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Dr. YV Siva Rama Reddy
Associate Professor, Malla Reddy Institute of Management, Hyderabad, India

Dr. K Sankar Rao
Associate Professor, Malla Reddy Institute of Management Hyderabad, India

Corresponding Author:
Dr. YV Siva Rama Reddy
Associate Professor, Malla Reddy Institute of Management, Hyderabad, India

Indian stock market integration with global stock markets: An impulse and response analysis to global shocks

YV Siva Rama Reddy and K Sankar Rao

Abstract
The overarching goal is to help Indian investors better manage overseas risks and add to the existing body of knowledge. Company that can adapt to new circumstances. One indicator of India's economic strength is the country's stock market's integration with global stock markets. By analyzing the triggers and subsequent impacts of these occurrences. To predict how the Nifty50 would move in relation to the global market indexes, the variance decomposition approach is used. Because of its rapid economic development and improved access to international financial markets, India's stock market has been very unpredictable throughout the last several decades. The Indian economy faces several risks, despite the fact that integration has made things more flexible and maybe helpful. We call attention to three problems. For example, when the Indian economy is faltering, stock returns fall sharply, but they slowly recover when things improve. According to Report, factors like as FIls, market sentiment, and investor behavior are responsible for these reactions. We also have evidence indicating the Indian market is still somewhat isolated, even if it has become more connected to global markets. Not with standing limitations at the federal, state, or regional levels or maybe shocks that are sector-specific or global in scope? This study's findings highlight the significance of investors' and politicians' familiarity with the interrelated nature of the world's financial institutions. Knowing the impact and transmission of global shocks on India's stock market is crucial for achieving financial stability, making sound investment choices, and developing an effective risk management plan.

Keywords: Stock markets integration, Johensen cointegration, VECM, variance decomposition

Introduction
India′s economic size of 4 trillion dollars is the number four in the world, surpassing that of Japan. reason includes National Economic Development policy instruments formally practised by wise Government, and on the other hand Raise the ties and relations ND that India is drawing AT present with economies overseas throughout world. This has made for an interchange as well as imitative internment, to a whole new level. So the stock markets integrated and started to grow in size reflecting the unity of all national exchanges their impact on globally oriented investment tactics economic BOOM Hua'an Rong! East 14. And As a result, the size of stock markets expanded from $1.4 trillion in 2014 to 5.4 trillion 2024. In percentage terms it amounted 21.5 percent annual growth. The integrated stock markets lead investors to enjoy the benefits of liquid financial markets, global distribution, risk diversification and international investment opportunities. But to benefit from these advantages, one must: understand the level of integration of stock markets, such is implied by connection ', takes a stand in which response Nifty50 makes to shocks from global market index and impulse from Nifty50 movements into global stock indices is essential for investors. This study will use the method of Johensen cointegration to ascertain cointegration in long run interval between stock markets. To find short run dynamics training and longitudinal moving to equilibriums, the VECM model is employed in this paper. The study also used VECM Impulse- The Relay graphic method and the Variance Decomposition method to test Nifty50′s response with the shocks of global stock indices in particular. Contrariwise, it also measured the impact of Nifty50 lies on these indices.

Research Gap
Over the past decade, have examined the effects on trading and other commercial activities between major countries (European Union), major trade blocs (East Asia), or major economies in various regions (DemBook). However, we focused on something quite

different this present time. Namely, whether Indian share markets have become integrated into China share markets and North American stock exchanges for natural curves of nationalism could form unity around India as it joins an extended Asia region (such as Japan, Korea). Whether or not BRICS stock markets are integrated with those in India-standing at the edge of things and yet trading everywhere! As it is known that India is entering an era of new economic linkages and relations abroad, so we must be aware that Indian investors now trade with almost all the stock markets in the world.

Review of Literature

Experts conduct numerous studies in various locations around the world on stock market links and integrations. Some of the major ones are given here: Jin Suk Park (July 2025) studied what to do with the European Union stock markets, while Sher (May 2024) used VECM based Granger Causality Test in his study for China's stock market integration with the developed world. Jana (Aug, 2021) Better states "Even though Asia is a leader in the field of technology, its stock market is less developed than those in America and Europe." Sheu and Liao researched the forces connecting (today) among developed market of USA and emerging BRIC stock markets & Granger Causality Relationships. Indicated was non-linear co-integration shows multi-directional interaction from time to time. At the same time, they noted International risk diversification. in the first instance between these emerging markets and those of the Developed World They moderated that thesis. Sharma *et al.* BRICS stock markets were affected by each other. But not on a large scale. This means that investors have chance for diversification opportunity between major (national or ethnic). Jain, N. also concluded there is no long memory association between Indian Nifty and rest of the BRICS Stock exchanges. (Monica Sharma, October) in their study used AVEC test, Wald test to test L jung-Box and Granger causality.

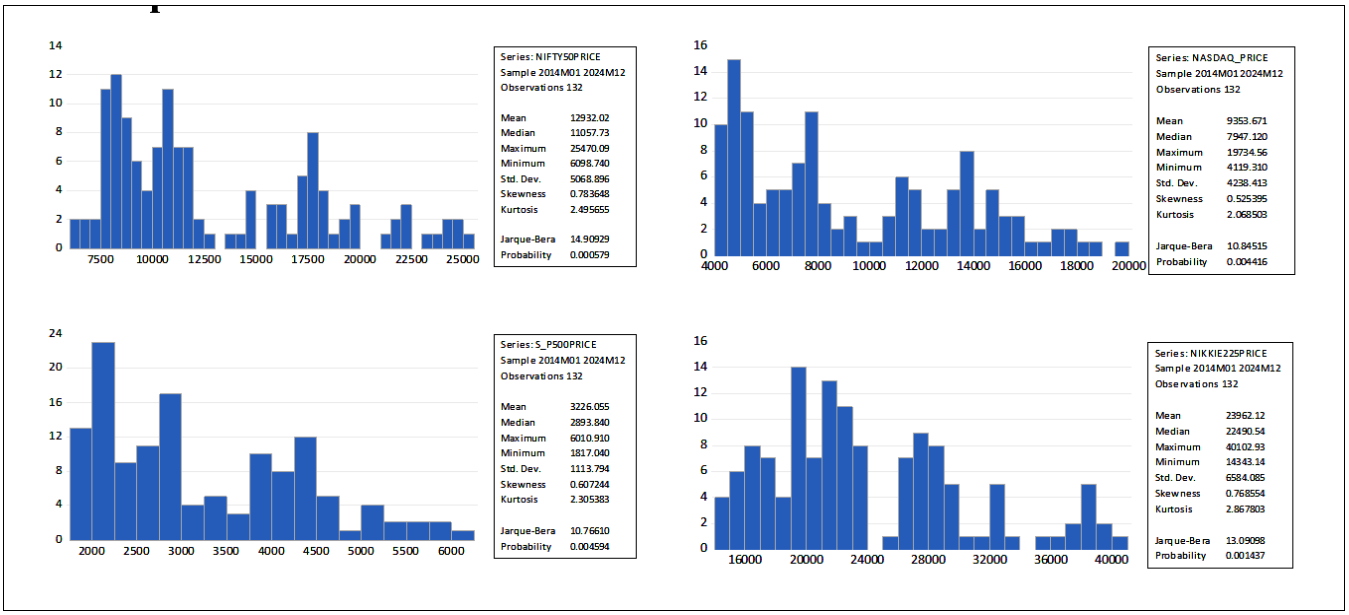
Research Methodology

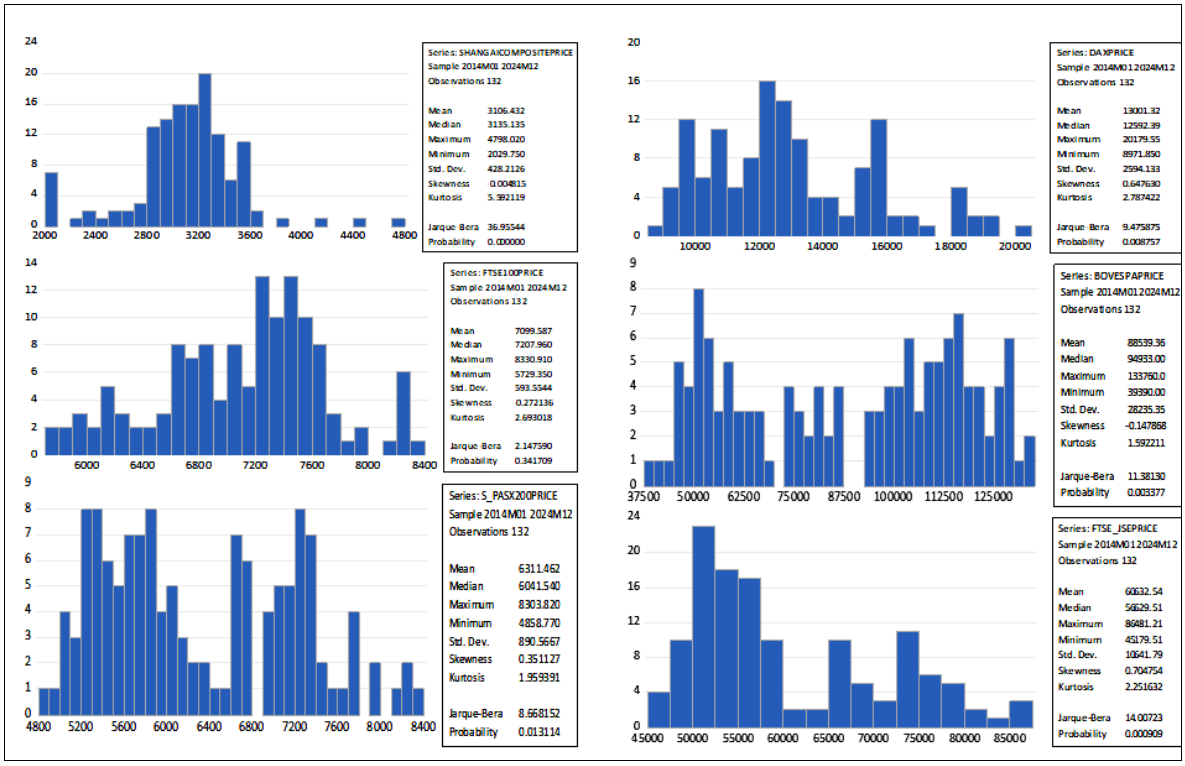
Data: The study extends from 2014 until 2024.This is because we cannot know the future, and although we know history, predictions about later conditions are always uncertain So India has had a political change--elementary measures must be postponed for later consideration outside of these immediate circumstances.; 2014 saw great changes in its economy as a result of policies that differ significantly from current ones Because India is trying to establish relationships with countries all over the world, all stock indices representing each of the continents are used.

S.NO	Country	Stock Index Symbol	Stock Exchange
1	India	Nifty50	National Stock Exchange
2	USA	NASDAQ	NASDAQ Inc
3	USA	S&P500	S&P Global Inc
4	China	Shanghai Composite	Shanghai Stock Exchange
5	Japan	Nikkie225	Tokyo Stock Exchange
6	UK	FTSE100	London Stock Exchange
7	Germany	DAX	Frankfurt Stock Exchange
8	Brazil	BOVESPA	B3 - Brazil Bolsa Balcão Stock Exchange
9	Australia	S&P ASX200	Australian Securities Exchange
10	South Africa	FTSE/JSE All share Index	Johannesburg Stock Exchange (JSE)

Results and Discussion

Descriptive Statistics





Nifty50, S&P 500 in Asia, the NASDAQ, Nikkie 225, DAX, S&P ASX 200 in Europe and ASX 200 Index: S&P100 in America all show positive skewness. FTSE/JSPE index which include FTSE100 Index, Shanghai Composite index and Bovespa Index exhibit negative skewness Also, the stock index among various global stock indexes with the highest kurtosis is 5.59; moreover, China Shanghai composite index holds the highest value for peaked ness. It shows little difference so far as stocks are concerned that S&P ASX200 has a low value for kurtosis (1.95) and peakness is no greater than average. Among all the stock indices in the world: The stock index with a maximum standard deviation is Germany's stock index The BOVESPA Index, with a standard deviation of 28235.35; The stock index with a minimum standard deviation is China's stock index The Shanghai Composite, with a standard deviation of 428.26. Jarque Bera test, on all global stock indices except FTSE100, rejects that the assumption of normal distribution of data is at $p<0.05$ level, significance appeared not to be existing. It revealed that there is no normality in all collected data, But the Jarque Bera-test of all global stock indices reject the hypothesis that data is normally distributed at $p<0.05$, which was not significant. As a result, normality in these data does not correspond very well with theory. For a long run relationship cointegration between these two markets, the data must in at least one form be stationary difference first. ADF test were used to judge whether the data are stationary or not.

Unit-root test Augmented Dickey fuller test of Global stock indices

- **H_0:** There is unit root in stock indices data, that is stock indices data are at non-stationary
- **H_1:** There is no unit root in stock indices data, that is stock indices data are at stationary

Stock Index	Symbol	Level Lag Length	ADF Statistic (Level)	P-value (Level)	First Difference Lag Length	ADF Statistic (First Difference)	P-value (First Difference)
Nifty50	1	0.408358	0.9827	0	-8.929259	0	0
NASDAQ	1	0.902515	0.9953	0	-9.194412	0	0
S&P500	0	1.461621	0.9992	0	-9.976781	0	0
Shanghai Composite	6	-4.813505	0.0001	2	-7.826543	0	0
Nikkei225	0	0.224265	0.9732	0	-10.30707	0	0
FTSE100	1	-2.041505	0.269	1	-8.853609	0	0
DAX	1	-0.186359	0.9361	0	-9.971576	0	0
BOVESPA	3	-0.786462	0.8192	2	-9.015344	0	0
S&P ASX200	0	-0.635307	0.8577	0	-10.20019	0	0
FTSE/JSPE	0	-0.291277	0.9219	3	-7.144998	0	0

At level, all stock indices except the Shangai composite index are non-stationary series, stationary at first differences. If the sample data is stationary at first difference though non-stationary at level, then Johensen cointegration test could be done at level shows where integration among global stock indices

Johensen Cointegration test:

- **H0:** There is no cointegration equation;
- **H1:** There is cointegration equation;

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	Prob.**
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None *	0.406014	282.5287	239.2354	0.0001
At most 1 *	0.377459	216.3745	197.3709	0.0039
At most 2	0.313893	156.1834	159.5297	0.0749
At most 3	0.224196	108.3397	125.6154	0.3444
At most 4	0.214937	76.10001	95.75366	0.5028
At most 5	0.136249	45.36709	69.81889	0.8190
At most 6	0.109391	26.76534	47.85613	0.8630
At most 7	0.050620	12.05242	29.79707	0.9300
At most 8	0.039849	5.455228	15.49471	0.7587
At most 9	0.002287	0.290805	3.841465	0.5897
Trace test indicates 2 cointegrating equation(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 (Max-eigenvalue)				
Hypothesized		Max-Eigen	0.05	Prob.**
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None *	0.406014	66.15422	64.50472	0.0345
At most 1 *	0.377459	60.19116	58.43354	0.0332
At most 2	0.313893	47.84368	52.36261	0.1351
At most 3	0.224196	32.23967	46.23142	0.6418
At most 4	0.214937	30.73292	40.07757	0.3770
At most 5	0.136249	18.60175	33.87687	0.8454
At most 6	0.109391	14.71292	27.58434	0.7705
At most 7	0.050620	6.597189	21.13162	0.9680
At most 8	0.039849	5.164423	14.26460	0.7209
At most 9	0.002287	0.290805	3.841465	0.5897
Max-eigenvalue test indicates 2 cointegrating equation(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

In the Johansen cointegration test output, the null hypothesis was rejected. At the 5% level of significance, it can be concluded that more than two cointegration equations exist among global stock indices with the trace statistics. Max-Eigen value test also indicates 2 cointegration equations occurred.

During the sample period, global stock indices are in long run equilibrium relationship.

In order to consider, the short run dynamics and long run equilibrium of dependent variables, we use VECM (Vector Error Correction Model) model to represent this relationship. because there is cointegration between global stock indices at the level of non-stationary data.

Vector Error Correction Model

The formula for VECM model is given under,

$$\Delta Yt=\Pi Yt-1+i=1\sum p-1\Gamma i\Delta Yt-i+\mu+\varepsilon t$$

Here, NIFTY50t−1=α0+β1S&P500t−1+β2NASDAQt−1+β3 FTSE100t−1+β4NIKKEI225t−1+β5DAXt−1+β6 BOVESPAt−1+β7FTSE/JSEt−1+β8S&P/ASX200t−1+β9 SHANGHAIt−1+ut

where:

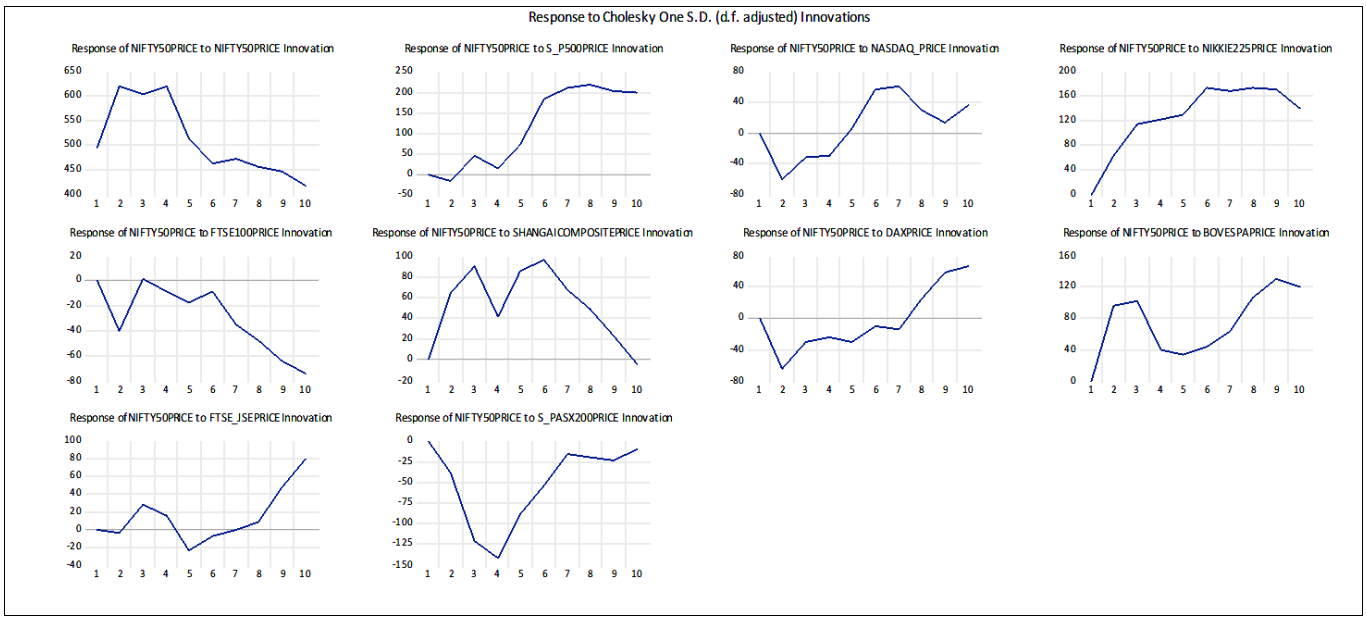
- α0\alpha_0α0 = constant term (intercept)
- βi\beta_iβi = cointegration coefficients
- utu_tut = stationary error correction term

To conduct VECM model, optimal lag length criteria is found with VAR lag order selection criteria, the optimal lag order is 4 by LR test statistic.

VECM estimates that the NIFTY50 index reflects both long-term equilibrium dynamics and notable short-term interactions with international stock marketsLiang The findings from the VECM of NIFTY50 estimate that around about 27 percent of any deviation between those indices in time period one from their long-term equilibrium values will revert within just one period This note suggests that Indian equities progressively return to an equilibrium aftershocks and confirms the existence of a stable cointegrating relationship.

The computed cointegrating equation indicates that different stock indices reflect different levels of strength and direction between their long-term relationships with NIFTY50. NIFTY50 is positively correlated with NASDAQ, FTSE100, DAX, Shanghai Composite, and Australian S&P / ASX200, can be seen that these markets tend to move in the same direction over time as India and other places around them agree with one another

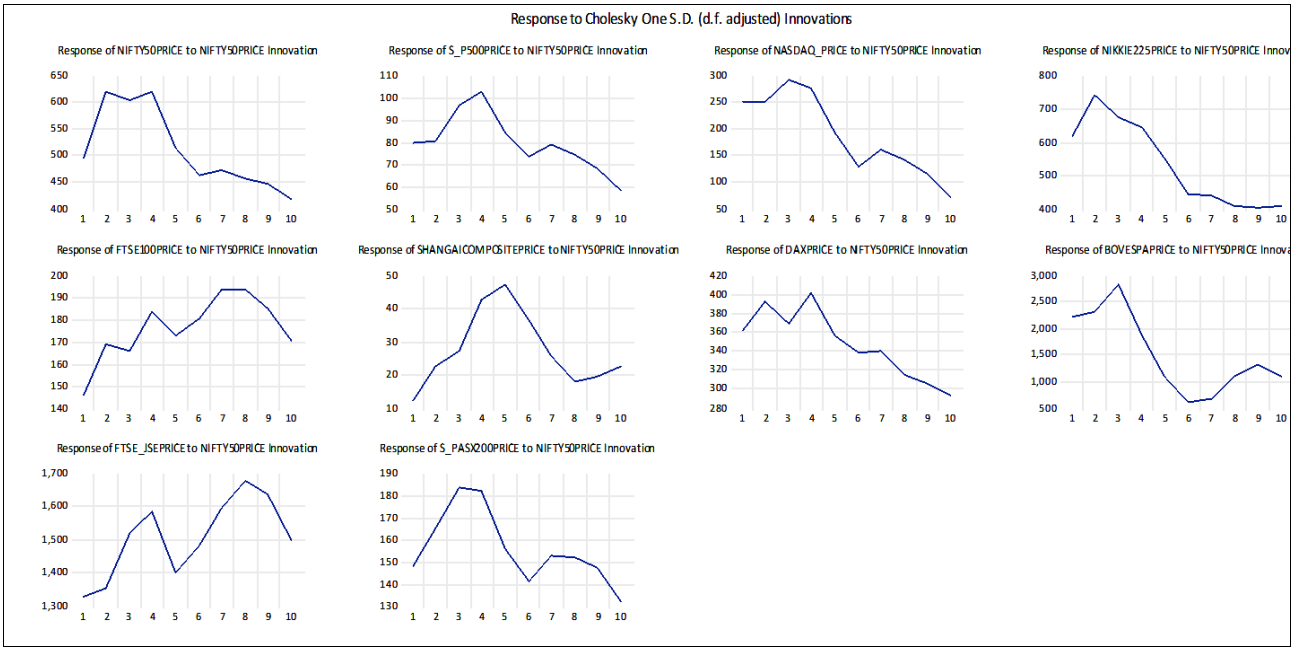
Response of Nifty50 to Innovations in Global stock Indices



As demonstrated in the impulse response study, the NIFTY50 is wholeheartedly oriented to U.S. and Euro-Asian markets so that is why stocks there generally react positively well whenever it takes a shock from the S&P500, NASDAQ or DAX. Another feature of the other impact appearances is that when the NIFTY50 suffers a shock from the Shanghai Composite, this generally leads its response to be more variable. The impacts from emerging markets like the South African market index (FTSE_BINK) or that in Brazil (Bovespa) are less notable and transient. Almost all of the results suggest that NIFTY50s volatility and performance, or in general, that of the Indian stock market, can be mainly explained by developed country shocks in international financial markets. This information also indicates that United States men square off with 98 yuan going all across NIFTY50 movements.

Response of Global stock indices to Innovations in Nifty50

Taking the impulse response of global stock indices to new innovations, one sees the path along which shocks that start in our Indian stock market ansible can go from there to other parts of the world. This study suggests that for each of the three consecutive days on which NIFTY50 shocks occur, seven global indices show significant responses. However, in terms of size the first effect is superior; only one day after a NIFTY50 shock contrasted strongly with four days later its average influence disappears entirely. Developed markets such as the S&P 500, NASDAQ, and DAX show large but temporary positive responses. This makes it evident that one Indian market shock is felt by the world. The ASX200, the FTSE100, and Shanghai Composite all respond positively, representing regional markets that show Asian-European trade and investment connections. The responses in developing markets like FTSE JSE (South Africa) and BOVESPA (Brazil) are, in contrast, still fairly slight. In general, the results strongly suggest that India's integration into world finance is still in its infancy because despite having been affected by global markets more than it has exerted an impact of its own.]] I found out that anything innovatively and moderately massive from the NIFTY50 will have some impact on developed economies as well as run- and reforming ones like South Africa or Brazil.



Variance Decomposition using Cholesky Factors: Variance Decomposition: Forecasting Nifty50 movements.

Methods to forecast its own shocks and those from international stock indices. The study selected a 10 year horizon for forecasting Nifty50 movements. Nifty50 has been explained by its own shocks with 81.24%, and 70.28% by DAX price movements. A 6.58% impact was found for the American S&P500 index. The Us Indices Houses with great external impact on the Nifty50 S&P 500 dominant global volatility transmitter

Variance Decomposition of NIFTY50PRICE:

Period	S.E.	NIFTY50PRICE	S_P500PRICE	NASDAQ_PRICE	FTSE100PRICE	NIKKIE225PRICE	SHANGAICOMPOSIT	DAXPRICE	BOVESPAPRICE	FTSE_JSEPRICE	S_PASX200PRICE
1	493.5	100	0	0	0	0	0	0	0	0	0
10	1808	81.24	6.538	0.449	0.21	5.95	1.172	0.47	2.178	0.318	1.472

Variance Decomposition of S_P500PRICE:

Period	S.E.	NIFTY50PRICE	S_P500PRICE	NASDAQ_PRICE	FTSE100PRICE	NIKKIE225PRICE	SHANGAICOMPOSIT	DAXPRICE	BOVESPAPRICE	FTSE_JSEPRICE	S_PASX200PRICE
1	114.3	48.46	51.54	0	0	0	0	0	0	0	0
10	461.2	30.56	49.58	2.828	3.765	1.01	0.218	11.35	0.184	0.273	0.234

Variance Decomposition of NASDAQ_PRICE:

Period	S.E.	NIFTY50PRICE	S_P500PRICE	NASDAQ_PRICE	FTSE100PRICE	NIKKIE225PRICE	SHANGAICOMPOSIT	DAXPRICE	BOVESPAPRICE	FTSE_JSEPRICE	S_PASX200PRICE
1	428.5	33.71	52.78	13.5	0	0	0	0	0	0	0
10	2048	9.615	48.3	15.86	5.102	1.659	0.259	18.51	0.139	0.308	0.243

Variance Decomposition of FTSE100PRICE:

Period	S.E.	NIFTY50PRICE	S_P500PRICE	NASDAQ_PRICE	FTSE100PRICE	NIKKIE225PRICE	SHANGAICOMPOSIT	DAXPRICE	BOVESPAPRICE	FTSE_JSEPRICE	S_PASX200PRICE
1	234.2	38.87	20.13	12.85	28.15	0	0	0	0	0	0
10	792.3	49.68	4.141	22.88	18.2	1.761	1.832	0.493	0.582	0.255	0.18

Variance Decomposition of NIKKIE225PRICE:

Period	S.E.	NIFTY50PRICE	S_P500PRICE	NASDAQ_PRICE	FTSE100PRICE	NIKKIE225PRICE	SHANGAICOMPOSIT	DAXPRICE	BOVESPAPRICE	FTSE_JSEPRICE	S_PASX200PRICE
1	1109	31.12	25.38	4.554	0.725	38.22	0	0	0	0	0
10	3488	24.56	16.18	8.999	0.658	29.05	2.587	8.888	0.758	5.274	3.05

Variance Decomposition of SHANGAICOMPOSITEPRICE:

Period	S.E.	NIFTY50PRICE	S_P500PRICE	NASDAQ_PRICE	FTSE100PRICE	NIKKIE225PRICE	SHANGAICOMPOSIT	DAXPRICE	BOVESPAPRICE	FTSE_JSEPRICE	S_PASX200PRICE
1	166.1	0.571	4.115	0.01	0.687	2.921	91.7	0	0	0	0
10	705	1.733	1.599	0.102	1.705	1.318	70.28	14.03	0.475	2.077	6.684

Variance Decomposition of DAXPRICE:

Period	S.E.	NIFTY50PRICE	S_P500PRICE	NASDAQ_PRICE	FTSE100PRICE	NIKKIE225PRICE	SHANGAICOMPOSIT	DAXPRICE	BOVESPAPRICE	FTSE_JSEPRICE	S_PASX200PRICE
1	590.8	37.61	34.03	4.501	4.636	0.601	0.116	18.51	0	0	0
10	1938	32.45	18.55	2.44	1.292	0.277	2.535	40.01	0.109	0.883	1.452

Variance Decomposition of BOVESPAPRICE:

Period	S.E.	NIFTY50PRICE	S_P500PRICE	NASDAQ_PRICE	FTSE100PRICE	NIKKIE225PRICE	SHANGAICOMPOSIT	DAXPRICE	BOVESPAPRICE	FTSE_JSEPRICE	S_PASX200PRICE
1	4513	23.75	13.17	3.466	9.256	1.028	0.36	0.389	48.59	0	0
10	14504	13.17	4.441	5.816	8.404	7.344	0.798	0.942	55.05	2.813	1.224

Variance Decomposition of FTSE_JSEPRICE:

Period	S.E.	NIFTY50PRICE	S_P500PRICE	NASDAQ_PRICE	FTSE100PRICE	NIKKIE225PRICE	SHANGAICOMPOSIT	DAXPRICE	BOVESPAPRICE	FTSE_JSEPRICE	S_PASX200PRICE
1	2098	39.98	15.72	3.668	7.186	7.307	0.819	2.61	0.494	22.22	0
10	6737	50.29	2.193	1.788	1.796	12.3	5.521	7.1	0.574	18.22	0.223

Variance Decomposition of S_PASX200PRICE:

Period	S.E.	NIFTY50PRICE	S_P500PRICE	NASDAQ_PRICE	FTSE100PRICE	NIKKIE225PRICE	SHANGAICOMPOSITEPRICE	DAXPRICE	BOVESPAPRICE	FTSE_JSEPRICE	S_PASX200PRICE
1	218.9	45.55	23.85	6.469	4.866	0.04	0.651	0.504	0.909	0.239	16.92
10	683.1	52.6	13.21	13.11	2.178	0.345	1.166	2.784	3.723	1.511	9.362

Discussion

India's Economy, the fourth largest in the world, keeps growing with its current stock markets size. This is the result of government policies and importantly, economic and trade relations across the globe. Therefore, both domestic investors and those from foreign countries are attracted to Indian Stock Markets time to time integrated One research employed Johensen cointegration and garnered two cointegration equations, while VECM indicated that there is a positive correlation between Nifty50 and NASDAQ, FTSE100, DAX, Shanghai Composite, S&P/ASX200 of Australia as the various markets tend to move in tandem with India over time. Impulse-and-reaction graphs showed that the major indices of Western World stock market movement have crossed behind the increasing size of India's stock markets-and contributes this as one important point in Nifty50 playing a less important role in integration. Response analysis certified Nifty50 of Indian Stock Market plays a secondary role to market integration. The variance decomposition indicates that the prediction movement of Nifty50 tends to be more reliant on itself and is helped continuously by Britain's FTSE100.

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