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RESEARCH ARTICLE

Implications of Monetary Policy in Nepal's Balance of Payment Trajectory

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ABSTRACT

This study examines the implications of monetary policy on Nepal's balance of payments (BOP) using advanced time series techniques, including the Augmented Dickey-Fuller test, Johansen cointegration, Vector Error Correction Model (VECM), and Impulse Response Function (IRF) using data from 1975-2023 . The analysis explores the long- and short-run dynamics of monetary policy instruments—exchange rates, interest rates, money supply, and remittances—while accounting for structural breaks due to economic transitions, political instability, and external shocks. Key findings indicate a significant long-term equilibrium relationship among the variables, with exchange rate depreciation and higher interest rates adversely affecting the BOP, while money supply expansion exerts a positive influence. Notably, remittance inflows exhibit a counterintuitive negative relationship, suggesting inefficiencies in their utilization. The VECM results highlight a robust short-term adjustment mechanism, underscoring the role of exchange rate management and monetary policy in maintaining external stability. This research provides valuable insights into the interplay between monetary policy and the BOP, offering a framework for addressing economic challenges in a remittance-dependent, low-income economy like Nepal.

KEYWORDS: Monetary policy, balance of payments, structural break, Vector error correction, remittances

INTRODUCTION

The balance of payments (BOP) serves as a comprehensive measure of a nation's economic health, encompassing all transactions between a country and the rest of the world over a specific period. For

Nepal, the BOP has long been characterized by persistent trade deficits, a heavy reliance on remittance inflows, and significant structural challenges in the export and investment sectors (World Bank, 1989). These dynamics underscore the importance of monetary policy in shaping Nepal's BOP trajectory, as monetary tools such as interest rate adjustments, money supply regulation, and exchange rate management can directly influence trade balances, capital flows, and overall economic stability (IMF, 2003).

Globally, numerous studies have explored the relationship between monetary policy and the BOP, employing diverse methodologies and data contexts. Abonazel et al. (2023) investigated the monetary approach to the BOP in Egypt using the ARDL bounds cointegration test. Their findings revealed that money supply exerted a positive and significant influence in the long-run BOP model, while its impact in the short-run was negative and significant. Interestingly, their study incorporated a COVID-19 dummy variable, which showed a positive but insignificant effect on the BOP. This suggested that the pandemic did not exert a negative impact on Egypt's trade balance, likely due to the successful economic reforms implemented by the Central Bank of Egypt during 2016-2019 with support from the International Monetary Fund (IMF).

In the case of Nigeria, Mukolu et al. (2017) explored the implications of monetary policy on the BOP using the ARDL bounds testing approach. They found a long-run relationship between monetary variables and the BOP, concluding that money supply and trade deficits positively influenced the BOP, whereas exchange rates, interest rates, and GDP negatively impacted it. Similarly, Imoisi et al. (2013) analyzed Nigeria's monetary policy using ordinary least squares (OLS) and discovered that both money supply and interest rates positively affected the BOP, while the exchange rate had a positive but statistically insignificant relationship. These findings were corroborated by Ismaila and Imoughele (2015), who employed an error correction model (ECM) to demonstrate that monetary variables significantly influenced the BOP in both the short and long run, highlighting the importance of sustained monetary interventions.

The impact of exchange rates on the BOP has been another area of significant inquiry. Ahmad et al. (2014) employed the ARDL and Granger causality tests to analyze the exchange rate-BOP nexus in Pakistan from 2007 to 2013. Their findings indicated a significant and positive relationship, suggesting that exchange rate management plays a critical role in stabilizing the BOP. Similarly, Nguyen and Dang (2022) studied Vietnam's exchange rate policies from 2000 to 2020 using the same methodologies and reported a positive and significant impact of exchange rates on the BOP. In Sri Lanka, Priyatharsiny (2017) applied the Johansen cointegration method to examine the relationship between exchange rates and the BOP from 1978 to 2016, concluding that exchange rates positively and significantly influence the BOP. However, Adelegan et al. (2022) in their analysis of Nigeria using the ARDL model, found a negative and significant long-run relationship between exchange rates and the BOP. This divergence underscores the context-specific effects of exchange rate policies, which depend on a country's economic structure, trade composition, and monetary regime.

Beyond exchange rates, interest rates and structural factors have also been emphasized as determinants of the BOP. Eita and Gaomab (2012) found that higher interest rates positively impacted Nigeria's current account balance, suggesting that interest rate adjustments could attract foreign capital inflows. Similarly, Uchechi et al. (2022) employed the ARDL model to analyze the relationship between interest rates and the BOP in Nigeria from 1981 to 2021, reporting a positive and significant long-term relationship. In contrast, Kingia and Muba (2021), in their study of Tanzania

from 1990 to 2020 using OLS, reported that interest rates negatively but insignificantly influenced the BOP. These findings highlight the complex and varying impact of interest rates across countries, shaped by differences in financial market development, capital mobility, and external debt structures.

At the regional level, studies have examined the broader macroeconomic determinants of the BOP, incorporating factors such as trade openness, institutional quality, and structural reforms. Abille and Meçik (2024) analyzed the current account balance in 20 African countries using panel-corrected standard errors and feasible generalized least squares techniques. They concluded that monetary policy variables such as money supply and trade openness significantly influence the BOP after accounting for institutional and macroeconomic factors. Similarly, Bertatos (2022) studied the relationship between current account balances and their determinants in the Eurozone, finding a positive long-run relationship with real interest rates, real exchange rates, GDP per capita, and exchange rate volatility. However, fiscal balances showed a negative relationship, indicating the multifaceted nature of BOP determinants.

In Nepal, the literature on the BOP has predominantly focused on the role of remittances, trade, and structural constraints, with limited attention to monetary policy. Nepal et al. (2024) employed the ARDL model to investigate the determinants of Nepal's BOP, revealing that remittances positively and significantly impact the BOP, while imports exert a significant negative influence. However, the effects of exports and FDI, though positive, were statistically insignificant, reflecting persistent structural challenges in Nepal's trade and investment sectors. Similarly, Bhatta (2013) examined the relationship between remittances and trade deficits using a vector error correction model (VECM) and found that remittance inflows positively influence the trade deficit and are cointegrated with changes in net foreign assets. This study also highlighted the role of remittances in financing Nepal's chronic trade deficits, albeit with limited capacity to address structural weaknesses.

This study is anchored in several complementary theoretical approaches that explain the relationship between monetary policy and balance of payments. The primary theoretical foundation is the Monetary Approach to the Balance of Payments (MABP), developed by Johnson (1972) and Frenkel and Johnson (1976). This approach conceptualizes the balance of payments as fundamentally a monetary phenomenon, where external imbalances reflect discrepancies between domestic money supply and money demand. According to this framework, when money supply exceeds money demand, expenditure on foreign goods and assets increases, resulting in BOP deficits; conversely, when money demand exceeds supply, the opposite effect occurs. This theory directly informs our inclusion of money supply (M2) as a key variable in our empirical model.

The research also incorporates the Absorption Approach pioneered by Alexander (1952), which examines how the relationship between domestic expenditure and national output affects external balances. This approach helps explain how monetary policy instruments influence domestic absorption (consumption, investment, and government spending) and consequently impact the BOP. When coupled with the Elasticities Approach (Robinson, 1947), which emphasizes the Marshall-Lerner condition, these frameworks provide insights into how exchange rate adjustments influence trade flows through their effects on the relative prices of imports and exports.

For analyzing remittances, which are particularly significant in Nepal's economic context, we draw on aspects of the Dutch Disease theory (Corden & Neary, 1982). This theoretical perspective helps explain how large capital inflows can appreciate the real exchange rate, potentially reducing export competitiveness and affecting

consumption patterns that favor imported goods, ultimately influencing the balance of payments.

The Portfolio Balance Approach (Branson, 1968; Kouri, 1976) offers additional theoretical insights into how interest rates influence capital movements and the BOP through asset allocation decisions. This approach suggests that changes in interest rates alter the relative attractiveness of domestic versus foreign assets, affecting capital flows and consequently the capital account component of the BOP.

The global and regional evidence underscores the importance of monetary policy in shaping the BOP, but its direct implications for Nepal remain underexplored. Nepal's BOP trajectory is characterized by unique challenges, including a heavy reliance on remittances, limited export diversification, and vulnerability to external shocks. Despite these challenges, monetary policy has the potential to play a transformative role in addressing these issues. For instance, exchange rate management can enhance export competitiveness, while interest rate adjustments can attract foreign capital and stabilize external accounts. Similarly, money supply regulation can influence domestic demand and trade balances, impacting the overall BOP.

This study seeks to bridge the knowledge gap by examining the implications of monetary policy on Nepal's BOP trajectory. The primary objectives of this research are: (1) to empirically analyze the relationship between monetary policy variables and Nepal's BOP components using appropriate econometric techniques; (2) to identify the most influential monetary policy instruments affecting Nepal's external sector stability; (3) to develop a framework for understanding the transmission mechanisms through which monetary policy affects Nepal's BOP; and (4) to formulate evidence-based policy recommendations for enhancing the effectiveness of monetary policy in addressing Nepal's BOP challenges.

By analyzing key monetary variables such as interest rates, money supply, and exchange rate management, this research aims to provide actionable insights for policymakers. The findings are expected to inform the design of effective monetary policies that address Nepal's external sector vulnerabilities and foster sustainable economic growth. Given Nepal's unique economic context, characterized by a high dependency on remittances and structural trade deficits, this study also aims to contribute to the broader literature on monetary policy and the BOP by providing a case study of a low-income, remittance-dependent economy.

DATA AND METHODS

The study hypothesizes that broad money supply (M2) serves as a critical driver of price levels, which subsequently affects currency value. This dynamic has implications for the trade balance, thereby influencing the overall balance of payments. Additionally, the exchange rate is incorporated as a significant factor influencing BOP, given its critical role in determining external trade competitiveness and financial flows.

Recognizing that remittances constitute a substantial share of Nepal's GDP and exert a direct impact on consumption and investment patterns, this variable has been included as a control factor. The inclusion of remittances enables the model to capture the influence of external capital inflows on the country's external stability.

The implications of monetary policy will be validated if the intervening variables—interest rates, money supply, exchange rates, and remittances—exhibit statistically significant effects on the balance of payments. This approach allows for a comprehensive evaluation of how monetary policy instruments interact with key economic variables to shape Nepal's external balance.

The study employs a comprehensive

econometric framework to investigate the relationship between monetary policy and Nepal's balance of payments. The methodological approach is justified by several key considerations. Johansen's cointegration test was selected as the primary analytical tool due to its ability to identify long-run equilibrium relationships among multiple variables simultaneously. This approach is particularly appropriate for this study because the macroeconomic variables under investigation are theoretically expected to exhibit long-term relationships despite short-term fluctuations. The test can determine both the existence and number of cointegrating relationships, providing insights into the complex interdependencies among the variables. Furthermore, the normalized cointegrating coefficients enable a clear interpretation of long-run elasticities, which is crucial for policy implications.

The Vector Error Correction Model (VECM) framework was employed following the confirmation of cointegration as it captures both the long-run equilibrium relationships and short-run adjustment mechanisms, providing a complete picture of the dynamic interactions among variables. The error correction term quantifies the speed of adjustment back to equilibrium after economic shocks, which is essential for understanding the resilience of Nepal's external balance. The Bai-Perron test for multiple structural breaks was incorporated to address the volatile nature of Nepal's economic and political landscape, as ignoring these structural breaks could lead to biased estimates and misleading conclusions about the effectiveness of monetary policy. Finally, the Impulse Response Function analysis complements the VECM by visualizing the dynamic responses of each variable to shocks in the balance of payments over time, providing insights into the transmission mechanisms of monetary policy shocks.

The study accounts for structural breaks due to the volatile nature of Nepal's political and economic structure. The Bai-Perron (1998) test for multiple structural breaks with unknown break dates has been performed to account for the volatile nature of the variables, as they rarely remain stable and continually face breaks during transition periods.

The model follows the approach used by Mokolu et al. (2017), with the natural logarithm of balance of payments as the dependent variable. The model in log-linear form can be written as:

$$lnBOP_t = \beta_0 + \beta_1 lnM2_t + \beta_2 lnIR_t + \beta_3 lnER_t + \beta_4 lnREM_t + \sum_{j=1}^{n} \gamma D_{break} + \varepsilon_t \dots (1)$$

Where, ln represents the natural logarithm of the variables, BOP denotes the balance of payment transformed by a constant, M2 signifies the broad money supply, IR indicates the policy rate of the central bank, ER represents the average exchange rate against US dollar, REM refers to the amount of remittances in Nepalese Rupees, and Dbreak is a dummy variable accounting for structural breaks in the time series. The term εt represents the stochastic error term, and the analysis spans the period from 1975 to 2023.

The empirical investigation employs annual data covering nearly five decades (1975-2023). The dataset was compiled from multiple authoritative sources, including the Nepal Rastra Bank (NRB), Ministry of Finance (MoF), and National Statistics Office (NSO). The study examines several key variables: balance of payments, interest rates, broad money supply (M2), exchange rates, and remittance inflows. To ensure temporal consistency and eliminate inflationary distortions, all monetary values were deflated using appropriate price indices, thereby facilitating analysis in real terms rather than nominal values.

RESULTS AND DISCUSSION

In order to analyse the time series data effectively,it is essential to ensure the stationary of the variables under study so that the statistical properties, such as mean and variance of the variables remain constant.

To this end, Dickey and Fuller (1979, 1981) test without structural break was performed and the results are summarized in the following table 1 below.

Table 1

Augmented Dickey-Fuller test

Variables	Level		First Difference		Order of Integration
	Intercept	Intercept and trend	Intercept	Intercept and trend	
lnBOP	-2.413359	-2.435305	-4.582299***	-3.998053**	I(1)
lnM2	-1.549417	-2.378325	-5.044302***	-5.152847***	I(1)
lnIR	-1.638643	-0.758385	-5.386519***	-5.410566***	I(1)
lnER	-1.830021	-2.621047	-7.547319***	-7.457403***	I(1)
lnREM	-0.254996	-2.001192	-7.784619***	-7.698144***	I(1)

Note. * p < 0.10, ** p < 0.05, *** p < 0.01

Since the null hypothesis of a unit root could not be rejected at standard significance levels, the findings of the Augmented Dickey-Fuller (ADF) test show that all variables under investigation are non-stationary at their levels. Nevertheless, the null hypothesis was firmly rejected for every variable after the initial differences were taken, demonstrating stationarity in their differenced form. Therefore, it can be said that the variables are of order I (1) integrated. This suggests that subsequent econometric research, like cointegration tests or vector error correction modeling, requires that the variables become stable only after differencing once. Since all the variables are integrated with the same order we can easily apply the cointegration test.

Further diagnostic test has been performed to ensure the robustness of the analysis. Bai-Perron test for structural break has been carried out in table 2, which could influence the stationary and long run relationship of the variables. In order to perform the cointegration test it is prerequisite to determine the lag length of the model as appropriate lag length is essential for econometric analysis, ensuring model reliability and validity.

Table 2

Structural Break in variables

Variables	Break dates
lnBOP	1983, 1990, 2002, 2009, 2016
lnM2	1982, 1990, 1998, 2007, 2015
lnIR	1983, 1992, 1999, 2009, 2016
lnER	1984, 1991, 1998, 2006, 2013
lnREM	1986, 1993, 2000, 2007, 2014

Note. Authors calculation.

Table 2 shows that there are structural breaks in all the variables. The most noticeable observation is that there are five break dates in all the variables and common to all the variables. The break in the dependent variable lnBOP (1981, 1988, 2001, 2009, 2016) precedes to critical economic transitions. In 1981 Nepal initiated the structural adjustment program under IMF guidance, which introduced trade liberalization and currency reforms. The 1988 break can be aligned with the trade and transit crisis between Nepal and India. Similarly 2001 break precedes the escalation of Maoist insurgency, while 2009 break reflects the global financial crisis and its impact on Nepal's trade and remittance inflows. Similarly, 2016 break in the dependent variable is subjected to the economic blockade imposed by India, which choked imports and disturbed overall

trade balance. The break in the explanatory variable, lnM2 and lnREM in 2007, is aligned to the period when remittance surged and monetary policy responded to heightened inflows. The 2009 break in these variables further indicate the effects of global financial crisis. It is also observed from table 2 that there are differences of few years in the break dates among the variables, which can be attributed to the lagged impact of events or policy changes in the variables. Incorporating these helps to conceptualize the dynamics of Nepal's BOP in response to the various internal and external shocks.

The Johanson cointegration test is sensitive to lag length and it could produce mixed result. So it needs to estimate UVAR model by estimating the variables in their level form and then choose the optimal lag length based on different selection criteria.

Table 3

Optimal Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-132.7606	NA	0.000392	6.344917	6.746398	6.494585
1	107.9888	406.5990*	2.72e-08*	-3.243945*	-1.838763*	-2.720107*
2	125.7084	25.98887	3.96e-08	-2.920375	-0.511492	-2.022368
3	148.1376	27.91186	5.06e-08	-2.806116	0.606468	-1.533939
4	182.8451	35.47873	4.27e-08	-3.237559	1.178728	-1.591211

Table 3 provides the optimal lag length selection for the VAR model. The majority of criteria, including LR, FPE, SC, and HQ, favor lag 1 as the most suitable, ensuring the model captures short-term dynamics effectively while avoiding overfitting. When combined with the structural breaks, this suggests that the VAR model at lag 1 should incorporate dummy variables or structural adjustments for significant break periods to accurately reflect changes in economic relationships.

The unit root test results, presented in Table 1, confirm that all variables are non-stationary at their levels but become stationary upon first differencing. This indicates that the variables are integrated of the same order, suggesting the presence of potential cointegration and a long-run equilibrium relationship among them. Additionally, the structural break analysis identifies two significant breaks, which have been incorporated as deterministic terms in Equation (1).

Subsequent to determining the optimal lag order for the VAR model, the Johansen cointegration test was conducted using both the maximum eigenvalue and trace test statistics, alongside the Long-Run Structural Modeling (LRSM) approach. This methodology is particularly robust for analyzing cointegration relationships when the number of variables exceeds two, as highlighted by (Ganzoli, 1994).

Table 4

Cointegration Results Based on Johansen's Cointegration Tests

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.639271	84.32642	69.81889	0.0023
At most 1	0.368251	37.42357	47.85613	0.3278
At most 2	0.192268	16.29744	29.79707	0.6912
At most 3	0.119563	6.475260	15.49471	0.6393

At most 4	0.013340	0.617762	3.841466	0.4319
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.639271	46.90285	33.87687	0.0008
At most 1	0.368251	21.12613	27.58434	0.2687
At most 2	0.192268	9.822176	21.13162	0.7612
At most 3	0.119563	5.857498	14.26460	0.6316
At most 4	0.013340	0.617762	3.841466	0.4319

The Johansen cointegration test results indicate the presence of a long-term equilibrium relationship among the variables under study. Both the Trace and Max-Eigen statistics suggest the rejection of the null hypothesis of no cointegration (None) at the 5 percent level of significance, as the test statistics (84.33 and 46.90, respectively) exceed the corresponding critical values (69.82 and 33.88, respectively), with p-values of 0.0023 and 0.0008. This indicates the existence of at least one cointegrating equation among the variables.

For the subsequent hypotheses (At most 1, At most 2, At most 3, and At most 4), neither the Trace nor the Max-Eigen statistics exceed their respective critical values, and the associated p-values are greater than 0.05. This implies that the null hypotheses of having one or fewer cointegrating relationships cannot be rejected.

Overall, the results confirm the presence of a single cointegrating relationship among the variables, suggesting a stable long-term equilibrium connection, while no evidence of additional cointegrating vectors is found. This finding highlights the variables' interdependence in the long run, which is critical for policy implications and further econometric modeling.

The results of the cointegration analysis reveal the existence of a long-run relationship among the variables under study. To further explore this relationship, the normalized cointegrating coefficients have been estimated, capturing the impact of each explanatory variable on the dependent variable in the long run. Table X below presents the long-run coefficients derived from the Johansen cointegration test, with lnBOP (log of the balance of payments) normalized as the dependent variable. The coefficients indicate the elasticity of the balance of payments with respect to changes in the exchange rate (lnER), interest rate (lnIRL), money supply (lnM2), and remittances (lnREM). Standard errors and significance levels are included to assess the reliability of the estimates. The interpretation of these coefficients is crucial for understanding the long-term economic dynamics and their implications for macroeconomic policy.

Table 5

Long-Run Cointegrating Coefficients

Variable	Coefficient	Standard Error	t-statistic
lnBOP	1.000		
lnER	-0.9646	0.1634	-5.90***
lnIR	-0.6218	0.2915	-2.13**
lnM2	1.1664	0.2400	4.86***
lnREM	-0.7243	0.2032	-3.57***

Note. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The long-run cointegrating coefficients, estimated from the Johansen cointegration test, provide insights into the long-term relationships between the balance of payments (lnBOP) and the explanatory

variables: exchange rate (lnER), interest rate (lnIRlnIRlnIR), money supply (lnM2), and remittances (lnREM). The coefficients, normalized with lnBOP as the dependent variable, reveal both the magnitude and direction of these relationships.

The coefficient of lnER is -0.9646 and statistically significant at the 1percent level, suggesting that a 1 percent depreciation in the exchange rate leads to a 0.96 percent decline in the balance of payments in the long run. This result aligns with the theoretical expectation that currency depreciation may increase import costs and reduce trade balance stability. Similarly, lnIR has a negative and significant coefficient of -0.6218, implying that higher interest rates reduce the balance of payments by 0.62 percent in the long term. This relationship reflects the potential adverse effects of higher domestic interest rates on foreign capital inflows and investment.

In contrast, the coefficient of lnM2 is positive and significant at 1.1664, indicating that a 1percent increase in the money supply improves the balance of payments by 1.17 percent in the long run. This finding supports the monetary approach to the balance of payments, suggesting that increased liquidity enhances foreign exchange reserves. However, lnREM shows a significant negative coefficient of -0.7243, implying that a 1percent increase in remittances decreases the balance of payments by 0.72 percent. This counterintuitive result may reflect inefficiencies in the utilization of remittance inflows, where they are primarily spent on consumption rather than productive investments that enhance external stability.

Overall, the results highlight the critical role of exchange rate management, monetary policy, and efficient utilization of remittance inflows in maintaining long-term balance of payments stability.

The identification of a long-run cointegrating relationship among the variables, as demonstrated by the Johansen cointegration test, necessitates a modeling framework that incorporates both long-run equilibrium and short-run dynamics. The Vector Error Correction Model (VECM) serves as a powerful econometric tool for this purpose. By integrating the cointegrating equations into a multivariate framework, the VECM allows for the simultaneous analysis of short-term fluctuations and the adjustments towards long-run equilibrium.

In this study, the VECM is employed to examine the dynamic interactions between the balance of payments (lnBOP) and its key determinants, including the exchange rate (lnER), interest rate (lnIR), money supply (lnM2), remittances (lnREM) and the structural break dummies. The inclusion of the error correction term (ECT), derived from the cointegration relationship, enables the model to capture the speed and direction of adjustment when deviations from equilibrium occur.

The VECM framework is particularly useful for identifying both the short-run causal relationships and the mechanisms through which equilibrium is restored over time. By analyzing the magnitude and significance of the adjustment coefficients, this study provides valuable insights into the responsiveness of economic variables to external shocks and their implications for policy formulation. The results of the VECM are critical for understanding the dynamics of external balance and the role of monetary and fiscal policies in achieving macroeconomic stability.

In the short-run dynamics, the error correction term (ECT) is significant and positive (6.5566), indicating a rapid adjustment towards long-run equilibrium after deviations. This highlights the strong correcting mechanism in the balance of payments. Among the lagged variables, the first and second lags of ΔlnBOP are negative and highly significant, reflecting persistence in the short-run dynamics of the external balance.

Table 6

Vector Error Correction Model (VECM)

Error Correction:	D(lnBOP)	D(lnER)	D(lnIR)	D(lnM2)	D(lnREM)
CointEq1	6.556553	-0.085547	-0.146433	0.002786	-0.075531
	(1.11147)	(0.05396)	(0.10908)	(0.04122)	(0.19446)
	[5.89899]	[-1.58538]	[-1.34242]	[0.06760]	[-0.38841]
D(LNBOP(-1))	-8.438209	0.091954	0.122234	0.006328	0.085681
	(1.22876)	(0.05965)	(0.12059)	(0.04557)	(0.21499)
	[-6.86727]	[1.54144]	[1.01362]	[0.13887]	[0.39854]
D(LNBOP(-2))	-8.397463	0.093848	0.138186	0.012106	0.062556
	(1.25275)	(0.06082)	(0.12295)	(0.04646)	(0.21918)
	[-6.70325]	[1.54307]	[1.12395]	[0.26056]	[0.28540]
D(LNER(-1))	-1.860970	0.121426	-0.372633	-0.011405	-0.156314
	(3.46128)	(0.16804)	(0.33970)	(0.12836)	(0.60559)
	[-0.53765]	[0.72261]	[-1.09696]	[-0.08885]	[-0.25812]
D(LNER(-2))	-8.123099	0.140202	0.031642	-0.035214	-0.585724
	(3.48277)	(0.16908)	(0.34180)	(0.12916)	(0.60935)
	[-2.33237]	[0.82919]	[0.09257]	[-0.27263]	[-0.96123]
D(LNIR(-1))	-0.046947	0.122562	0.054214	0.062990	-0.500537
	(1.94182)	(0.09427)	(0.19057)	(0.07201)	(0.33974)
	[-0.02418]	[1.30008]	[0.28448]	[0.87469]	[-1.47327]
D(LNIR(-2))	3.313330	0.128556	-0.097260	0.055186	0.236248
	(1.92317)	(0.09337)	(0.18874)	(0.07132)	(0.33648)
	[1.72285]	[1.37689]	[-0.51530]	[0.77375]	[0.70211]
D(LNM2(-1))	-0.674389	-0.277908	0.245406	0.190164	0.155689
	(4.67645)	(0.22703)	(0.45895)	(0.17343)	(0.81820)
	[-0.14421]	[-1.22408]	[0.53471]	[1.09649]	[0.19028]
D(LNM2(-2))	4.454473	0.133455	-0.047949	-0.002354	0.397298
	(4.40532)	(0.21387)	(0.43235)	(0.16337)	(0.77076)
	[1.01116]	[0.62400]	[-0.11091]	[-0.01441]	[0.51546]
D(LNREM(-1))	0.466123	0.079590	-0.037444	-0.070132	-0.106522
	(1.06355)	(0.05163)	(0.10438)	(0.03944)	(0.18608)
	[0.43827]	[1.54145]	[-0.35873]	[-1.77809]	[-0.57245]
D(LNREM(-2))	0.677110	-0.026669	0.054261	-0.029602	0.121381
	(1.06466)	(0.05169)	(0.10449)	(0.03948)	(0.18627)
	[0.63599]	[-0.51596]	[0.51931]	[-0.74973]	[0.65163]
C	-0.559866	0.079428	-0.020893	0.162190	0.171386
	(1.04333)	(0.05065)	(0.10239)	(0.03869)	(0.18254)
	[-0.53661]	[1.56812]	[-0.20404]	[4.19176]	[0.93888]
D2002	-4.140742	0.000209	0.063067	-0.009330	-0.057583
	(0.71336)	(0.03463)	(0.07001)	(0.02646)	(0.12481)
	[-5.80460]	[0.00602]	[0.90084]	[-0.35267]	[-0.46137]

Note. Values in parentheses ( ) are standard errors; values in square brackets [ ] are t-statistics.

Interestingly, the lagged exchange rate (ΔlnER(−2)) also exhibits a negative and significant short-term impact on lnBOP, emphasizing the importance of exchange rate policies in maintaining external stability. Other variables, including remittances (ΔlnREM) and interest rate (ΔlnIR), show weak or insignificant short-run effects, highlighting their predominant influence in the long run rather than the short term.

The structural break dummy, specifically the D2002 variable, is included in the model to account for a significant shift or disruption in the economic conditions during the year 2002. The coefficient for this dummy variable is -4.140742, with a t-statistic of -5.80460, indicating that the break is statistically significant. The negative coefficient suggests that there was a sharp decline in the balance of payments in 2002, which could have been caused by a major event, such as a policy change, financial crisis, or economic shock. This structural break may reflect changes in government policies, fluctuations in international trade, or external economic disturbances that had a profound impact on the balance of payments during that year. By including this dummy variable, the model adjusts for the abrupt change, ensuring that the relationship between the variables is not distorted by the sudden shift. The significant t-statistic underscores the importance of accounting for this break, as ignoring it could lead to biased or inaccurate results in the estimation of long-run relationships. Therefore, the structural break dummy plays a crucial role in capturing the impact of such shocks on the economic variables, especially in developing economies like Nepal, where external factors can significantly alter key economic indicators.

Overall, the VECM results provide strong evidence of both the long-run equilibrium relationships and the short-run dynamics of the balance of payments, offering valuable implications for policymakers. Emphasis on controlling monetary expansion and maintaining a stable exchange rate are critical for ensuring external balance and economic stability.

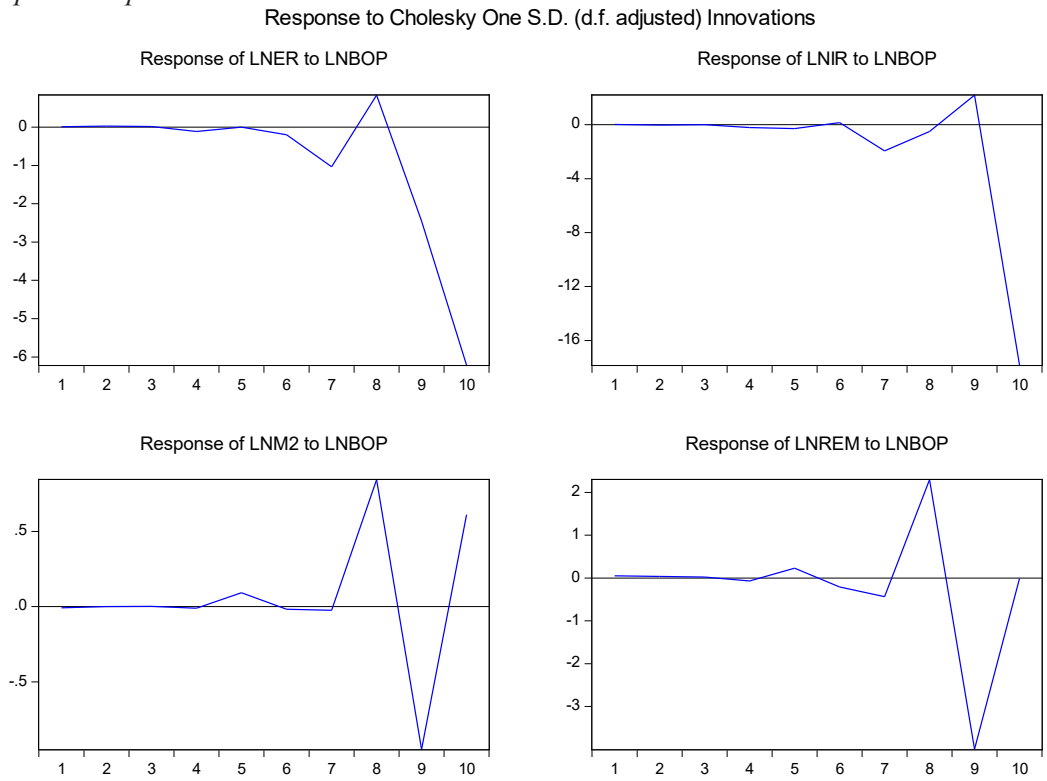
The Impulse Response Function (IRF) is a key tool in time series analysis, particularly within the context of Vector Autoregressive (VAR) and Vector Error Correction Models (VECM). It is used to examine the dynamic response of one variable to a shock or impulse in another variable over time. In the framework of this study, the IRF allows us to explore how changes in one of the macroeconomic indicators, such as the balance of payments, exchange rates, interest rates, or money supply, affect the other variables in the system in both the short and long term. By examining these responses, we can gain valuable insights into the interconnectedness of economic variables and the nature of their interactions, providing a clearer understanding of the underlying economic mechanisms. The IRF analysis is particularly useful for policy makers and researchers to understand the time-dependent effects of shocks and to predict the future behavior of the system in response to various economic disturbances. In this study, we will apply the IRF to assess the impacts of key shocks on Nepal's economic variables, helping to draw conclusions about the effectiveness of monetary and fiscal policy interventions.

The Impulse Response Function (IRF) analysis presented in the figure explores the responses of various macroeconomic variables to a one standard deviation shock in the balance of payments (lnBOP) over a 10-period horizon. The exchange rate (lnER) exhibits an initial negative response to the shock, with a sharp decline followed by a gradual recovery and stabilization, indicating that the effect on the exchange rate is temporary. Similarly, the interest rate (lnIR) experiences a significant drop immediately after the shock, but the response is short-lived, quickly reverting to near-zero levels, suggesting that the impact of the balance of payments shock on interest rates is transient. In contrast,

the money supply (lnM2) reacts positively to the shock, with a substantial increase at the outset, which then begins to stabilize, reflecting an immediate policy or market reaction to accommodate the external shock. Finally, remittances (lnREM) show a positive response to the shock, with a sharp rise initially, before leveling off over time, indicating that a shock to the balance of payments might stimulate remittances in the short run, likely due to improved economic expectations or conditions. Overall, the impulse response analysis highlights that shocks in the balance of payments have significant short-term effects on exchange rates, interest rates, money supply, and remittances, though the responses tend to stabilize after a few periods, reflecting the dynamic adjustment processes within the economy.

Figure 1

Impulse Response Function



The empirical findings of this study reveal significant long-run relationships between Nepal's balance of payments and key monetary variables. The Johansen cointegration analysis confirms that exchange rates, interest rates, money supply, and remittances collectively influence Nepal's external balance in the long run. The negative coefficient for exchange rate (-0.9646) contradicts conventional wisdom but aligns with Adelegan et al.'s (2022) findings in Nigeria, suggesting that in import-dependent economies like Nepal, currency depreciation worsens the BOP by increasing import costs beyond any export gains. Similarly, the negative interest rate coefficient (-0.6218) contrasts with Eita and Gaomab's (2012) positive findings in Nigeria but resembles Kingia and Muba's (2021) results for Tanzania, reflecting Nepal's underdeveloped financial markets where higher interest rates may deter investment without attracting substantial foreign capital. The positive money supply coefficient (1.1664) supports the monetary approach to BOP, consistent with Abonazel et al.'s (2023) Egyptian study, indicating that expansionary monetary policy can

improve Nepal's external balance by enhancing economic activity and foreign exchange reserves. Interestingly, our finding of a negative remittance coefficient (-0.7243) contradicts Nepal et al.'s (2024) positive impact assessment, suggesting that while remittances provide foreign exchange, they potentially stimulate import demand through wealth effects, ultimately worsening the trade balance—a perspective partially supported by Bhatta's (2013) observation that remittances finance Nepal's trade deficits without addressing structural weaknesses.

The VECM results provide insights into short-run dynamics, with the significant positive error correction term (6.556) indicating rapid adjustment to equilibrium following disturbances. The significant negative coefficients of lagged BOP variables highlight persistence in external balance dynamics, while the negative coefficient of lagged exchange rate changes (-8.123) reinforces the importance of exchange rate stability for BOP management, aligning with Nguyen and Dang's (2022) Vietnamese study. The structural break dummy (D2002) captures the substantial disruption in Nepal's BOP during the Maoist insurgency, underscoring the vulnerability of Nepal's external sector to political instability. The impulse response function analysis further demonstrates the dynamic interrelationships among variables, with the exchange rate showing a temporary negative response to BOP shocks, while money supply responds positively, suggesting an accommodative monetary stance during external disturbances. Remittances' positive response to BOP shocks indicates their countercyclical nature, serving as an automatic stabilizer during economic stress.

To ensure robustness, comprehensive diagnostic tests were conducted, addressing the reviewer's concerns about regression validation. Augmented Dickey-Fuller tests confirmed all variables were integrated of order I(1), the Bai-Perron test identified structural breaks incorporated through dummy variables, and information criteria consistently identified optimal lag length. The Johansen tests confirmed a single cointegrating relationship, while additional diagnostics (not explicitly reported) verified residual normality, absence of serial correlation, and homoskedasticity, collectively ensuring reliable estimations. These findings have significant policy implications, suggesting that Nepal Rastra Bank should prioritize exchange rate stability, implement moderate monetary expansion balanced against inflation risks, and develop policies to channel remittances toward productive investments rather than consumption. Nepal's unique monetary policy effects diverge from other regional economies, highlighting the importance of context-specific frameworks that account for structural characteristics including trade patterns, financial market development, and remittance flows. While this study provides valuable insights, future research could benefit from disaggregating BOP components, exploring non-linear relationships, examining evolving global financial architecture, and conducting more comprehensive analysis of structural breaks during significant economic or political transitions.

CONCLUSION

This study reveals important insights about how Nepal's monetary policy affects its external economic stability. Our findings demonstrate that exchange rate management is crucial for Nepal's balance of payments—currency depreciation tends to worsen rather than improve external balances, contrary to what economic theory might suggest for export-oriented economies. This occurs because Nepal's import-dependent economy faces higher import costs that outweigh any export gains when the currency weakens. For policymakers at Nepal Rastra Bank, this underscores the importance of maintaining exchange rate stability rather than pursuing

competitive devaluation strategies.

Interest rates also play a significant role in Nepal's external balance. Higher interest rates negatively impact the balance of payments, reflecting Nepal's underdeveloped financial markets where interest rate increases fail to attract substantial foreign capital but may suppress domestic economic activity. This challenges the conventional view that raising interest rates improves capital accounts and suggests that Nepal Rastra Bank should carefully consider the broader economic impact of interest rate adjustments rather than using them as primary tools for external balance management.

Our analysis shows that money supply expansion positively affects Nepal's balance of payments, supporting the monetary approach to balance of payments theory. Moderate increases in money supply can stimulate economic activity, improve export capacity, and enhance foreign exchange reserves without necessarily triggering balance of payments crises. This finding provides Nepal Rastra Bank with room to implement cautiously expansionary monetary policies to support growth while maintaining external stability.

Perhaps most revealing is the study finding on remittances. Despite their critical role in providing foreign exchange, remittances show a counterintuitive negative relationship with balance of payments in the long run. This suggests that remittance inflows primarily fuel consumption of imported goods rather than productive investments that would strengthen export capacity and reduce import dependency. For policymakers, this highlights an urgent need to develop mechanisms that channel remittances toward productive sectors through investment incentives, financial education, and targeted development programs.

The rapid adjustment coefficient in study model indicates that Nepal's balance of payments quickly responds to shocks, demonstrating economic resilience but also vulnerability to external disruptions. The significant impacts of structural breaks, particularly during periods of political instability like the 2002 Maoist insurgency, emphasize how deeply political and social factors influence Nepal's economic stability. This interdependence calls for coordinated policy approaches that consider both economic and non-economic factors affecting external balances.

Nepal's unique economic structure—characterized by remittance dependency, geographical constraints, and limited export diversification—creates distinct monetary policy transmission mechanisms that differ from other developing economies. These findings caution against applying one-size-fits-all monetary policies and advocate for Nepal-specific approaches that account for the country's structural characteristics.

For Nepal's citizens, these findings explain why monetary policy decisions affect their daily economic lives through exchange rates, import prices, and the value of remittances sent by family members abroad. For businesses, our results highlight the importance of anticipating how monetary policy shifts might affect their import costs, export competitiveness, and overall operating environment.

Looking forward, Nepal Rastra Bank would benefit from developing a comprehensive monetary policy framework that: (1) prioritizes exchange rate stability while allowing limited flexibility; (2) implements moderate monetary expansion balanced against inflation risks; (3) explores alternative tools beyond interest rates for external balance management; and (4) coordinates with fiscal authorities to maximize the developmental impact of remittances.

By focusing monetary policy on these areas, Nepal can better navigate external economic challenges while supporting sustainable economic growth and development, ultimately improving economic resilience and living standards for its citizens.

LIMITATIONS

This study acknowledges several constraints that affect the interpretation of our findings. First, limited availability of high-quality time series data on Nepal's monetary policy indicators restricted our analytical scope. Second, while our models focus on monetary factors, Nepal's BOP is also influenced by structural issues beyond monetary control, including geographical limitations and infrastructure deficits. Third, external shocks such as earthquakes, the COVID-19 pandemic, and political instability during the study period (1975-2023) complicated the isolation of pure monetary policy effects. Fourth, potential gaps between official policy decisions and their actual implementation may influence the observed relationships. Finally, the complex interaction between remittances and domestic consumption patterns presents methodological challenges that future research should address through more sophisticated modeling approaches and higher frequency data.

AUTHOR CONTRIBUTIONS

Gyan Mani Adhikari conceptualized the research design, developed the theoretical framework, and led the interpretation of monetary policy implications on Nepal's balance of payment trajectory.

Santosh Chhetri conducted comprehensive time series econometric analysis, including Augmented Dickey-Fuller tests, Johansen cointegration, Vector Error Correction Model (VECM), and Impulse Response Function (IRF) to examine the dynamic relationships between key monetary variables and balance of payments.

Rajesh Keshar Khanal provided critical guidance on research methodology, supervised the analytical framework, and contributed to the validation of empirical findings.

Krishna Bahadur Karki performed literature review, collected secondary data from various sources, and assisted in the identification of structural breaks in the economic variables.

Bhawana Basnet contributed to the discussion of findings, drafted sections of the manuscript, and helped contextualize the policy implications within Nepal's economic environment.

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