

Unveiling the Dynamics of Indian Stock Market Integration with Global Trading Partners: Insights through Impulse Response Analysis

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Purpose: The purpose of this study is to look into the integration of the Indian stock market with the stock markets of its major trading partners, with a focus on the dynamic relationships and spillover effects between India and six key global partners (Korea, China, Germany, Belgium, the UK, and Switzerland) from 2002 to 2021.

Design/Methodology/Approach: The study uses a Vector Autoregression (VAR) framework with Impulse Response Functions (IRFs) to examine daily log returns of stock indices. This approach captures how shocks in one market influence another over time, allowing for the examination of market integration and financial contagion.

Findings: The findings demonstrate substantial trends in financial contagion, suggesting that shocks originating in India's trading partners' stock markets significantly affect the Indian stock market, and vice versa. It reflects that world' financial markets are growingly becoming more integrated, especially with regard to developing nations like India.

Originality: This study adds to the growing literature on stock market integration by conducting a thorough examination of the Indian market's connection with its important worldwide partners. Studies on market interdependence are enhanced by the application of IRFs and the VAR framework, which provides a deeper knowledge of how global market dynamics impact emerging economies like India.

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Practical Implications: The findings have major significance for policymakers and investors, particularly in terms of understanding how global market volatility affect the Indian economy. These understandings can direct economic policies

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Keywords: Indian Stock Market, Stock Market Integration, Impulse Response Functions, Financial Contagion, Global Financial Markets.

1. Introduction

The degree of the financial markets' interdependence and mutual response to shocks is referred as stock market integration. These links between stock markets in various nations have grown more important in an era of globalized financial markets. The increasing interconnection of global financial markets has made cross-national stock exchange interactions a significant field of research. This interaction highlights how intricate the world's financial markets are and how important it is to have thorough risk management plans as indicated in studies like Manu & Menda (2017); Panopoulou & Pantelidis (2009). Thus, understanding this integration is essential for risk management, portfolio diversification, and the creation of economic policies for investors and policymakers. Pal & Garg (2020) also mentioned that investors should make the strategies that take into account not just domestic measurements but also the effects of worldwide market movements.

Stock market integration significantly impacts risk management, portfolio diversification, and economic policy formulation. High degrees of market integration suggest that shocks in one might spread fast to others, impacting asset prices and raising the risk of contagion, whereas low levels of integration can offer chances for diversification and hedging (Agénor, 2003).

In the past 20 to 30 years, research on stock market integration has been growing in importance. Numerous studies have looked into the integration of the Indian stock market with foreign markets. Researchers have evaluated the degree of integration and shock transmission using a variety of econometric methods, such as cointegration and VAR models. This research has been prompted by the need to better understand financial contagion, risk spillovers, and the consequences of market integration for a growing economy like India. The Indian stock market is

one of the biggest and most active emerging markets, and it has a significant impact on the regional and worldwide economies. Raj & Dhal (2009) indicated that after liberalization, the Indian market has been more in line with worldwide patterns, which has decreased the risks connected with overseas investments for portfolio diversification. Gaining an understanding of its integration with the stock markets of its trading partners can offer significant insights into investment strategies, market dynamics, and economic relationships.

India's trading links with its key partners, which include both established and emerging market nations, emphasize the need of researching these financial connections. More insight into the mechanisms underlying market interdependence is needed by investors and regulators in the wake of previous global financial crises and increasing market volatility. A thorough examination of stock market integration may provide useful insights for defining financial laws, directing foreign investment plans, and establishing economic policies to reduce the dangers of international market disruptions.

This study intends to provide light on the degree of market synchronization between India and its major trade partners as well as the potential spillover effects of external shocks on India's financial system. The purpose of this research is to study the integration of the Indian stock market with those of its major trading partners. It examines how the Indian market reacts to shocks in different foreign markets. It investigates the mutual links between the Indian stock market and its trading partners. It focuses on six of India's key trading partners (Korea, China, Germany, Belgium, the UK, and Switzerland), chosen based on their trade volume and long-standing economic connections with India. The Indian stock market's response to sudden shifts in the markets of its trading partners is analyzed

through Impulse Response Functions (IRFs), allowing for an in depth investigation of the dynamic cross-market linkages. It looks at the transmission of shocks from one market to another.

With regard to the level of India's stock market integration with six of its biggest trading partners (Korea, China, Germany, Belgium, the United Kingdom, and Switzerland), this article attempts to give an empirical analysis. This analysis adds to the current literature by concentrating on daily log returns over a long period of time, from 2002 to 2021, and identifying patterns in market interconnection and the form of financial contagion between these economies. The findings are intended to be useful for policymakers and scholars studying the relationship between emerging and developed financial markets. Additionally, the results are important for investors who want to maximize their portfolios by knowing how changes in the Indian stock market are related to developments in the worldwide financial markets.

The second section of the article gives a thorough overview of the literature on stock market integration. The third section describes the methodology used. The empirical results are presented in the fourth section. The findings are discussed in the fifth section. Lastly, the conclusion is provided in the sixth section.

2. Literature Review

2.1 Theoretical Frameworks Underpinning Stock Market Integration

Integration has emerged as a vital area of research in the context of globalization as both regulators and investors strive to figure out how market interconnections affect investment returns and financial stability. Stock market integration is based on a number of important theoretical frameworks. The Efficient Market Hypothesis (EMH) proposes that stock prices completely represent all available information, making it critical to investigate how shocks in one market affect others in linked markets. Similarly, International Portfolio Theory contends that cross-border investments contribute to risk diversification. Furthermore, the idea of market

co-movement implies that economically or politically related countries' stock markets tend to move in tandem when information and shocks spread between them. The integration shared by different markets has been extensively studied in literature through a variety of techniques.

2.2 Importance of Stock Market Integration in the Global Context

Studies by Claessens et al. (1995) and Bekaert et al. (1997), for example, have looked at emerging markets' financial integration and how they interact with developed markets. It has been discovered that although the level of integration varies over time and among countries, emerging markets have become more and more connected with global financial systems. Diebold & Yilmaz (2009) conducted a study that demonstrates the use of impulse response functions in the study of market integration. Specifically, the effects that spill over between key global financial markets were examined. The findings emphasized the significance of understanding the spread of shocks and the possibility of financial contagion.

2.3 Empirical Studies on Stock Market Integration

The findings of different studies have demonstrated that the linkages shared by the Indian stock market with others have significantly raised as a result of globalization and economic reforms.

Mixed findings have been reported by different studies related to the stock markets of various emerging and developed nations. Various studies like Elyasiani et al. (1998); Chong et al. (2003); Pandey & Kumar (2011); Menon et al. (2009); Gilmore & McManus (2004); Valadkhani & Chancharat (2008); Dedi & Yavas (2016); Panda & Nanda (2017); Aggarwal & Raja (2019); Habiba et al. (2020); Matar et al. (2021); Caporale et al. (2022) presented empirical evidence for the presence of a long-term cointegrating relationship among different stock markets of the world, while only a few studies, like Vo & Daly (2005); Sehgal et al. (2018); Thomas et al. (2017); Saji (2021), found an absence of any kind of linking relationship among different stock markets. With reference to the Indian stock market, Menon et al. (2009) reported that it is

associated with some of the markets around the world, whereas Rajwani & Mukherjee (2013) discovered that the Indian stock market does not share any integrating relation with any of the Asian markets.

2.4 Trade Linkages and Stock Market Integration

Furthermore, scholars have attempted to determine if trade links between various nations integrate the respective stock markets. Studies like Gilmore & McManus (2004); Abd Karim et al. (2006); Karim & Majid (2009); Paramati et al. (2015); Joyo & Lefen (2019) argued that the financial markets of the trading partner nations significantly cointegrate with each other. On the other hand, Elyasiani et al. (1998) indicated that the intensity of trade does not impact the integration of the respective stock markets, as this study found insignificant interdependence between the Sri Lankan stock market and the markets of its important trading partners.

There are still certain gaps in the literature, despite the fact that it offers insightful information about stock market integration and the application of impulse response functions. India and other emerging markets have received comparatively less attention than developed markets, which have been the subject of several studies. Furthermore, because market circumstances and integration levels can change quickly as a result of economic and geopolitical events, additional investigations are required due to the dynamic nature of financial markets. Furthermore, whereas impulse response functions provide a thorough understanding of shock transmission, integrating these results with

more general financial and economic theories may yield a more thorough understanding of market dynamics. More detailed features of market integration, like sector-specific responses and the effect of policy changes on shock propagation, should be explored in future research.

Overall, the existing literature presents mixed results, suggesting that the interdependence shared by different stock markets of the world is a dynamic phenomenon. Moreover, whether trade intensity really matters for integrating stock markets of different nations remains unanswered, especially in the context of the Indian stock market.

3. Methodology

3.1 Data Description and Sources

Historical stock market data is used for analysing the integration of the Indian stock market with its trading partners. The major stock indices from India and its main trading partners' daily closing prices have been used for analysis. The selected indices include India's BSESENSEX, Korea's KS11, China's SCI, Germany's DAX, Belgium's BEL20 and UK's LSEG.L, Switzerland's SMI. The data covers a sufficiently long period, encompassing different market cycles and economic events, from 2002 to 2021. Data was collected from the official websites of selected stock markets. India has always shared good trade ties with the selected trading partners over the years. Table 1 shows Percentage of India's bilateral trade with its selected major trading partners from the year 2002 to 2021.

Table 1. Percentage of India's bilateral trade with its selected large trading partners from 2002 to 2021.

Year	China	Germany	Switzerland	UK	Belgium	Korea
2002	3.85997	4.035858	2.413143	4.69739	4.820668	1.747567
2003	4.690972	3.904329	2.728542	4.362733	4.251181	2.331311
2004	5.803672	3.570761	2.872495	3.831227	3.774619	2.478192
2005	7.193128	3.74562	3.146469	3.83862	3.296993	2.459224
2006	7.838079	3.686936	2.795394	3.144367	2.500367	2.409325

2007	9.345322	3.706073	3.074816	3.039816	2.440543	2.167161
2008	8.37665	3.483655	2.738182	2.575371	2.005812	2.436625
2009	9.247859	3.794912	2.457184	2.387916	2.042126	2.708241
2010	10.28843	3.056285	3.999843	2.034092	2.186306	2.376557
2011	9.451778	3.032074	4.23953	2.138152	2.323006	2.213987
2012	8.846003	2.812878	3.83901	1.892808	2.029799	2.280091
2013	8.478375	2.636318	3.293703	2.116744	2.108865	2.108273
2014	9.224288	2.632481	2.865448	1.860753	2.212351	2.346734
2015	10.86524	2.87769	3.364486	2.177724	2.036734	2.548716
2016	11.24726	3.026986	2.575148	2.014313	2.080332	2.541111
2017	11.43229	2.830207	2.898097	1.800989	1.648778	2.77198
2018	10.83972	2.746615	2.319892	2.023902	1.96861	2.553398
2019	10.68162	2.598363	2.368692	1.954248	1.937198	2.588751
2020	12.09181	2.694988	1.951984	1.939249	1.738835	2.593033
2021	11.45565	2.328894	3.189162	1.773634	1.928762	2.505098
Average	9.062906	3.160096	2.956561	2.580202	2.466594	2.408269

Source: Researchers' Compilation

Based on trade volume and economic significance, the study identifies these nations as main trading partners of India. Furthermore, based on data availability, these nations are selected. Theoretical concepts of market co-movement and economic interdependence guided the selection of stock indices for each studied market.

Selecting daily closing prices ensures high-frequency data, improving the impulse response functions' accuracy and capturing the short-term dynamics of the market. Several studies, including Anoruo, Ramchander, & Thiewes (2003); Chang & Su (2010); Romero & Kasibhatla, (2013); Lehkonen & Heimonen (2014); and Verma & Rani (2016) have justified the use of daily closing prices of stock indices.

Firstly, the daily log returns of each index were computed to set the data up for analysis. Since log returns handle non-stationarity better and are easier to read in percentage terms than raw prices, they are preferred in statistics.

The log return for index i on day t is calculated as:

$$\text{Return}_{i,t} = \log (P_{i,t} / P_{i,t-1})$$

where $P_{i,t}$ is the closing price of index i on day t .

3.2 Estimation of Impulse Response Functions

Impulse Response Functions (IRFs) are an effective methodological tool used for capturing the dynamics of connectedness among different markets. IRFs, as part of the wider econometric methodology of Vector Autoregression (VAR) models, allows to track how a single shock in one market affects another over time. It provides an effective analytical framework for studying the long-term spillover effects of shocks in one market to other markets. In the context of stock market integration, this dynamic approach is especially pertinent since it illustrates the long-term interdependence across markets by capturing both the lag in responses to a shock and its immediate repercussions. By taking this method, the study intends to contribute to the field's knowledge of Indian stock market

integration processes and provide useful insights into the increasingly globalized financial landscape. Using this method, the study systematically examines the Indian stock market's response to the external shocks. This approach enables to quantify how quickly and to what extent the Indian market reacts to changes in the indices of the studied nations, revealing the depth and nature of their interconnectedness.

A Vector Autoregression (VAR) model has been utilized for examining the dynamic relationship and integration between the Indian stock market and its trading partners. The linear interdependencies between several time series variables can be captured using the VAR model. The model is described as follows:

$$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + u_t$$

where:

Y_t is a vector of the log returns of the stock indices at time t .

A_0 is a vector of constants,

A_i (for $i=1, \dots, p$) are matrices of coefficients,

p is the number of lags included in the model,

u_t is a vector of error terms.

The Akaike Information Criterion (AIC) was used for determining the number of lags, p . This metric suggests appropriate number of lags by adhering to the methodical process described by Hsiao, 1979. The optimal lags for the overall study period as suggested by AIC was 7. Next, impulse response functions were calculated to show the long-term effects of a single shock to one index on the returns of other indices. An impulse response function specifically gauges how the Indian stock market (as well as other markets) responds to a single innovation or shock in the stock market of a trading partner. The results from the impulse response functions are analyzed to interpret the integration and spillover effects between the Indian stock market and its selected trading partners.

4. Empirical Analysis

4.1 Impulse Response Function of Stock Indices: India and its major trading partners

Table 2 presents the response of BSE SENSEX and BEL 20 to the shocks from its own as well as from the other stock indices.

Table 2. Response of BSE SENSEX and BEL20 to its own as well as to the external shocks

Period	Response of BSE SENSEX							Response of BEL20						
	BSE SENSEX (India)	BEL20 (Belgium)	DAX (Germany)	KS11 (Korea)	LSE G.L (UK)	SCI (China)	SMI (Switzerland)	BSE SENSEX (India)	BEL20 (Belgium)	DAX (Germany)	KS11 (Korea)	LS G.L (UK)	SCI (China)	SMI (Switzerland)
1	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.015	0.000	0.000	0.000	0.000	0.000
2	0.007	0.001	0.000	0.000	0.000	0.000	0.000	0.002	0.006	0.001	0.000	-0.001	0.000	0.000
3	0.008	0.001	0.000	-0.001	0.000	-0.001	0.001	0.002	0.007	0.000	0.000	0.000	-0.001	0.000
4	0.012	0.000	0.000	0.001	0.000	0.000	0.000	0.003	0.009	0.000	0.001	0.000	0.000	0.000

5	0.009	0.0 01	0.000	- 0.001	0.000	0.00 0	0.000	0.0 02	0.0 08	0.00 0	0.0 00	0.0 00	0.0 00	0.00 0
6	0.010	0.0 01	0.000	0.000	0.000	- 0.00 1	0.000	0.0 02	0.0 08	0.00 0	0.0 00	0.0 00	0.0 00	0.00 0
7	0.010	0.0 01	0.000	0.000	0.000	0.00 0	0.000	0.0 02	0.0 08	0.00 0	0.0 00	0.0 00	0.0 00	0.00 0
8	0.010	0.0 01	0.000	0.000	0.000	0.00 0	0.000	0.0 02	0.0 08	0.00 0	0.0 00	0.0 00	0.0 00	0.00 0
9	0.010	0.0 01	0.000	0.000	0.000	0.00 0	0.000	0.0 02	0.0 08	0.00 0	0.0 00	0.0 00	0.0 00	0.00 0
10	0.010	0.0 01	0.000	0.000	0.000	0.00 0	0.000	0.0 02	0.0 08	0.00 0	0.0 00	0.0 00	0.0 00	0.00 0

Source: Author's Calculations.

Notes: Log returns of indices and Cholesky Ordering (BSESENSEX BEL20 DAX KS11 LSEG.L SCI) are used. Period ranges from day 1 to day 10.

The analysis shows that India's BSE SENSEX responds more significantly to its own shocks rather than the external shocks in terms of the magnitude. Initially, an impulse response of 0.019 has been noted to the own shock. Later on, the extent of response diminished but constant positive response could be maintained. It indicates that the BSE SENSEX responded positively to the own shocks throughout the period. However, for the external shocks, mixed response which were comparatively of lesser magnitude could be noted. Both positive and negative responses were noted. Positive response was observed for the shocks from some indices like (BEL20, DAX, SCI, SMI). On the other hand negative responses were observed for the shocks from other indices (like KS11, LSEG.L).

The BEL 20 index responded positively to its own shocks throughout the period. A positive response of 0.015 was observed initially which demonstrated significant rise in the index value after the shock. For the subsequent periods, positive response of smaller magnitude (around 0.008) was noted. The results suggested stable

positive response of the index to its own shocks. For the reaction to the external shocks, positive but varying responses could be observed. To the shocks from some indices (like DAX and SMI), smaller positive responses were observed. On the other hand, to the shocks from other indices (like BSE SENSEX), larger positive responses could be noted. From the second day onwards, the response to the own as well as to the external shocks remained constant and stable. It implies that initially the shocks create lasting impacts while in the subsequent periods, not much significant impact could be created. To the own shock, positive response was maintained while to the shocks from other indices negative response was also observed (like to the shock from LSEG.L on the second day following the shock). Negative response indicates significant fall in the value of the index following the period of shock. Overall, BEL 20 responded positively to the own as well shocks from the other indices after the shock. The positive impact remained up to some extent in the subsequent periods as well.

Table 3 represents the impulse response of DAX and KS11 to the shocks from own as well as from other stock indices (BSE SENSEX, BEL20, KS11, LSEG.L, SCI, SMI).

Table 3. Response of DAX and KS11 to its own as well as to the external shocks.

Period	Response of DAX							Response of KS11						
	BSE SENSEX (India)	BEL20 (Belgium)	DAX (Germany)	KS11 (Korea)	LSE G.L (UK)	SCI (China)	SMI (Switzerland)	BSE SENSEX (India)	BEL20 (Belgium)	DAX (Germany)	KS11 (Korea)	LSEG.L (UK)	SCI (China)	SMI (Switzerland)
1	0.005	0.014	0.012	0.000	0.000	0.000	0.000	0.006	0.003	0.004	0.038	0.000	0.000	0.000
2	0.002	0.004	0.004	0.001	0.000	0.000	-0.001	0.003	0.006	0.004	-0.024	0.001	0.000	0.003
3	0.002	0.006	0.005	0.000	-0.001	-0.001	0.000	0.006	0.004	0.004	0.001	0.000	-0.001	0.001
4	0.003	0.008	0.007	0.001	0.000	0.000	0.000	0.002	0.006	0.005	0.003	0.001	0.000	0.001
5	0.002	0.006	0.005	0.000	0.000	0.000	0.000	0.004	0.003	0.003	0.003	0.000	0.000	0.001
6	0.003	0.007	0.006	0.001	0.000	0.000	0.000	0.005	0.005	0.004	-0.002	0.000	-0.001	0.001
7	0.003	0.007	0.006	0.001	0.000	0.000	0.000	0.004	0.004	0.004	0.001	0.001	0.000	0.001
8	0.003	0.007	0.006	0.001	0.000	0.000	0.000	0.004	0.004	0.004	0.001	0.000	0.000	0.001
9	0.003	0.007	0.006	0.001	0.000	0.000	0.000	0.004	0.004	0.004	0.001	0.000	0.000	0.001
10	0.003	0.007	0.006	0.001	0.000	0.000	0.000	0.004	0.004	0.004	0.000	0.001	0.000	0.001

Source: Author's Calculations.

Notes: Log returns of indices and Cholesky Ordering (BSESENSEX BEL20 DAX KS11 LSEG.L SCI) are used. Period ranges from day 1 to day 10.

To its own shocks, a positive response of the index can be observed initially. The index displays a positive impulse response of 0.012 in the initial month which indicates a remarkable rise in the value immediately following the shock. Positive response has been observed in succeeding months as well which suggests that the index maintains an unremitting positive response to the own shocks over the studied period of time. Value of the responses remained around 0.006 which also indicates a more firm positive

response. Positive response was observed to the external shocks as well except few cases only (i.e. second day response to SMI, third day response to LSEG.L and SCI were negative). Comparatively higher positive response was observed to the shock from BSE SENSEX and BEL20. With remaining indices, responses of smaller magnitude and even null responses were noted. The results suggest that DAX responds more positively to BSE SENSEX and BEL20 than other indices. Reaction to all the shocks whether internal or external was observed to higher during initial periods than the subsequent days. Similar to BEL20 analysis, response of DAX was observed to be stabilized and constant

from second day onwards. It suggests that the initial shocks has lasting impacts on DAX and it does not responds much significantly in the upcoming periods. With BSE SENSEX, BEL20, DAX and KS11 positive responses were observed throughout the period. With other indices, null responses suggesting insignificant impact of the shocks has also been observed. Notably, few negative responses has also been observed (i.e. second day response to SMI, third day response to LSEG.L and SCI). Positive, negative and no reaction to different shocks at different times suggest dynamic or varied reaction of the index to the internal and external shocks. Overall, the results suggest that DAX index gets positively affected by the shocks initially and the positive impact remains persistent up to some extent in the upcoming periods as well. Moreover, stable responses over time reflects the lasting impact of the initial shocks from the internal as well as external financial market.

To its own shocks, the KS11 index responded positively and significantly during initial period which indicated a substantial rise in the index value immediately after the shock. During subsequent days both positive and negative responses were observed. The response was observed to be declining and ultimately reduced to zero which shows that with the passage of time the influence exerted by the internal shock on the financial market declines. The value of response

was observed to be 0.038 initially and it revolved around 0.004 during later periods. Higher positive responses were observed to the shocks from BSE SENSEX, BEL20 and DAX than the other indices. Apart from the own index, few negative responses were observed only to the shocks from SCI. It implies that the index mostly reacts positively to the shocks. Similar to the responses observed in most of the previous analyses, comparatively stabilized responses were observed second day onwards. It implies that initial shocks inserts lasting influence on KS11 and it does not get that much significantly impacted in the subsequent periods. The index was observed to react positively in most of the cases. However, few negative and null responses were also noted. Thus, it indicates mixed response of the index to the shocks. Overall, the results demonstrate that KS11 experiences an immediate substantial influence due to the shocks from internal as well as external markets. On the other hand, during subsequent days following the shock, it remains dynamic as mixed or negative responses are observed. Apart from minor fluctuations, the responses were observed to be more stable during subsequent days following the shock. It reflects that initial shock generates lasting impact on the financial market.

Table 4 represents the impulse response of LSEG.L and SCI to the shocks from its own as well as other stock indices.

Table 4. Response of LSEG.L and SCI to its own as well as to the external shocks.

Pe ri o d	Response of LSEG.L							Response of SCI						
	BSE SENSE X (India)	BEL2 0 (Belgi um)	DAX (Ger many)	KS1 1 (Kor ea)	LSE G.L (UK)	SCI (Ch ina)	SMI (Switz erland)	BS E L2 X (Be lgi um)	BE L2 X (Be lgi um)	DA X (Ge rm any)	K S1 (K or ea)	LS E G. L (U K)	S CI (C hi na)	SMI (Swi tzerl and)
1	0.006	0.012	0.002	0.00 1	0.02 7	0.00 0	0.000	0.0 05	0.0 01	0.0 01	0. 00 0	- 0.0 01	0. 05 8	0.00 0

2	0.003	0.006	0.003	0.00 0	0.00 6	- 0.00 1	0.000	0.0 04	0.0 03	0.0 01	0. 00 0	0.0 01	0. 03 3	- 0.00 1
3	0.003	0.007	0.002	0.00 0	0.01 2	- 0.00 1	0.000	0.0 03	0.0 02	0.0 00	0. 00 1	0.0 00	0. 01 1	- 0.00 1
4	0.003	0.007	0.001	0.00 1	0.01 5	0.00 0	0.000	0.0 03	0.0 01	0.0 01	- 0. 00 1	0.0 00	0. 03 4	0.00 0
5	0.004	0.007	0.003	0.00 0	0.01 1	0.00 0	0.000	0.0 04	0.0 02	0.0 01	0. 00 0	0.0 01	0. 03 7	- 0.00 1
6	0.004	0.007	0.002	0.00 1	0.01 3	- 0.00 1	0.000	0.0 04	0.0 02	0.0 00	0. 00 0	0.0 00	0. 02 2	- 0.00 1
7	0.003	0.007	0.002	0.00 1	0.01 3	0.00 0	0.000	0.0 03	0.0 01	0.0 00	0. 00 0	0.0 00	0. 02 7	0.00 0
8	0.004	0.007	0.002	0.00 1	0.01 2	0.00 0	0.000	0.0 03	0.0 02	0.0 01	0. 00 0	0.0 00	0. 03 3	0.00 0
9	0.004	0.007	0.002	0.00 1	0.01 3	0.00 0	0.000	0.0 04	0.0 02	0.0 01	0. 00 0	0.0 00	0. 02 8	- 0.00 1
10	0.003	0.007	0.002	0.00 1	0.01 3	0.00 0	0.000	0.0 03	0.0 01	0.0 00	0. 00 0	0.0 00	0. 02 7	- 0.00 1

Source: Author's Calculations.

Notes: Log returns of indices and Cholesky Ordering (BSESENSEX BEL20 DAX KS11 LSEG.L SCI) are used. Period ranges from day 1 to day 10.

To its own shock, the index demonstrated a significant positive response of 0.027 initially which indicated a remarkable rise in the index value following the shock. During the upcoming periods as well, the responses were observed to remain positive throughout. Value of the responses remained around 0.013 during subsequent days following the shock which indicated a more stabilized positive response. Significant and higher positive responses were observed to the shocks from BSE SENSEX, BEL 20 and DAX than the other indices i.e.

KS11, SCI and SMI. Mostly positive and some null responses were observed. On the other hand, few negative responses were also noted (i.e. second and sixth day response to KS11; third and sixth day response to SCI). It shows that the index does response significantly to the shocks from internal as well as external shocks. However, the nature of response remains dynamic or varied with the passage of time. Again similar to most of the previous analyses, more stabilized and comparatively constant responses were observed second day onwards. It implies that the initial shock has a lasting influence on the index value and its value does not change that

much significantly in the upcoming months. During most of the months, positive responses has been observed however few negative responses were also noted (i.e. second, third and sixth day response to shocks from SCI). Moreover, near-zero responses were also noted and specifically to SMI all responses were null. Altogether, mixed responses demonstrating the dynamic behaviour of the financial market has been noted. It signifies that not all the external shocks can insert a significant change on the financial market of a nation.

Overall, the results suggest that LSEG.L responds substantially positively during immediate period after the shock. The positive responses remain persistent up to some extent in the upcoming periods as well. The stability of the impulse responses over time may reflect the lasting impact of the initial shock on these financial markets, with LSEG.L showing a particularly strong initial positive response. Comparatively stronger initial responses and more stabilized responses in later months reflect remarkable and lasting impacts of the internal and external shocks on the financial market of a nation.

To its own shocks, the SCI index responded positively throughout the period and the values of responses were also observed to higher than the external shocks. Initial response of 0.058 indicated remarkable rise in the index value

immediately following the shock. Values in the subsequent months revolved around 0.030 which also suggested a stabilized positive reaction of the index to the internal shock. Comparatively higher positive responses were observed during initial periods than the subsequent periods following the shocks. Apart from the consistent positive responses, few negative values were also noted specially in case of SMI. The mixed responses suggest that financial market does responds significantly to the shocks but nature of the response remains dynamic or varied. From second day onwards following the shock, more consistent results were observed which again suggests that the initial shocks generate relatively higher lasting impacts on the financial market.

Overall, the results suggests that SCI gets substantially affected positively immediately following the shocks and the positive impact remains persistence up to some degree in later periods as well. Stabilized reactions with passage of time reflects the lasting impact of initial shocks on the financial market. Moreover, mixed responses including negative and null responses suggests that the reaction of market remains varied or dynamic over time.

Table 5 represents the impulse response of SMI to the shocks from its own as well as other stock indices (BSE SENSEX, BEL20, DAX, KS11, LSEG.L, SCI).

Table 5. Response of SMI to its own as well as to the external shocks.

Period	BSE SENSEX (India)	BEL20 (Belgium)	DAX (Germany)	KS11 (Korea)	LSEG.L (UK)	SCI (China)	SMI (Switzerland)
1	0.004	0.011	0.004	0.000	0.001	0.000	0.008
2	0.002	0.005	0.002	0.001	0.000	0.000	0.002
3	0.002	0.005	0.002	0.000	0.000	0.000	0.003
4	0.003	0.007	0.002	0.001	0.000	0.000	0.005
5	0.002	0.006	0.002	0.000	0.000	0.000	0.003
6	0.002	0.006	0.002	0.001	0.000	0.000	0.004
7	0.002	0.006	0.002	0.001	0.000	0.000	0.004

8	0.002	0.006	0.002	0.001	0.000	0.000	0.004
9	0.002	0.006	0.002	0.001	0.000	0.000	0.004
10	0.002	0.006	0.002	0.001	0.000	0.000	0.004

Source: Author's Calculations.

Notes: Log returns of indices and Cholesky Ordering (BSESENSEX BEL20 DAX KS11 LSEG.L SCI) are used. Period ranges from day 1 to day 10.

To all the shocks whether internal or external, the index responded positively throughout. Near zero and null responses were also observed but no negative response could be observed. It signifies that the index responds in a positive way to the shocks or the shocks do not exert any influence on it. To its own shock, initial response of 0.008 was noted and in the subsequent months, it revolved around 0.004. It indicates a sudden rise in the index value following the shock period which remains sustained with the passage of time as well however with a lower magnitude. Different from most of the previous analysis, a consistent positive response without any negative response in any of the case has been observed to be maintained which reflects the stabilized reaction of the index to the shocks from internal as well as external financial markets. Unlike some of the other indices, SMI's impulse responses are observed to be consistently positive in all periods. This indicates that SMI experiences positive changes due to the shocks from internal as well as external markets throughout the observed time frame. The stability of the impulse responses over time may reflect the lasting impact of the initial shock on these financial markets, with SMI showing a consistently positive response throughout the observed period.

The findings suggest that the financial market responds positively immediately after the shock is generated and the positive impact remains persistent up to some extent in the later periods as well. Relatively stabilized responses with the

passage of time reflects the lasting impact generated by the shocks on the financial market. Figure 1 presents the response of the studied indices to its own as well as to the external shocks.

5. Discussion

By tracing the dynamic reactions to market shocks using impulse response functions (IRFs), the study's findings offer important new insights into the integration of the Indian stock market with its selected trading partners. The findings point to a number of significant trends that advance the theory of market interconnectedness and financial contagion.

The impulse response analysis revealed that the Indian stock market (BSE SENSEX) responds more strongly to its own shocks than to external shocks from its trading partners. This suggests that domestic factors continue to play a dominant role in the performance of the Indian market, although global shocks do affect the market to varying extents. For instance, BSE SENSEX shows positive responses to shocks from European markets like BEL20 and DAX, while the responses to Asian markets like KS11 and SCI are more mixed, with both positive and negative responses observed. This mixed response reflects the complex nature of regional market interactions, possibly driven by differing economic structures and trade relationships. Results indicate that BSE SENSEX is more sensitive to domestic shocks than those from international trading partners. This suggests that domestic factors are still the main drivers of market performance in India, even though global shocks do affect the market to varying degrees.

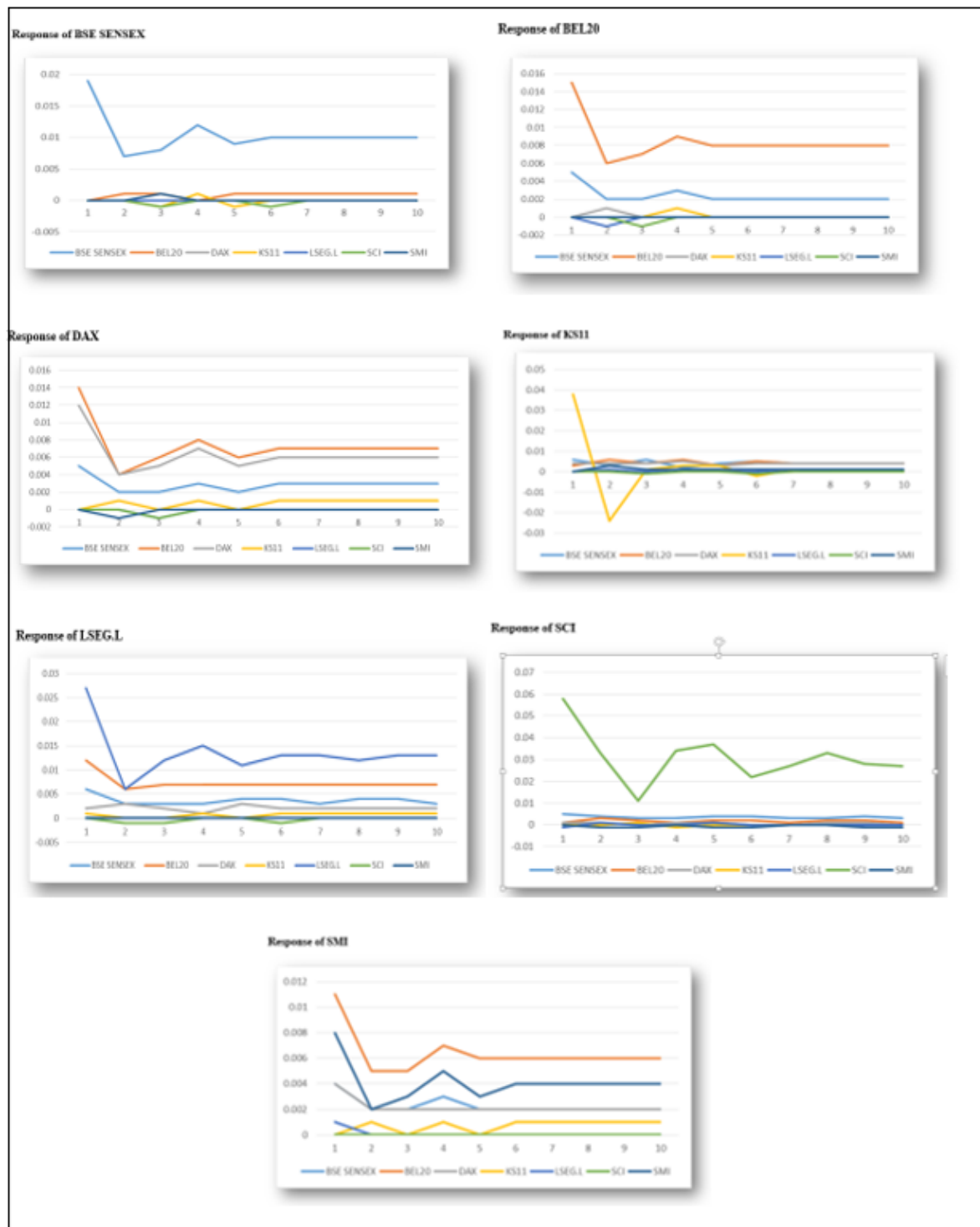


Figure 1. Response of the studied indices to its own as well as to the external shocks.

Source: Author's Calculations.

Thus, the BSE SENSEX responds positively to shocks coming from European markets like BEL20 and DAX, but the responses to Asian markets like KS11 and SCI are more mixed, exhibiting both positive and negative responses. This inconsistent behavior suggests that regional

market interactions are complex and may be caused by different economic structures and trade relationships.

The findings also imply that financial markets in the United Kingdom (LSEG.L) and Switzerland (SMI) have reasonably stable positive responses

to shocks from both internal and external sources. Because of their established risk management procedures and diverse portfolios, these markets are more resilient to shocks, which may explain their stability. A less long-term impact is indicated by the more dynamic responses of emerging markets, such as Korea's KS11, to external shocks. These markets first react significantly but then show signs of short-term instability.

Moreover, the findings suggest that markets react to exogenous shocks differently depending on the sector. Certain indices, such as the SMI, show a constant positive response, indicating that some sectors of the Swiss economy may be more resilient to external shocks than others. More research in this area could be interesting, especially to determine how sector-specific traits affect the overall integration of stock markets.

These results are consistent with earlier research on market integration like Dedi & Yavas (2016); Dunis *et al.* (2013), Gilmore & McManus (2004); Habiba *et al.* (2020); Matar *et al.* (2021), which has demonstrated how different emerging and developed economies are becoming more integrated into the global economy while maintaining some degree of independence. The dynamic character of the responses emphasizes the significance of comprehending the underlying reasons that drive these responses, implying that although shocks are transmitted uniformly and predictably, global financial markets are not.

6. Conclusion

By utilizing impulse response functions inside a VAR framework to analyze the interaction between the Indian stock market and its selected major trading partners, this study adds to the increasing body of literature on stock market integration. The findings show that while the Indian market is still more sensitive to local

shocks, it is also affected by external shocks. The study implies that domestic forces continue to be important in driving market behavior in India, even in the face of growing globalization.

These findings hold important implications for academics, investors, and regulators. Given the varying reactions to shocks from different markets, the evidence of partial integration implies that international diversification might still be a useful risk management approach for investors. In order to develop financial and economic policies that both maximize the advantages of international capital flows and lessen the effects of shocks to the world economy, policymakers must have a thorough understanding of the scope and character of this integration. By using impulse response functions to capture the dynamic interactions across markets, the study makes a methodological contribution to the field and emphasizes the significance of both short- and long-term analysis.

The analysis also shows that the degree of integration is dynamic and evolves over time and geographically, necessitating ongoing observation of these connections, particularly in light of shifting geopolitical and economic conditions. Future research could broaden this approach by looking into sectoral disparities in shock transmission or the effect of policy interventions in promoting market integration.

Overall, it can be concluded from the findings of the study that although there is a growing degree of integration between the Indian stock market and international markets, especially with its major trading partners, this integration is uneven and time-varying, highlighting the significance of both local and foreign factors in determining market dynamics.

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