Examining the Impact of GDP on the Nepalese Stock Market: Insights from Co-integration and Granger Causality Tests

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Abstract

The stock market reflects the national and international economic health. It promotes investment opportunities and the economic growth of the nation. This study examined the long-run relationship between Gross Domestic Product (GDP) fluctuations and the Nepalese Stock Market Index (NEPSE) employing the econometric models. By using the quantitative analysis of data collected from June 2005 to December 2023, this research applied advanced models such as co-integration to explore long-term equilibrium, vectors auto-regression (VAR) to analyze the short-run impact, and Grangers' causality tests for identifying cause and effect, and variance decomposition for the quantify the impact. Analyzing the unit root tests revealed that GDP growth rates and stock market indices are integrated at the second difference, leading to the application of the Johansen co-integration test. Results showed no evidence of long-term co-integration between GDP and NEPSE. As a result, a Vector Auto-Regression (VAR) model is employed to assess the short-term dynamics. The VAR analysis indicated that lagged values of NEPSE have a significant positive effect on current NEPSE values. Granger causality tests revealed that GDP has a significant causal impact on NEPSE, but NEPSE does not significantly influence GDP. Variance decomposition analysis further demonstrated that NEPSE's own past values predominantly drove its oscillations, while GDP had minimal impact on the NEPSE.

Keywords: *Stock Market, Co-integration, Granger causality, Vectors Errors Correction, Vectors auto-regression, and Variance Decomposition.*

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Introduction

The stock market is a crucial element of the financial system. It serves as a pipe for channelling capital to the public companies. Its importance extends not only to providing a variety of investment opportunities but also reflects and shapes overall economic growth (Lal et al., 2013). Investors, economists, policymakers, managers, and researchers depend on the stock market and economic indicators to make decisions. The behavior of the stock market is closely related with the number of buyers and sellers. Its performances largely rely on the balance of supply and demand. When demand exceeds supply, stock prices rise, and when supply surpasses demand, prices fall (Fama, 1981). Stock market travels are reflected in fluctuating returns, with bullish markets reflecting optimism and bearish markets representing pessimism. The total volume of transactions in the share market is indicated by its liquidity and assists as a measure of market fluctuations.

Microeconomics, a sub-section of economics, involves detailed intrinsic values analysis of specific company information such as earning per share, dividends, and financial ratios (e.g., price-to-earnings, debt-to-equity) to derive financial performance. Numerous studies, including Sharma (2011) and Benishay (1961), have examined the impact of dividends, earnings, and other factors on stock market performance. Technical analysis, using tools

such as moving averages, the relative strength index, and Elliott wave theory, tries to predict market trends rely on statistical and behavioral indicators (Alves, 2015; Vaiz et al., 2016). This multifaceted approach emphasizes the complication of understanding stock market behaviors. While microeconomics study at individual company performance, macroeconomics emphases on broader economic indicators, such as money supply, GDP, interest rates, treasury bills, remittances, foreign exchange rates, and inflation. Various studies (e.g., Hussainey & Khanh Ngoc, 2009; Rjoub et al., 2009; Rahman et al., 2009; Eldomiaty et al., 2020; Iqbal et al., 2014; Naka et al., 1998; Heng et al., 2012; Kaur & Chaudhary, 2022) have explored the effect of these macroeconomic variables on stock markets performance across various regions.

The objectives of this research article are to the determine whether there is a long and short-term equilibrium relationship between Gross Domestic Product (GDP) and the Nepalese Stock Market Index using Johansen co-integration tests. It conducted to identify the direction of causality between GDP and the stock market index and determine if GDP Granger-causes the stock market index or vice versa. It explored the relative importance of lagged values of the stock market index and GDP in explaining the variations in each other over both long and short-run horizons. The article assessed the stationarity of GDP growth rates and the stock market index by performing unit root tests (Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests). It evaluated the appropriate lag length for the Vector Auto-Regression (VAR) model by applying the Schwarz Information Criterion (SIC) and verifying model stability through the CUSUM test and LM test for serial correlation.

A keen interest inspires this study in understanding how the stock market fluctuates, which needs to be better studied in financial-economic research in Nepal. The goal is to examine how lagged value affects future performance. To see how it connects with larger economic factors. It assesses the cause-and-effect relationship between the GDP and the stock market. The research desires to fill important gaps in knowledge. The findings will help make better policies, improve investment strategies, and deepen the understanding of how economic factors and the stock market interplay. The study included sections such as the abstract, introduction, literature review, research methods, discussions, and conclusions to achieve its objectives.

Literature Review

Many academic researchers have been steered to study the relationship between GDP and stock market values. Most of the study has repeatedly found that stock market performance tends to increase when the GDP increases. The performance of the stock market and the GDP are shown to be positively correlated. Below are some related of significant literary works:

Akaike (1974) established the Akaike Information Criterion (AIC) as a model for selection of lagged length, and goodness of fit with model complexity. Fama (1981) revealed the efficient market hypothesis (EMH), categorizing information reflection in stock market indices into weak, semi-strong, and strong forms, on the basis of past performance from available information. The research examined the influence of macroeconomic variables such as GDP, industrial production, interest rates and money supply on the stock markets. The results suggested that most of these macroeconomic factors have significant impacts on the stock market in the different degrees. Engle and Granger (1987) innovated co-integration and error correction models, for detailing their estimation and testing. Empirical results validate co-integration in specific economic relationships. Garcia and Liu (1999) revealed the significant influences from real income, financial intermediaries, saving rates, financial intermediaries, and stock market liquidity. Johansen (1995) explored co-integration vectors GDP and stock market performance, providing a likelihood-based estimation method. Roll et al. (1997) investigated the pricing of macroeconomic risks in the stock market, establishing significant relationships. Naka et al. (1998) revealed the associations between macroeconomic variables and the Indian stock market by using the Vector Error Correction model.

Al-Sharkas (2004) examined into the long-term equilibrium relationship between stock prices and macroeconomic variables. The researcher examined various macroeconomic variables employing the vector error correction model (VECM) of the Amman Stock Exchange (ASE). The empirical results revealed a long-term equilibrium relationship between stock prices and macroeconomic factors. Rahman et al. (2009) connected macroeconomic variables with Malaysian stock prices using a VAR framework. The results revealed co-integration among them.

Hosseini et al. (2011) examined four macroeconomic variables in China and India. The results originated the short- and long-run equilibrium with the stock market performance. Muthike and Sakwa (2012) assessed the determinants of Nairobi Stock Exchange. The results revealed the significant relationship with macroeconomic indicators.

Shrestha & Subedi (2014) employed NEPSE data from 2000 to 2014. The results revealed strong correlation between Consumer Price Index, Treasury Bill Rate, Broad Money Supply with the NEPSE index. NEPSE responded positively to money supply and inflation but negatively to Treasury bills (T-bills). Fan et al. (2018) explored the causality between stock markets and Chinese housing, by employing wavelet analysis model. The findings showed that the stock market and housing prices have positive effects. Thapa (2019) examined affecting factors of stock prices in Nepalese commercial banks (2008-2018), by employing secondary data and questionnaires. The regression model showed dividends, and earnings per share positively impact stock prices. But the interest rates and price-to-earnings ratios and have negatively affect them. Availability of Liquidity was found to enhance market performance. Lingaraja et al. (2020) assessed stock market movements and determinants of macroeconomic variables. The association between Asian emerging markets and developed markets have short-run relationships. Naik & Reddy (2021) assessed the effect of macroeconomic factors on the liquidity of the Indian stock market. The finding revealed the significant impacts among them.

Liow et al. (2006) investigated the relationship between expected risk on stocks market and the main macroeconomic risk issues as replicated in the general business and financial conditions. The research employed a three-step estimation strategy such as principal component analysis, GARCH (1, 1), and GMM) to model. The macroeconomic factors were included like GDP growth, GDP growth, inflation, interest rate, exchange rate, and money supply). The results revealed the first and second moments on stock market had excess returns of four major markets, like Hong Kong, Singapore, Japan, and the UK. The results exhibited that the movements of the macroeconomic risk components and the risk and conditional movements of the risk on property stocks are time-varying and dynamically related. However, there are some differences across the stock markets in terms of the importance and the direction of the influence of the macroeconomic risk factors. Acikalin et al. (2008) assessed the association between returns on stock and macroeconomic factors in the Turkish economy. On a quarterly dataset, they found long-run stable relation between ISE and four macroeconomic factors: exchange rate, interest rate, GDP, and current account balance. This method employed co-integration tests and the vector error correction model (VECM). Causality tests revealed unidirectional association between macroeconomic factors and the ISE index. According to this research, the ISE index is positively affected by fluctuations in foreign exchange rate, GDP, and current account balance. Contrary, interest rates are affected by changing in the stock market index.

Alrabadi (2012) examined the Amman Stock Exchange (ASE) as a case study to examine the behavior, weekday regularities, and macroeconomic causes of aggregate market liquidity in developing stock markets performance. This study examined every stock that was traded in ASE between 2002 and 2010. During the study period, aggregate market liquidity exhibited a shifting pattern. The mid of the week is when it gets the worst. Mondays and Sundays are when spread and depth are at their higher point. On Tuesday, stock price is at its lowest, and on Thursday, it is at its higher point. Vychytilova et al. (2019) examined the impact of macroeconomic variables on the volatility of stock prices in the auto industry. Using quarterly panel data from the 11 countries, the study examined 19 macroeconomic variables from January 2000 to December 2017. They employed a mixed-effect model based on a genetic algorithm and the AIC, comparing its effectiveness on econometric model. The findings indicated the positive relationships between stock movement and variables such as stock market development, unemployment and GDP. Olokoyo et al. (2020) examined the long-run equilibrium between macroeconomics determinants and stock market performance in Nigeria. The study employed the data from the Central Bank of Nigeria Statistical Bulletin and the World Development Indicators. It utilized the Vector Error Correction Model (VECM) analysis. The results directed that there is a co-integration and long-term association between GDP growth rate and stock market performance.

The study analyzed the relevant theories, developed the hypotheses based on previous research. It included the research design and statistical tools, data analysis employing various models. Based on the developed the research questions and objectives, the given below research hypotheses developed for empirical research on the relationship

of GDP and stock market performance. These hypotheses are associated with the research methodology and interpretation of the empirical data.

H0: There is no long-run relationship between GDP stock market performance.

H0: There is no causal relationship between GDP and stock market performance.

H0: There is no link between the current and the lagged values of the variables.

Research Methodology

This study employed a comprehensive econometric approach to assess the relationship between Gross Domestic Product (GDP) fluctuations and the Nepal Stock Market. The research methodology is structured in various stages to ensure the analysis and accurate results. The research utilized the secondary data from NEPSE, the Nepal Rastra Bank (NRB), the Securities Board of Nepal (SEBON), the World Bank, and listed company financial statements. It covered the period from June 2005 to November 2023. Around of 310 observations were collected by using a judgmental sampling method to ensure the relevance of the variables.

The study used the quantitative analysis methods. It employed specifically Excel and Eviews-10, for time series regression analyses. The econometric models used by including the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests for unit root testing, Johansen co-integration tests for long-term relationships, and Vector Auto-Regression (VAR) models for short-term dynamics. Unit root tests (ADF and PP) are employed to determine whether the GDP growth rate and the NEPSE index are stationary. The Johansen co-integration test is employed to examine the long-term equilibrium relationship between GDP and the NEPSE index. A VAR model is used for the short-run equilibrium. Schwarz Information Criterion (SIC) are used for the optimum lag length. Best on the research objectives, Granger Causality Testing is employed for causal relationship and the Variance Decomposition for the weighted of relationship between the variables. The lag length, the CUSUM test, and the LM test are used to ensure the serial correlation and the model's stability.

Results and Discussions

The study investigated the relationship between Gross Domestic Product (GDP) and the Nepalese Stock Market Index, exploring how changes in GDP influence stock prices. The analysis covered both long-run and short-run dynamics, employing various econometric techniques to uncover the nature of these interactions. The unit root tests, specifically the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, revealed that both GDP growth rate and the stock market index are integrated of order two, indicating that they require differencing twice to achieve stationarity. The next step is to conduct the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, which supports the use of Johansen co-integration for further analysis. To determine the optimal lag length for the Vector Auto-Regression (VAR) model, various criteria such as Schwarz Information Criterion (SIC) identifies a lag length of 2 as optimal. This lag length confirms the model's stability, which is further verified by the CUSUM test and the LM test for serial correlation, both of which indicate that the model is stable.

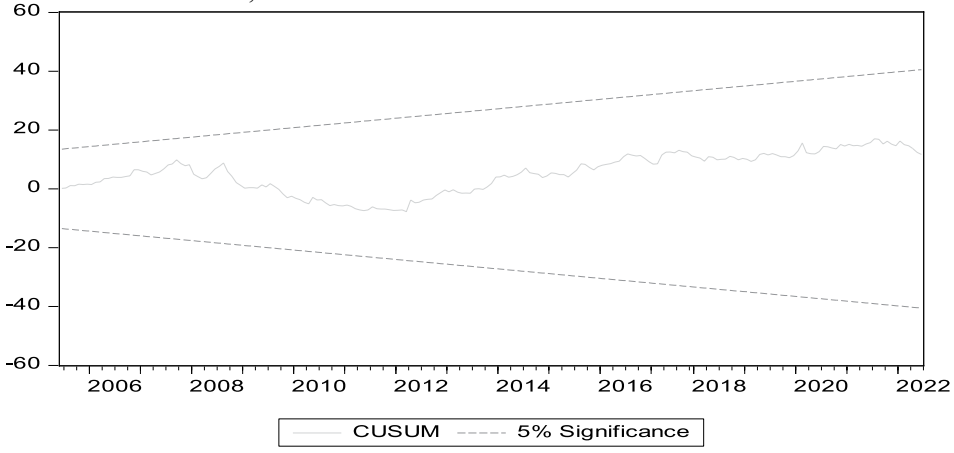

Figure: CUSUM Test

The above figure indicated that the model stabilizes within a significance level of five percent at lag order (1, 1). Before conducting the bound test, a residual diagnostics test is performed to examine the existing of serial correlation. The Breusch serial correlation LM test is employed to assess whether the residuals exhibit serial correlation.

Table

Breusch Serial Correlation LM Test of GDP

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.63	Prob. F(1,202)	0.20
Obs*R-squared	1.65	Prob. Chi-Square(1)	0.19

Source: Author Calculation by using Eviews-10

The above Breusch Serial Correlation LM Test, indicated that the p-value of the F-statistic. It observed R-square are both higher than the five percent significance level. The null hypothesis of the LM test is accepted, referring that there is no serial correlation in the residuals. Therefore, the researcher can proceed with further econometric statistical tests.

Johansen Co-Integration Test

The Johansen co-integration identifies the long-run relationship. The given table exhibited the Trace and Max-Eigen value tests value of GDP and stock market performance.

Table

Trace and Max-Eigen Value Tests of GDP to Index

Lags interval (in first differences): 1 to 2				
Hypothesized No. of CE(s)	Trace Values		Max-Eigen Values	
	None	At most 1	None	At most 1
Eigen value	0.025	0.008	0.025	0.008
Trace Statistic	6.329	1.550	4.779	1.550
0.05 Critical Value	15.49	3.841	14.26	3.841
Prob.**	0.656	0.213	0.769	0.213

Max and Trace test indicated no co-integration at the 0.05 level

Source: Author Calculation using Eviews-10

The above table exhibited the Johansen co-integration test that examined whether a long-term equilibrium relationship exists between GDP and the stock market performance. The maximum eigen and trace tests both fail to reject the null hypothesis of no co-integration at the 5% significance level. It suggested that there is no long-term co-integrated relationship between the GDP and stock market performance. This result implies that the variables do not have long-run relationship between GDP and stock market of Nepal.

Short-Run Analysis

The VAR model assessed the short-run dynamics between GDP and the stock market index. The results indicated significant effects of lagged values of both GDP and the index on the current values.

Table

VAR model of GDP and Index

Variable	LINDEX	LGDP
LINDEX(-1)	1.112	-0.001
	-0.07	-0.002
	[15.23]	[-0.89]

Variable	LINDEX	LGDP
LINDEX(-2)	-0.13	0.002
	-0.07	-0.002
	[-1.81]	[1.18]
LGDP(-1)	-2.86	1.91
	-1.26	-0.03
	[-2.31]	[66.95]
LGDP(-2)	2.87	-0.91
	-1.26	-0.03
	[2.27]	[-32.02]
C	0.102	0.0062
	-0.123	-0.038
	[0.81]	[2.181]

Source: Author Calculation using Eviews-10

The above table exhibited a one-unit increase in the lagged value of LINDEX is associated with a 1.112-unit increase in the current value of LINDEX, which is statistically significant. The effect of the lagged value of LINDEX two periods ago is negative but not statistically significant. A one-unit increase in the lagged value of GDP is connected with a significant decrease of 2.867 units in the current value of LINDEX. A one-unit increase in the lagged value of GDP two periods ago tends to a significant increase of 2.872 units in the current value of LINDEX. These equations demonstrated that the stock market index and GDP have dynamic interdependencies in the short-run, with GDP having both negative and positive effects on the stock market performance depending on the lag period.

Granger Causality Test

The VAR Granger Causality Test revealed a significant causal relationship of GDP with the stock market index. The results suggested that changes in GDP can influence stock market index values, but not vice versa. The test indicated that GDP does Granger-cause the stock market index at the 5% significance level. There is no significant causal relationship running from the stock market index to GDP.

Table

Pairwise Granger causality test of GDP and Index

Null Hypothesis:	Obs	F-Statistic	Prob.
LGDP does not Granger Cause LINDEX	191	3.13	0.05
LINDEX does not Granger Cause LGDP		1.56	0.21

Source: Author Calculation using Eviews-10

Variance Decomposition

The below table exhibited, in the short run, the stock market index's own lags account for nearly all of its variation, with GDP having minimal impact. Over a ten-month period, GDP's contribution to the variation in the stock market is negligible, with the index's own lag values being the predominant factor in its oscillations. In the long run also, the stock market's own lagged values continue to be the dominant factor influencing its fluctuations. The contribution of GDP to the stock market's long-term variation remains minor.

Table

Variance Decomposition of INDEX and GDP

Variance Decomposition of INDEX				Variance Decomposition of GDP		
Period	S.E.	LINDEX	LGDP	S.E.	LINDEX	LGDP
1	0.07	100	0	0.00	0.19	99.80

	Variance Decomposition of INDEX			Variance Decomposition of GDP		
Period	S.E.	LINDEX	LGDP	S.E.	LINDEX	LGDP
2	0.11	99.81	0.18	0.00	0.04	99.95
3	0.14	99.39	0.60	0.00	0.02	99.98
4	0.16	98.77	1.22	0.00	0.01	99.98
5	0.18	98.02	1.97	0.01	0.02	99.98
6	0.20	97.15	2.84	0.01	0.03	99.96
7	0.22	96.21	3.78	0.02	0.06	99.93
8	0.23	95.22	4.77	0.012	0.11	99.88
9	0.24	94.20	5.79	0.022	0.18	99.81
10	0.26	93.18	6.81	0.025	0.27	99.72

Source: Author Calculation using Eviews-10

In the long-run, the stock market's own lagged values continue to be the dominant influencing factor its fluctuations. The contribution of GDP to the stock market's long-term variation remains minor.

Conclusion

The analysis indicated that there is no evidence of a long-run co-integrated relationship between GDP and the Nepalese Stock Market Index, short-term dynamics revealed significant interactions. The stock market index and GDP have dynamic interdependencies in the short term, with GDP having both negative and positive effects on the stock market index depending on the lag period. Lagged values of index have a significant impact on the stock market index, with both positive and negative effects depending on the lag period. However, the stock market index did not significantly influence GDP in the short run. The Causality Test revealed a significant causal relationship from GDP to the stock market index. The results underscored a weak form of efficiency in the Nepalese stock market with the gross domestic product.

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