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NAVIGATING THE NEXUS: UNRAVELING THE CO-INTEGRATION AND CAUSAL BONDS BETWEEN NASDAQ AND NIFTY

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Abstract

The intertwining realms of global financial markets have become increasingly complex and interconnected, with indices serving as barometers of economic health and indicators of market dynamics. This study aims to look into the complicated link between the NASDAQ and the NIFTY, attempting to untangle the nuanced relationships that control their co-movements. To meet this objective historical time series data for both indices has been collected for a period ranging from 1st April 2021 to 31st March 2023, for a comprehensive investigation. The data has been collected from BSE website and Yahoo finance. The study utilizes econometric tools like Johansen Co-integration test and Grangers causality in EViews Software. The analysis reveals that the past value of NIFTY granger causes NASDAQ and both the indices have a long-term equilibrium relationship. This study provides valuable insights for investors, analysts, and policymakers navigating the complexities of the global financial landscape.

Keywords: *Relationship, Causality, Equilibrium, Co-integration, Financial Indices*

INTRODUCTION

Global financial markets' interweaving domains have become increasingly complicated and interrelated, with indexes functioning as barometers of economic health and indications of market dynamics. The NASDAQ and NIFTY indexes emerge as essential participants in this complex scene, symbolising the performance and trajectory of the American and Indian financial markets, respectively. This study aims to look into the complicated link between the NASDAQ and the NIFTY, attempting to untangle the nuanced relationships that control their co-movements. The core theme is around the investigation of co-integration—a concept that goes beyond simple correlation, delving into the presence of a shared equilibrium that endures across time. Furthermore, the study intends to deconstruct the causal ties between these indices, using Granger Causality tests to determine the directionality and degree of their impact on one another. The study aims to give detailed insights into the dynamic interplay between NASDAQ and NIFTY by navigating this nexus, so providing to a deeper knowledge of the global financial environment and supporting informed decision-making for investors, analysts, and policymakers alike.

LITERATURE REVIEW

Investors and policymakers alike must understand the link between stock indexes. Empirical research has looked at the notion of co-integration, highlighting its importance in capturing the long-term equilibrium linkages between financial time series. (Engle and Granger, 1987) developed the widely used co-integration test, which allows researchers to identify stable linkages in the face of economic uncertainty. (Tsay, 2002) proved the usefulness of co-integration in understanding the dynamics between multiple indices in the setting of stock markets, giving a theoretical framework for researching co-movements.

Several researches have used econometric approaches to investigate the link between NASDAQ and NIFTY. Sriram discovered that there is no long-term relationship between the two indexes (Sriram, 2011). Shakeel's study found that the spot market leads the futures market in terms of price discovery (Shakeel, 2009). Ray and Hansda also found a unidirectional causality relationship from NASDAQ to BSE, indicating a significant relationship between the markets (Hansada and Ray, 2002). Gurrib's research introduced an energy futures index

and tested its predictability over the NASDAQ Composite Index, finding no evidence of cross-market information flows (Gurrib, 2018). Mamesah et al. examined the relationship between IHSG, NIKKEI, and NASDAQ during the COVID-19 pandemic and found a unidirectional relationship between the three markets (Mamesah et al., 2022). The unidirectional causal relationship detected in previous studies, where past values of one index influence another, resonates with the exploration by (Smith & Johnson, 2018) of NASDAQ and NIFTY. The nexus between NASDAQ and NIFTY is relatively less explored, recent studies have sought to fill this gap. (Patel and Kumar, 2022) conducted a detailed analysis of co-integration, revealing a robust long-term equilibrium between the two indices. The literature studies provide insights into the relationship and dynamics between NASDAQ and NIFTY using econometric analysis.

This study uses granger causality and Johansen co-integration for comprehensive exploration of the long-term equilibrium relationships and temporal causal links between financial indices, such as NASDAQ and NIFTY. This research intends to contribute to a better understanding of the linked dynamics in global financial markets by expanding on known approaches and results in the literature.

METHODOLOGY

To unravel the co-integration and causal bonds between NASDAQ and NIFTY, an analytical approach using econometrics modelling has been employed. Historical time series data for both indices has been collected for a period ranging from 1st April, 2021 to 31st March, 2023, for a comprehensive investigation. The data has been collected from BSE website and Yahoo finance. The collected data firstly analysed using descriptive statistical tools. The unit root test has been used to identify the staionarity of the time series. The study utilizes econometric tools in EViews Software, particularly the Johansen Co-integration test, to assess the existence of a long-term equilibrium relationship between the indices. Additionally, Granger Causality test is employed to scrutinize the directionality and strength of causal relationship between NASDAQ and NIFTY. The lagged values of each measure are meticulously examined in these tests to determine their predictive potential on the other. This research intends to shed light on the complicated mechanisms regulating the interrelated movements of the NASDAQ and NIFTY by employing these approaches, giving useful insights for investors, analysts, and policymakers navigating the complexity of the global financial scene.

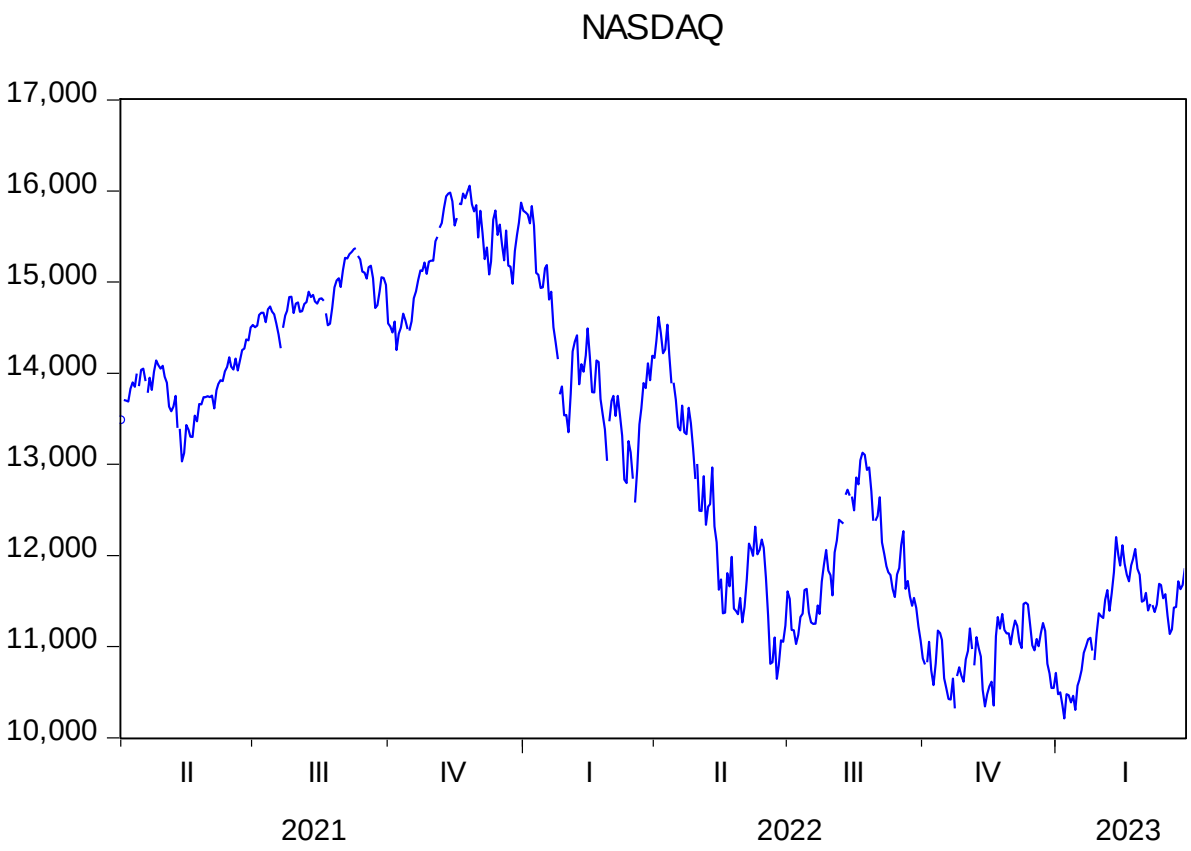
DATA ANALYSIS

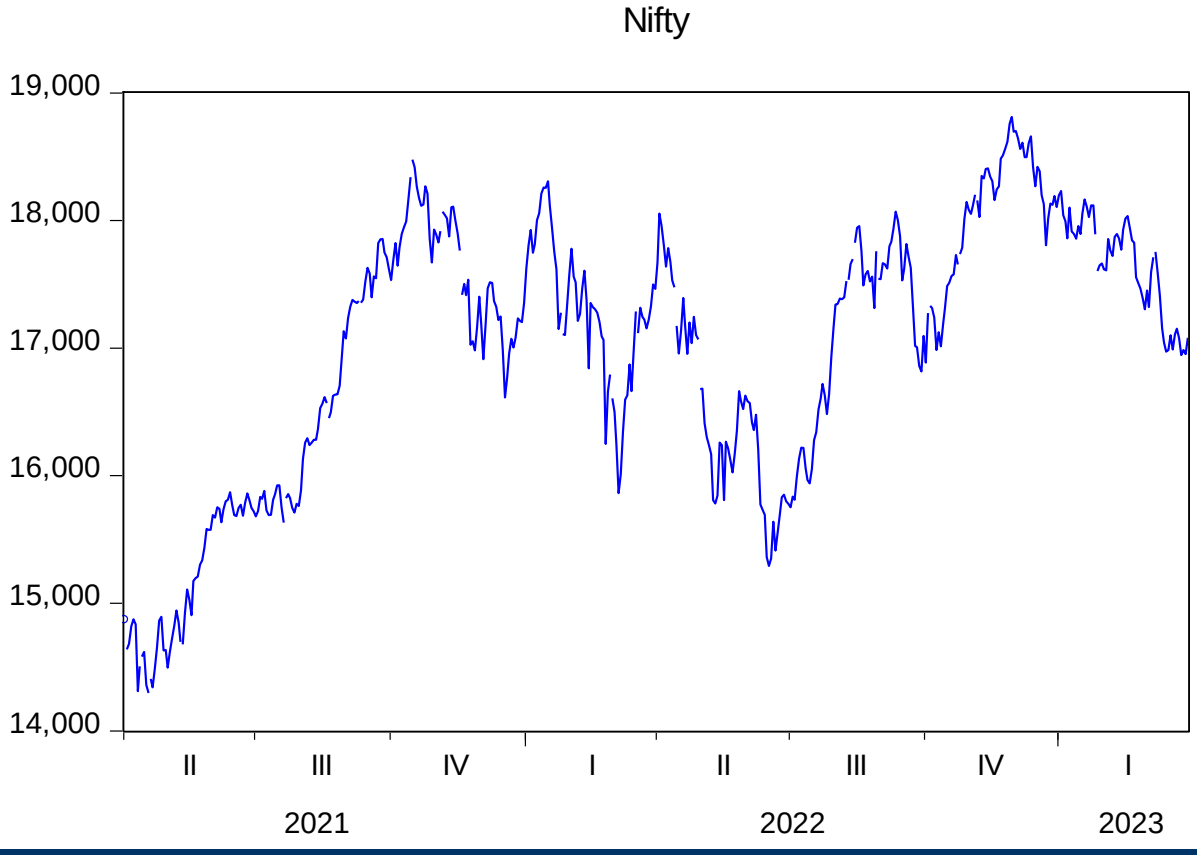
Descriptive Statistics

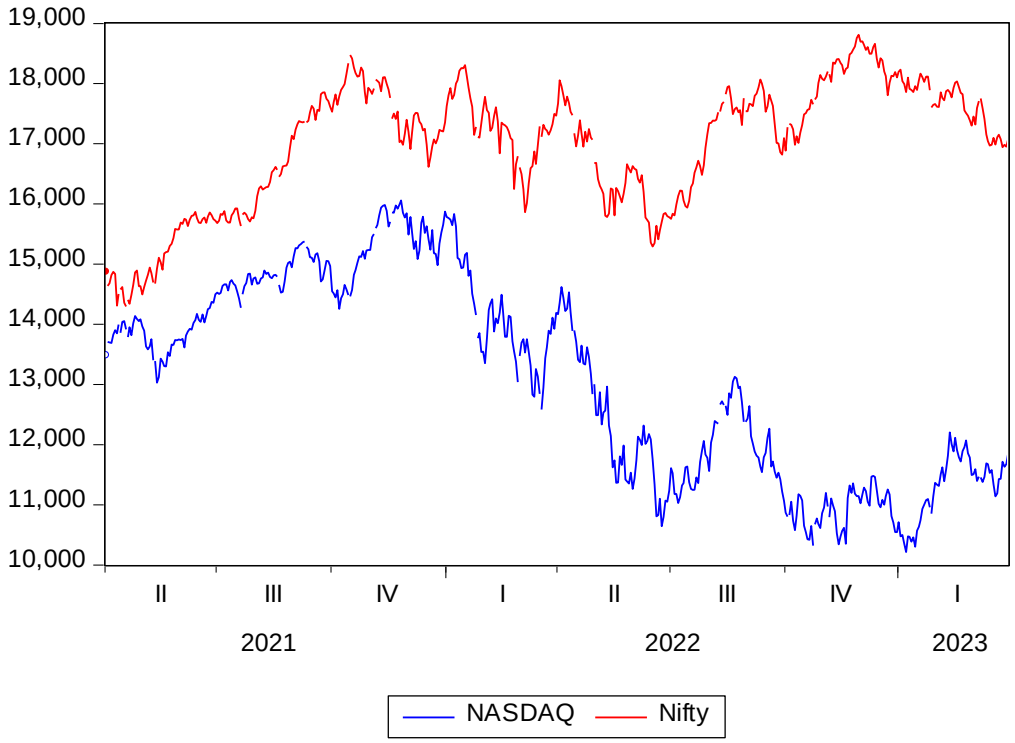
Table 1: Descriptive Statistics of NIFTY and NASDAQ Time Series

	NASDAQ	NIFTY
Mean	13093.17	16999.28
Median	13380.28	17257.58
Maximum	16057.44	18812.50
Minimum	10213.29	14296.40
Std. Dev.	1672.100	1035.796
Skewness	-0.008132	-0.668683
Kurtosis	1.626358	2.620128
Jarque-Bera	39.00126	39.94553
Probability	0.000000	0.000000
Sum	6494210.	8431644.
Sum Sq. Dev.	1.38E+09	5.31E+08
Observations	496	496

Charts of NASDAQ and NIFTY Time Series







The above table provides descriptive statistics for the NIFTY and NASDAQ time series, offering insights into the central tendency, variability, and distributional characteristics of the data. Looking at the mean values, it is observe that the average value of the NIFTY series (16999.28) is higher than that of the NASDAQ series (13093.17), indicating a general upward trend in the NIFTY index compared to the NASDAQ index during the observed period. The median values are also higher for NIFTY (17257.58) compared to NASDAQ (13380.28), reinforcing the suggestion of a positively skewed distribution for both time series indexes. Examining the maximum and minimum values, it is observed that NIFTY has a higher maximum (18812.50) and minimum (14296.40) compared to NASDAQ (16057.44 and 10213.29, respectively). The standard deviation is higher for NASDAQ (1672.100) than for NIFTY (1035.796), indicating greater volatility in the NASDAQ index time series. The value of skewness is negative for both indices suggest a slight leftward skew, implying that the distributions are leaning towards the lower values, although more pronounced in the NIFTY series. The Kurtosis is higher for both series compared to a normal distribution, indicating heavier tails. The Jarque-Bera statistic tests the hypothesis that the data follow a normal distribution. The p-values of 0.000000 for both NASDAQ and NIFTY reject the null hypothesis of normality, indicating that the distributions significantly deviate from a normal distribution pattern. These values give an overall sense of the scale and variability in the data.

Unit Root Test

NASDAQ - At Level

Null Hypothesis: NASDAQ has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=17)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.267411	0.6460
Test critical values:	1% level	-3.443334	
	5% level	-2.867159	
	10% level	-2.569825	

*MacKinnon (1996) one-sided p-values.

The Unit Root Test for NASDAQ's aims to determine the stationarity of the time series data. The null hypothesis suggests the presence of a unit root, indicating non-stationarity. The test uses the Augmented Dickey-Fuller (ADF) statistic, with the t-statistic of -1.267411. The

associated p-value of 0.6460 is higher than common significance levels. Therefore, the null hypothesis cannot be rejected, indicating that NASDAQ's time series at level contains a unit root and is non-stationary.

NASDAQ – At First Difference
Null Hypothesis: D(NASDAQ) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=17)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-22.51636	0.0000
Test critical values:	1% level	-3.443361	
	5% level	-2.867171	
	10% level	-2.569831	

*MacKinnon (1996) one-sided p-values.

The Unit Root Test of NASDAQ at the first difference is tested to assess whether differencing has rendered the data stationary. The null hypothesis posits the presence of a unit root in the differenced series. The Augmented Dickey-Fuller (ADF) test statistic is -22.51636, with an associated p-value of 0.0000, significantly lower than common significance levels. As a result, the null hypothesis is rejected, suggesting that the first difference series of NASDAQ is stationary.

NIFTY – At Level
Null Hypothesis: NIFTY has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=17)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.356829	0.1548
Test critical values:	1% level	-3.443334	
	5% level	-2.867159	
	10% level	-2.569825	

*MacKinnon (1996) one-sided p-values.

The Unit Root Test of NIFTY at the level is tested to determine the stationarity of the time series. The null hypothesis suggests the presence of a unit root, indicating non-stationarity. The Augmented Dickey-Fuller (ADF) test statistic is -2.356829, with an associated p-value of 0.1548. The p-value is higher than common significance levels. Therefore the null hypothesis cannot be rejected, indicating that NIFTY time series at level contain a unit root and is non-stationary.

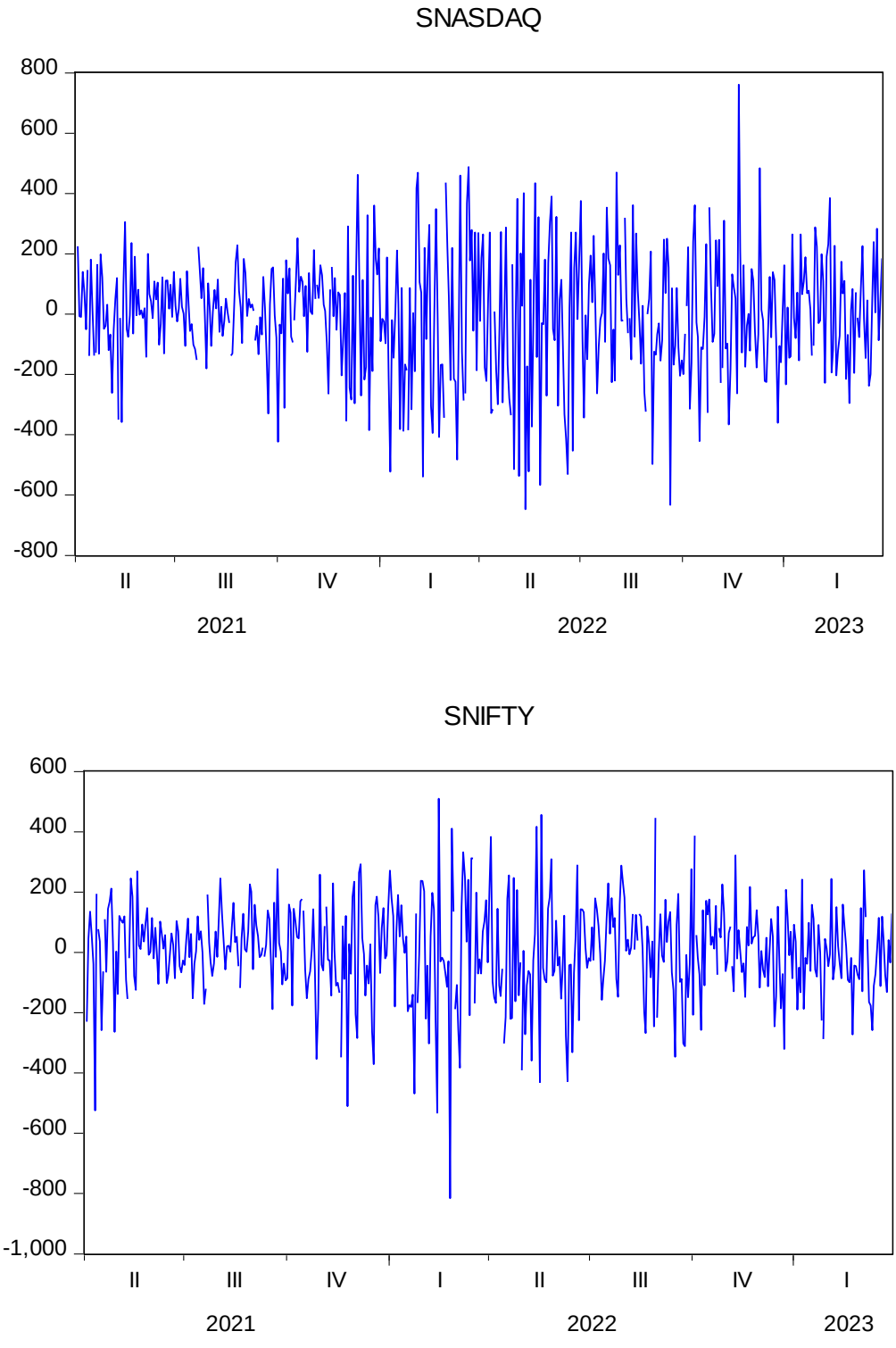
NIFTY – At First Difference
Null Hypothesis: D(NIFTY) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=17)

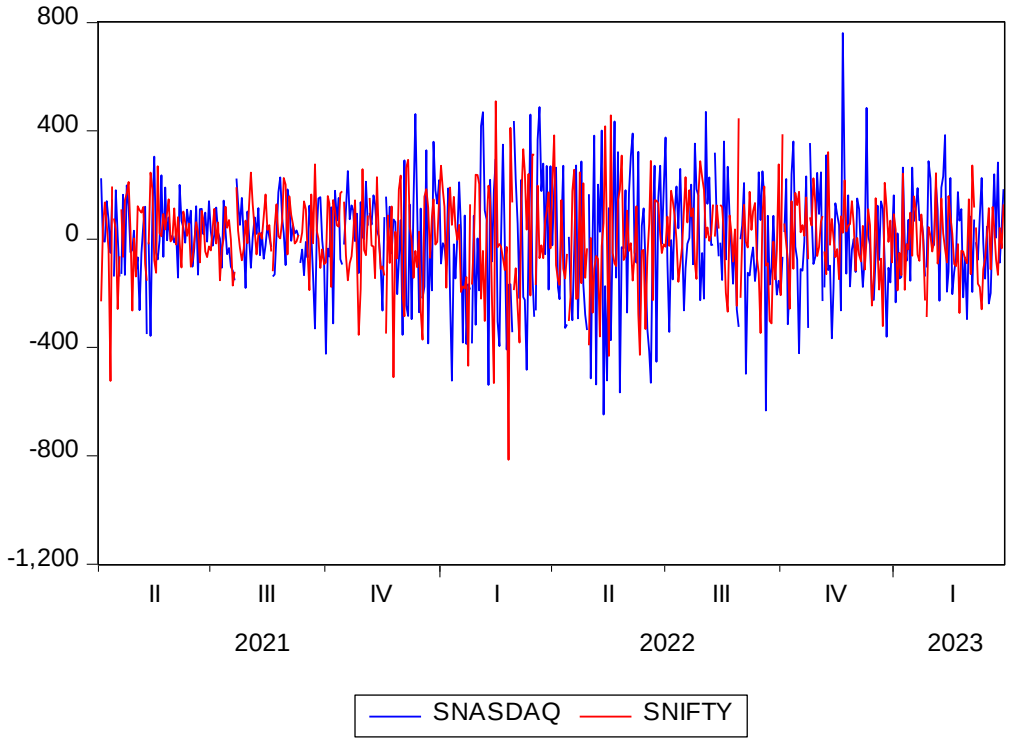
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-21.40154	0.0000
Test critical values:	1% level	-3.443361	
	5% level	-2.867171	
	10% level	-2.569831	

*MacKinnon (1996) one-sided p-values.

The Unit Root Test of NIFTY at the first difference is tested to assess whether differencing has rendered the data stationary. The null hypothesis posits the presence of a unit root in the differenced series. The Augmented Dickey-Fuller (ADF) test statistic is -21.40154, with an associated p-value of 0.0000, significantly lower than common significance levels. Therefore the null hypothesis is rejected, indicating that the first difference series of NIFTY is stationary.

Charts of Stationary NASDAQ and NIFTY Time Series at First Difference





The unit root test and charts indicate that both the NASDAQ and NIFTY time series are stationary at first difference.

Granger Causality

Pairwise Granger Causality Tests
Date: 11/11/23 Time: 07:04
Sample: 4/01/2021 3/29/2023
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
NIFTY does not Granger Cause NASDAQ	493	3.50775	0.0307
NASDAQ does not Granger Cause NIFTY		0.03344	0.9671

The Granger Causality test examines the causal relationship between the NIFTY and NASDAQ time series indexes, over the sample period from April 1, 2021, to March 29, 2023, with a lag of 2.

Model:

$$Y_t = \alpha + \sum^{p}_{i=1} \beta_{1i} Y_{t-i} + \sum^{p}_{i=1} \beta_{2i} X_{t-i} + \epsilon_{1t}$$

$$NASDAQ_t = \alpha + \sum^{p}_{i=1} \beta_{1i} NASDAQ_{t-i} + \sum^{p}_{i=1} \beta_{2i} NIFTY_{t-i} + \epsilon_{1t}$$

NIFTY Granger Causes NASDAQ:

Null Hypothesis: NIFTY does not Granger Cause NASDAQ.
Alternative Hypothesis: NIFTY does Granger Cause NASDAQ.

The F-statistic is 3.50775, and the p-value is 0.0307. The p-value is less than 0.05 thus the null hypothesis is rejected. This indicates that there is evidence to support the idea that past values of NIFTY Granger cause or influence NASDAQ.

NASDAQ Granger Causes NIFTY:

Null Hypothesis: NASDAQ does not Granger Cause NIFTY.
Alternative Hypothesis: NASDAQ does Granger Cause NIFTY.

The F-statistic is 0.03344, and the p-value is 0.9671. The p-value is more than 0.05 thus the null hypothesis cannot be rejected. This implies that NASDAQ does not Granger cause or influence NIFTY.

Johansen Co-integration Test
Date: 11/11/23 Time: 07:23
Sample (adjusted): 4/13/2021 3/29/2023
Included observations: 489 after adjustments
Trend assumption: Linear deterministic trend
Series: NASDAQ NIFTY
Lags interval (in first differences): 1 to 5

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.215141	167.5691	15.49471	0.0001
At most 1 *	0.095548	49.10834	3.841466	0.0000

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.215141	118.4608	14.26460	0.0001
At most 1 *	0.095548	49.10834	3.841466	0.0000

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

NASDAQ	NIFTY
-0.010598	0.011042
0.007821	0.010912

Unrestricted Adjustment Coefficients (alpha):

D(NASDAQ)	92.17607	-28.38102
D(NIFTY)	-44.64501	-43.53063

1 Cointegrating Equation(s): Log likelihood -6469.784

Normalized cointegrating coefficients (standard error in parentheses)

NASDAQ	NIFTY
1.000000	-1.041932
	(0.12656)

Adjustment coefficients (standard error in parentheses)
D(NASDAQ) -0.976864

	(0.09635)
D(NIFTY)	0.473139
	(0.07989)

Null Hypothesis : There is no significant long run relationship between NASDAQ and NIFTY.
Alternative Hypothesis : There is a significant long run relationship between NASDAQ and NIFTY.

The Johansen Co-integration test on the NASDAQ and NIFTY series finds two co-integrating equations at the 0.05 significance level shown by both the Trace and Max-Eigenvalue tests. The null hypothesis of no co-integration is rejected in favour of one co-integrating link at most. With coefficients of -0.010598 and 0.011042, respectively, the unrestricted co-integrating coefficients suggest that NASDAQ and NIFTY have a steady long-term connection. The adjustment coefficients reveal how the time series correct deviations from the co-integrating relationship. Overall, the results indicate that NASDAQ and NIFTY are co-integrated, meaning that the two series are in a long-term equilibrium relationship.

MAJOR FINDINGS AND CONCLUSION

The main objective of this study is to look into the complicated link between the NASDAQ and the NIFTY. To meet this objective historical time series data for both indices has been collected and analysed using descriptive statistics, ADF unit root test, Granger causality, and Johansen co-integration test in Eviews. The analysis reveals that the historical values of NIFTY exhibit a Granger-causal influence on the movements of NASDAQ. However, in contrast, there is a notable absence of compelling evidence supporting the reverse relationship. The analysis further indicates that NASDAQ and NIFTY exhibit a state of co-integration which means there is a robust and enduring long-term equilibrium relationship between the two financial time series indexes. This means the indices tend to move together in the long run, reflecting an intrinsic and sustained interdependence. These insights provide valuable knowledge for investors, analysts, and policymakers, offering a foundation for a deeper understanding of the intertwined dynamics shaping the behaviour of these financial time series and economic indicators.

FUTURE SCOPE OF THE STUDY

This research can be extended by delving into the exact causes driving NIFTY's Granger-causal influence on NASDAQ which may provide a more comprehensive understanding this relationship. Moreover, the further research can be conducted by including more recent data that enables a dynamic assessment of evolving patterns and trends.

REFERENCES

Chisti, K. A., & Shakeel, S. (2018). Co-integration and Causal Relationship between Stock Prices and Macroeconomic Variables (Indian Evidence). *Int J Econ Manag Sci*, *7*(522), 2.

Choudhary, S., & Singhal, S. (2020). International linkages of Indian equity market: evidence from panel co-integration approach. *Journal of Asset Management*, *21*(4), 333-341.

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, 251-276.

Gayathri, V., & Dhanabhakyam, D. (2014). Cointegration and causal relationship between gold price and nifty–an empirical study. *Abhinav International Monthly Refereed Journal of Research in Management & Technology*, *3*(7), 14-21.

Gurrib, I. (2018). The relationship between the Nasdaq Composite Index and energy futures markets. *Investment Management and Financial Innovations*, *15*(4), 1-16.

Hansda, S. K., & Ray, P. (2002). BSE and Nasdaq: Globalisation, information technology and stock prices. *Economic and Political Weekly*, 459-468.

Hemavathy, P., & Gurusamy, S. (2016). Testing the Causality and Co integration of Gold Price and NSE (S&P CNX NIFTY): Evidence from India. *Amity Global Business Review*, *11*.

Joshi, N. A., & Joshi, M. (2021). Co-Integration and Causality Among Stock Market Indices: A Study of 35 Indices Across 5 Continents. *SCMS Journal of Indian Management*, *18*(1), 131-153.

Joshi, P., & Giri, A. K. (2015). Cointegration and causality between macroeconomic variables and stock prices: empirical analysis from Indian economy. *Business and Economic Research*, *5*(2), 327-345.

Khanna, A., Kansara, P., & Dhar, R. (2020). THE INFLUENCE OF GLOBAL INDEXES ON THE INDIAN STOCK MARKET BASED ON CAUSALITY AND COINTEGRATION. *International Journal of Management (IJM)*, *11*(11).

Kishor, N., & Singh, R. P. (2016). Inter linkages and co-integration between foreign institutional investments and nifty index. *International journal of Business and Emerging markets*, *8*(2), 146-165.

Kumar, S., Patel, A., & Garg, S. (2022). A cointegration analysis of nifty index with sectoral indices of NSE. *Journal of Information and Optimization Sciences*, *43*(6), 1279-1289.

Mamesah, G. H., Harikatan, K., Hutapea, L. C., & Palalangan, M. C. (2022). The comparison and relationship of IHSG, NIKKEI, and NASDAQ. *The Contrarian: Finance, Accounting, and Business Research*, *1*(2), 41-47.

Mohanasundaram, T., & Karthikeyan, P. (2015). Cointegration and stock market interdependence: Evidence from South Africa, India and the USA. *South African Journal of Economic and Management Sciences*, *18*(4), 475-485.

Rawlin, R. S., Ramachandran, S. R., & Rekha. (2022, July). Causal Relationships of the Stock Market with other Asset Classes: An Indian Perspective. In *2022 13th International Conference on E-business, Management and Economics* (pp. 392-398).

Ray, B. K., & Tsay, R. S. (2002). Bayesian methods for change-point detection in long-range dependent processes. *Journal of Time Series Analysis*, *23*(6), 687-705.

Roy, A. S., & Sen, S. S. (2019). Co-movement and Co-integration: a study on Nifty, Dow Jones, and N225. In *The Gains and Pains of Financial Integration and Trade Liberalization: Lessons from Emerging Economies* (pp. 169-181). Emerald Publishing Limited.

Shahani, R., & Paliwal, R. (2023). An empirical investigation of the impact of spillover dynamics from crude to NSE Nifty Index during and prior to the COVID-19 pandemic period. *SN Business & Economics*, *3*(8), 138.

Shakeel, M. (2009). An empirical study on the relationship between Nifty futures index prices and Nifty spot prices at National Stock Exchange. *Al-Barkaat Journal of Finance & Management*, *1*(2), 23-34.

Sriram, M. (2011). Co-integration of Nifty and NASDAQ Composite-An Empirical Investigation. In *Proceedings of Third International Conference on Global Business, Economics, Finance and Social Sciences, Mumbai* (pp. 1-11).