(RIR(-1)*EF*CG) + C(11)*DUM_84 + C(12)*DUM_IR; EQ7: YGAP = C(1) + C(2)*YGAP(-1) + C(3)*YGAP(-2) + C(4)*RIR(-1) + C(5)*EF + C(6)*OP + C(7)*(EF*OP) + C(8)*(RIR(-1)*EF) + C(9)*(RIR(-1)*OP) + C(10)*(RIR(-1)*EF*OP) + C(11)*DUM_84 + C(12)*DUM_IR;

Prior to analyzing the regression equations, their diagnostic statistics are examined. The nature of the regressions show a common pattern: the inclusion of control variables at both the intercept and the elasticity with respect to RIR leads to more significant results up to Eq. 7. Since the regressions include lagged dependent variables, which invalidates the standard DW test for serial correlation, the Breusch-Godfrey (BG) statistic is used. The BG statistic suggests that there is absence of serial correlation (e.g. fail to reject the null of no serial correlation). The adjusted R^2, the goodness of fit, suggests that moving from Eq. 1 to Eq. 7 leads to a higher adjusted R^2 statistics - from the base regression with a statistics of about zero to being statistically significant at 0.42 in the final equation, Eq. 7.[12] The same pattern is found with F-Prob statistic, which tests for the joint test that all the coefficients are zero; the significance of the F-statistic increases up to Eq. 7, where it is significant at 1%. **The trend of the significance of the two statistics, suggests that the regressions in model 2, especially the final equation, are acceptable for analysis.**

The result of $\beta_{3,1}$ in model 1, suggests that there exists both economically weak and statistically insignificant relation. The bank rate (which is the policy rate in Nepal) has an insignificant economic and statistical effect on the real 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). Adding shock dummy and regime shift dummy, the coefficient of the 1984 shock is found to be insignificant, the regime shift dummy capturing the period of economic liberalization is found to be slightly significant at 11% level. Nonetheless, this is suggestive evidence that this regime shift had changed the nature of the macroeconomic and financial linkage leading to a weakening of the traditional monetary policy management. This may be contributed by the massive growth in the formal bank and financial institutions which perhaps signifies the development of the domestic financial system – growth has been more than twelve time growth in the twelve years of the second phase of the first period,.

The elasticity coefficient, $\beta_{3,1}$, is further explored in model 2 through inclusion of additional variables (namely EF, CG and OP). As mentioned earlier, this transforms the equation changing both the intercept and the elasticity with respect to RIR(_-1). In all cases (Eq. 3 – 7) in Model 2, the elasticity coefficient is now statistically significant however it is still economically weak. This result however is, 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. The second model is modified with step-wise inclusion of control variables; it is observed that:

- 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).

- The 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

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

prior result suggests that the development of the financial sector has enhanced the contribution of the elasticity of RIR(-1) on the output gap (interaction of CG and RIR(-1)). Similarly, external integration has also enhanced 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 a magnitude of two times. While this suggests that external sector integration has contributed more to strengthen monetary policy efficacy than that of financial sector development, it is observed nonetheless that both contribute in this regard.

- The intercept term and the elasticity term of the interaction of both EF with that of CG and OP with respect to 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 thus highlights that the there is insignificant contribution of EF, which is already suggested from the prior individual result of EF.

The above results suggest that known variables of EF, CG and OP, which are included in the regression to control for elasticity coefficient of RIR (-1) results in the statistics either have contrary signs or economically and statistically insignificant suggesting that those have minimal contribution to movements in the output gap. By process of elimination, this suggests and that movement in the output gap is **driven** by unidentified variables, e.g. the residual.

The question is now thus, what is contributing to the residual? The above empirical results suggest that EF, CG and OP do not contribute this. 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 is equal to 0.03. Likewise, the magnitude is generally ten times greater than the coefficient of RIR (-1). *This suggests that the period of economic liberalization has a broad impact on the financial system. This has also contributed to weaken to the traditional relationship of monetary policy with the real economy.*

The NRB Act 2002 was brought to address the changes in the monetary and financial system of the country. However, the insignificant coefficient from zero suggests that the weakness in formulation and implementation of monetary policy may have contributed to the result. It is important to point out that the period of the early to mid 2000 period was tricky as the country experienced a domestic security problem. This may have contributed to this result.

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 the real output

V. Summary, Insights and Closing Remarks

5.1 Summary: The macroeconomy is linked with the financial market by allocating resources and risks. Importantly, this macro-financial link is closely intertwined with monetary policy management since it contributes to fine-tuning and making it more effective. However, increasing financial development and globalization have

significantly changed the nature of this link. This gap is evident from the recent global economic and financial crisis. The paper thus aims to obtain insight on how these changes have impacted on the effectiveness of monetary policy management by undertaking the case 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 is not economically and statistically significant in relation to the output gap. Examining this result further by taking into account contribution of direct financing, domestic financial development and external integration, in the above-mentioned relationship, finds that while the elasticity of real interest rate remains economically insignificant its contribution is now statistically significant; however the direction of effect is opposite to that of the theoretically predicted sign. Surprisingly, the interaction contribution of both domestic financial sector development along with external integration, suggests that their contribution significantly enhances the effectiveness of monetary policy. 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 massive growth in the monetary and financial system, suggesting that existing traditional monetary management, which focus on bank driven indirect financing, has not been able to adjust to the development in the domestic financial system, which is providing a source of alternative financing beyond that of the banks.

5.2 Insight: The paper highlights the insight that there should be a regular process to review the macro-financial link to ensure optimal fine-tuning of monetary policy management. Based on this insight, which is consistent with authors such as GLJ (2009) and Maskay (2010), three recommendations are obtained for the case of Nepal: (1) in the formulation of domestic monetary policy, it is suggested to expand focus on the whole financial system beyond that of the monetary system; (2) incorporating this in the formulation of monetary policy, which suggest some level of coordination within the financial sector, such as with capital markets; (3) develop effective monetary instruments, such as particularly developing policy interest rate affecting market interest rate, along with other instruments in line with the development in the financial system.

5.3 Closing Remarks: There are a number of limitations and caveats: (1) First, there are data quality problems, less so for monetary but more so for real, in the developing country of Nepal; (2) Secondly, there are some caveats on the economic indicators such as the use of the policy rate which has been found to be less effective, with there existing alternative measures 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 which 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

	1	2	3	4	5	6	7
Year	GDP	HPGDP	INT	INF	EF	Credit	OPEN
1975	138262	132151.3	15	16.5	0	5.95	NA
1976	143101	136621.3	15	-0.6	0	5.26	25.53
1977	142628	141152.3	15	2.6	0	6.45	26.65
1978	146115	145870.3	15	11.4	0	7.08	26.63
1979	149453	150916	15	3.4	0	6.61	24.17
1980	147473	156432.5	15	9.3	0	9.96	31.26
1981	161439	162548.2	15	13.6	0	10.67	33.25
1982	169385	169302.1	15	10.6	0	10.14	31.14
1983	170244	176721.9	15	14	0	9.87	32.16
1984	185594	184836.3	15	6.3	0	10.2	29.02
1985	196020	193609	15	4	0	10.82	31.92
1986	205239	203011.6	15	15.9	0	12.03	32.03
1987	208566	213039.5	15	13.4	0	12.45	32.74
1988	223115	223710.5	15	10.9	0	12.77	33.75
1989	234681	234997.7	11	8.3	0	14.17	33.49
1990	245169	246868.2	11	9.7	0	14.03	32.34
1991	260925	259286	13	9.7	0	14.05	35.99
1992	272847	272198	13	21.1	0	14.07	43.7
1993	281394	285567.5	13	8.8	0	14.73	47.45
1994	303113	299364.3	11	9	6.96	17.8	56.94
1995	311147	313516.7	11	7.7	5.91	23.01	60.6
1996	328456	327990.1	11	8.1	4.94	26.76	59.43
1997	345193	342726.4	11	8.1	4.53	28.07	65.35
1998	356275	357672.2	9	8.3	4.75	31.38	58.02
1999	372237	372798.8	9	11.4	6.87	32.62	54.12
2000	394586	388063.2	7.5	3.4	11.36	35.25	57.5
2001	413429	403417.2	7.5	2.4	10.5	35.02	55.8
2002	414091	418877.7	6.5	2.9	7.55	36.91	46.23
2003	429699	434561.5	5.5	4.8	7.16	39.33	44.25
2004	448654	450537.8	5.5	4	7.72	40.64	46.15
2005	463165	466827	5.5	4.5	10.41	41.46	44.06
2006	480435	483430.8	6.25	8	14.79	42.21	44.76
2007	493651	500314.2	6.25	6.4	25.58	43.52	44.58
2008	522260	517412.3	6.5	7.7	44.75	49.51	46.04
2009	542903	534593.5	6.5	13.2	53.43	54.05	46.93
Source	1, GON, Economic Survey (various issues); 2. From author calculations using HP filter; 3. NRB; 4 NRB; 5, 6 and 7; fro GON and NRB.						

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				