Examining the Impact of Macroeconomic Variables on the NEPSE Index: VECM Approach

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Abstract

NEPSE plays a pivotal role in Nepal's financial ecosystem, fostering economic growth, corporate development, and investment opportunities. The study of macroeconomic variables' impact on the NEPSE Index is significant as it provides insights for investors and policymakers to make informed decisions, enhancing market efficiency and economic stability. This study examines the impact of macroeconomic variables on the NEPSE Index using secondary data from 1994 to 2023 and the VECM approach, revealing a long-run equilibrium among variables with significant influences from GDP, WTI, IR, and M2. The analysis highlights rapid adjustments towards equilibrium, negligible effects from lagged GDP and IR changes, and asymmetric causal relationships observed in Engle-Granger tests. The regression analysis shows moderate explanatory power with significant model fit indicators and reveals no residual autocorrelation or serial correlation, suggesting robustness in modeling the NEPSE Index dynamics. Recommendations include leveraging these findings for targeted policy interventions to enhance market stability and investor confidence.

Keywords: *Gross domestic product growth rate, Inflation rate, Weighted average treasury interest rate, Broad money supply growth rate, NEPSE index, Economic growth*

1. Introduction

Microeconomics studies individual market behaviors, while macroeconomics examines a nation's overall economic activity and interventions (Mankiw, 2018), with inflation eroding currency purchasing power and guiding monetary policy for economic stability (Blanchard, 2017). Interest rates, crucial for borrowing and investment returns, impact economic activities, managed by central banks to achieve economic goals (Taylor, 1993). Inflation, a persistent rise in prices, erodes purchasing power, affecting consumer spending and economic stability (Blanchard, 2017). Interest rates profoundly impact economic activities, affecting borrowing costs, investment decisions, consumer spending, and currency exchange rates, with higher rates potentially attracting foreign investment (Taylor, 1993). Security transaction volume indicates investor interest and market liquidity, crucial for understanding financial market dynamics (Hull, 2016). GDP, as a comprehensive measure of economic output within a nation's borders, is vital for assessing economic management of economic challenges is mirrored in the development of key macroeconomic indicators. GDP emerged in the early 1900s, gaining prominence post-World War II, while the systematic measurement of unemployment began in the 20th century amid the Great Depression. Modern inflation measurement using indices solidified its role in governance, and interest rates, rooted in ancient times, formalized with central banking, evolved into critical tools for monetary policy.

The Nepal Stock Exchange (NEPSE), established under the Companies Act of 2006 and operating under the Securities Act of 2007, serves as Nepal's principal stock exchange. As of January 2024, NEPSE-listed businesses have a market capitalization of Rs. 330,765.9 crore, equivalent to approximately US$26 billion. NEPSE's current paid-up capital stands at NRs. 1,00,000,000, with ownership including the Government of Nepal, Nepal Rastra Bank, Employees Provident Fund, Rastriya Banijya Bank (formerly Nepal Industrial Development Corporation), and various securities brokers (NEPSE, 2023). The exchange features two indices: the NEPSE Index and the Sensitive Price Index, the latter focusing on top-performing companies but excluded from this study.

For this study's objectives, the NEPSE price index, a market capitalization-weighted index reflecting the number of ordinary shares listed, was utilized. Research in developed nations suggests a link between stock values and macroeconomic indicators (Fama & Schwert, 1977). Conversely, in less developed Asian markets, including Nepal, macroeconomic variables may not reliably predict stock market fluctuations due to information processing limitations (Fung and Lie, 1990). Phuyal's (2016) study using a vector error correction model found an equilibrium relationship between NEPSE and various macroeconomic factors, including CPI, money supply, exchange rate, interest rate, and remittance volume. Shrestha and Pokhrel (2019) used an ARDL model to explore the links between the stock index, consumer price index, broad money supply, 91-day Treasury bill rate, political shifts, and policy changes. They found strong positive associations with money supply and negative correlations with interest rates, along with a modest positive relationship between inflation, supportive policies, and political stability. These findings underscore the significance of understanding macroeconomic factors for financial analysts, investors, and policymakers in navigating dynamic financial markets. This study aims to address gaps left by previous national and international researchers by including variables not previously considered. It focuses on the impact of macroeconomic variables on the NEPSE index using secondary data from 1994 to 2023.

The research methodology involves systematic processes for solving research questions, including research design, population rationale, data sources, and analysis methods. This study uses secondary data to evaluate the effects of real GDP growth, inflation, and treasury interest rates on the NEPSE index, analyzing time series data from 1994 to 2023. Econometric tools such as Johansen cointegration tests, VECM, and VAR Granger causality tests ensure rigorous analysis, with data sourced from reliable institutions like the Economic Survey of Nepal, CBS, NRB, and NEPSE.

Review of literature are divided into two parts: theoretical Review and empirical review.

Theoretical review: Random Walk Hypothesis: According to Malkiel (1973), the future movement of a stock's price or the market direction cannot be forecasted based on historical behavior due to random fluctuations. The random walk theory, validated by the independence of successive price changes and their distribution (Fama, 1965), asserts that stock prices are unpredictable because they follow arbitrary motions. According to Bachelier (1900) and Osborne (1959; 1964), while perfect independence in price changes may not exist, the random walk hypothesis holds if the dependence is insufficient to outperform the buy-and-hold strategy. Additionally, price changes follow some distribution, which helps investors assess the risk of common stocks (Karlin & Pinsky, 2011).

Efficient Market Hypothesis (EMH): Fama (1970) coined "Simple Market" to describe a market where prices reflect all available information, aligning with the efficient-market hypothesis (EMH), which posits that it is impossible to consistently achieve returns above average market returns on a risk-adjusted basis using public information. Samuelson (1965) also contributed to this theory, demonstrating that in an informationally efficient market, price changes are unforecastable, supporting dynamic asset allocation, consumption-savings solutions, and option-pricing models by Black, Scholes (1973), and Merton (1973). Fama (1965) operationalized the efficient-market hypothesis (EMH) with the concept that "prices fully reflect all available information," contributing significant empirical methodologies such as the event study and econometric tests of asset-pricing models. This work uncovered numerous empirical regularities and anomalies across various financial markets, diverging from Samuelson's more theoretical approach (Fama, 1965). A decade after Samuelson (1965) and Fama (1965a; 1965b; 1970), the EMH framework was extended for risk-averse investors, showing that marginal-utility weighted prices are unforecastable under rational expectations (LeRoy, 1973; Rubinstein, 1976; Lucas, 1978). This neoclassical version, incorporating various factors such as non-traded assets, state-dependent preferences, and asymmetric information, maintains that markets efficiently aggregate information and equilibrium prices instantly reflect all available information.

Empirical Review: Stock market performance, an indicator of overall market or individual stock trends, provides investors with actionable insights and reflects the state of the economy (Economy Watch, 2022). Key predictors of stock prices include GDP, inflation rate, interest rates, and USD foreign exchange rates (Maghayereh, 2002; Osisanwa & Atanda, 2012). To maximize stock market investment returns, investors should regularly monitor factors like gold prices, T-bill rates, GDP, inflation, and exchange rates (Abbas et al., 2014). Studies by Schwert (1981) and Chen, Roll, and Ross (1986) found that stock prices respond unfavorably to unexpected inflation and are influenced by industrial production, inflation, risk premium, and term structure changes, showing a significant relationship with macroeconomic variables in the US market.

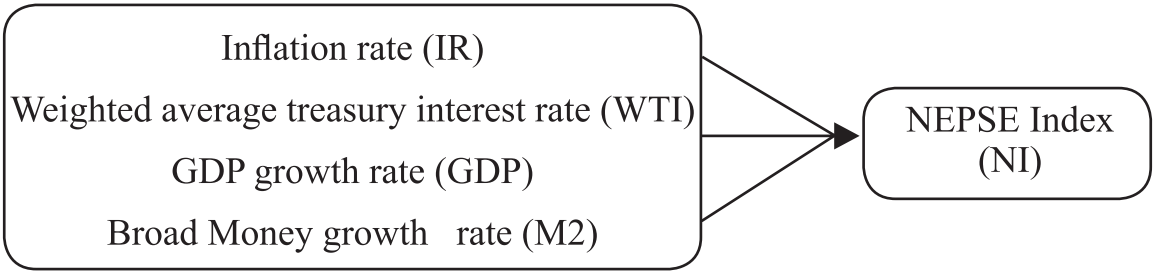
Mukherjee and Naka (1995) utilized vector error correction models to establish a long-term equilibrium relationship between the Japanese stock market and key macroeconomic variables including exchange rates, money supply, inflation, industrial production, long-term government bond rates, and call money rates. Pethe and Karnik (2000) investigated the relationship between stock prices and macroeconomic factors such as industrial production, exchange rates, prime lending rates, and various measures of money supply. They emphasized the significant impact of economic activity, particularly industrial output, on stock prices. Flannery and Protopapadakis (2002) analyzed the effects of macroeconomic conditions on daily returns of a broad equity market index over a 16-year period, highlighting substantial negative impacts of money supply, producer pricing index (PPI), and consumer price index (CPI) on market value-weighted returns.

Ibrahim and Aziz (2003) explored the dynamic linkages between macroeconomic factors and Malaysian stock prices, emphasizing a positive correlation between industrial output and stock prices, indicating that higher real industrial production enhances firms' future cash flow expectations. Adel (2004) studied the impact of macroeconomic parameters on stock prices using data from the Amman Stock Exchange (ASEX), finding that industrial production positively influences stock prices, while inflation exhibits a negative association. Gan, Lee, Yong, and Zhang (2006) investigated the relationship between macroeconomic variables and the New Zealand Stock Exchange (NZSE) index, using co-integration tests to reveal significant connections with GDP, money supply, inflation, and interest rates, shedding light on the factors influencing stock market movements in New Zealand. Kandir (2008) examined how macroeconomic variables influenced Turkey's stock market pricing, finding a positive correlation between inflation rates and stock prices, alongside significant impacts of interest and currency rates on stock returns. Pilinkus (2009) utilized Pilin Granger causality tests to analyze macroeconomic variables and the Lithuanian stock market index, identifying directional relationships where some variables were influenced by the stock market index and others influenced stock market returns.

Abu-Libdeh and Harasheh's (2011) regression study investigated macroeconomic factors and Palestinian stock prices, revealing a strong correlation with variables like inflation, GDP, exchange rate, Libor rate, and balance of trade, although Granger causality tests showed no causal relationships. Osamwonyi and Osagie (2012) employed Vector Error Correction Models (VECM) to analyze the Nigerian capital market index and macroeconomic variables from 1975 to 2005, including interest rates, inflation, exchange rates, fiscal deficit, GDP, and money supply. They concluded that macroeconomic factors significantly influence the Nigerian stock market index. These studies collectively enhance our understanding of the complex relationships between macroeconomic variables and stock market prices over both short and long terms. While money supply, GDP, inflation, and interest rates consistently emerge as critical factors, their specific impacts can vary across different economies. Bhusal's (2017) use of the Markov chain model to study the NEPSE index's long-term behavior further contributes to insights into stock market dynamics by analyzing the probabilities and expected times of transitions between states (increment, constant, and decrease) of the NEPSE index.

Pun and Shahi (2018) utilized Support Vector Regression and Artificial Neural Network models to predict daily stock prices across ten sectors in the NEPSE, evaluating performance metrics for each sector. In 2019, Saud and Shakya compared prediction accuracy using GRU with various optimization techniques, finding GRU with Adam to be the most accurate. In 2020, they further analyzed prediction methods with Vanilla RNN, LSTM, and GRU, highlighting advancements in deep learning for stock price forecasting (Saud & Shakya, 2020). Shahi et al. (2020) integrated financial news sentiments with LSTM and GRU models for stock price prediction, underscoring the role of sentiment analysis in market forecasting. Conversely, Devkota and Dhungana (2019) studied Nepal's macroeconomic factors—broad money supply, gold price, interest rates, and real exchange rates—revealing interest rates as the primary determinant of the NEPSE Index, despite varied data on GDP and inflation correlations, thus contributing to understanding the nuanced connections between macroeconomic indicators and stock market behavior in Nepal. Sigdel (2022) studied the relationship between government expenditure and economic growth in Nepal from 1990/1991 to 2020/2021, finding significant positive impacts but also inefficiencies and the need for more accountable capital spending. Most variables were significant at the 1% level, except for EA and EH.

Conceptual Framework: In the Nepalese context, the NEPSE Index is positively affected by GDP growth, enhancing corporate earnings and investor confidence (Chen, Roll, & Ross, 1986). Conversely, higher inflation rates can diminish stock prices due to reduced purchasing power and corporate profitability, though moderate inflation may signal economic growth, influencing stock prices neutrally or positively (Fama, 1965). Changes in the weighted average treasury interest rate in Nepal impact borrowing costs, affecting corporate profitability and investor sentiment, thus influencing the NEPSE Index negatively with higher rates and potentially positively with lower rates (Rigobon & Sack, 2004). Broad money supply (M2) can impact the NEPSE Index by influencing liquidity and investment levels; higher M2 typically boosts stock prices through increased liquidity and lower interest rates (Mishkin, 1996). Conversely, reduced M2 can limit investment and lower stock prices, reflecting tighter monetary conditions (Friedman & Schwartz, 1963).



2. Model Specification

To determine the impact of macroeconomic variables on the NEPSE index, the study formulates the following econometric variable:

+ e-----------(1)

Where,

NI = NEPSE Index

GDP= GDP growth rate

WTI= Weighted average treasury interest rate

IR=Inflation rate

M2= Broad money growth rate

b_0 = coefficient constant, b_1, b_2 and b_3 = slope of variables

e = stochastic error term

3. Data Analysis and Result

Analyzing time series data from 1994 to 2023, this study investigates the impact of macroeconomic variables on NEPSE. The 30-year dataset is analyzed using unit root tests, co-integration tests, and Vector Error Correction Model techniques to explore result.

3.1. Unit Root Test

The Augmented Dickey-Fuller (ADF) test is used to confirm the stationarity of the time series data, ensuring a time-invariant mean and variance. The test results, detailed in Table 1, verify the absence of a unit root, indicating the series is stationary.

Table 1: ADF Test Results

Null Hypotheses:	t-Statistic	Prob.
NI has a unit root	-1.032	0.727
D(NI) has a unit root	-6.954	0.0000

Null Hypotheses:	t-Statistic	Prob.
GDP has a unit root	-4.571	0.001
D(GDP) has a unit root	-7.888	0.000
WTI has a unit root	-2.593	0.105
D(WTI) has a unit root	-5.273	0.0000
IR has a unit root	-3.104	0.037
D(IR) has a unit root	-7.073	0.000
M2 has a unit root	-3.694	0.009
D(M2) has a unit root	-7.538	0.000

Source: Researcher's Estimation using EViews 12

The unit root test results indicate that the NEPSE Index (NI), GDP, weighted average treasury interest rate (WTI), inflation rate (IR), and broad money supply (M2) have unit roots at their levels, as their t-statistics are not significantly lower than the critical values at conventional significance levels (Prob. > 0.05). However, the first differences of these variables D(NI), D(GDP), D(WTI), D(IR), and D(M2) do not have unit roots, as their t-statistics are significantly lower (Prob. = 0.000), indicating stationarity. Thus, the variables are integrated of order one, I(1), implying that they become stationary after differencing once.

3.2 Co-integration Test

The ADF test shows that all-time series data are integrated at the first order, suggesting potential co-integration. The Johansen co-integration test, with a 0.05 significance level, is then used to examine co-integration among the variables, as detailed in Table 2.

Table 2: Johansen Co-integration Test Results

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		**Trace**	**0.05**	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.786974	80.50219	69.81889	0.0055
At most 1	0.594437	37.2046	47.85613	0.3379
At most 2	0.209509	11.9352	29.79707	0.9341
At most 3	0.173954	5.352368	15.49471	0.7703
At most 4	5.17E-05	0.001447	3.841465	0.9681

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.786974	43.29759	33.87687	0.0028
At most 1	0.594437	25.2694	27.58434	0.0961
At most 2	0.209509	6.582828	21.13162	0.9684
At most 3	0.173954	5.350921	14.2646	0.697
At most 4	5.17E-05	0.001447	3.841465	0.9681
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				

Source: Researcher's Estimation using EViews 12

E-Views analysis at the 0.05 significance level indicates one co-integrating equation with a corresponding error correction term (ECT). This suggests a long-run equilibrium among the variables, warranting further exploration through the vector error correction model (VECM).

3.3 Vector Error Correction Model

If non-stationary but I(1) time series exhibit co-integration, the Vector Error Correction Model (VECM) can be used to investigate both short-run and long-run dynamics. The conventional Error Correction Model (ECM) for co-integrated series is expressed as follows:

NI=b0+b1t-1+b2WTIt-1 + b3IR t-1 + b4 M2 t-1 + λECTt-1 +∈t----(2)

Where **∈t** is stochastic error term.

ECT is the error correction term and is the OLS residual from the following long run co integrating regression:

+ ∈t -----------(3)

and is characterized by

ECT t-1= NI t-1- () ----- (4)

The error correction term (ECT) adjusts the short-term response of the dependent variable, such as GDP, to deviations from long-run equilibrium, with its coefficient indicating the speed of equilibrium restoration. To avoid multicollinearity or specification errors, determining the optimal lag length (k) is crucial; this study uses E-Views for lag selection.

Table 3: Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-535.2054	NA	1.04E+10	37.25554	37.49128	37.32937
1	-487.6249	75.47250*	2.26e+09*	35.69827*	37.11271*	36.14125*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Researcher's Estimation using EViews 12

Based on consistent criteria for lag selection, a lag order of k = 1 is chosen. Table 4 presents the Vector Error Correction Model (VECM) estimation, employing a maximum lag length of 1. All evaluation criteria (LR, FPE, AIC, SC, and HQ) support this choice, balancing between model fit and complexity.

Table 4: Estimation of VECM Parameters (Long Run Dynamics)

The estimation of the Vector Error Correction Model (VECM) parameters for the long-run dynamics, presented in Cointegrating Equation (1), yields a log likelihood of -463.2919.

NI	GDP	WTI	IR	M2
1.000000	829.1179	183.1079	-240.9009	-406.1736
	(113.534)	(97.7496)	(125.256)	(70.8546)
	[7.30284]	[1.87323]	[-1.92326]	[-5.73250]

Source: Researcher's Estimation using EViews 12

The normalized coefficients for the NEPSE Index (NI), GDP, weighted average treasury interest rate (WTI), inflation rate (IR), and broad money supply (M2) indicate the long-run relationships among these variables. The coefficient for GDP (829.1179) is statistically significant with a high t-statistic (7.30284), suggesting a strong positive impact on the NEPSE Index. The coefficient for WTI (183.1079) has a lower t-statistic (1.87323), indicating a weaker positive impact. The coefficient for IR (-240.9009) is statistically significant with a t-statistic (-1.92326), implying a negative impact. The coefficient for M2 (-406.1736) is also statistically significant with a high t-statistic (-5.73250), indicating a substantial negative impact on the NEPSE Index. These results suggest that GDP positively influences the NEPSE Index, while higher inflation rates and broad money supply negatively impact it, with WTI showing a less significant positive effect.

Table 5: Short Run Dynamics

Dependent Variable: D(NI)				
	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
CointEq1	-0.092713	(0.03040)	[-3.04993]	0.0061
D(NI(-1))	-0.425608	(0.19230)	[-2.21325]	0.0381
D(GDP(-1))	-0.108907	(16.5932)	[-0.00656]	0.9948
D(WTI(-1))	23.66139	(27.4750)	[0.86120]	0.3989
D(IR(-1))	2.335382	(22.4362)	[0.10409]	0.9181
D(M2(-1))	-22.49866	(11.4744)	[-1.96078]	0.0633
C	84.78937	(56.0081)	[1.51388]	0.1450

Source: Researcher's Estimation using EViews 12

Table 5 presents the short-run dynamics of the Vector Error Correction Model (VECM) for the NEPSE Index (NI). The error correction term (CointEq1) has a coefficient of -0.092713, with a t-statistic of -3.04993 and a p-value of 0.0061, indicating a significant speed of adjustment towards long-run equilibrium.

The lagged change in NI (D(NI(-1))) has a negative coefficient of -0.425608 with a t-statistic of -2.21325 and a p-value of 0.0381, suggesting that past changes in NI negatively influence its current changes. The lagged changes in GDP (D(GDP(-1))) and IR (D(IR(-1))) are statistically insignificant with very high p-values (0.9948 and 0.9181, respectively), indicating no short-term effect on NI. The lagged change in WTI (D(WTI(-1))) shows a positive coefficient of 23.66139 but is statistically insignificant (p-value of 0.3989), indicating a weak short-term positive effect. The lagged change in M2 (D(M2(-1))) has a negative coefficient of -22.49866 with a t-statistic of -1.96078 and a p-value of 0.0633, suggesting a marginally significant negative short-term impact on NI. The constant term (C) is positive but statistically insignificant, indicating it does not significantly affect NI in the short run.

Overall, the significant negative coefficient for the error correction term and past changes in NI suggest a correcting mechanism towards long-term equilibrium and the influence of past performance on current NI changes.

Table 6: Summary Statistics

R-squared	0.598293	Mean dependent var	67.93214
Adjusted R-squared	0.48352	S.D. dependent var	400.9522
S.E. of regression	288.1506	Akaike info criterion	14.37716
Sum squared resid	1743646	Schwarz criterion	14.71021
Log likelihood	-194.2803	Hannan-Quinn criter.	14.47898
F-statistic	5.212818	Durbin-Watson stat	1.984946
Prob(F-statistic)	0.002004		

Source: Researcher's Estimation using EViews 12

Table 6 provides a summary of the regression analysis statistics for the NEPSE Index (NI). The R-squared value of 0.598293 indicates that approximately 60% of the variance in the dependent variable is explained by the independent variables in the model. The adjusted R-squared value of 0.48352, which adjusts for the number of predictors in the model, suggests a moderate level of explanatory power. The standard error of the regression (S.E. of regression) is 288.1506, reflecting the average distance that the observed values fall from the regression line. The Akaike Information Criterion (AIC) and Schwarz Criterion (SC) values of 14.37716 and 14.71021, respectively, provide measures for model selection, with lower values indicating a better fit. The log likelihood of -194.2803 supports the overall fit of the model. The F-statistic of 5.212818 and its corresponding p-value of 0.002004 indicate that the model is statistically significant, suggesting that the independent variables collectively have a significant impact on the dependent variable. The Durbin-Watson statistic of 1.984946, which is close to 2, suggests that there is no significant autocorrelation in the residuals. These statistics collectively demonstrate that the model has a moderate fit and the independent variables significantly influence the NEPSE Index, though there is room for improvement in explanatory power.

3.4 Diagnostics Tests of the Model:

To ensure robustness, efficiency, and reliability, the fitted VECM model must undergo diagnostic testing.

3.4.1 Goodness of Fit:

Table 6 shows that 59.82% of the variation in the NEPSE Index is explained by the model, with a Durbin-Watson statistic of 1.98 indicating no spurious results, and a p-value of 0.002 confirming the model's overall adequacy.

3.4.2 Diagnostic Tests:

Goodness of fit is the initial measure for assessing the overall significance of the model, while diagnostic tests provide an in-depth examination of the model's internal validity and overall health.

3.4.3 Coefficient Diagnostic Test:

Coefficient diagnostic tests are used to verify the robustness of estimated coefficients. In this study, the Wald test is applied for this purpose.

The results of the Wald test are presented in Table 7.

Table 7: Wald Test Result

Wald Test:			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	4.69045	(7, 21)	0.0027
Chi-square	32.8331	7	0.000

Source: Researcher's Estimation using EViews 12

With a Chi-square probability of 0.000, which is less than 0.01, it can be concluded that the estimated coefficients are statistically significant at the 1% level.

3.4.4 Residual Diagnostic Test:

The residual diagnostic test, using the serial correlation Lagrange Multiplier (LM) test as shown in Table 8, is essential for assessing the model's robustness by checking for autocorrelation among residuals.

Table 8: Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.572175	Prob. F(2,19)	0.5737
Obs*R-squared	1.59061	Prob. Chi-Square(2)	0.4514

With a Chi-square test statistic probability of 0.4514 (greater than 0.05), the null hypothesis cannot be rejected, indicating no evidence of autocorrelation among the residuals.

3.4.5 Causality Test:

Engle and Granger (1987) suggest that when variables are both integrated of order 1 (I(1)) and cointegrated, it indicates potential causal relationships between them. In this study, Johansen cointegration analysis confirms cointegration among the examined variables, suggesting possible causal links. Results from E-Views are detailed in Table 9, aimed at exploring causality among macroeconomic variables.

Table 9: Engle and Granger Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.	Remarks
GDP does not Granger Cause NI	29	11.7175	0.0021	Unidirectional causal relationship from GDP to NI
NI does not Granger Cause GDP		0.25258	0.6195	
WTI does not Granger Cause NI	29	1.96913	0.1724	
NI does not Granger Cause WTI		0.9339	0.3428	
IR does not Granger Cause NI	29	0.08437	0.7738	
NI does not Granger Cause IR		0.00851	0.9272	
M2 does not Granger Cause NI	29	0.15825	0.694	
NI does not Granger Cause M2		0.68949	0.4139	
WTI does not Granger Cause GDP	29	0.01773	0.8951	
GDP does not Granger Cause WTI		2.10356	0.1589	
IR does not Granger Cause GDP	29	4.97284	0.0346	Unidirectional causal relationship from IR to GDP
GDP does not Granger Cause IR		0.12951	0.7218	
M2 does not Granger Cause GDP	29	8.85584	0.0062	Unidirectional causal relationship from M2 to GDP
GDP does not Granger Cause M2		0.01131	0.9161	
IR does not Granger Cause WTI	29	0.11183	0.7408	
WTI does not Granger Cause IR		0.58565	0.451	
M2 does not Granger Cause WTI	29	0.19142	0.6654	
WTI does not Granger Cause M2		0.00643	0.9367	
M2 does not Granger Cause IR	29	0.16744	0.6857	
IR does not Granger Cause M2		4.54064	0.0427	Unidirectional causal relationship from IR to M2

Table 9 presents the results of the Engle and Granger causality test assessing the causal relationships among variables. The test evaluates whether one variable Granger-causes another based on significant F-statistics and associated probabilities. It shows a unidirectional causal relationship from GDP to the NEPSE Index (NI) with a high F-statistic of 11.7175 and a low probability of 0.0021, suggesting that GDP influences NI. Similarly, there is evidence of a unidirectional causal relationship from inflation rate (IR) to GDP, supported by an F-statistic of 4.97284 and a probability of 0.0346. Conversely, no significant causality is found in other relationships such as NI causing GDP, WTI causing NI, and M2 causing GDP, among others, as indicated by higher p-values above the conventional significance level of 0.05. These findings indicate that while GDP and IR exert causal influence on other variables, there is no strong evidence of causal relationships in the reverse directions for most pairs examined in this study.

4. Conclusion

In the Nepalese context, NI, GDP, WTI, IR, and M2 are integrated of order one (I(1)), achieving stationarity after differencing. A co-integrating equation with an error correction term (ECT) suggests long-run equilibrium among these variables, supporting VECM analysis with lag order k = 1. GDP positively influences NI significantly, WTI has a weaker positive effect, IR negatively impacts NI, and M2 has a substantial negative effect. VECM analysis confirms a significant error correction term, indicating rapid adjustment towards equilibrium. Lagged changes in NI negatively affect current NI changes, with insignificant effects from lagged GDP and IR changes. WTI shows a weak positive short-term effect, while M2 has a marginally significant negative impact. The constant term (C) does not significantly affect NI in the short run. The regression analysis for the NEPSE Index (NI) in Nepal shows moderate explanatory power, with a standard error of regression (S.E.) and favorable AIC and SC values. The model's log likelihood supports its fit, and an F-statistic indicates statistical significance. The Durbin-Watson statistic suggests no significant autocorrelation in residuals. The Wald test confirms coefficient significance, while the LM test finds no serial correlation. Engle and Granger causality tests reveal GDP's influence on the NEPSE Index (NI) and inflation rate (IR) on GDP, indicating asymmetric causal relationships.

Implications:

The implications of this study are profound for both investors and policymakers in Nepal. By understanding the significant influences of GDP, WTI, IR, and M2 on the NEPSE Index, stakeholders can make more informed decisions that enhance market efficiency and economic stability. The demonstrated rapid adjustments towards equilibrium and the robustness of the model highlight the reliability of these insights. Policymakers can leverage these findings to implement targeted interventions that stabilize the market, boost investor confidence, and promote sustainable economic growth. For investors, this knowledge allows for better risk management and investment strategies, ultimately contributing to a more resilient financial ecosystem in Nepal.

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