Co-integration of National Stock Exchange India with Global Stock Markets: An Empirical Analysis

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Abstract: Stock market investments strategies are always complex and extremely tough to understand as the quantum of data is very high. In the recent years so many methods have been used to evaluate and understand various phenomenon's of the market but the machine learning techniques have been mostly used for understanding the dynamics of market and forecasting the market prices. The goal of this paper is to examine how the Indian stock market (NSE) interacts with other global stock markets, including those of industrialized nations (the USAand Japan) and emerging nations (China, Indonesia) From January 2000 through June 2020, the stock markets of various economies. By using the Granger Causality Test, Johansen Cointegration Test, and Vector Error Correction Model (VECM), the degree of cointegration is assessed. The study's empirical findings demonstrate that there is cointegration between the Indian and US stock markets. According to the study's conclusions, investors may create diverse portfolio strategies to reduce risk. The findings demonstrated that by making investments in developing economies like Brazil and Indonesia, Indian investors might minimize the risk to their portfolios.The literature review was confined to the Scopus database only and for a limited time frame that leads to some of the avenues for future research.

Keywords: Cointegration, Vector Error Correction Model (VECM), Developed Economies, Developing Economies, Globalization, Stock Market, India.

1.Introduction

International financial markets and economies have become more integrated as a result of globalization, and the free. The flow of money and international trade.. Economic investment means the investment in the form of purchase of new machines, increase in stocks, amount spent on plant, inventory, and others. Business investment means the amount which is used to start a new business or the amount which is used in the business. Financial investment means the investment in risk-free or risky assets in order to earn some profit in the future. The profit may be in the form of rent, interest, premiums, dividends, and others. Investor: An investor is an individual who deals with capital to the invest in the various financial models whereas the return they will get specific investment.This has improved how closely global stock price indices move together. The financial markets of other economies are impacted

by the transmission of information about economic fundamentals from one economy to the market (Wong et al., 2004; Sharma, 2011; Chand &Thenmozhi, 2013; Bhatia & Binny, 2014; Michail & Melas, 2019).Fundamentally, cointegrated financial markets with long-term ties and comparable trends are more likely to provide similar returns, which limits the advantages of global diversity and the ability of investors to manage their risk. However, very few other studies provide a case against the fusion of financial markets (Young, 1993; Mervyn et al., 1994).Financial time series data set like stock market return series generally demonstrate alleged volatility clustering. Volatility of a series on any day is function of previous day volatility. It means to be reminisced here that the propensity of the volatile behaviour of the financial markets to appear in bands is termed as volatility clustering and variance as a measure of risk has been modelled by the investment community extensively for the last two decades. To capture this volatile behavior, the technical method, autoregressive conditional heteroskedasticity (ARCH), which deployed past disturbances to predict the variance was proposed by Engle (1982).The current study aims to investigate the cointegration of the Indian stock market with the stock markets of three developed (the USA and Japan) and three emerging (Brazil and China,) economies from January 2000 to June 2020. The degree of co-integration across international stock markets is assessed using a cointegration methodology that makes use of the Vector Error Correction Model (VECM), the Johansen Cointegration Test, and the Granger Causality Test.The essay is set up like follows: The literature on the cointegration of stock markets is discussed in Section 2. The data utilised and the techniques used in the study are described in Section 3. The study's Section 4 also includes an analysis and presentation of the empirical findings. The study is concluded in Section 5 with a summary of its consequences.

2. Review of Literature

As we know that literature is considered as he back-bone in every research work in which different models and mediums are used. The reviewed literature in this paper has focused on understanding the relationship between the Indian stock market (NSE) India and other global financial markets.

Only a few stock markets showed indications of cointegration with others, according to the research. In a 15-year study, Malkamaki (1992) looked at the stock markets of Finland, Sweden, and their major trading partners. According to the findings, the German and British markets outperformed the Scandinavian ones. While using a various phenomenal concepts the study of the grounded theory approach in which data about various prediction model was used to understand (Glaser and Strauss,2006).The data trust commonly Commission (Ridder and Simon,2016) was written for a big Data and Society Special kind of a fraction about critical data Studies (CDS).The data that is draged from various Potals about analysing the critical condition of a stock and its future in the tune of common stock investor"(Porter,1995).According to Kenen (1976), financial integration is the level of linkage between financial markets. Economic academics have been studying the cointegration of stock markets globally for the past 20 years; some of the more significant ones are described here.A few empirical studies have found substantial correlations between the stock prices of developed and emerging economies (Meric & Meric, 1989; Ben Zion et al., 1996; Husain &Saidi, 2000; Chen et al., 2002; Wong et al., 2004; Floros, 2005; Aktar, 2009; Srikant & Aparna, 2012). While a select number (Joshi et al., 2021; Wang & Moore, 2008; Wang & Tonks, 1989) concentrated on the connections between developed stock markets.

Aggarwal and Raja explored the opportunities for international diversification by examining and analysing the cointegration among the stock markets of the BRIC economies (Brazil, Russia, India, and China) during the reform era. They discovered a long-term cointegrating association among the chosen stock markets.In most of the areas a lot of work has been in various fields and various financial instruments from time to time but a lot more is needed in various financial instruments and in this

research with the help of big data various equity shares will be evaluated through various tools to determine the trend in the future whether possible or not. This trend will be used to understand the future pattern of various shares and help various stakeholders of the market.

3. Research Methodology

3.1 Descriptive Statistics: The study begins with Descriptive Statistics wherein the mean and median are taken as measures of central tendency and to capture volatility the values of measures like standard deviation,

	Japan	USA	India	Indonesia	China
Mean	0.000895	0.001006	0.000496	0.00045	0.0009
Median	0.001807	0.001012	0.000335	0.000798	0.001537
Max	0.02859	0.033759	0.051825	0.022272	0.033144
Min	-0.03858	-0.03023	-0.02161	-0.03284	-0.03156
Std. Dev.	0.01136	0.007878	0.008701	0.007411	0.008838
Skewness	-0.53004	-0.63757	1.115424	-0.43859	-0.35512
Kurtosis	3.792605	6.23404	8.319345	5.149493	4.909725
Jarque-Bera	18.03107	126.3887	336.8801	56.5924	43.24455
Probability	0.000122	0	0	0	0
Observations	247	251	243	252	250

skewness and kurtosis are described. In order to approve normality of the series under consideration, the Jarque–Bera test has been used. In order to provide understanding of the movement of stock returns in volatile period, time plots of daily log difference of the adjusted returns from 2000 to 2020.

Table 1

3.2 Unit Root Test Enhancement Dickey-Fuller

The Unit Root Test's objective is to evaluate thenature of the series under study's stationarity. Augm Dickey-Fuller Stationarity Test from 1979 was used to determine the nature of the series under investigation. The following theory is created to investigate the stationary nature of these theories.

Null Hypothesis (H): Series 0 contains a unit root.

Alternative Hypothesis (H): In a series, there is no unit root. 1

For the Unit Root test, the following regression equation can be used.

3.3 Test of Johansen Cointegration

The ability of two or more variables to move together through time and place is referred to as co-integration. By using Johansen's Cointegration Test over a lengthy period of time, the link between the Indian stock market and developed and emerging nations has been examined in the current study. The nonstationary series are the target of this statistical test. The co-integration of the time series under examination supports the long-term connection hypothesis.

The null hypothesis is that there are no co-integrating equations among the variables.

Alternative Hypothesis: That there is co-integrating equations among the variables.

3.4 Model for Vector Error Correction (VECM)

When the statistical findings support the long-run connection, a vector error correction model is developed.

3.5 Cross Relationship between National Stock Exchange of India and other Global Financial Markets

India and Japan

India and USA

India and China

India and Indonesia
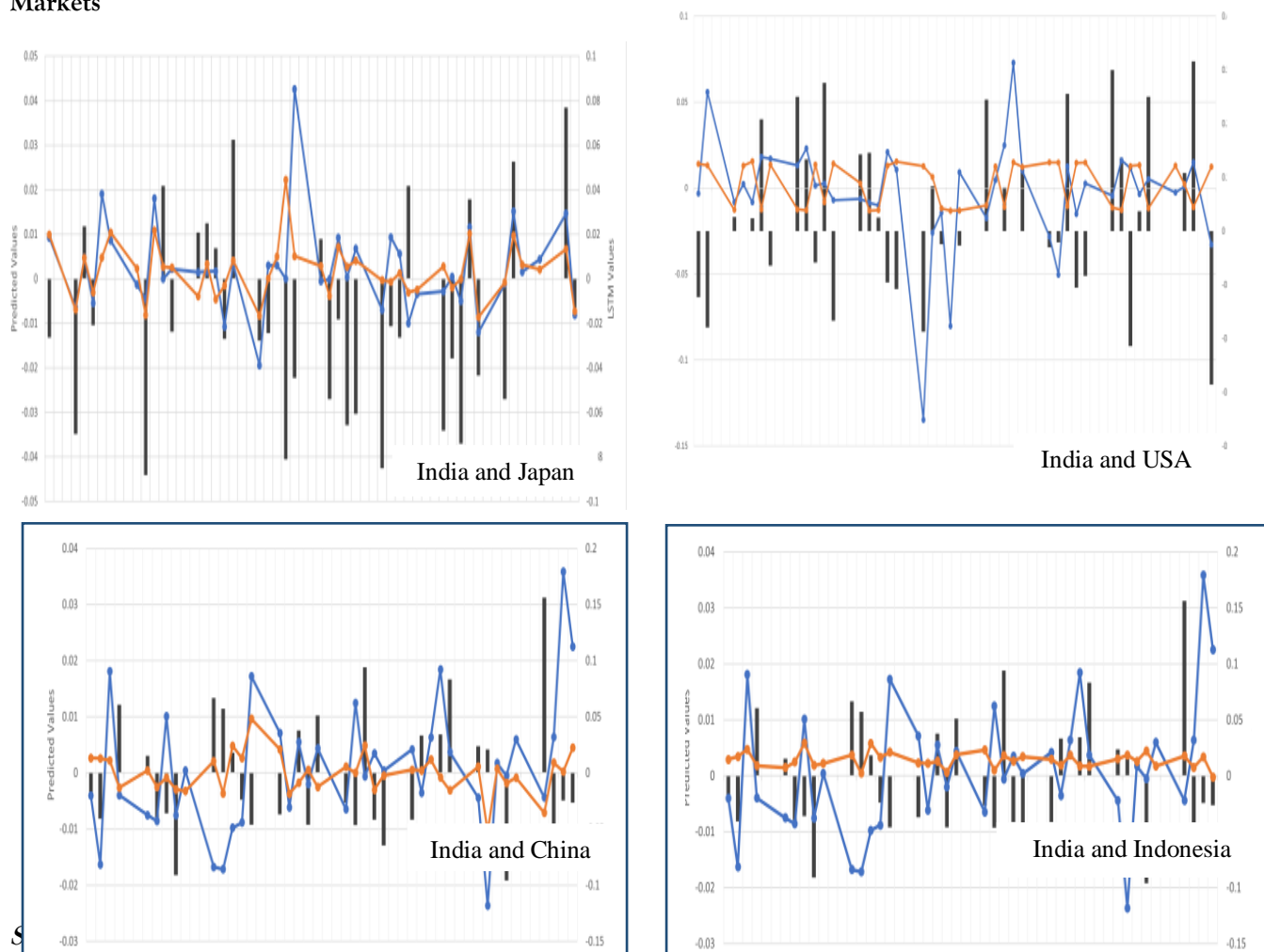
3.6 Empirical Results and Analysis

The unit root test of stationarity, comprising the Augmented Dicky-Fuller tests, is shown in Table 3. (ADF). According to the data, the p-value of ADF statistics for both emerging and developed economies is more than 0.05, which suggests that the series is not stationary. It indicates that the studied series are not stationary.

Correlation Matrix of Market Indices

	japan	USA	India	China	Indonesia
Japan	1				
USA	0.538679	1			
India	0.958015	0.582205	1		
China	0.643086	0.480424	0.675731	1	
Indonesia	0.672164	0.371089	0.66617	0.804146	1

Table 2

Source: Author's Calculations

Table 2 exhibits the pair wise correlation between the returns of all the 5 sampled indices from 2000 to 2020. It can be concluded that all the stock markets are positively correlated. As the economies are

globally integrated and the capital flows across borders, the stock markets across the world have come nearer and are heavily dependent on one another. Due to integration of the economies, investors diversify their portfolio internationally, leading to the spread of the risk across economies.

Results of Augmented Dickey–Fuller test for Stationarity.

Particulars	Japan	USA	India	China	Indonesia
ADF T Statistics in Level (Probability Value)	-7.25961 (0.000)	-6.00024 (0.000)	-7.00751 (0.0000)	-13.4052 (0.0000)	-10.4165 (0.000)
ARCH Effects Obs *R-squared Prob(Chi-Square)	266.764 (0.000)	205.1658 (0.000)	152.5634 (0.0000)	80.87995 (0.0000)	77.5243 (0.0000)

Table 3

Source: Author's Calculations

The Augmented Dickey-Fuller (ADF) test is used in the research to determine whether the data satisfies the stationarity requirement. From thesignificant p values of ADF test in Table 3,stationaritycan be established for all the indices.

Japan

India

USA

China

Indonesia

Average Mixed Graph
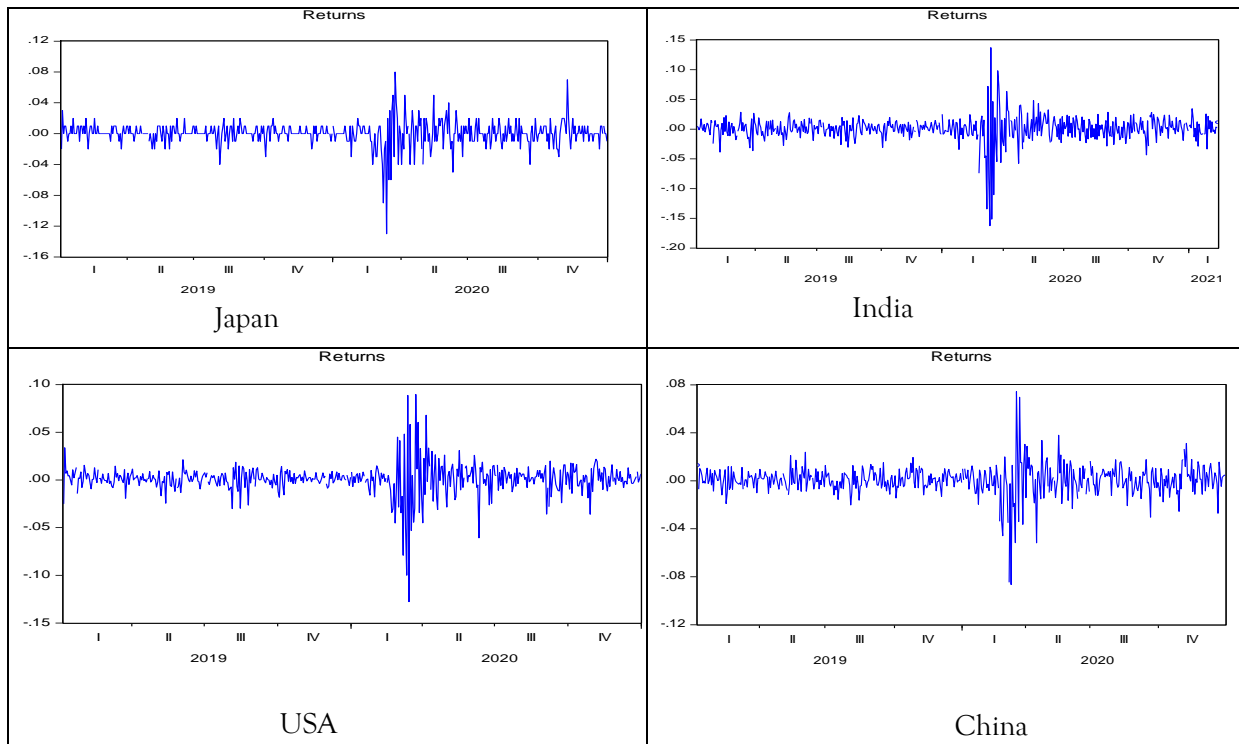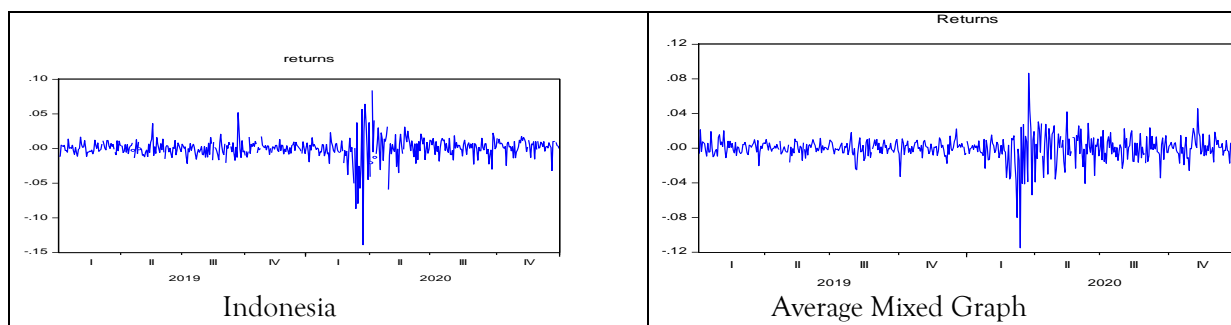
It is clear from the above graph that most of the markets have shown a similar pattern during short period of time but cannot maintain that relationship in long term pattern, which was present in the few markers only. Moreover, the volatility clustering can also be observed form all the time series viz. today's volatility explains tomorrow's volatility, and furthermore, it is obvious from the plots that the stock market returns dataset shows mean reversion, which implies presence of stationarity in the series.

3.7 Vector Error Correction Model (Developed Economies)

Country	Indices	Error Correction Model		
		Co-efficient	Std. Error	t-statistic
USA	D(lnNASDAQ)	0.00038	0.0004	3.6654
Japan	D(lnNIKKIE)	0.00076	0.0015	-1.5543
	c	3.45		

Vector Error Correction Model (Developing Economies)

Country	Indices	Error Correction Model		
		Co-efficient	Std. Error	t-statistic
China	D(LNSSE)	-0.00023	0.0004	-0.5417
Indonesia	D(LNJKSE)	-0.00011	0.0015	-1.6492
	c	-1.16		

The aforementioned statistics demonstrate that there is bivariate causation between the NASDAQ and NSE. While there is modest short-term causation from NASDAQ to BSE, the amplitude of short-term causality from NSE to NASDAQ is considerable The NASDAQ becomes an endogenous variable and NSE is confirmed to be an exogenous variable by the Granger causality statistics.

The aforementioned statistics demonstrate the existence of univariate causation between SSE and BSE. While there is little short-term causation from NSE to SSE, the magnitude of short-term causality from SSE to NSE is large Granger causality statistics show that the Shanghai Stock Exchange has an impact on the Indian Stock Market, but the opposite is not true.

5. Conclusions and Implications

As the market is affected by various global and local factors, it has been usually observed that in most of the researches focus has been on many factors than a particular section of field. The most common tool used for predicting the future price of various Financial Instruments is trend approach that is based on calculating the future of an event from it historical database. In some of the cases observing a trend is not that though, but in some of the cases it proves worthless.The current article makes an effort to investigate the cointegration of the Indian stock market with the stock markets of three established and three emerging nations. The fact that the USA and Indian stock indexes have a reciprocal link shows how interdependent these global stock indices are. The options for investors to hedge their investment risk are constrained by this important connection.By making simultaneous investments in these two markets, investors cannot diversify their risk.The lack of a causal relationship between the stock indexes of developing economies suggests that these indices are independent of one another. It suggests that rising economies provide a variety of investment options. By concurrently investing in these rising economies, investors may readily diversify their portfolios and reduce their risk exposure. When investing in these stock indexes, investors have a greater possibility of making large returns.

Furthermore, the study advises investors to exercise caution while investing in the American market because of the markets' considerable cointegration and long-term equilibrium linkages. Similar dangers may manifest in both markets at the same time. Opportunities for Indian businesses operating in the US to hedge against foreign investment are still scarce. As a consequence, it is highly anticipated that the study's empirical findings would be beneficial to policymakers, investment firms, investment funds, institutional investors, individual investors, and institutional investors.

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