Monetary Policy Pass Through Considering the Reserve Ratio and Policy Rate in Nepal: An Empirical Gaze Using SVAR Analysis

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Abstract

Utilizing the monthly data from July 2017 to July 2024, this study attempts to analyze the monetary pass through in Nepal with the use of the reserve requirements (quantity) and the repo rate (price) on the base rate and the lending rates. The study fits a 2 lagged VAR and recursively identified SVAR. An interaction term of repo rate and CRR has been used which represents the effects of liquidity constraints. All the series are I (1) using the PP test. Results reveal that a one percentage point increase in repo rate increases the base rate by 0.32 percentage points and the lending rate by 0.45 percentage points (after two months). The corresponding increase in the CRR, increases both the rates by around 0.22 percentage points. A positive and statistically weak interaction term signifies that there's a lame synergy effect. The SVAR impulse responses notify the repo shocks account for 50 percent of the forecast error variance in lending rates over a 12-month period contrasting to the CRR shocks (as 10–15 percent). The pass-through is quicker than with pre-corridor research, however the structural liquidity frictions hinders it to be complete. There is a possibility that Nepal's interest rate-based channel and policy efficiency might be improved by reducing the range of the corridor, adding a counter-cyclical modification to the CRR, and changing the modality of the base rate.

Keywords: Repo rate, CRR, interest rate corridor, pass through, SVAR

JEL Classifications: C22, C32, E51, E52

Introduction

Central banks are liable for the interest rate management since they are obliged to maintain price and financial stability. To accomplish the task of the interest rate management, Nepal has been using the Interest Rate Corridor (IRC) system since 2016 as a hanging corridor[1]. The IRC comprises of three bands which are the upper ceiling as SLF rate, the mid-range known as the repo rate (or the policy rate), and the lower floor which is also known as the SDF rate. Out of these three rates, the policy (repo) rate is very important. It is supposed to anchor the weighted average interbank rate. In the year 2020, NRB upgraded its IRC to a full-fledged

[1] A hanging corridor the ceiling and floor rate are there is the place, the policy rate is not specified. The central bank uses the reserve-money as the target and lets the interbank rate to hang within the corridor (IMF, 2022).

form for the commercial banks and for all banks and financial institutions in the year 2021[2]. As an important component of IRC, the repo rate outlines the marginal cost of funding by banks. So, any changes in the repo rate should be imitated in the market interest rates that is set by banks. For instance, any base rate revisions by banks helps to transmit monetary impulses to the firms as well as households. The economic decision making of the people and the businesses are thus affected (Nepal Rastra Bank [NRB], 2025). However, empirical research focus that the pass-through of the interest rates in Nepal is still feeble and lame. This is because only a small part of decisions affecting to the adjustment of policy rate is mirrored on the lending rates (NRB, 2013). It has also been seen that a decrease in a percentage in repo rate reduces the lending rate by two-thirds of a percentage point in the two quarters (Saborowski & Weber, 2013). So, this gap motivates for a study of pass through after NRB adopted the IRC[3].

To put into the perspective for our analysis we touch the key achievements of NRB since 2010. Starting from 2011 till 2025 the bank has been shifting the quantity control instruments to the interest-based instruments. The bank transitioned to all these to gain an effective transmission mechanism. The bank cut the CRR by 0.5 percentage points and used the open-market operations with an aim to stabilize the inflation around 8 percent in the FY 2011/12. Likewise, in the FY 2012/13, the base-rate regime was introduced which mandated banks to disclose minimum lending added with the cost. This was done to enhance the transparency of the price (NRB 2013). All these reforms later on resulted to lay the foundation for the formation of the IRC which was again an effort to promote a greater openness and minimize the unfair pricing (NRB, 2013).

NRB further made several refinements focusing more on the price and less on the measures of the liquidity management. The base-rate reinforced a bonding between the cost of the funds and the prices of the loans. After the major shocks in the economy, the 2015 earthquake and the 2020/21 pandemic, NRB decreased the repo rate to 3 percent and increased the deposit floor rate and used the corridor rate. The rate of inflation was increased in between (FY 2019 and FY 2023) which led to a rise in the 11 percentage points in base rates with the rise and fall in the CRR. The SLF and SDF rates were used to stabilize the overnight rates during the time of stress. When the inflation lessened and the balance-of-payments went on to be surplus in the FY 2024/25, NRB reduced the base rate to 6.53 percent (NRB 2024).

In the IRC, the repo rate works as a policy indicator because it affects the marginal funding cost of the banks directly. Because of this, the base-rate equation is, the marginal cost plus the CRR/SLR carry plus the risk premium. This adjusts quickly in response to the changes in the repo rate (NRB 2024). India's movement towards MCLR's adoption in the year 2016 focuses on the trend towards transparency in pricing[4]. This phenomenon has been a worldwide

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2 Full-fledged corridor is a symmetrical policy framework. The central bank's policy rate in this type of corridor is in between the standing lending-facility ceiling and the deposit facility floor. To make the interbank rate move around the policy repo rate is the main gist of this type of corridor (IMF, 2022).

3 Pass through shows how movements of the policy rates are transferred to the market-based parameters. This is also a narrowed form of analysis when compared to a larger transmission mechanism which involve various channels with which the monetary policy impacts on the economy (IMF, 2020).

4 When the base rate is compared to the Marginal Cost of Funds-based lending, the MCLR is sensitive as it includes marginal funding costs, tenor premiums, and operating costs which are not in the base rate. And also, RBI (2015) tells us that the mechanism of MCLR increases transparency and better speed of the monetary policy transmission as well.

adoption. The reserve ratios and the standing bank rate ceiling set a boundary for the creation of liquidity and anchoring with the market rate (BIS 2008).

The effectiveness of the monetary policy rests on the rate of the interest rate transmission mechanism. To analyze the policy shocks an efficient mechanism known as the SVAR is deployed quite often which was first developed by Sims (1980), followed by Bernanke & Mihov (1998) and Christiano et al. (1999) as well. However, the literature on these studies is limited in the South Asia, and especially in Nepal. Due to the short of lengthy data with high frequency, studies in Nepal is limited. Recent studies generally focus only to the reduced form regressions, which do not seem to capture the causality and determine the influence of reserves ratios as well (Rai & Shrestha, 2022). So, we estimated a country specific SVAR which contains an interaction term (repo rate × CRR) that reflects pass-through provided the case of liquidity constraints. This study can be used to comprehend that how the repo transactions gets outpaced in the case of Nepal when the financial market is segmented (Uhlig, 2005).

Review of the Literature

This section focuses to synthesize the theoretical and empirical findings relevant to the study.

Theoretical Review

The transmission mechanism is a sequence of the lagged policy instruments connected to the aggregate demand, which specifies that the monetary policy can influence the inflation and output. In this study, our focus is in the interest rate channel. We briefly discuss on the other channels as well, viz., the credit channel (bank-lending and balance-sheet channel), the asset-price/wealth channel, the exchange-rate channel, and the expectations channel (Bernanke & Gertler 1995; Bernanke & Blinder 1988). While discussing all the channels it becomes significant to discuss that which channel transmits effectively in the case of small open economy like Nepal. For this we tried to group the variables in our empirical model. These variables act as proxies of price (the repo rate) and the quantity (CRR) which effects the transmission mechanism.

One of the major goals of the central bank is to control the economy with controlling of the interest rates. This phenomenon works under the interest rate channel. In the interest-rate channel a tightening in the interest rate policy decreases the demand of credit by the real estates. It also reduces the investment and consumption and vice versa (European Central Bank [ECB], 2025). This channel is related to that how quick and holistically the policy rate is transferred to the retail lending and deposit rates. With all these assessments, the basic aim of this paper comes out to measure that particular pass-through.

The movements in the interest rate are magnified through the channels of credit through the financial frictions. For instance, an increase in a CRR, ceteris paribus, decreases the reserves of the banks. This scenario hinders the appetite for lending focused at the marginal borrowers. In the same time higher interest rates decrease the value of the borrowers' collaterals and make the balance sheet weaker. Due to this scenario, we are encouraged to add an interaction term of CRR × repo rate (Bernanke & Gertler, 1995). Likewise, the asset-price/wealth channel produces this same effect by increasing the price of equity and property assets through the lower rates. This increases the net worth of the households who used to

eradicate the restrictions in borrowing. This seems to be a constrained path, it does not get shut-down by the weak capital-market depths especially in case of Nepal (Reserve Bank of Australia, 2025).

An increase in the policy rates in the exchange-rate channel encourages the capital inflow, currency appreciation, the suppression of the net export; however, when the policy rate is decreased it lays the reverse effect (IMF 2020). This mechanism is suppressed by the soft peg of Nepal with an Indian rupee but it is not entirely counteracted. Because of this, we take the domestic price channels in terms of empirical focus (IMF, 2020)[5]. Not the least, but the expectations channel works using the central-bank credibility and communication. Let's say even without an adjustment in the current policy, the forward guidance is capable of changing the long-term rates (ECB 2025). In this study, we do not propose to discuss these expectations, however, we offer these concepts as a background to our findings.

Empirical Reviews

Perspective of the IMF

A study by IMF (2020) suggested that when the policy rate is rose by one percentage point, then it would cut the GDP of 39 emerging economies nearly by 1.1 percent in twelve months. And the worst scenario is when a country is under a floating exchange rate regime, and at the same time the policies make the money tighter, it depreciates the currency making the cost of imports higher and thereby affecting the economy. So, when there are the hard regimes (strict policy stances) posed by an economy with its markets all over the globe, this channel affects the economy even more. Nepal however, has a currency pegged and the markets in Nepal are also relatively thin. Thus, a transmission is submissive and largely focused at the domestic channels. In this case, World Bank (2019) has stated that the effective exchange rate channel is built upon the credible institution, liquid markets, and it is also well aligned with the fiscal regulations.

SAARC Nations

The monetary policy pass through in South Asia is quite heterogeneous. India switched to the system of MCLR (Marginal Cost of Lending Rate) in the year 2016. Doing this, the policy rate in India tends to reflect the lending rate also moving the rupee in 1:1 ratio (Mohanty, 2012; Mishra et al., 2016). However, in Pakistan the situation is yet to improve. The fiscal dominance or the large government borrowing has weakened the signal of the monetary transmission. Due to this, the large policy adjustments are transmitted only weakly to impact the credit costs or in the exchange rate (Choudhri et al., 2015). However, in the case of smaller economies, a different scenario is seen. In Bangladesh, though the inflation targeting regime is still incomplete, the monetary policy in the country affects the GDP and prices more effectively. This is also because Bangladesh has a clear central bank communication and the banks are also competitive (Younus, 2017). At this point, Nepal continues to be the exception. Since, there is a pegged system, the external pressure, such as the price changes in the international market, tends to affect the prices in Nepal rather than through the interest rate

[5] Nepal's currency is conventionally pegged to the Indian rupee in 1993 at a fixed rate of NPR 1.6 = INR 1 and floating with other currencies accordingly. The peg has been aiming to maintain the price stability and competitiveness in trade given the dependence of trade of Nepal with India due to the close borders (IMF, 2018; NRB, 2021).

adjustments in the country itself. Nevertheless, a study using an ARDL estimation of 2006-2018 indicates the change in the interest rates, money supply, and credit influence the prices and output. This effect is not strongly as it is affected by the imported inflation though emphasizing the incomplete pass-through. This necessitates to comprehend the actual effects of Interest Rate Corridor even more (Shrestha & Bhatta, 2018; Dhakal & Timsina, 2020).

However, the central bank's aim to control the short-term interest rates might produce the opposite effect. The crisis (the capital outflow) which occurred in Malaysia in the year 1997/98 reduced the effectiveness of the interest rate channel leading to the shocks in the money-supply which became quite challenging (Raghavan & Silvapulle, 2012). So, all these structural breaks signify the importance of the SVAR estimates which are stressed tested across regimes. And this also seems to be of a particular importance to small, dynamic economies like Nepal.

Gap in research

Though the focus to the IRC has been oriented, study has not been conducted which employs the interaction of combined price-based (repo rate) and the quantity-based (CRR) pass through to the base and the lending rates explaining the cause of the interbank rate not being around to the repo rate. The current study uses annual, or the data prior corridor implementation and using a single-instrument VARs. However, this study aids in filling the gap with the estimation of an SVAR with a repo rate and CRR's interaction term. This gives the evidence of the magnitude of the distributional effects of liquidity constraints on disorienting a policy pass-through in Nepal.

Research Methodology

Research Design

We used time-series research design focusing mainly onto the analysis of VAR and SVAR (using the structural form). VAR is useful in explaining how the group of the interconnected variables affect each other over time (dynamic). It stresses on how the past values of the variables are affecting to each other considering minimum initial assumptions. On the other side, the SVAR assists us to understand the orthogonal policy changes affecting the variables to gain a causal inference. We therefore employ monthly data with VAR and SVAR to assess both the short and long run impacts that affects the changes in the monetary policy.

Model Motivation

Our detailed specification rests on the case of Nepal where the price mechanism (policy repo rate) and a quantitative restriction (CRR) affect to the base rates which charged by banks. We again look at the pass through (to the firms and households) to the lending rate which is pass on through the base rate but with the under the same set of the variables. As banks add their costs and the risk premiums to determine the rates, these pass through seems crucial to be taken (Bernanke & Gertler 1995; Mishkin 1996). CRR assists in redistributing the liquidity and upon the restrictive policies the supply of the loanable funds are decreased (Agensor & Montiel 2008). To adhere this concept in the study, we use the interaction term combining both the repo rate and the CRR. This is because whenever the restrictive policies are taken, for both the policy rate and the CRR, the assessment whether the pass through is widened in the economy or not.

This phenomenon is generally predicted for the economies with the insubstantial financial system (Disyatat 2008).

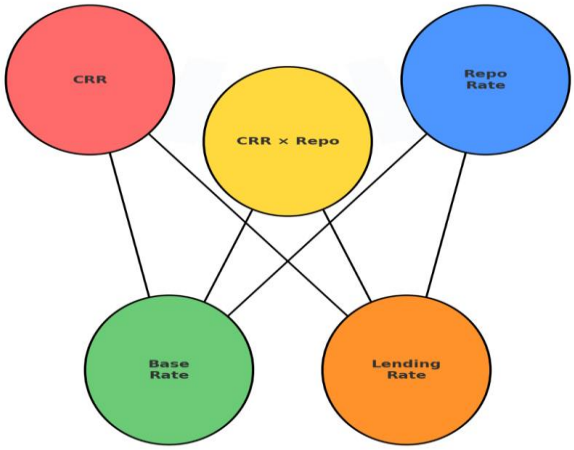
$$Base\ rate = f[reporate, crr, (reporate \times crr)] \ldots\ldots\ldots (1)$$

$$Lending\ rate = f[reporate, crr, (reporate \times crr)] \ldots\ldots\ldots (2)$$

Generally, evidence shows that combining the interest rate and reserve requirement is useful. This is best described by the financial accelerator effect which is proposed by Bernanke, Gertler, and Gilchrist (1999). This pinpoints a situation where severe credit conditions tend to become worse during the periods of rising liquidity and the fluctuations of the interest rate. A study by Saxegaard (2006) and Christensen (2011) shows the impact of reserve requirements on interest rates seems to be affected by the liquidity in the market. Bhattacharyya & Sensarma (2008) confirm that by employing both of the instruments, the central bank outlines the macro financial situation. This also confirms why only the use of the linear models is not good. Hence, the models with an interaction term that we've used makes it clearer how several variables are interconnected, which seems meaningful for the policymakers (linkage depiction in the Figure 1).

Figure 1

Conceptual Framework



Note. Author's creation (using Python).

Data and Variables

The monthly time series data ranging from July 2017 till July 2024 has been used. The variables of our interest are the policy rate (repo rate), the CRR, the base rate, and a weighted average lending rate. The data is obtained from Quarterly Economic Bulletin (NRB 2025a). The data are kept in percentage points. We do not operate any seasonal adjustments. The interaction of the repo rate and the CRR has been used as a proxy to assess the effects of liquidity constrained. We use Python (Jupyter) software, to conduct the data analysis and conduct the estimations.

Unit Root Tests and Stationarity

We purposefully estimate the Phillips Perron test (since we are using the monthly data) to identify the order of integration of the variables. This test is reliable even if the data possess heteroskedasticity and there is the presence of serial correlation (Newey West, 1987). In the

same way, we estimate the VAR by using the first differenced form of the variables (Lutkepohl, 2007).

VAR specification

An unrestricted VAR is chosen for the study[6]. This model assists us to describe the changing relationships between the repo rate and the interest rates. The approach by Sims (1980) mentions that in the VAR, every variable is viewed as endogenous. He also asserts that in VAR there are no a priori assigned equations specified to the variables.

In a simplified way, our VAR model is

$$Z_t = \psi + K_1 Z_{t-1} + K_2 Z_{t-2} + \cdots + K_p Z_{t-p} + \mu_t \ldots\ldots\ldots\ldots (3)$$

The vector of variables are presented as Z_t which consists of the Repo rate [Repo_t], CRR [CRR_t], interaction of Repo and CRR [$(\text{Repo} \times \text{CRR})_t$], base rate ($\text{BaseRate}_t$), and the lending rate (Lending Rate_t). There are the intercepts present in the ψ matrix. Likewise, the K_i is the lag matrices of size (5×5) which is for values of i = 1 ,..., p. Similarly, μ_t represents the white-noise (called as innovations) in the equation (Cheong & Boodoo, 2008).

The use of the interaction term in Z_t allows it to locate whether the monetary policy instruments affect the behavior of the system. This term is one of the parts of the VAR system, also an external regressor where there is the possibility of its lags to influence the endogenous variables. This helps to test the outcomes of using the policy tools in unison. It also specifies that how the developing countries handle the monetary policies. This is because the interest rates and quantitative instruments are practiced jointly in many of the economies (Bhattacharyya & Sensarma, 2015). The interaction seems crucial because it is necessary to assess not only how the repo rate and the CRR simultaneously affect the lending rates, but also it focuses on the regulation of the money supply. Though the VAR was unrestricted at first, but it was made restricted by the theories to identify the structural shocks. For the analysis, the chosen lag length was suggested after reviewing the results of information criteria and running diagnostic tests.

Structural VAR and Cholesky Decomposition

To separate the structural shocks, the recursive SVAR has been used. The VAR is changed to an SVAR by depending on the short-run restrictions and the recursive Cholesky decomposition of the residual matrix[7]. The variables are set up in the 5×5 contemporaneous impact matrix which is, B_0 which has ones on the main diagonal and zeros in the rest. Through this, the following equation is obtained,

$$B_0 \epsilon_t = \nu_t \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where, ϵ_t are the unexpected shocks that VAR failed to elaborate. The independent shocks (strcutural shocks) are explained by ν_t which are orthogonal. The matrix B_0 also follows

[6] An unrestricted VAR allows us to explain the interdependencies not using the ex-ante restrictions when the relationships among variables is not known. All the variables as endogenous over here and it is quite often in the macro econometric research. (Lutkepohl, 2005; Sims, 1980).

[7] The structural shocks in the SVAR model is determined by Cholesky determination. It does so by ordering the variables in a recursive way. The variable placed as first ordered (in the first column of the Cholesky decomposition matrix) has an immediate contemporaneous effect on all other variables. The final variable in the ordering reacts only with a lag. It makes identification problem easier since it imposes a priori restrictions on the recursive structure. However, it also depends highly on the ordering which has been selected (Sims, 1980; Uhlig, 2005).

the Cholesky ordering. This is done by imposing each of the variables that affect contemporaneously to those ordered after it. Taking the reference of the monetary transmission theory, the policy instruments are ordered before the market rates, the repo rate at first, followed by CRR, base rate, and the lending rate. The ordering which is recursive coincides with the findings with the literature of the monetary policy shocks in the small open economies (Bhattacharyya & Sensarma, 2008). This means that the policy variables tend to react to market rate socks but with a delay. This is just like the market rates which tend to respond to policy shocks. The monetary policy using the repo rate shock is interpreted as the first form of shock which is orthogonal to others. Changing the order of CRR in the model, the impulse response remained the same in every case. So, the use of the SVAR in the study conducted by Cheong & Boodoo (2008) allows the researchers to understand the path and impact of tightening interest rates in the economy.

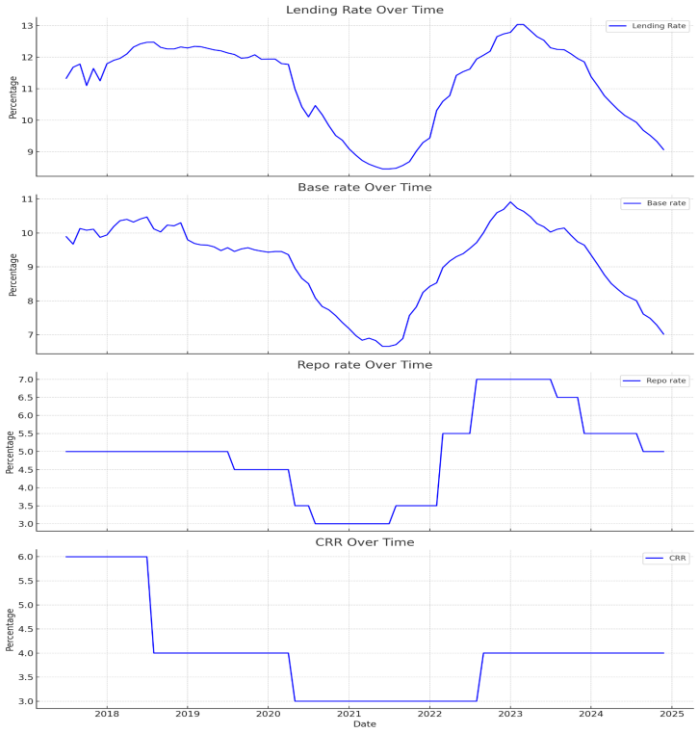
Results and Discussion

Graphical Analysis

The monthly series of the repo rate, CRR, and the base rate together with weighted-average lending rate are plotted on figure 2. The four variables show two strong cycles, a post-COVID-easing (2020-21) and a sudden tightening (2022-23). It can be observed that co-movement implies monetary shocks inflationary peaks and liquidity strains, as opposed to idiosyncratic bank behaviour.

Figure 2

Depiction of the Movement of the Rates Over Time



Note. Author's Analysis (Using Python)

The pre-COVID policy was slightly tight in the direction of maintaining the rates high, but still, stable. NRB has thereby reduced the repo economic decision by 4.5 percent to 3

percent and eased CRR in 202021, which brought an evident decline in base and lending rates. The inflation booms of 2022 was reverted; a rise in repo and CRR rates made lending rates go beyond 13 percent by the mid of 2023. Such fluctuations show that policy shocks are prevalent in the short run values of the rate in Nepal (NRB 2024).

The repo rate and the CRR explain the monetary policy interventions carried out by a central bank. The repo rate is seen to move together with the lending and the base rates. This confirms the reliable sign of the monetary policy effectiveness in the country (Bernanke & Blinder, 1992; Mishkin, 2007). The decrease in the CRR during the pandemic reflects that banks were allowed to possess more liquidity. However, when the banks lent an enough amount, the central bank had to tighten its policies after the pandemic. On the whole, all the aspects of the graph underline the ability of the monetary policy to adjust to internal changes and the outside factors that affect the monetary policy.

Results of PP Test

Table 1 depicts the PP test statistic, p-value and the inferred level of integration for each of the variables, using both levels and first differences.

Table 1

Analysis of the PP Test

Variables used	PP statistic at level	P value	PP statistic at first difference	P-value	Verdict
Repo Rate	–2.45	0.12	–7.30	0.000	I(1)
Cash Reserve Ratio	–1.91	0.32	–5.10	0.001	I(1)
Base Rate	–1.76	0.39	–5.65	0.000	I(1)
Lending Rate	–1.58	0.48	–4.70	0.000	I(1)

Note. Author's Analysis, Using Python (Jupyter)

All the data are stationary at first difference, which is advantageous to use in the VAR and SVAR model that we've used which aids to capture the short run dynamics as well. We tried running Johansen Juselius cointegration, Ordinary Least Squares and the Error Correction Model (not discussed in this paper), none of them suggested a stable long run cointegration[8]. Thereafter following Lutekepohl (2007)'s concept we tended to opt for the unrestricted VAR in the initial scenario that does not incorporate the error correction analysis.

Selection of Best Lags and Diagnostic Tests

The lag order selected from the Akaike Information Criterion (AIC) and Final Prediction Error (FPE) seemed to be 2, however, the Schwarz Criterion (SC) preferred a lag of 1. Since, we are looking for a good fit and for the proper behavior of the residuals, the 2 lags were included for the initial analysis of the VAR. The model diagnostic tests on the VAR (lags=2) residuals indicated that there was no autocorrelation (Portmanteau and LM tests seemed to have p-values > .1 for all the lags tested). There was also no problem with heteroskedasticity as well. The Jarque Bera test revealed that the residuals showed normality.

In addition to this, all the inverse roots of the VAR companion matrix are within the unit circle. This ensures that the VAR seems to be stable (difference stationary). With all these,

[8] When any of the cointegration regimes such as Engle Granger (1987)'s and Johansen (1988)'s cointegration do not seem to exist (when all the variables are I(1)), the Vector Error Correction Models (VECM) is not appropriate and in such cases an unrestricted VAR model is used (Lutkepohl, 2007).

the results of impulse response analysis and forecast error variance decomposition seems to be reliable in this VAR analysis (Lutkepohl, 2007)[9].

Results of VAR

In the table 2, every row represents the result by adding up the two lagged coefficients for an explanatory variable (given with the standard errors in parentheses). This shows the two month's total short run effect. The coefficients for the lagged dependent variable and any other controls are not listed here since they were included in the estimation process to make the explanation shorter.

Table 2

Results of VAR – Impacts on Short Run

Dependent Variable	Sum - Lags of **Δ**Repo	Sum - Lags of **Δ**CRR	Sum - Lags of **Δ**Repo * CRR	Sum - Lags of **Δ**Base Rate	Sum - Lags of **Δ**Lending Rate	R^2
ΔBase Rate	0.32** (0.14)	0.15* (0.08)	0.04 (0.03)	–	0.05 (0.07)	0.45
ΔLending Rate	0.45*** (0.10)	0.22** (0.07)	0.08** (0.04)	0.51*** (0.11)	–	0.59

Note. Author's Analysis (Using Python); 2 lags of each variable is included. *,**,*** denote significance at 1%**,** 5%, and 10% respectively.

Analysis – VAR With Interaction

The monetary policy affects the repo rate and the CRR as expected by showing the anticipated positive results. At first, a rise of 1 percentage point in the repo rate tends to a rise of 0.32 percent in the base rate in the following two months (the change is statistically significant at the 5 percent level). The Banks change the lending rates in the same direction also with a similar speed. This is in response to the changes in the policy rate which shows how the regular interest rates are transmitted through the usual process of monetary transmission. When the central banks begin to hold more reserves, it makes up the base rate a 1 percentage point rise in CRR, leading to roughly an increase of 0.15 percent in the base rate over the short term (significant at 10 percent significance level). We can comprehend that the higher CRR increases the need of the funds that banks need or it reduces the liquidity that is available. This leads banks to charge higher interest on the loans. The interaction term (Repo × CRR) seems to be positive (0.04), however, not statistically significant. Although repo and CRR each have a strong effect on the base rate, when they both interact together, it does not add a lot to the short run movements.

The lending rates increase by 0.45 percent within the next two months each time the repo rate goes up by 1 percentage point. We know that a higher CRR requires banks to keep more funds which causes the rates to rise by 0.22 percent because banks have less amount to lend. Specifically, the repo rate and CRR having a strong relationship also indicates that the tightening of the money increases the impact when they are used together. This is especially in times when there is liquidity shortage. This depicts that both the repo rate and the CRR help to

[9] Forecast error variance decomposition (FEVD) presents the variance of the forecast error of the variables in VAR and SVAR system which is attributed to the structural shocks. The prediction uncertainty in percentage (variance) can be measured which is related to shocks and it also enables us to understand the degree and mechanism with which a variable gets affected by the shocks (Fusari et al., 2024).

shape the working of the monetary transmission mechanism. On the other hand, the base rate, which is determined by banks, seems important. The lags of it indicate that the changes in the base rate appear in the lending rates very quickly (p value <0.01) confirming the concept that base rates are influenced by the policy rate and themselves influence lending rates.

On one side, the lending rate seems to be highly sensitive to the shifts in the base rate, the base rate, on the other side also changes marginally due to changes in the lending rates. This again demonstrates that the changes in policy tend to influence the pricing more than anything, the other way around. The significant R^2 (0.59) in the lending reflects that the repo rate, CRR, and the base rate play a significant role in explaining the variations in short term lending. On the other hand, the base rate has a slightly lower R^2 (0.45) since things like market competition and the funding expenses seem not to be visible in the data.

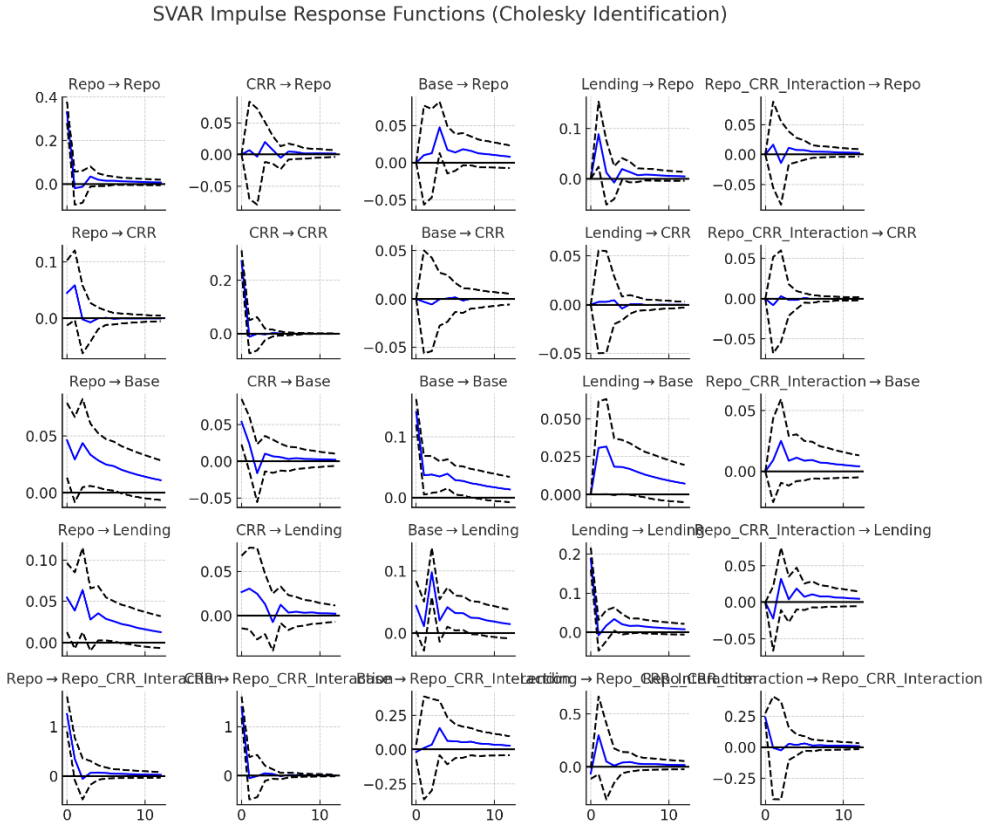
Robustness Tests

The model obtained was again tested without including the interaction term and also by changing in the lag structures, for each combination of variables. The tests showed the same result as of the previous. As a result of these stability checks, we are confident that Nepal's monetary policy is to be expected to work well through the channels of the interest rate and the reserve requirements. Banks seem to be affected by the shifts in the policy instruments, though most significantly when changes happen simultaneously.

SVAR and IRF

Figure 3

IRF Through SVAR



Note. Author's Analysis (Using Python)

The recursive (cholesky) short-run constraints signifies the chronological order of the policy steps and market responses which is on a monthly basis. The IRFs is estimated from SVAR model which uses a Cholesky decomposition. Each graph describes how one of the elements is changed when the changes are made in the other factor. This depicts about the policies alignment with each other. The horizontal axis is time and the vertical are the amount of the responses. The blue lines are the estimated values and dashed black lines are the confidence intervals that are under 95 percent domain. The repo rate is seen to lay a quick positive reaction (to the top left plot), then it drops back down after a brief time. This demonstrates that it is used as a short-term policy intervention. It also strongly reacts to its own impact, which shows that it maintains the pattern that it started with.

When the repo rate changes, the lending rates and base rates seem to go up mildly with significance. This reveals a consistency with the mechanism of how the monetary policy is passed through the system. The repo rate is also seen to contribute to the determination of the CRR. This highlights a coordination towards transmission between the monetary policies variables. The base and the lending interest rates, both go up by an uncertain amount. This is because of the shock borne by the interaction term. And also, this change appears to be statistically significant in the initial periods as well. However, the effects of lending rate shocks on the central bank's rates do not seem to be substantial. Due to this, adjusting policy in accordance with the response to the lending behavior does not occur easily. When both of the repo rate and CRR are tightened, their combined effect on the base and lending rates seems to be more powerful. But, when compared only to the combined effect of both, it is less powerful. This denotes that combined policy effects seem quite effective for the sustenance of the central bank's policy objectives rather than moving alone.

Table 2

SVAR Identification and Contemporaneous Effect

Variables Used	Positions ordered	Source of Contemporaneous Shocks	Probability to affect Contemporaneously
Repo Rate	First	Nil	All
CRR	Second	Repo Rate	Base Rate, Lending Rate
Base Rate	Third	Repo Rate, CRR	Lending Rate
Lending Rate	Fourth	Repo Rate, CRR, Base Rate	None

Note. Author's Analysis (Using Python)

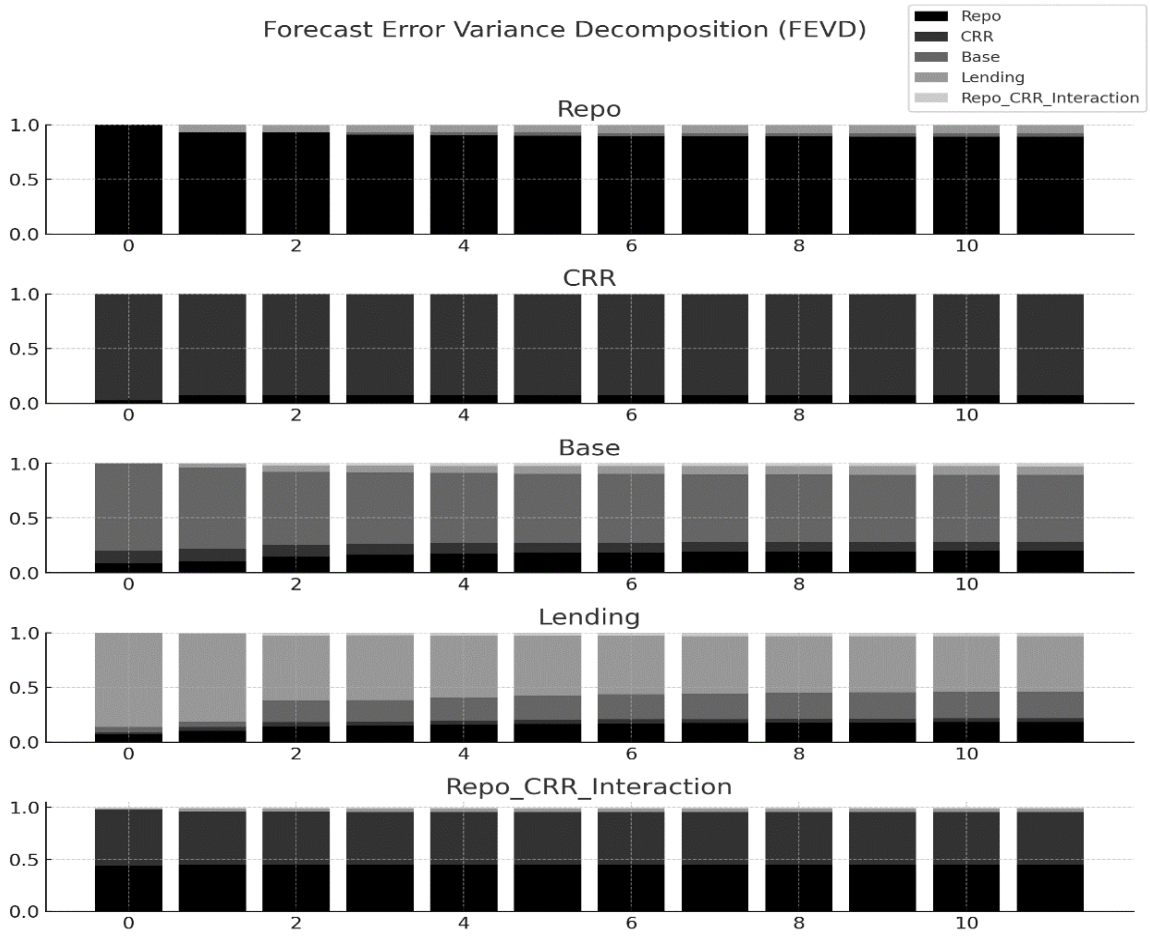
Table 2 depicts the process of determining the contemporaneous effects in the SVAR model by Cholesky decomposition with a specific order of the variables. The repo rate is set independently when compared to the other factors. It generally affects the other decisions theoretically around the similar time frame. The CRR is seen to be influenced directly by the repo rate. However, the impacts are seen to affect both the repo rate and the lending rates. Since the base rate is in third, it seems that the effects of the changes in the repo rate and CRR enables it to change the lending rate. The lending rate comes after repo. The CRR and the base rate shows that it is shaped up by all of those variables, but it cannot simply cause impact to those variables directly at the same time. In implicit terms this seems that the structure is set up in such a way that the repo rate and the CRR brings changes in banks interest rate, however these interest rates do not cause changes in the repo rate or the CRR in the real time.

Forecast Error Variance Decomposition (FEVD)

The contribution of the structural shocks for the change in the variable over a period of time in an SVAR model is explained by FEVD. Under the short run (the first three months) the base rate fluctuates due to its own internal shocks. After a year, the effects of monetary policy variables start to effect with more precision. The repo rate seems to impact the base rate. This accounts for around 40 to 50 percent of the forecast change over the next year. Coming to this time, around 10 to 15 percent of the shocks tends to stem from the CRR as well. This states that the monetary policy doesn't always pose an instant influence on the interest rates, but also it seems to be meaningful over a certain time.

Figure 2

FEVD



Note. Author's Analysis (Using Python)

The trends seen in the lending rate are quite similar. Initially, the base rate plays a huge role in the repo rate shocks. However, the repo rate shocks seem more important as time passes by. By the twelve months, more than half of the differences in the lending rate is seen to be explained by the repo shocks. This clarifies that how the repo rate shocks impact on the lending rate. The impact of the base rate seems to be powerful when monetary policy tends to start. At the same time, reserve requirement rules only contributed about 10 to15 percent on how much lending rates have changed. This explains that their influence seems to be less significant than that of the influence of the interest rate adjustments. The repo rate and the CRR are the external

factors during the Cholesky decomposition. And also, their forecast variances come mostly from the bank-specific shocks over the time. This confirms that the policy choices lead to the financial conditions in the long term.

Conclusions and Further Scope

Conclusions

With the use of VAR/SVAR, the policy tools appear to affect the market partially with lags. A one percentage point of the repo shock provides a 0.45 percentage point effect on the lending, whereas a CRR shock gives an effect of a 0.22 percentage points. These revelations seem to coincide with the prior studies (Budha, 2015). The positive but the negligible effect of the interaction of the repo and CRR confirms that when both of the rates are tightened, it gives a small impact on the current liquidity conditions. Concentrated banking, the thin money markets, and import prices which is driven by pegs, continue to make transmission mechanism even weaker (Shrestha & Bhatta 2018).

Though Nepal has been implementing the IRC, the stabilization of policy rate against the interbank rate is still to be achieved. The interbank rate is towards the ceiling when there is shortage of liquidity and towards the floor during the case of abundant liquidity. It appears that the current situation of the T-bill market, corridor bands, and mechanism of liquidity forecast are somehow responsible for the interbank rate not being anchored. To adjust the bands of the corridors and the liquidity buffers, this study might mark a point (not a solution/suggestions/recommendation as a whole) by using an SVAR approach which separated the independent and combined effects of the repo and CRR through the interaction of it. From the empirical justifications, narrowing down the corridor, cyclical adjustment of CRR, and readjusting/revisiting the base rate formula or the base rate itself to lessen the pass-through lags seems to be significant. Overall, in Nepal the IRC's difficulties stems through the disaggregated financial structure, shadow banking, information asymmetries, unrealistic profit targets, and government's fiscal operations and many more. Through these difficulties, it is commendable that the central bank seems to be cautious enough to have put into an effort to maintain the IRC's rationale and enhance transmission through refining the policy rates, conducting an active OMO's, introduction of SDF, promoting digital payments, adjustments in the regulatory retail portfolios, monitoring of the interbank rates, communication of the monetary policy stance, etc.

Further Scope

This study has several scopes to be diversified. The variables such as expected inflation, credit and the exchange rate could be used. Also, a threshold or the regime-switching SVAR could be deployed to determine whether the pass-through had acted differently in the tight and loose liquidity situations. Likewise, one can employ panel-SVAR using the bank level data to measure the heterogeneity in the transmission which helps to assess ownership types and the strength of balance sheets. The use of an exogenous dummy variables in crisis (earthquake, COVID-19) could also be used to measure the structural breaks. Not only this the Bayesian shrinkage or the local projection methods could be used by employing the extra effects of parameter instability as well.

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Appendix

Lending Rate, Base Rate, Repo Rate, and CRR Monthly Trends

Date	Lending Rate	Base rate	Repo rate	CRR
2017 July	11.33	9.89	5.0	6
2017 August	11.68	9.67	5.0	6
2017 September	11.78	10.13	5.0	6
2017 October	11.1	10.08	5.0	6
2017 November	11.64	10.11	5.0	6
2017 December	11.25	9.87	5.0	6
2018 January	11.79	9.94	5.0	6
2018 February	11.9	10.19	5.0	6
2018 March	11.96	10.36	5.0	6
2018 April	12.1	10.4	5.0	6
2018 May	12.32	10.32	5.0	6
2018 June	12.42	10.41	5.0	6
2018 July	12.47	10.47	5.0	6
2018 August	12.47	10.12	5.0	4
2018 September	12.31	10.03	5.0	4
2018 October	12.26	10.23	5.0	4
2018 November	12.26	10.21	5.0	4
2018 December	12.32	10.3	5.0	4
2019 January	12.29	9.8	5.0	4
2019 February	12.34	9.69	5.0	4

Date	Lending Rate	Base rate	Repo rate	CRR
2019 March	12.33	9.65	5.0	4
2019 April	12.28	9.64	5.0	4
2019 May	12.23	9.59	5.0	4
2019 June	12.2	9.48	5.0	4
2019 July	12.13	9.57	5.0	4
2019 August	12.08	9.45	4.5	4
2019 September	11.97	9.53	4.5	4
2019 October	11.98	9.56	4.5	4
2019 November	12.07	9.5	4.5	4
2019 December	11.93	9.46	4.5	4
2020 January	11.94	9.43	4.5	4
2020 February	11.94	9.45	4.5	4
2020 March	11.8	9.45	4.5	4
2020 April	11.77	9.36	4.5	4
2020 May	10.99	8.96	3.5	3
2020 June	10.43	8.66	3.5	3
2020 July	10.11	8.5	3.5	3
2020 August	10.47	8.08	3.0	3
2020 September	10.18	7.83	3.0	3
2020 October	9.83	7.73	3.0	3
2020 November	9.52	7.57	3.0	3
2020 December	9.37	7.36	3.0	3
2021 January	9.09	7.18	3.0	3
2021 February	8.89	6.97	3.0	3
2021 March	8.73	6.84	3.0	3
2021 April	8.61	6.9	3.0	3
2021 May	8.53	6.83	3.0	3
2021 June	8.46	6.66	3.0	3
2021 July	8.46	6.66	3.0	3
2021 August	8.48	6.71	3.5	3
2021 September	8.57	6.89	3.5	3
2021 October	8.69	7.57	3.5	3
2021 November	9.02	7.82	3.5	3
2021 December	9.29	8.25	3.5	3
2022 January	9.44	8.42	3.5	3
2022 February	10.31	8.53	3.5	3
2022 March	10.6	8.98	5.5	3
2022 April	10.78	9.17	5.5	3
2022 May	11.42	9.3	5.5	3
2022 June	11.54	9.39	5.5	3
2022 July	11.62	9.54	5.5	3
2022 August	11.94	9.72	7.0	3
2022 September	12.06	10.01	7.0	4
2022 October	12.19	10.34	7.0	4
2022 November	12.65	10.6	7.0	4
2022 December	12.74	10.69	7.0	4
2023 January	12.79	10.91	7.0	4
2023 February	13.03	10.72	7.0	4
2023 March	13.03	10.64	7.0	4
2023 April	12.84	10.48	7.0	4
2023 May	12.65	10.27	7.0	4
2023 June	12.53	10.18	7.0	4
2023 July	12.3	10.03	7.0	4
2023 August	12.24	10.11	6.5	4
2023 September	12.23	10.14	6.5	4
2023 October	12.11	9.94	6.5	4

Date	Lending Rate	Base rate	Repo rate	CRR
2023 November	11.96	9.74	6.5	4
2023 December	11.85	9.64	5.5	4
2024 January	11.38	9.35	5.5	4
2024 February	11.08	9.06	5.5	4
2024 March	10.78	8.77	5.5	4
2024 April	10.55	8.51	5.5	4
2024 May	10.34	8.34	5.5	4
2024 June	10.15	8.17	5.5	4
2024 July	9.93	8.0	5.5	4
2024 August	9.68	7.61	5.0	4
2024 September	9.52	7.49	5.0	4
2024 October	9.33	7.29	5.0	4
2024 November	9.07	7.02	5.0	4

Note. Nepal Rastra Bank, Quarterly Economic Bulletin.