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Stock market development and economic growth in Nepal: Evidence from ARDL cointegration and granger causality analysis

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Research Article

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Abstract
This study examines the relationship between stock market development and economic growth in Nepal using ARDL cointegration and Granger causality analysis. The ARDL bounds test reveals a long-run cointegration relationship between stock market development and economic growth, with the F-statistic exceeding the upper bound critical values at all significance levels. The long-run analysis shows that stock market index negatively affects economic growth, while market capitalization and money supply positively influence growth. The exchange rate demonstrates a significant negative effect on growth, indicating that currency depreciation hampers the macro economy. Granger causality tests further suggest unidirectional causality between stock market development and economic growth. The error correction model (ECM) reveals a rapid adjustment process, with 52.31% of disequilibrium corrected each period. These findings provide empirical insights into the relationship between stock market development and economic growth in Nepal, offering valuable implications for policymakers and investors.
Keywords: stock market development, economic growth, ARDL cointegration, granger causality

1. Background of the Study

Economic growth is widely acknowledged as a fundamental driver of societal progress, fostering higher living standards, reducing poverty, and strengthening global competitiveness (Ashraf & Weil, 2024; Pérez de la Fuente, 2016; Schwab, 2019). An effective and well-functioning financial system is essential in promoting and sustaining economic expansion (Distia, 2023; European Central Bank, 2017; Levine, 1996; Yao et al., 2023). In this context, stock markets have emerged as key institutions of the financial system that facilitate capital allocation, enhance liquidity, support price formation, drive innovation, and promote technological progress, ultimately contributing to economic vitality (Chikwira & Mohammed, 2023; Nowbutsing & Odit, 2009; Qamruzzaman & Wei, 2018; Rajan & Zingales, 1996).

In developing economies where access to conventional financing options is constrained, stock markets are especially vital for directing resources toward productive sectors (Beck & Levine, 2004). Additionally, they enhance economic stability by facilitating effective risk diversification and acting as an indicator of investor confidence and economic outlook (Arestis et al., 2001; Levine, 1996; Masoud, 2013). The relationship between stock market development and economic growth has been extensively explored in the literature. Early work by Levine and Zervos (1998) highlighted a positive correlation, emphasizing that stock markets enhance growth

through better resource allocation and increased liquidity. This position is mirrored by Beck and Levine (2004), who isolated stock market liquidity as a critical element that independently contributes to economic growth alongside banking sector development. Subsequent research has further explored this relationship, considering various dimensions of stock market development, such as stock market index, market capitalization, trading volume, and market volatility, in relation to economic growth (Estrada et al., 2010; Hailemariam & Guotai, 2014).

The establishment of the Nepal Stock Exchange (NEPSE) in 1993 marked a significant milestone in the country's financial market development (Bhattarai et al., 2021). Over the years, Nepal's GDP per capita has experienced a steady increase from 187.26 billion in 1994 to 1433.93 billion in 2024, reflecting gradual economic progress as shown in table 1. Despite policy reforms and technological advancements, the Nepalese stock market remains relatively small, illiquid, and volatile. Over its three decades of operation, the NEPSE index has fluctuated significantly, rising from 226.03 in 1994 to a peak of 2883.41 in 2021 before declining to 2240.41 in 2024, reflecting stock market volatility. Likewise, market capitalization as percentage of GDP (MCGDP) follows a similar trend, rising from 6.96% in 1994 to a peak of 92.15% in 2021 before dropping to 62.29% in 2024. In addition, Exchange Rate in NPR/USD (ER) steadily depreciates from 49.59 in 1994 to 133.38 in 2024, showing a weakening Nepalese Rupee against the US dollar. However, Money Supply in million NPR(MS) expands substantially from 69,777.1 million in 1994 to 6,974,063.9 million in 2024, reflecting increased liquidity in the economy.

Table 1

Trends in Economic and Financial Indicators in Nepal (1994-2024)

Variables	1994	2000	2004	2010	2014	2021	2024
GDPPC	187.26	223.83	279.59	585.28	821.46	1252.75	1433.93
NEPSE	226.03	360.70	222.04	477.73	1036.10	2883.41	2240.41
MCGDP	6.96	11.36	7.72	31.60	47.35	92.15	62.29
ER	49.59	71.10	74.75	75.04	98.53	118.33	133.38
MS	69777.1	186120.8	262057.0	820986.7	1565967.1	5190928.7	6974063.9

Nepal's distinct economic structure, financial limitations, and policy environment necessitate a deeper examination of the dynamic interaction between stock market development and economic growth. While studies in developed economies often report a positive and significant impact of stock market development on growth, findings from developing countries, including Nepal, remain inconclusive. Additionally, the direction of causality—whether stock market

development drives economic growth or vice versa—remains unclear, warranting further country-specific analysis. Therefore, this study aims to empirically investigate the relationship between stock market development and economic growth in Nepal using the ARDL cointegration bound testing approach and Granger causality testing method over the period 1994–2024. While, various cointegration techniques exists, such as the residual-based approach (Engle & Granger, 1987) and the maximum likelihood approach (Johansen, 1991, 1995; Johansen & Juselius, 1990), the ARDL model is particularly suited for this study due to its flexibility in handling small sample sizes and accommodating variables with different levels of integration.

The subsequent sections are structured to delve into review of literature, followed by a methodological discourse. Finally, results are discussed in light of existing theories, with a concluding segment outlining implications for investors, policymakers, and future research prospects within Nepal and similar emerging markets.

2. Literature Review

2.1 Theoretical Perspectives on the Finance-Growth Nexus

The relationship between stock market development and economic growth has been a central debate within the finance-growth nexus. The theoretical perspectives on this relationship are classified into four main hypotheses: the supply-leading hypothesis (SLH), the demand-following hypothesis (DFH), the feedback hypothesis (FBH), and the neutrality hypothesis (NLH). The SLH argues that stock market development is a prerequisite for economic growth, as it enhances savings through financial assets, fosters capital accumulation, and ultimately drives economic expansion (Schumpeter, 1911). In contrast, the DFH, proposed by Robinson (1979), asserts that financial sector development is a consequence of economic growth rather than a driver of it. Patrick (1966) introduced the "stage of development" hypothesis, also referred to as the FBH, which combines elements of both SLH and DFH, suggesting that the causal relationship between financial development and economic growth evolves over time as an economy advances. Lastly, the NLH posits that stock market development and economic growth are unrelated and do not influence each other (Vo et al., 2016). These theoretical perspectives provide a basis for examining the stock market-economic growth relationship in Nepal.

2.2 Empirical Evidence in Global Context

Empirical research investigating the relationship and causality between stock market development and economic growth has produced diverse findings. For example, Levine and Zervos (1998), utilizing cross-country data, observed that stock market liquidity and banking sector development significantly contribute to economic growth, capital accumulation, and productivity. However, factors such as stock market size, volatility, and integration were not found to be consistently linked to growth. Similarly, Beck and Levine (2004) confirmed that stock market and banking sector development positively influence economic growth, while stock market liquidity and banking development maintain an independent association with growth.

Vazakidis and Adamopoulos (2009) demonstrated that, economic growth has a long-term positive effect on stock market development and also Granger-causes it. Conversely, Elhassan and Braima (2020) found that while market capitalization exerts a positive and significant long-term impact on economic growth, the turnover ratio and stock trading values exhibit insignificant negative effects. Furthermore, Sarwar et al. (2020) highlighted the role of financial development and human capital in driving economic growth in emerging economies. Likewise, Pradhan et al. (2019) identified a long-term cointegration between stock market development and economic growth in G-20 nations, with the panel Granger causality test confirming that variables such as bond market development, stock market performance, inflation, and real interest rates influence economic growth in the long run.

Hailemariam and Guotai (2014), analyzing data from 17 emerging and 10 developed markets, found a statistically significant direct and indirect relationship between stock market development and economic growth, primarily through its impact on investment behavior. Their findings reinforce the idea that stock market development plays a crucial role in promoting economic expansion. Similarly, Qamruzzaman and Wei (2018) identified a long-run connection between financial innovation, stock market development, and economic growth in Bangladesh, with Granger-causality tests supporting a bidirectional causal relationship among these variables over both short- and long-term horizons. Singh and Verma (2024) further reported that money supply significantly and positively influences economic growth, with causality tests revealing strong linkages between economic growth, money supply, capital formation, and interest rates.

However, some studies present a contrasting perspective. Bhide (1993) argued that stock market liquidity could potentially hinder economic growth by discouraging savings and negatively impacting capital accumulation. Similarly, Vo et al. (2016) found no substantial correlation

between stock market development and economic growth in Vietnam, with no evidence of causality between financial structure and economic expansion. Masoud (2013) highlighted that weak institutional frameworks and low investor confidence in emerging markets limit the effectiveness of stock markets in driving growth. Arestis et al. (2001) suggested that banking institutions tend to play a more dominant role in such economies, whereas stock markets remain underdeveloped and volatile.

Further supporting this view, Samargandi et al. (2015) suggested that excessive financial development may have a negative effect on economic growth in middle-income countries. Similarly, Ben Naceur and Ghazouani (2005) found no significant relationship between banking and stock market development and overall economic growth in MENA countries, with stock market growth sometimes exhibiting a negative association when accounting for banking sector development. Additionally, El-Khadrawi (2023) argued that greater exchange rate volatility tends to impede economic growth, emphasizing the need for stable exchange rate policies to support economic stability.

2.3 **Empirical Evidence in Nepal**

Dhungana (2023) identified a long-term cointegration between stock market development indicators—such as gross national savings, market capitalization, gross capital formation, trading turnover, and the stock market index—and economic growth. Additionally, the Granger causality test confirmed a unidirectional causal relationship between economic growth and stock market development. Similarly, Baral (2019) reported a significant positive association between stock market development and economic growth, with stock market indicators accounting for notable variations in Nepal's economic growth.

Bhattarai et al. (2021) highlighted that stock market size and liquidity play a crucial role in driving economic growth by facilitating capital mobilization and risk diversification. Their findings also suggested a unidirectional causality from economic growth to stock market development. Likewise, Bist (2017) established that market capitalization has a strong positive influence on economic growth in both the short and long term and a bidirectional causality between market capitalization and economic growth. Maharjan (2020) further confirmed a cointegrating relationship between market capitalization and economic development, with short-run causality running from market capitalization to GDP.

Pokharel (2020) emphasized the role of Nepal's capital markets in fostering economic growth through efficient fundraising, resource allocation, fair price determination, and liquidity. The study concluded that capital market development drives economic growth in both the short and long run, although no evidence was found supporting the reverse causality. Mukit et al. (2014) also demonstrated a strong correlation between market capitalization and Nepal's real economic growth. Similarly, Ranjit (2021) found that broad money supply, market capitalization, and the NEPSE index significantly contribute to real GDP. On the other hand, Bhatta and Mishra (2021) suggested that while the stock market has a statistically significant impact on GDP growth, its influence remains weak. Their findings imply that stock prices may not sufficiently capture valuable information for forecasting GDP trends.

3. Methods and Procedures

3.1 Study Design and Framework

This study seeks to investigate the evolving relationship between stock market development and economic growth in Nepal. To achieve this, Autoregressive Distributed Lag (ARDL) model to assess cointegration and the Toda and Yamamoto (1995) procedure to determine the causal direction between stock market development and economic growth has been applied. Adopting a quantitative research design within a positivist framework, the study emphasizes empirical analysis to validate the relationship between stock market development and economic growth in Nepal.

3.2 Variables and Data Description

This study employs annual time-series data from 1994 to 2024 to analyze the relationship between stock market development and economic growth in Nepal, incorporating key financial market indicators. Although Nepal's financial sector dates back to the establishment of Nepal Bank Limited in 1937 and the first public share issuance by Biratnagar Jute Mill in 1936, significant stock market development only gained momentum following the financial liberalization policies of the late 1980s. The selected timeframe encompasses key structural transformations in Nepal's financial sector and the evolution of NEPSE, which transitioned from the Securities Exchange Centre in 1993 into a formalized stock exchange in 1994.

Economic growth is represented by GDP per capita (GDPPC), which reflects overall economic performance and living standards. Stock market development, the independent variable, is measured using the NEPSE index (NI) and stock market capitalization to GDP ratio (MCGDP).

To enhance model robustness, control variables such as money supply (MS) and exchange rate (ER) are included to account for broader macroeconomic influences. Data for these variables were sourced from official records of Nepal Rastra Bank.

3.3 Model Specification and Methodology

For estimation and modeling purpose, the study specifies the following general model to capture the relationships in the variables.

$$GDPPC_t = f(NI_t, MCGDP_t, ER_t, MS_t) \quad \text{.....(1)}$$

Equation 1 indicates that GDP per capita ($GDPPC_t$) is a function of the NI**,** MCGDP**,** ER**,** and MS**.** To estimate this relationship empirically, the equation was arranged into a linear regression model as follows

$$GDPPC_t = \alpha + \beta_1 NI_t + \beta_2 MCGDP_t + \gamma_1 ER_t + \gamma_2 MS_t + \epsilon_t \quad \text{.....(2)}$$

(Where, α = Intercept term, β1, β2 = Coefficients of independent variables NI and MCGDP, γ1, γ2 = Coefficients of control variables ER and MS and ϵt = Error term capturing unobserved factors)

The current study employs the ARDL model, as proposed by Pesaran et al. (2001), to analyze the relationships between the selected variables. Initially, unit root tests were conducted using the Dickey-Fuller GLS test (Dickey & Fuller, 1979) and the Phillips-Perron test (Phillips & Perron, 1988). While the ARDL methodology does not necessitate unit root testing, it is important to conduct these tests to ensure that none of the variables under consideration are integrated of order two, I(2), or higher. This step is crucial because the ARDL model requires that all series be integrated of order zero (I(0)) or one (I(1)), which ensures that the F-statistics produced by Pesaran et al. (2001) and Narayan (2004) remain valid.

The ARDL bound test model applied was presented in equation (3).

$$\Delta GDPPC_t = \alpha + \sum_{i=1}^{p} \delta_i \Delta GDPPC_{t-i} + \sum_{i=0}^{q} \beta_1 \Delta NI_{t-i} + \sum_{i=0}^{q} \beta_2 \Delta MCGDP_{t-i}$$
$$+ \sum_{i=0}^{q} \gamma_1 \Delta ER_{t-i} + \sum_{i=0}^{q} \gamma_2 \Delta MS_{t-i} + \lambda_1 GDPPC_{t-1} + \lambda_2 NI_{t-1}$$
$$+ \lambda_3 MCGDP_{t-1} + \lambda_4 ER_{t-1} + \lambda_5 MS_{t-1} + \epsilon_t$$
$$\text{.....(3)}$$

(Where, $\Delta GDPPC_t$ is the change in GDP per capita at time t, α is a constant term (intercept), δi is short-run coefficients of the lagged differences of GDPPC, β1, β2, γ1, γ2 are short-run coefficients for the first differences of independent and control variables, λ1, λ2, λ3, λ4, λ5 are long-run coefficients of the level variables, p, q is optimal lag orders for cointegrating equations based on Akaike Information Criteria (AIC) and ϵt is Error term.)

From Equation (3), the existence of cointegration is confirmed by testing the null hypothesis H_0 : $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$ (no co-integration) against the alternative hypothesis $H_1 : \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq 0$ (co-integration). If the computed F-statistic is less than the lower bound critical value, we do not reject the null hypothesis of no cointegration. Alternatively, if the F-statistic is greater than the upper bound of the critical values, the null hypothesis of no cointegration is rejected. The inference is inconclusive if the F-statistic lies between the lower and upper bounds.

Once cointegration is established, estimation and formulation of long-run model is done for statistical evidence of a long-run relationship or cointegration. The long-run coefficients are estimated using OLS procedures using equation 4.

$$GDPPC_t = \alpha + \beta_1 NI_t + \beta_2 MCGDP_t + \gamma_1 ER_t + \gamma_2 MS_t + \epsilon_t$$
$$\text{.....(4)}$$

The short-run dynamics is estimated through the Error Correction Model (ECM) representation and the existence of cointegration is confirmed by the significance of the ECM term.

The Error Correction Model (ECM) for the given ARDL model follows:

$$\Delta GDPPC_t = \alpha + \sum_{i=1}^{p} \delta_i \Delta GDPPC_{t-i} + \sum_{i=0}^{q} \beta_1 \Delta NI_{t-i} + \sum_{i=0}^{q} \beta_2 \Delta MCGDP_{t-i}$$
$$+ \sum_{i=0}^{q} \gamma_1 \Delta ER_{t-i} + \sum_{i=0}^{q} \gamma_2 \Delta MS_{t-i} + \phi ECM_{t-1} + \epsilon_t$$
.....(5)

(Where, Δ represents the first difference of the variables, δi, $\beta 1$, $\beta 2$, $\gamma 1$, $\gamma 2$ are Short-run coefficients of explanatory variables, ECM_{t-1} is the error correction term (lagged residual from the long-run equation), ϕ is the coefficient of the error correction term and ϵ_t is the error term.)

This study ensures the statistical reliability of its findings by implementing various diagnostic tests. The Ramsey Regression Specification Error Test (Ramsey, 1969) is used to check model stability, while the Breusch-Godfrey test (Breusch, 1978; Godfrey, 1978) detects serial correlation. To examine heteroscedasticity, the Breusch-Pagan test (Breusch & Pagan, 1979) is applied, and the Jarque-Bera test (Jarque & Bera, 1987) assesses the normality of residuals. A model that passes these tests without bias can be deemed suitable for analysis.

Furthermore, this research evaluates the stability of both long-run and short-run coefficients using the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squared recursive residuals (CUSUMSQ) tests (Brown et al., 1975). These tests have also been recommended by Pesaran and Pesaran (1997) and Rahman and Kashem (2017) for assessing parameter stability. If coefficient instability is detected, potential corrective measures include expanding the sample size or incorporating dummy variables (Greene, 2012; Gujarati, 2009), will be applied.

3.4 Granger Causality Analysis

To determine the direction of causality between stock market development and economic growth, this study employs the Toda and Yamamoto (1995) Granger causality approach. This method offers a key advantage as it accommodates variables that may be non-stationary or cointegrated without requiring prior cointegration tests. The causality analysis is conducted by evaluating the significance of lagged values and variable coefficients using the Wald F-statistic within an augmented vector autoregressive (VAR) framework. A statistically significant p-value for the F-statistic indicates the presence of causality.

4. Results and Discussion

4.1 Descriptive Statistics

Table 2 presents the descriptive statistics for the natural logarithm of the selected variables (NI, MCGDP, GDPPC, ER, and MS) to provide insight into the distribution characteristics of the data over the 31 observations. The mean values for each variable are as follows: NI (6.335), MCGDP (3.030), GDPPC (6.221), ER (4.416), and MS (13.439), reflecting the average levels of each variable. The median values are similar for all variables, with only minor variations, indicating that the distributions are roughly symmetrical. The maximum and minimum values show the range of the data, with NI showing the highest maximum value (7.967) and the lowest minimum (5.096). For MCGDP, GDPPC, and MS, the range of data is slightly narrower, with ER showing the smallest range among all variables. The standard deviation (Std. Dev.) is highest for MS (1.453) followed by MCGDP (0.962) and NI (0.902). ER has the lowest standard deviation (0.274). All variables show near-zero skewness, with NI having a slightly positive skew (0.231) and MCGDP showing a slight negative skew (-0.188), while other variables (GDPPC, ER, and MS) exhibit very minimal skewness, suggesting a nearly symmetrical distribution. Likewise, all variables display relatively low kurtosis values, with MCGDP showing the lowest (1.551), while ER (2.105) has a slightly higher kurtosis.

The Jarque-Bera test for normality shows p-values greater than 0.05 for all variables, indicating that the null hypothesis of normality cannot be rejected for any of the variables at the 5% significance level. Overall, the descriptive statistics demonstrate that the data for these five variables are relatively stable, normally distributed, and exhibit some variability, with MS and MCGDP showing the highest variation and ER exhibiting the least.

Table 2

Descriptive Statistics of the Variables

Statistics	NI	MCGDP	GDPPC	ER	MS
Mean	6.335219	3.030256	6.220755	4.416401	13.43936
Median	6.169046	3.242472	6.159262	4.322807	13.46419
Maximum	7.966729	4.523427	7.268173	4.893202	15.75771
Minimum	5.095895	1.509995	5.232488	3.903789	11.15306
Std. Dev.	0.901616	0.961629	0.736683	0.273876	1.453394
Skewness	0.230615	-0.188024	0.017728	0.062259	0.074162
Kurtosis	1.668062	1.551255	1.399425	2.105107	1.688568
Jarque-Bera	2.566274	2.893689	3.310668	1.054437	2.249895
Probability	0.277166	0.235312	0.191028	0.590245	0.324670
Observations	31	31	31	31	31

The progressions of these variables throughout the sample period are depicted in the Fig. 1.

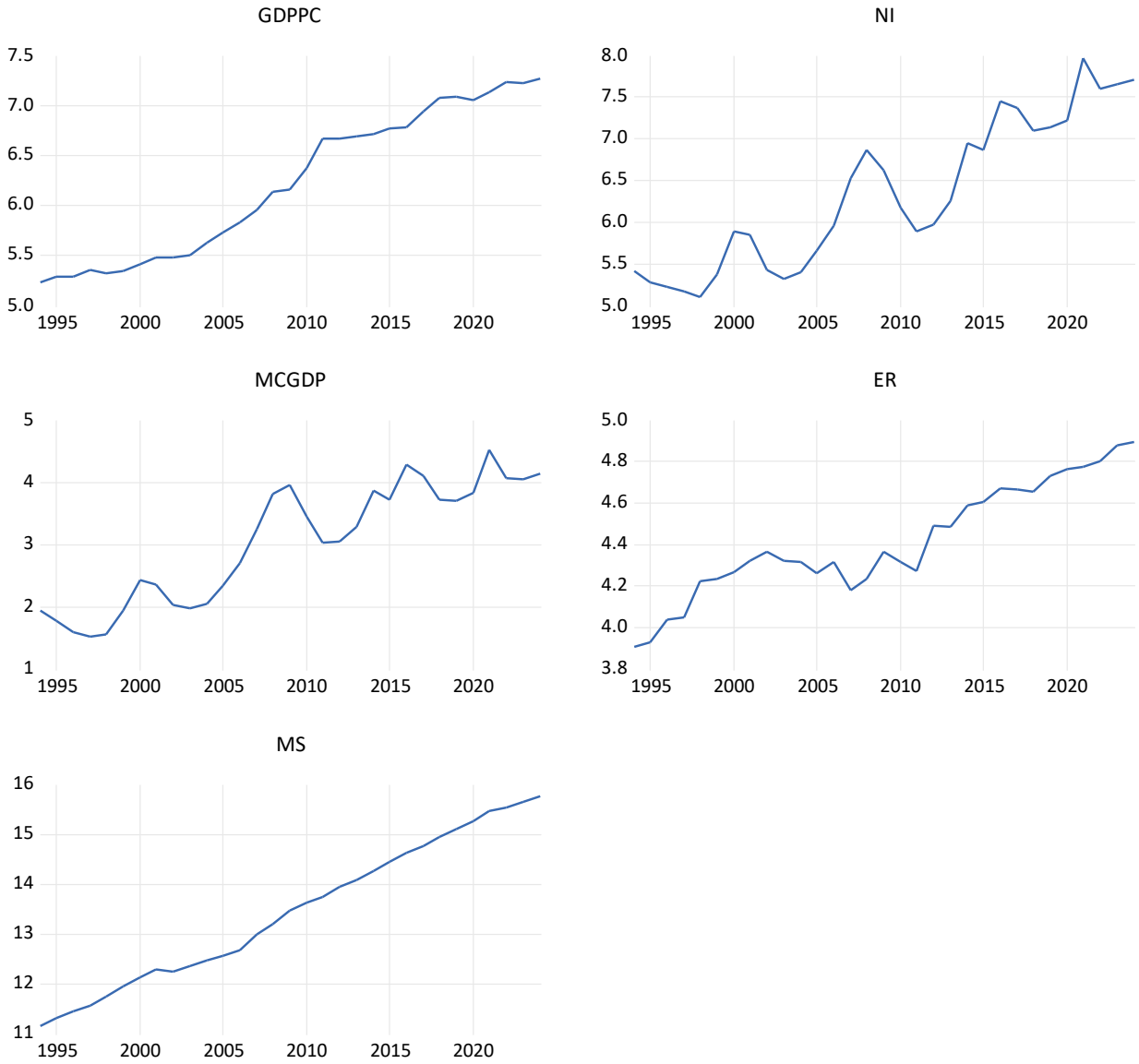


Fig. 1. Progression of the Variables

4.2 ARDL Bounds Test for Cointegration

The ARDL Bounds Testing approach, proposed by Pesaran et al. (2001), requires that none of the variables be integrated of order I(2), as the presence of such variables would invalidate the methodology. To verify this condition, the study applied the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) to determine the order of integration.

Additionally, the Phillips-Perron (PP) test (Phillips & Perron, 1988) was used to confirm the integration order of the variables. Table 3 displays the results of the unit root tests, which examine the stationarity of the chosen variables at their original levels (I(0)) and after first

differencing (I(1)). The test statistics and corresponding p-values strongly suggest that there is no unit root at I(1), indicating that the variables become stationary once first differenced. This makes the data suitable for further cointegration analysis. The complete findings of the stationarity tests are provided in Table 3.

Table 3

Stationary Test

Variables	At Level I(0)		At First Difference I(1)	
	Statistics	p-value	Statistics	p-value
Augmented Dickey-Fuller Test (ADF)				
GDPPPC	-0.0745	0.9436	-4.3551	0.0019
NI	-0.6229	0.8509	-4.4766	0.0015
MCGDP	-0.9454	0.7593	-4.6325	0.0010
ER	-0.8248	0.7969	-6.9024	0.0000
MS	0.03647	0.9548	-4.0639	0.0039
Phillips-Perron Test (PP)				
GDPPPC	-0.1051	0.9401	-4.3688	0.0018
NI	-0.2304	0.9239	-7.3433	0.0000
MCGDP	-0.6799	0.837	-6.4571	0.0000
ER	-0.8317	0.7954	-6.8131	0.0000
MS	0.00695	0.952	-4.0639	0.0039

After confirming stationarity, the appropriate lag order was determined using the Akaike Information Criterion (AIC), Hannan-Quinn Criterion (HQ), Schwarz Criterion (SC), and Final Prediction Error (FPE) (Akaike, 1974; Hannan & Quinn, 1979; Schwarz, 1978). Table 4 presents the results of lag order selection for the ARDL model, identifying the optimal lag length. The log-likelihood values indicate model fit, with higher values signifying a better fit. The Likelihood Ratio (LR) statistic supports a significant lag order, while the lower values of SC and HQ suggest an optimal lag of 1. However, the AIC and FPE criteria, which prioritize predictive accuracy, recommend a lag length of 2, as models with lower values are preferred. Therefore, the ARDL model adopts a lag length of 2, aligning with the AIC and FPE criteria to enhance predictive performance.

Table 4
Lag Order Selection

Lag	Log L	LR	FPE	AIC	SC	HQ
0	15.81914	NA	3.26e-07	-0.746148	-0.510407	-0.672317
1	182.0700	263.7082*	1.98e-11	-10.48758	-9.073141*	-10.04460*
2	211.6989	36.78070	1.70e-11*	-10.80682*	-8.213672	-9.994677

* 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

Based on the Akaike Information Criterion (AIC), the optimal lag length of 2 has been selected, making the ARDL *(2,2,2,2,0)* model the most appropriate choice. This selection strikes a balance between effectively capturing the underlying data relationships and reducing the risk of overfitting. The details of the selected model are presented in Fig. 2.

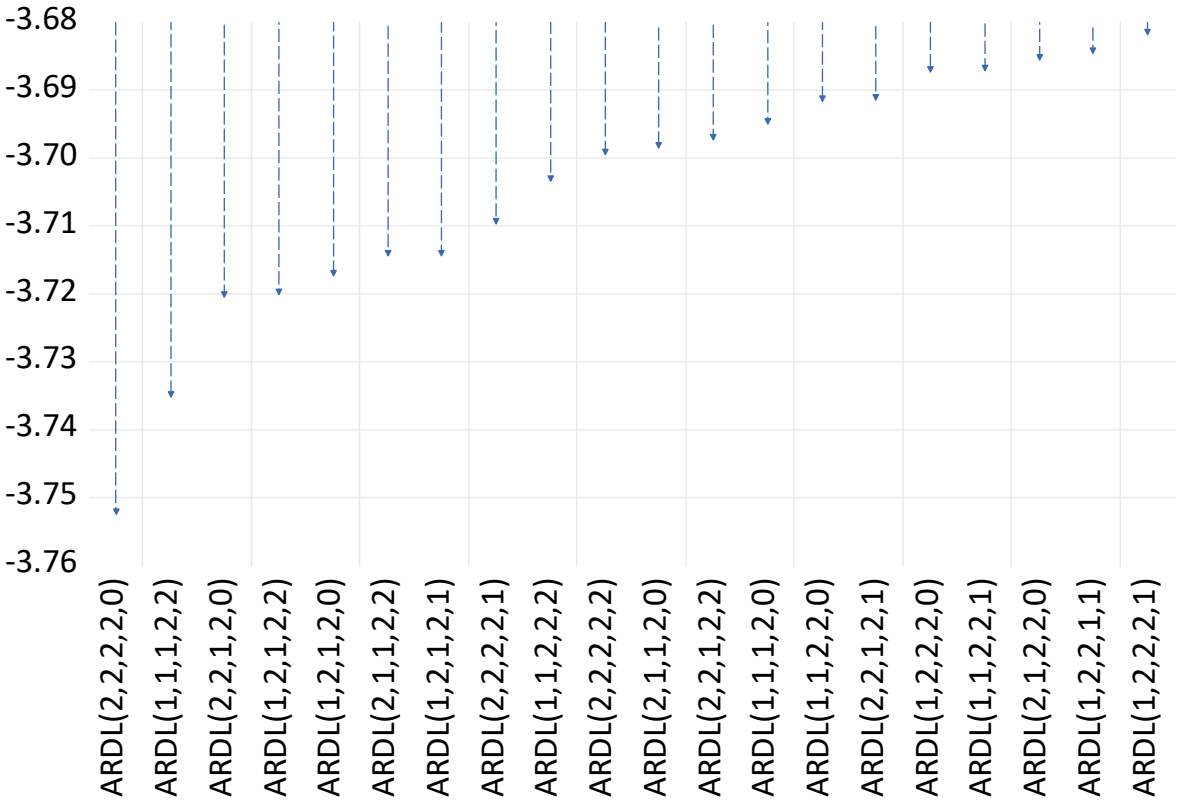


Fig. 2. Akaike Information Criteria (Top 20 Models)

The ARDL model *(2,2,2,2,0)* was employed to examine both the long- and short-run relationships between NI, MCGDP and GDPPC, while incorporating control variables (ER, MS)

in Nepal. The bounds test for cointegration, based on the F-statistic, was conducted following the methodology of Pesaran et al. (2001). The results, presented in Table 5, show that the calculated F-statistic (5.336430) surpasses the critical upper bound value (I(1)) at the 1%, 5%, and 10% significance levels. Therefore, the null hypothesis of no cointegration is rejected, confirming the presence of a long-run relationship between stock market development, control variables, and economic growth in Nepal. These results align with previous studies, including Chakraborty (2008) and Bhattarai et al. (2021), which also found a significant long-term relationship between stock market development and economic growth.

Table 5

ARDL Bounds Test for Cointegration

F-Bound Test			Null Hypothesis: No Levels Relationship	
Test Statistic	Value	Significance	I(0)	I(1)
F-Statistic	5.336430***	10%	2.450	3.520
K	4	5%	2.860	4.010
		1%	3.740	5.060

(* significant at 10%, ** significant at 5%, *** significant at 1%, I(0) show lower critical bound value and I(1) represent upper critical bound value, k is the number of independent variables for explained variable in ARDL model)

The estimated long-run coefficients are presented in Table 6. The NI shows a negative and statistically significant effect on economic growth, aligning with the findings of O. and O. (2017). This suggests that an increase in the stock market index may be associated with a decrease in economic growth, possibly reflecting inefficiencies, low liquidity, and speculative trading that can harm long-term economic growth. On the other hand, MCGDP shows a positive and significant effect, consistent with the results of Qamruzzaman and Wei (2018) and Ranjit (2021), indicating that stock market capitalization can support economic development by providing investment opportunities. Furthermore, the exchange rate (ER) control variable exhibits a substantial negative influence, consistent with El-Khadrawi (2023), suggesting that depreciation of the currency destabilizes the macro economy. Lastly, the money supply (MS) has a highly significant positive impact, in line with the findings of Singh and Verma (2024), highlighting the importance of liquidity in driving economic activity.

Table 6

Long Run ARDL Model Estimates

Unrestricted Constant and No Trend (Case 3) (2,2,2,2,0)

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**

NI	-0.2786	0.0894	-3.1165	0.0046***
MCGDP	0.2326	0.0983	2.3661	0.0260**
ER	-1.2351	0.3261	-3.7870	0.0009***
MS	0.7291	0.0813	8.9684	0.0000***

(* significant at 10%, ** significant at 5%, *** significant at 1%)

The ARDL cointegrating series is presented in Fig. 3.

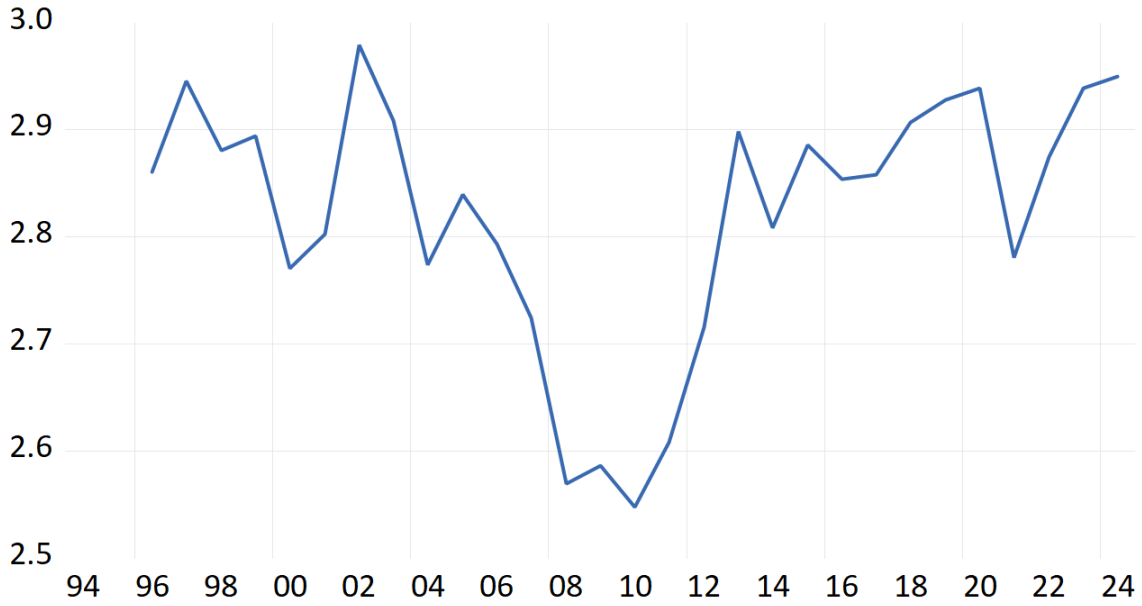


Fig. 3. ARDL Cointegrating Series

The ECM regression results derived from the ARDL model is presented in Table 7 to provide insights into the short-run dynamics and the speed of adjustment toward long-run equilibrium. The error correction term (CointEq(-1)) is negative and highly significant, confirming the existence of a long-run relationship and indicating that 52.31% of deviations from equilibrium are corrected per period, ensuring economic stability. In the short run, the lagged change in the NEPSE Index (D(NI(-1))) has a positive but weakly significant effect on economic growth, suggesting that past stock market performance may influence economic expansion. However, contemporaneous changes in NI (D(NI)) are statistically insignificant, implying that short-term stock market fluctuations do not immediately affect GDP growth. Conversely, stock market capitalization to GDP (D(MCGDP)) exhibits a negative and significant short-run impact, indicating that rapid financial market expansions may not always yield immediate economic

benefits. The lagged effect (D (MCGDP (-1))) is also negative but weaker in significance, reinforcing the idea that stock market development takes time to influence growth. The exchange rate (ER) exerts a strong and highly significant negative impact on GDP growth in both its contemporaneous form and lagged form, suggesting that currency depreciation disrupts short-run economic stability, possibly due to rising import costs and inflationary pressures. Lastly, money supply (MS) has a positive and significant effect, highlighting its role in stimulating short-term economic activity. However, excessive liquidity expansion without corresponding investment growth could pose inflationary risks. The Durbin-Watson (D/W) value of 1.9158 indicates absence of autocorrelation in the model, confirming the statistical integrity of the analysis. R-squared, the coefficient of determination, defines the proportion of total variations in the dependent variable. In the above ECM model, the given value of R-squared is 0.9039 explaining 90.39% goodness of fit it means the model properly explains the stock market performance. Similarly, the value of adjusted R-squared is 0.8655, explains 86.55% goodness of fit, total variation in dependent variable is explained by regression line and the rest is due to the other factor.

Table 7

Short-Run Model Estimates

Unrestricted Constant and No Trend (Case 3) (2,2,2,2,0)

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
CointEq(-1)	-0.5231	0.0906	-5.7752	0.0000***
D(GDPPC(-1))	-0.2293	0.1284	-1.7862	0.0892*
D(NI)	0.0772	0.0646	1.1941	0.2464
D(NI(-1))	0.1975	0.0936	2.1093	0.0477**
D(MCGDP)	-0.1579	0.059	-2.6771	0.0145**
D(MCGDP(-1))	-0.1832	0.0989	-1.8524	0.0788*
D(ER)	-0.6231	0.0873	-7.1386	0.0000***
D(ER(-1))	-0.3068	0.1019	-3.0114	0.0069***
C	1.5955	0.2614	6.103	0.0000***
R-squared	0.9039	Mean dependent var		0.0683
Adjusted R-squared	0.8655	S.D. dependent var		0.0778
S.E. of regression	0.0285	Akaike info criterion		-4.028

Sum squared resid	0.0163	Schwarz criterion	-3.604
Log likelihood	67.404	Hannan-Quinn criter.	-3.895
F-statistic	23.539	Durbin-Watson stat	1.9158
Prob(F-statistic)	0.0000		

(* significant at 10%, ** significant at 5%, *** significant at 1%)

The Breusch-Godfrey Serial Correlation LM Test was conducted to examine serial correlation. Since the p-values for both the F-statistic and Chi-square statistic were greater than 0.05, the null hypothesis of no serial correlation was not rejected. This suggests that the residuals of the ARDL model do not exhibit serial correlation, affirming the reliability and efficiency of the model's estimates. A summary of the diagnostic test results is presented in Table 8.

Table 8

Serial Correlation Test

F-statistic	0.135582	Prob. F(2,14)	0.8743
Obs*R-squared	0.551026	Prob. Chi-Square(2)	0.7592

Table 9 displays the results of the Breusch-Pagan-Godfrey (BPG) test for heteroscedasticity. With p-values for both the F-statistic (0.550554) and Chi-square statistic greater than 0.05, the null hypothesis of homoscedasticity is not rejected. This indicates that the ARDL model does not suffer from heteroscedasticity, ensuring the residuals' variance remains consistent across observations. The absence of heteroscedasticity contributes to the robustness of the estimated coefficients and reinforces the model's validity for making inferences.

Table 9

Heteroskedasticity Statistics

F-statistic	0.550554	Prob. F(12,16)	0.8502
Obs*R-squared	8.475066	Prob. Chi-Square(12)	0.7470
Scaled explained SS	2.350606	Prob. Chi-Square(12)	0.9986

Furthermore, the Jarque-Bera (JB) test statistic of 0.096621 with a p-value of 0.952838 (>0.05), presented in Figure 4, indicates that the residuals adhere to a normal distribution. As the p-value exceeds the 1%, 5% and 10% significance threshold, the null hypothesis of normality is not rejected. This confirms that the residuals of the ARDL model follow a normal distribution, reinforcing the reliability of the model's statistical inferences.

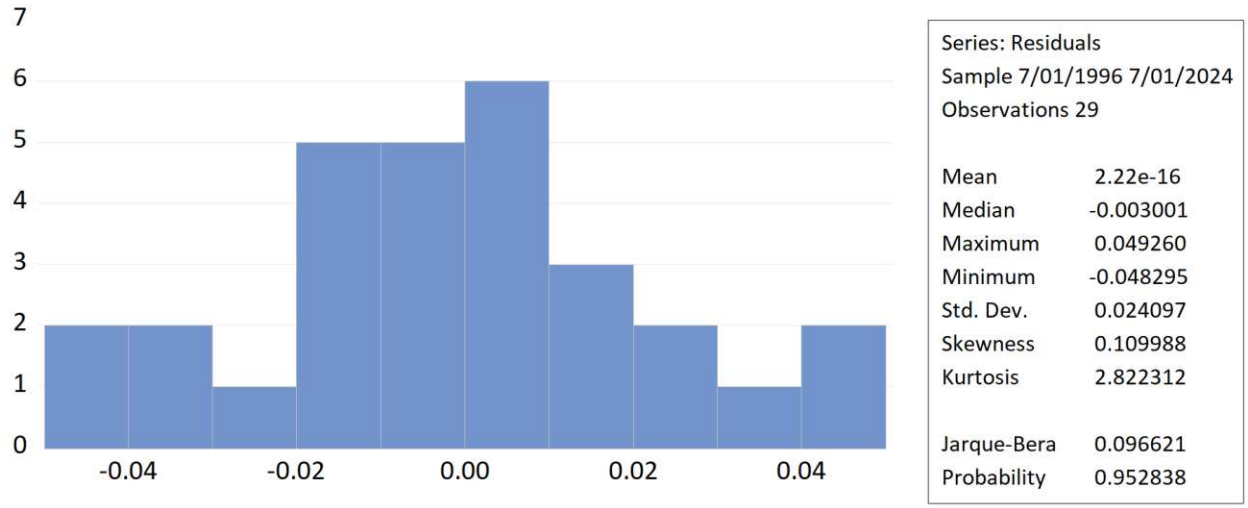


Fig. 4 Normality test

Likewise, Table 10 displays the results of the Ramsey RESET test, which assesses specification errors in the model. The test yields an F-statistic of 1.7928, indicating that the model is appropriately specified and free from any specification errors.

Table 10

Ramsey RESET Test

	Value	Df	Probability
F-statistic	1.7928	(1, 15)	0.2005

The graphical outputs of CUSUM and CUSUMSQ statistics, shown in Fig. 5 and 6, demonstrate that both plots stay within the 5% critical bounds (denoted by the dotted red lines), indicating stable parameters and consistent model performance. This finding suggests no structural breaks, further supporting the reliability of the estimated coefficients over time.

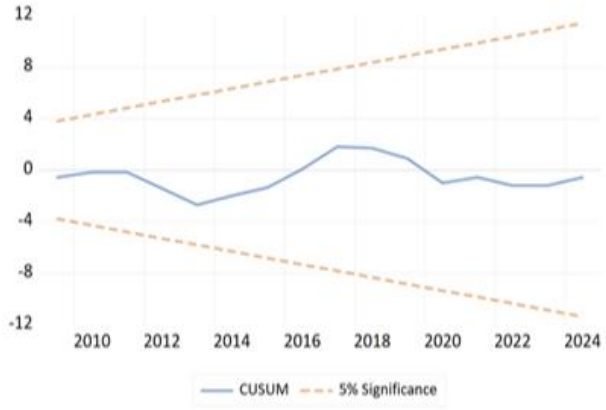


Fig. 5 CUSUM

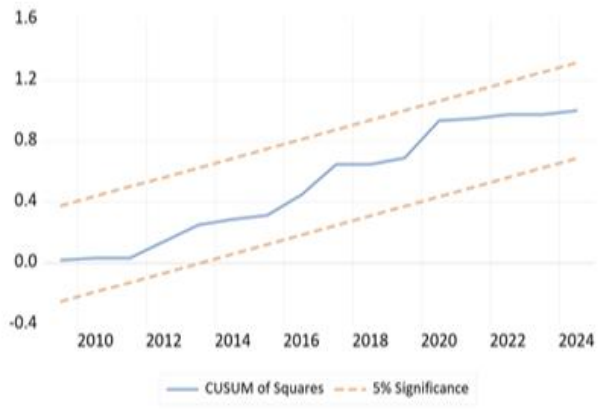


Fig. 6 CUSUM of Squares

4.7. Granger Causality Test

The existence of cointegration opens the possibility for either unidirectional or bidirectional causality. The results of the Toda-Yamamoto causality test, as presented in Table 11, indicate the presence of several unidirectional causal relationships between the variables. Specifically, the NEPSE Index (NI) significantly causes GDP per capita (GDPPC), as evidenced by the significant Wald statistic. However, GDPPC does not significantly cause NI, confirming a unidirectional causality from NI to GDPPC. Similarly, market capitalization-to-GDP (MCGDP) shows a significant causal impact on GDPPC, but the reverse relationship is not significant. This pattern highlights that both NI and MCGDP are key drivers of economic growth but are not reciprocally influenced by GDPPC in this analysis. In addition, MCGDP significantly influences the exchange rate (ER), while no reverse causality is detected further confirming unidirectionality. Furthermore, GDPPC significantly causes changes in the money supply (MS), and both NI and MCGDP exhibit significant causal relationships with MS, suggesting their critical roles in influencing monetary dynamics. Additionally, a unidirectional relationship is observed from the exchange rate (ER) to the NEPSE index (NI), implying that external economic conditions reflected in exchange rate fluctuations impact the stock market index. However, no evidence of bidirectional causality is observed between any pair of variables.

Table 11
Granger Causality/Block Exogeneity Wald Tests

Dependent Variable	GDPPC	NI	MCGDP	ER	MS	Direction of Causality
GDPPC	–	10.9890*** (0.0041)	14.3473*** (0.0008)	3.1125 (0.2109)	4.0246 (0.1337)	NI → GDPPC***; MCGDP → GDPPC***
NI	4.0578 (0.1315)	–	3.3438 (0.1879)	5.9235* (0.0517)	1.2463 (0.5362)	ER → NI*
MCGDP	2.2965 (0.3172)	4.5180 (0.1045)	–	4.1828 (0.1235)	0.9928 (0.6087)	None
ER	2.0820 (0.3531)	4.1587 (0.1250)	4.9218* (0.0854)	–	0.5175 (0.7720)	MCGDP → ER*
MS	9.4384*** (0.0089)	9.9801*** (0.0068)	12.6912*** (0.0018)	2.5483 (0.2797)	–	GDPPC → MS***; NI → MS***; MCGDP → MS***

5. Conclusion

This study examined the relationship between stock market development and economic growth in Nepal using the ARDL model, considering both long-run and short-run dynamics. The analysis revealed that stock market development, as measured by the NEPSE Index (NI) and market capitalization to GDP (MCGDP), significantly influences economic growth in Nepal. The relationship, however, is nuanced. Stock market volatility, as reflected by the NEPSE Index, has a negative impact on long-term growth, driven by inefficiencies and speculative behaviors, while market capitalization to GDP positively contributes to economic growth by facilitating capital mobilization.

Control variables, such as the exchange rate (ER) and money supply (MS), also have notable effects on economic growth. Exchange rate depreciation was found to negatively affect economic growth, underlining the importance of exchange rate stability for macroeconomic balance. In contrast, money supply growth positively affects short-term economic activity, though it carries inflationary risks if not matched by productive investment.

The ARDL bounds test confirmed a long-run equilibrium relationship between stock market development and economic growth, while the Error Correction Model (ECM) highlighted that past stock market performance influences economic growth. The Granger causality test showed a unidirectional causality among the variables, with key indicators like the NEPSE Index and market capitalization to GDP serving as primary drivers of GDP per capita revealing the

importance of the stock market development in shaping economic growth and monetary variables while highlighting the absence of reciprocal influences in this dataset.

Diagnostic tests for serial correlation, heteroscedasticity, normality, and stability validated the robustness and reliability of the model, confirming its consistency over time. Based on these findings, the study recommends enhancing stock market efficiency through improved transparency, reduced speculative activities, and increased market liquidity. Encouraging stock market capitalization by incentivizing company listings and attracting foreign investment is also vital. To address exchange rate volatility, the government should focus on stabilizing the currency and managing monetary policy prudently. Effective money supply management is necessary to balance liquidity and control inflation. Strengthening the financial sector, promoting financial inclusion, and integrating stock market development into long-term economic strategies are crucial for fostering sustainable growth. By implementing these measures, Nepal can better leverage its stock market to drive economic development.

6. Declarations

6.1 Ethical Approval and Consent to Participate

This study uses secondary data obtained from publicly available sources. Ethical approval and consent to participate were not required for this study as no human participants or personal data were involved.

6.2 Consent for Publication

Not applicable.

6.3 Funding

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