Examining the Interconnectedness of Stock Indices and their Impact on Indian Stock Market

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Abstract

Indian stock market is one of the outperforming market globally as it holds 5th position globally in terms of market capitalization. Its steady progress has gained investors' confidence globally. At this juncture it is quite imperative to examine the interconnectedness of stock indices and their impact on Indian stock market during Russia Ukraine war. To examine the same indices of the five largest economies in the world based on their GDP namely Dow Jones Industrial Average (DJIA), Shanghai Composite Index (SSEC), Nikkei Index, DAX index, FTSE index and NIFTY index representing the stock markets of USA, China, Japan, Germany, UK and India were taken for the study. The study results reveal that although these markets exhibit some degree of interrelationship, the impact is relatively weak. For the most part, the variance in returns of the sampled indices is driven primarily by their own shocks rather than by shocks originating from other markets.

Keywords:

Interconnectedness, Stock market indices, Granger causality test, Correlation, Diebold-Yilmaz test

Introduction

Indian stock market is one of the outperforming market globally as it has surged to 5th position in the market capitalization ranking globally. It has overtaken the countries like Canada, U.K., France and Germany. India's capital market has moved towards a steady progress, it had a market share of 1.6% in June 2013, in past 15 years its average market capitalization is 2.8% and currently it stands at 4% (

Angelone n.d.). This raising scenario of market capitalization reflects the investors faith and the strong resilience of Indian stock market across global indices.

Though the Indian stock market is a growing market in terms of market capitalization it is bound to volatility due to many global factors and internal factors. The volatility is induced by global factors which ultimately affects global indices and the Indian stock market (Goel, 2023). Moreover, understanding the stock market movement for profitable investment is a billion-dollar question and attracts multiple guesses and analysis to give answer for the same. It is always believed that Indian stock market movement is influenced by global stock market movement particularly US market. Bull or bearish movement in those markets create a change in the Indian market.

After Covid-19 pandemic, the global stock market landscape has been significantly reshaped due to intensified connectivity among the global markets. Thus in this article an attempt has been made to examine the interconnectedness of stock indices and their impact on the Indian stock market during Russia and Ukraine war. To study the same, the stock market indices of the 5 largest economies of the world based on their GDP were considered. The study results will enable the investors to take the informed decision with regard to their investment in various markets and also be helpful in devising the diversification strategy.

Review of Literature

Recent studies have highlighted the evolving dynamics of global and regional stock market integration, particularly in relation to the Indian stock market. Varma et al. (2021) revealed that the COVID-19 pandemic significantly impacted global economic growth, with GDP and S&P 500 returns declining sharply. Tripathi and Sethi (2012) examined the short- and long-run relationships between the Indian stock market and advanced emerging markets such as South Africa, Brazil, Poland, Taiwan, Mexico, and Hungary, finding unidirectional impacts and notable linkages. Singh and Kishor (2017) found that while the Indian market leads Hong Kong and Japanese markets, it is influenced by the USA and UK, with no long-run relationship observed among other indices and Nifty.

Muthukumaran et al. (2011) analyzed the effects of the global financial crisis, concluding that it adversely affected the Indian stock market. Earlier, Tripathi and Sethi (2010) studied integration with the US, UK, Japan, and China, finding strong ties only with the US. Rajiv Menon et al. (2009) also explored Indian market integration with major exchanges like the US, China, and Hong Kong, identifying partial relationships. Raj and Dhal (2008) emphasized that regional and global markets are interlinked and that the Indian stock market tends to generate higher returns than its regional counterparts.

Mukherjee and Mishra (2005) found long-run integration between India and several Asian markets such as Thailand, Greece, Philippines, Korea, Indonesia, and Malaysia. Their broader study of 23 countries over 16 years (1990–2005) revealed increasing long-run integration, especially among countries within the same region, with developed economies like the USA and several European nations leading the Indian market. Additionally, Lamba's study (2005) noted that among South Asian markets—India, Sri Lanka, and Pakistan—India is influenced by the US, UK, and Japan, whereas Sri Lanka and Pakistan remain relatively isolated.

Though there are many studies related to interconnectedness during various events, studies related to interconnectedness during the Russian Ukraine war is very less. Thus, in this article an attempt has been made to examine the interconnectedness of stock indices and their Impact on Indian stock market during the Russia Ukraine war.

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Objectives of the study

To examine the lead lag relationship between the variables.

To understand the impact of variance in one market on the other market.

Research Methodology

A descriptive research design was adopted for the study. To examine the impact of global stock market movements on the Indian stock market, indices of the five largest economies in the world, based on GDP, were considered. The selected indices were the Dow Jones Industrial Average (DJIA), Shanghai Composite Index (SSEC), Nikkei Index, DAX Index, FTSE Index, and Nifty Index, representing the stock markets of the USA, China, Japan, Germany, the UK, and India, respectively. Daily closing prices of all selected indices were obtained from a secondary source (www.investing.com) for the period from August 2020 to August 2025. The data were analyzed using relevant econometric models in EViews software. To understand the basic characteristics of the variables, descriptive statistics and correlation analysis were performed. The Granger Causality test was conducted to explore lead–lag relationships. Finally, the Diebold–Yilmaz Spillover Index (DYIndex) approach was applied to measure the connectedness among the variables.

Results and Discussions

At the preliminary stage the data was thoroughly analyzed to ensure there are no missing values and unit root test was performed to test the stationarity of the variable. Daily returns for the variables were obtained using the following formula.

$R = \ln (P_t/P_{(t-1)})$

were,

ln - Log

P_t = Closing price on day t,

P_{t-1} = Closing price on day t-1.

From the detailed statistics presented in Table 1, it can be inferred that the mean values of all variables are close to zero, indicating that the average daily returns are approximately zero. The standard deviation of the NIKI is 0.013, suggesting that it is more volatile than the other indices. The skewness values show that all variables, except the DJIA, have negative skewness, indicating long left tails and a higher probability of negative returns for investors. In contrast, the DJIA has positive skewness, implying a long right tail and a higher probability of positive returns. Similarly, the kurtosis coefficients for all variables are positive and greater than 3, indicating leptokurtic distributions, which are more peaked than the normal distribution. This suggests that the data are not symmetrically distributed. Furthermore, the p-values from the Jarque–Bera test are all below 0.05, confirming that the variables are not normally distributed — a result that is common for financial time series data.

Table 01: Descriptive Statistics

	DAX	***DJIA***	***FTSE***	***NIKI***	***SSEC***	***NIFTY***
Mean	***0.001***	***0.000***	***0.000***	***0.001***	***0.000***	***0.001***

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Median	***0.001***	***0.001***	***0.001***	***0.001***	***0.000***	***0.001***
Maximum	***0.076***	***0.076***	***0.046***	***0.097***	***0.078***	***0.046***
Minimum	***-0.051***	***-0.056***	***-0.051***	***-0.132***	***-0.076***	***-0.061***
Std. Dev.	***0.011***	***0.009***	***0.008***	***0.013***	***0.010***	***0.009***
Skewness	***-0.132***	***0.003***	***-0.502***	***-0.649***	***-0.328***	***-0.489***
Kurtosis	***7.235***	***8.314***	***7.983***	***16.701***	***11.960***	***7.000***
Jarque-Bera	***909***	***1426***	***1305***	***9565***	***4076***	***856***
Probability	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***
Observations	***1212***	***1212***	***1212***	***1212***	***1212***	***1212***

Source: Compiled from descriptive statistics output calculated by using Eviews

The results of the correlation analysis presented in Table 2 indicate that the Nifty has a negative correlation with the FTSE and a positive correlation with the DAX, DJIA, Nikkei (NIKI), and SSEC. Both the DJIA and Nikkei show a negative correlation with the DAX, and a negative correlation also exists between the DJIA and the Nikkei. The FTSE has a negative correlation with the Nikkei, SSEC, and Nifty. The Nikkei exhibits a negative relationship with all variables except the Nifty, while the SSEC shows a negative relationship with both the FTSE and the Nikkei. Although the correlation analysis reveals the presence of both positive and negative relationships among the indices, the strength of these correlations is generally weak, indicating the absence of strong linear relationships between the variables.

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Table 02: Correlation Analysis

	DAX	*DJIA*	*FTSE*	*NIKI*	*SSEC*	*NIFTY*
DAX	***1***					
DJIA	***-0.0232***	***1***				
FTSE	***0.0336***	***0.0842***	***1***			
NIKI	***-0.0241***	***-0.0291***	***-0.0234***	***1***		
SSEC	***0.0071***	***0.0312***	***-0.0017***	***-0.0182***	***1***	
NIFTY	***0.0259***	***0.0091***	***-0.0325***	***0.0031***	***0.0333***	***1***

Source: Compiled from correlation analysis output calculated by using Eviews

The Granger Causality results presented in Table 3 explain how the lagged returns of global markets impact returns in the Indian market. The results indicate that the lagged returns of the DJIA and FTSE cause movements in the Nifty. There exists a unidirectional causality from the DJIA to the Nifty and from the FTSE to the Nifty. Additionally, the lagged returns of the Nifty cause movements in the Nikkei (NIKI), indicating a unidirectional causality running from the Nifty to the Nikkei.

Table 03: Lagged returns of the global markets and its impact on the Indian market

Null Hypothesis:	*Lag*	*Obs*	*F-Statistic*	*Prob.*
DAX does not Granger Cause NIFTY	***1***	***1211***	***1.4744***	***0.2249***
NIFTY does not Granger Cause DAX			***0.5735***	***0.4490***
DJIA does not Granger Cause NIFTY	***1***	***1211***	***5.9461***	***0.0149***
NIFTY does not Granger Cause DJIA			***0.1189***	***0.7303***
FTSE does not Granger Cause NIFTY	***1***	***1211***	***5.8754***	***0.0155***
NIFTY does not Granger Cause FTSE			***2.1465***	***0.1432***
NIKI does not Granger Cause NIFTY	***3***	***1209***	***0.2756***	***0.8431***
NIFTY does not Granger Cause NIKI			***3.3472***	***0.0185***
SSEC does not Granger Cause NIFTY	***1***	***1211***	***0.0077***	***0.9301***
NIFTY does not Granger Cause SSEC			***1.7198***	***0.1900***

Source: Compiled from Granger Causality output calculated by using Eviews

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The Granger Causality results presented in Table 4 explain how the lagged returns of global markets influence the returns of other markets. The results indicate the presence of unidirectional causality from the DAX to the DJIA, from the FTSE to the DJIA, from the DAX to the SSEC, and from the FTSE to the SSEC. A bidirectional causality is observed between the DAX and the FTSE. Overall, the returns of the DJIA are influenced by both the DAX and the FTSE, and similarly, the SSEC is affected by the DAX and the FTSE.

Table 04: Lagged returns of the global markets and its impact on the other markets

Null Hypothesis:	Lag	Obs	F-Statistic	Prob.
DJIA does not Granger Cause DAX	1	1211	0.00115	0.97300
DAX does not Granger Cause DJIA			5.71123	0.01700
FTSE does not Granger Cause DAX	1	1211	5.13278	0.02370
DAX does not Granger Cause FTSE			39.27690	0.00000
NIKI does not Granger Cause DAX	1	1211	0.08813	0.76660
DAX does not Granger Cause NIKI			1.53735	0.21530
SSEC does not Granger Cause DAX	1	1211	0.01322	0.90850
DAX does not Granger Cause SSEC			4.41804	0.03580
FTSE does not Granger Cause DJIA	1	1211	5.30719	0.02140
DJIA does not Granger Cause FTSE			0.00931	0.92310
NIKI does not Granger Cause DJIA	1	1211	0.69983	0.40300
DJIA does not Granger Cause NIKI			0.20838	0.64810
SSEC does not Granger Cause DJIA	1	1211	0.63906	0.42420
DJIA does not Granger Cause SSEC			1.17227	0.27920
NIKI does not Granger Cause FTSE	1	1211	0.17325	0.67730
FTSE does not Granger Cause NIKI			0.30413	0.58140
SSEC does not Granger Cause FTSE	1	1211	1.73276	0.18830
FTSE does not Granger Cause SSEC			8.14676	0.00440
SSEC does not Granger Cause NIKI	1	1211	0.05708	0.81120
NIKI does not Granger Cause SSEC			0.03661	0.84830

Source: Compiled from Granger Causality output calculated by using Eviews

The results of the Diebold–Yilmaz test explain the spillover effect of variance in returns from one market to another. Based on the findings, 98.6% of the variance in Nifty returns is attributed to its own shocks, while 0.5%, 0.2%, 0.6%, and 0.1% are due to the variance in the returns of the DJIA, DAX, FTSE, and SSEC, respectively. Overall, 1.4% of the variance in Nifty returns is influenced by other markets.

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Similarly, 98.2% of the variance in the DJIA is due to its own shocks, with the remaining 1.8% explained by other markets (excluding India). For the DAX, 99.2% of its return variance is explained by its own shocks, while 0.8% comes from other markets. In the case of the FTSE, 95.6% of its return variance is due to its own shocks, and 4.4% is explained by other markets. For the Nikkei (NIKI), 99% of its variance is due to its own shocks, with the remaining 1% explained by other markets (excluding the SSEC). Finally, 98.5% of the variance in the SSEC is due to its own shocks, while 1.5% comes from other markets (excluding the NIKI). Among the study variables, the FTSE is the most influenced by global markets, while the DAX is the least influenced. Conversely, the variance in DAX returns has the strongest impact on other markets, whereas the Nikkei and the SSEC have the weakest impact.

Table 05: Spillover (Connectedness)

	NIFTY	***DJIA***	***DAX***	***FTSE***	***NIKI***	***SSEC***	***From Others***
NIFTY	***98.60***	***0.50***	***0.20***	***0.60***	***-***	***0.10***	***1.40***
DJIA	***-***	***98.20***	***0.50***	***1.00***	***0.20***	***0.10***	***1.80***
DAX	***0.10***	***0.10***	***99.20***	***0.60***	***-***	***-***	***0.80***
FTSE	***0.30***	***0.50***	***3.30***	***95.60***	***0.10***	***0.20***	***4.40***
NIKI	***0.50***	***0.10***	***0.20***	***0.10***	***99.00***	***-***	***1.00***
SSEC	***0.20***	***0.10***	***0.40***	***0.70***	***-***	***98.50***	***1.50***
To others	***1.20***	***1.40***	***4.60***	***3.00***	***0.40***	***0.40***	***10.90***
Including own	***99.80***	***99.50***	***103.80***	***98.60***	***99.40***	***98.90***	***0.02***

Source: Compiled from Diebold-Yilmaz test output calculated by using Eviews

In conclusion, although these markets exhibit some degree of interrelationship, the impact is relatively weak. For the most part, the variance in returns of the sampled indices is driven primarily by their own shocks rather than by shocks originating from other markets.

Conclusion

In the era of globalization, the stock markets are highly interconnected, the happening of any event and its effect on any global market will impact the other markets too. For eg. few events such as terrorist attack on twin tower, global financial crisis, and COVID- 19 pandemic has affected the markets globally though the event may have pertained or not pertained to the respective market. This reveals the market efficiency and alters the investors actions towards investment strategies.

The descriptive analysis of the present study reveals that the average daily return of all the indices are almost zero and the market risk is high in case of NIKI index (standard deviation =0.013), US markets has produced positive returns when compared to other markets taken for the study. The correlation analysis results reveal that the Nifty has a negative correlation with the FTSE and a positive correlation with the DAX, DJIA, Nikkei (NIKI), and SSEC.

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The analysis on lead lag relationship between Indian market and other global markets reveals that the lagged returns of the DJIA and FTSE cause movements in the Nifty. The lead lag relationship between global markets reveal that DJIA are influenced by both the DAX and the FTSE, and similarly, the SSEC is affected by the DAX and the FTSE.

The analysis on the impact of variance in one market on the other market using Diebold-Yilmaz test reveals that 98.6% if variance in Nifty returns is due to its own shock, while the rest is contributed by DJIA (0.5%), DAX(0.2%), FTSE(0.6%) and SSEC(0.1%). Similarly with regard to other markets taken for the study the DJIA reacts for 98.2%, DAX for 99.2%, FTSE for 95.6%, NIKI for 99% and SSEC for 98.5% of its own variances.

Thus to conclude although these markets exhibit some degree of interrelationship, the impact is relatively weak. For the most part, the variance in returns of the sampled indices is driven primarily by their own shocks rather than by shocks originating from other markets.

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