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FINANCIAL TURBULENCE AND RECOVERY IN STOCK MARKETS AMONG INDIA AND ITS MAJOR ASIA-PACIFIC COUNTERPARTS: AN ANALYTICAL STUDY DURING THE GLOBAL FINANCIAL CRISIS PERIOD AND POST-FINANCIAL CRISIS PERIOD

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ABSTRACT

Understanding stock market correlations is essential for gauging financial integration, identifying risk diversification potential, and supporting investment management especially during economic downturns in a globally connected landscape. This paper presents a comprehensive correlation analysis among India (S&P BSE SENSEX) and ten prominent Asia-Pacific countries— China (SSE Composite), Israel (TA-125), Japan (Nikkei), Hong Kong (Hang Seng), Taiwan (TSEC), Indonesia (Jakarta Composite), South Korea (KOSPI), Australia (S&P/ASX 00), Singapore (FTSE), and Russia (MOEX Russia)—across two pivotal phases: the global financial crisis period, spanning from August 7, 2007, to April 16, 2009 and post-financial crisis period, from April 20, 2009, to December 30, 2019. Using a combination of descriptive statistics and correlation analysis on the calculated returns from daily adjusted market closing series of these indices, the study assesses the degree of association among the indices of India and the ten economies, with normality diagnostics guiding the selection of the appropriate correlation methodology. The normality tests indicate that none of the return series follow normal distribution and validate the use of the non-parametric Spearman Rank Correlation method. Results reveal persistently weak correlations among the S&P BSE SENSEX and other indices, suggesting scope for minimal co-movement across the indices in both periods. Although correlation among returns from Indian and ten Asia-Pacific indices grew from the crisis to the post-crisis period, no strong association emerged, showing only modest inter-market linkages in both intervals.

Keywords: *Asian Markets, Recovery Period, Risk Management, Investment Diversification.*

Introduction

Globalization and the easing of cross-border financial restrictions, alongside domestic regulatory reforms, have underscored the importance of financial integration. While developed economies had already embraced financial consolidation as a complement to globalization, emerging economies started adopting cautious financial liberalization in the mid-1980s. The integration of financial markets across countries promotes greater uniformity in performance under standardized frameworks, giving investors access to higher risk-adjusted returns and enhancing both the competitiveness and efficiency of capital allocation. These processes have positioned countries for more sustainable economic growth by enhancing risk management capabilities. When domestic markets are more connected to international systems, the risks associated with market volatility and asset price fluctuations can be more readily diversified and mitigated. The investors can distribute capital across multiple regions, reducing the impact of localized depressions and supporting broader financial stability. Meanwhile, advancements in technology and communication networks further accelerate the integration process. Open financial markets and economic collaboration enhance the ease of equity transactions and maintain liquidity within the system (Levine and Zervos, 1998b). This also contributes to rising stock prices in domestic markets, fostering optimism among investors regarding future price trends (Henry, 2000). In recent times, the integration of stock indices, worldwide, has become a prominent aspect of financial integration, especially among countries with strong financial infrastructures. Consolidated indices facilitate unified asset trading,

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both domestically and internationally, while incorporating systematic risk adjustments and benefiting from advanced financial services. Integrated system standardizes the returns of stocks that are more likely exposed to identical risks, irrespective of their geographical location or economic condition (Bekaert and Harvey, 2003), thus allowing investors to optimize portfolios across borders. The internationalization of stock indices brings numerous advantages, as countries benefit from being part of an integrated financial network. Harmonized stock exchanges, by efficiently transmitting price signals, account for all relevant factors influencing asset pricing (Reddy, 2003).

Stock market integration, while fostering economic cohesion, heightens systemic risks by rapidly propagating crises to other integrated markets, increasing vulnerability to contagion effects. During financial crises, the benefits of improved communication and global integration are questioned, as integrated markets can swiftly transmit distress signals. This interconnectedness amplifies the impact of crises, spreading shocks across economies with limited relief from domestic adjustments. The 2008-09 financial crisis, originating from the U.S. housing bubble, escalated into a global-wide recession marked by banking failures, reduced investments, and restricted credit, triggering a stock market collapse during the years from 2007 to 2009. Emerging markets tend to be more responsive to local crises; however, as countries become increasingly integrated, the risks associated with such crises tend to diminish. Similarly, while the process of integration is influenced by periods of economic depression, the likelihood of financial instability escalates when nations are more tightly interconnected on a global scale.

Past Studies and Research Gap

The study of stock market correlation analysis has become a focal point for the researchers. In addressing this issue, the thorough review of previous studies has been done, and some of them are referred in this section. Mukherjee (2007) undertook a detailed comparative analysis of the Indian stock market (NSE) vis-à-vis global markets, including New York Stock Exchange (NYSE), Hong Kong Stock Exchange (HSE), Tokyo Stock Exchange (TSE), Russian Stock exchange (RSE), Korean Stock exchange (KSE), covering the period from January 1995 to July 2006. The study had been carried out into four distinct economic phases: the East-Asian crisis (1995–97), the technology boom (1999–2001), global recession recovery (2001–03), and the market investment affluent (2003–06). The analysis employed both qualitative and quantitative approaches. Qualitatively, it compared index performances on five dimensions like market capitalization, number of listed securities, listing agreement, circuit filters and settlement. Quantitatively, correlation analysis and exponential trend models assessed inter-market linkages and risk-return dynamics. Results revealed negligible correlation between India and other markets during the East Asian crisis, signifying minimal integration. In another study by Ranpura et al. (2011) explored short-term causal linkages and co-movements between the Indian stock market (BSE Sensex) and indices from ten developed and emerging economies. The study analyzed daily adjusted market closing series from July 1997 to December 2009, divided into two sub-periods: Period-I (1997–2003) and Period-II (2003–2009). The sample included markets from China (SCI), Brazil (BVSP), South Korea (KOSPI), U.S. (DJIA), U.K (FTSE), Hong Kong (HANGSENG), Singapore (STI), Japan (NIKKEI), Germany (DAX), and Australia (AORD). On daily stock market closing series and log-transformed return series, the study applied conventional statistical tools and correlation test to examine stock market interdependency. Findings revealed a strong correlation between India and markets like China, Brazil, and Australia when considering daily market closing data. Guidi (2010) analyzed the interconnections between the Indian stock market (BSE 30) and three developed Asian markets—Hong Kong (Hang Seng), Japan (Nikkei 225), and Singapore (STI)—over the period from January 4, 1999, to June 17, 2009. Due to data constraints, the STI series began on August 31, 1999. Using daily returns derived from daily closing prices, the study employed correlation and causality methods to identify relationships among the indices. Low correlation association had been observed between India and each of the three markets, indicating limited short-term co-movement. Further, the analysis was extended with cointegration tests and a bivariate DCC-GARCH model to examine long-term linkages and volatility dynamics. Results showed no cointegrating relation between India and the selected markets, highlighting opportunities for portfolio diversification. Visalakshmi and Manickavasagam (2018) investigated the interconnections among the BRICS nations—Brazil (IBOVESPA), Russia (MICEX), India (NIFTY), China (SSE Composite), and South Africa (JSE)—from January 2, 2001, to May 31, 2017. Using daily closing prices under a correlation-causality framework, the study analyzed stock market interdependencies. The findings indicated moderate to high positive correlations between India and Brazil, China, and South Africa, while India showed a weaker association with Russia. Kishor and Singh (2017) examined stock market linkages among BRICS nations from January 1, 2007, to December 31, 2014, using daily adjusted market closing values to calculate return series. Employing Johansen Co-integration tests, Unit Root, Granger Causality, Impulse Response Functions, and Variance Decomposition Models, the study assessed both long-term and short-term relationships. The results observed significant positive correlations between Indian and other BRICS indices, with the strongest correlations observed between India and South Africa, followed by India and Brazil. However, no long-term co-integration was found, suggesting limited alignment over time. Unidirectional as well as bidirectional causality existed between India and other BRCS nations.

Although existing studies had examined stock market correlations, very few had analyzed the changing correlation patterns among major Asian indices, particularly focused on India's S&P BSE SENSEX, during the global financial crisis and its aftermath. This gap highlights the need for deeper exploration into how associations evolved through these critical periods.

Objectives of the Study

Insights from gaps identified in the past literature review have shaped the two objectives of this current study, which are as follows:

- To study the statistical properties of the calculated return series derived from the daily adjusted stock market closing values of eleven stock indices with a focus on analyzing the correlation among the calculated returns related to India's S&P BSE SENSEX and the indices of ten Asia-Pacific economies during the global financial crisis period, spanning from August 7, 2007, to April 16, 2009;
- To explore the statistical attributes of the calculated return series derived from the daily adjusted market closing values of eleven stock indices with a focus on analyzing the correlation among calculated returns related to India's S&P BSE SENSEX and the indices of ten Asia-Pacific economies during the post-financial crisis period, from April 20, 2009, to December 30, 2019.

Data and Methodology

Sample Design & Data Period

This study based on secondary data, investigates the correlation dynamics between the calculated returns from stock indices of India (S&P BSE SENSEX) and the ten other major Asia-Pacific countries, namely China (SSE Composite), Israel (TA-125), Japan (Nikkei), Hong Kong (Hang Seng), Taiwan (TSEC), Indonesia (Jakarta Composite), South Korea (KOSPI), Australia (S&P/ASX 00), Singapore (FTSE), and Russia (MOEX Russia) across two noticeable periods: the 2008–09 Global Financial Crisis, covering periods, from August 7, 2007 – April 16, 2009 and the post-crisis recovery phase up until the COVID-19 pandemic ranging between April 20, 2009 to December 30, 2019.

The selection of sample Asia-Pacific countries and India with their respective domestic stock indices were based on the GDP ranking (nominal) published by World Bank, 2019 along with data availability using judgment sampling method. Firstly, the study considers the adjusted daily stock market closing series of each index, sourced from platforms like www.yahoofinance.com and www.investing.com and also from the official websites of the indices. From the stock market adjusted closing series the return (in log transformation) series are generated by taking the formula $R_t = lnP_t - lnP_{t-1}$, where stock market return (R_t) is the logarithmic transformation of the difference between daily adjusted closing stock market index and the previous day adjusted closing stock market index points (P_t and P_{t-1}), allowing for a granular analysis of returns.

The chosen timeframe is pivotal, as it encapsulates the significant global market disruptions and transitions influenced by India's second-generation economic reforms. This segmentation was validated by past studies, such as those by Dooley and Hutchison (2009), Cheung et al. (2010), which emphasize the heightened volatility and liquidity interventions by central banks during these periods. Notably, the crisis started on August 7, 2007, when markets first collapsed, leading to liquidity interventions by the U.S. central banks, and ended on April 16, 2009, post the G20 summit in London when global markets began to stabilize. The study's methodology involves comprehensive statistical testing, including rigorous diagnostic checks to select appropriate parametric or non-parametric methods, ensuring the robustness of the correlation analysis across these markets. Initially, descriptive statistics were generated for all ten-return series, followed by correlation testing, which aimed to capture the evolving integration patterns and potential for diversification benefits within the two analyzed periods.

Descriptive Statistics

Descriptive statistics are fundamental for summarizing and interpreting the primary characteristics of a dataset, providing a brief quantitative overview that reveals the underlying structure and patterns of the data. These statistics encompass measures of central tendency, variability, and shape, such as mean, standard deviation, skewness, and kurtosis. Unlike inferential statistics, descriptive statistics aim to describe and simplify raw data without generalizing beyond the sample.

Normality Test of the Series

A chief assumption of any parametric statistical application is that the data set must have normal distribution. This assumption implies that the sample data series, say x_i should be distributed with zero mean, or, E(X) =0. It means that most of the data points stretch closely around the mean value and the series forms the bell-shaped symmetric curve. To establish the normality nature of the series, this study follows Shapiro−Wilk test. The test hypothesis and decision rule are as follows:

Table1: Hypothesis Testing and Decision Rule of Shapiro−Wilk Test

Test	Hypothesis	Decision Rule
Shapiro−Wilk Test of Normality checking of the series	• H_0: the calculated returns from daily adjusted index closing series of the select sample countries individually are normally distributed • Alternative hypothesis, H_1: the calculated returns from daily adjusted index closing series of the select sample countries individually are non- normal in nature.	• If P−Value< 0.05, H_0 is rejected concluding the return series are not following normal distribution • If P−Value > 0.05, H_0 is not rejected concluding the return series are normally distributed

Correlation Test

Correlation is utilized here as an initial measure of integration among these stock indices. Depending on normality, either the Pearson correlation test (for normally distributed data) or the Spearman rank correlation test (a non-parametric alternative) will be applied. Both tests yield a correlation coefficient, indicating the degree and direction of association between market indices, providing foundational insights into cross-market relationships.

Spearman Rank Correlation

When the data series are found non-normal series—the Spearman Rank Correlation method is used as an alternative. This non-parametric test evaluates the strength and direction of a monotonic relationship between two variables by analyzing ranked values instead of raw data. Spearman's approach is especially recommended when data display a monotonic pattern, as shown in scatter plots, and is ideal for assessing correlations in non-normally distributed or ordinal data. Unlike Pearson’s correlation, Spearman’s test emphasizes rank-based association, capturing monotonic relationships without assuming linearity. The formula for calculating Spearman Coefficient in terms of Pearson test is as follows:

$$r_{R(x)R(y)} = \frac{cov\,(R(X),R(Y))}{\sigma_{R(X)}\sigma_{R(Y)}}$$

Cov (R(X), R(Y)) is the covariance of the ranked values of the original series and $\sigma_{R(X)}$ and $\sigma_{R(Y)}$ stand for the standard deviations of the ranked variables. Normally, Spearman Correlation is computed by using the following formula:

$$r_{R(x)R(y)} = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$$

Where, d_i is the difference between the two ranks of each observation, i.e. R(X)-R(Y).

The value of Pearson coefficient always lies between –1 and +1. If both the variables are moving in the same (opposite) direction, then it would be said that they have positive (negative) correlation. The rule of thumb in elucidating correlation coefficient is shown in following Table-2.

Table 2: Interpretation of Observed Correlation Coefficient

Coefficient Ranges	Interpretation
(±)0.00—(±)0.10	Presence of Insignificant correlation (positive/ negative)
(±)0.11—(±)0.39	Presence of Weak correlation (positive/ negative)
(±)0.40—(±)0.49	Presence of Low correlation (positive/ negative)
(±)0.50—(±)0.69	Presence of Moderate correlation (positive/ negative)
(±)0.70—(±)0.89	Presence of Strong correlation (positive/ negative)
(±) 0.90—(±)0.99	Presence of very Strong correlation (positive/ negative)
(±)1.00	Perfectly correlated (positive/ negative)

After conducting the correlation test, hypothesis testing is used to determine if the observed sample correlation significantly represents the true population correlation. This test assesses two possibilities: if the population correlation coefficient (ρ) is close to zero, suggesting no significant linear association, or if ρ significantly differs from zero, indicating a meaningful relationship. The test outcome hinges on comparing the observed r (r_{obs}) and critical r (r_{crit}) derived from the t-distribution table based on the degrees of freedom (n−2). This comparison aids in either accepting the null hypothesis (H_0) (no correlation) or rejecting it in favor of the alternative hypothesis, H_1(significant correlation). Statistically, Null Hypothesis (H_o) can be written as:

Table 3: Hypothesis Testing and Decision Rule of Correlation Coefficient

Test	Hypothesis	Decision Rule
Significance of Pearson Correlation Coefficient	• Null hypothesis, H_0: ρ=0, i.e., the population correlation coefficient is not significantly different from zero; • Alternative hypothesis, H_1: ρ≠0, i.e., the population correlation coefficient is significantly different from zero	• If $r_{crit} > r_{obs}$ then null hypothesis will not be rejected, concluding there exist no significant correlation • If $r_{crit} < r_{obs}$ then null hypothesis will be rejected, concluding the presence of significant correlation

After estimating observed r (r_{obs}), critical t-statistics, critical r (r_{crit}) has to be found from the t-table based on the degrees of freedom and the significance level.

Empirical Results and Interpretations

This section presents the empirical findings aligned with the objectives of this study, focusing on the correlation dynamics among the calculated returns from daily adjusted stock index closing series of India's chosen index and those of the ten selected Asia-Pacific nations. Prior to the correlation analysis, a comprehensive overview of the descriptive statistics is provided to summarize the dataset characteristics. Additionally, conventional test of normality was rigorously conducted to ensure the appropriateness of the correlation tests.

Addressing to Objective-1

Studying the statistical properties of the calculated return series derived from the daily adjusted stock market closing values of eleven stock indices with a focus on analyzing the correlation among the calculated returns related to India's S&P BSE SENSEX and the indices of ten Asia-Pacific economies during the global financial crisis period

Descriptive Statistics

The descriptive statistics captures the basic features of the data. The descriptive statistics table is attached as follows labeling the nature of the return series of the eleven indices including India:

Table 4: A Summary of Descriptive Statistics

Parameters (Indices)	Sample Size	Minimum Statistics	Maximum Statistics	Mean Value	Standard Deviation	Variance	Skewness		Kurtosis	
							statistics	Standard Error	statistics	Standard Error
S&P BSE SENSEX (India)	200	−0.136670968106 7407	0.119042828031 0384	−0.001586212193554	0.035279060633961	0.001	−0.163	0.172	1.855	0.342
China (SSE Composite)	200	−0.122044376806 7506	0.165211413621 6888	−0.002767539194223	0.037946641902333	0.001	0.192	0.172	1.801	0.342

Israel (TA-125)	200	−0.1713360015110009	0.0901738508314406	−0.001934190725665	0.028731382431025	0.001	−1.010	0.172	7.604	0.342
Japan (Nikkei225)	200	−0.1673958351384789	0.1187552065060645	−0.003320146819701	0.031487366483692	0.001	−1.066	0.172	5.645	0.342
Hong Kong (Hang Seng Index)	200	−0.2224672365828107	0.1491139438477665	−0.001824049756745	0.042582205229964	0.002	−0.202	0.172	5.778	0.342
Taiwan (TSEC weighted Index)	200	−0.0960628313872101	0.1405466399286000	−0.002002148048365	0.030242556302665	0.001	0.371	0.172	3.232	0.342
Indonesia (Jakarta Composite Index)	200	−0.1437621773338945	0.1855581564992766	−0.001672972985322	0.037152780492271	0.001	−0.263	0.172	6.598	0.342
S Korea (KOSPI Composite Index)	200	−0.1452255826046557	0.1734204115390968	−0.001633124318193	0.034340214721818	0.001	−0.059	0.172	6.672	0.342
Australia (S&P/ASX 200)	200	−0.1110683953985868	0.0858875705296752	−0.002325691945623	0.024873250220672	0.001	−0.477	0.172	3.048	0.342

Singapore (FTSE Singapore)	200	−0.121515189510261 8	0.132847254666904 0	−0.003091927347445	0.030973048114280	0.001	−0.002	0.172	4.663	0.342
Russia (MOEX Russia Index)	200	−0.376238963296058 4	0.258411806097916 6	−0.003121589273817	0.056723197693422	0.003	−0.929	0.172	13.064	0.342

Source: Compilation of secondary data using SPSS 21.0

Findings

It has been observed that there are total 200 observations in each return series and no missing value has been found. The minimum and maximum returns have been found in the Hang Seng Index series from Hong Kong and Jakarta Composite Index (Indonesia). Low standard deviations indicate that the observations are very close to mean return values of the series. Positive skewness has been found in the returns from TSEC weighted index (Taiwan) and SSE Composite Index (China) that have longer right tails of the distributions. The rest of the return series have negative skewness and have longer left tails. The positive and negative skewness values determine the distributions are not symmetric in nature and hence no series has been following normal distribution. The return series of S&P BSE SENSEX (India) and SSE Composite Index (China) had positive kurtosis values less than 3 and looked the shape of platykurtic curve, i.e. less peaked than normal distribution curve. The positive values have been found for the rest of the series that have kurtosis greater than 3 and called leptokurtic distribution. The kurtosis values of the series also confirm that no series have been following normal distribution.

Normality Test of the Return Series

The normality test of the series has been carried out to detect the correct application of the parametric or non-parametric correlation test. The Shapiro-Wilk test is performed as the normality test. The test results with p-value, decision rule and test inferences are as follows:

Table 5: Result of the Shapiro-Wilk Test of Normality

Countries (Stock Indices)	Statistic	P−Value	Decision Rule	Decision on H_0 (*H_0: The return series are normally distributed.*)	Inferences
India (S&P BSE SENSEX)	0.976	0.002	P<0.05	Rejected	Non-normal series
China (SSE Composite)	0.982	0.011	P<0.05	Rejected	Non-normal series
Israel (TA-125)	0.890	0.000	P<0.05	Rejected	Non-normal series
Japan (Nikkei225)	0.910	0.000	P<0.05	Rejected	Non-normal series
Hong Kong (Hang Seng Index)	0.898	0.000	P<0.05	Rejected	Non-normal series
Taiwan (TSEC weighted Index)	0.947	0.000	P<0.05	Rejected	Non-normal series
Indonesia (Jakarta Composite Index)	0.860	0.000	P<0.05	Rejected	Non-normal series
S Korea (KOSPI Composite Index)	0.878	0.000	P<0.05	Rejected	Non-normal series
Australia (S&P/ASX 200)	0.952	0.000	P<0.05	Rejected	Non-normal series
Singapore (FTSE Singapore)	0.902	0.000	P<0.05	Rejected	Non-normal series
Russia (MOEX Russia Index)	0.801	0.000	P<0.05	Rejected	Non-normal series

Source: Compilation of secondary data using SPSS 21.0

Findings

It is found that all observed p-values are less than 0.05 that clearly indicates that the null hypothesis is rejected and the return series follow non-normal distribution. Hence, as the test shows non-normality with p values < 0.05, it is followed by using non-parametric correlation approach, namely Spearman Rank Correlation test.

Spearman Rank Correlation

The Spearman rank correlation matrix is given as follows:

Table 6: The Spearman Rank Correlation Matrix of the Return of adjusted market closing Series among India and the select Ten sample countries' Stock Indices belong to the Asia-Pacific Region during global financial crisis Period

Countries (Stock Indices)	India (S&P BSE SENSEX)	China (SSE Composite)	Israel (TA-125)	Japan (Nikkei225)	Hong Kong (Hang Seng Index)	Taiwan (TSEC weighted Index)	Indonesia (Jakarta Composite Index)	S Korea (KOSPI Composite Index)	Australia (S&P/ASX 200)	Singapore (FTSE Singapore)	Russia (MOEX Russia Index)
India (S&P BSE SENSEX)	1.000	0.109 (0.124)	0.257** (0.000)	0.280** (0.000)	0.3** (0.000)	0.326** (0.000)	0.270**(0.000)	0.303**(0.000)	0.337**(0.000)	0.269**(0.000)	0.273**(0.000)
China (SSE Composite)	0.109 (0.124)	1.000	0.283** (0.000)	0.220** (0.002)	0.499** (0.000)	0.372** (0.000)	0.318** (0.000)	0.416** (0.000)	0.322** (0.000)	0.312** (0.000)	0.229** (0.001)
Israel (TA-125)	0.257** (0.000)	0.283** (0.000)	1.000	0.443** (0.000)	0.574** (0.000)	0.518** (0.000)	0.468** (0.000)	0.557** (0.000)	0.521** (0.000)	0.585** (0.000)	0.539** (0.000)
Japan (Nikkei225)	0.280** (0.000)	0.220** (0.002)	0.443** (0.000)	1.000	0551** (0.000)	0.551** (0.000)	0.431** (0.000)	0.583** (0.000)	0.664** (0.000)	0.566** (0.000)	0.294** (0.000)
Hong Kong (Hang Seng Index)	0.323** (0.000)	0.499** (0.000)	0.574** (0.000)	0.551** (0.000)	1.000	0.682** (0.000)	0.596** (0.000)	0.708** (0.000)	0.693** (0.000)	0.774** (0.000)	0.436** (0.000)
Taiwan (TSEC weighted Index)	0.326** (0.000)	0.372** (0.000)	.518** (0.000)	0.551** (0.000)	0.682** (0.000)	1.000	0.473** (0.000)	0.737** (0.000)	0.696** (0.000)	0.633** (0.000)	0.491** (0.000)
Indonesia (Jakarta Composite Index)	0.270** (0.000)	0.318** (0.000)	0.468** (0.000)	0.431** (0.000)	0.596** (0.000)	0.473** (0.000)	1.000	0.521** (0.000)	0.564** (0.000)	0.587** (0.000)	0.481** (0.000)
S Korea (KOSPI Composite Index)	0.303** (0.000)	0.416** (0.000)	0.557** (0.000)	0.583** (0.000)	0.708** (0.000)	0.737** (0.000)	0.521** (0.000)	1.000	0.686** (0.000)	0.655** (0.000)	0.491** (0.000)
Australia (S&P/ASX 200)	0.337** (0.000)	0.322** (0.000)	0.521** (0.000)	0.664** (0.000)	0.693** (0.000)	0.696** (0.000)	0.564** (0.000)	.686** (0.000)	1.000	0.699** (0.000)	0.474** (0.000)
Singapore (FTSE Singapore)	0.269** (0.000)	0.312** (0.000)	0.585** (0.000)	0.566** (0.000)	0.774** (0.000)	0.633** (0.000)	0.587** (0.000)	0.655** (0.000)	0.699** (0.000)	1.000	0.492** (0.000)
Russia (MOEX Russia Index)	0.273** (0.000)	0.229** (0.001)	0.539** (0.000)	0.294**(0.000)	0.436**	0.491** (0.000)	0.481** (0.000)	0.491** (0.000)	0.474** (0.000)	0.492** (0.000)	1.000

**** Correlation is significant at the 0.01 level (2-tailed)**

Source: Compilation of secondary data using SPSS 21.0

Findings

The Spearman correlation matrix is described in the above table. It has been observed that the return from S&P BSE SENSEX (India) has been enjoying weak association with the returns from the indices of the ten countries of the Asia-Pacific region. Although positive associations have been found, but coefficient values are less than 0.4. Coefficients are statistically significant at 0.01 level at 2-tailed test. However, the correlation between SSE Composite Index (China) and S&P BSE SENSEX is not statistically significant, while all other correlations are statistically significant.

Addressing to Objective-2

Exploring the statistical attributes of the calculated return series derived from the daily adjusted market closing values of eleven stock indices with a focus on analyzing the correlation among calculated returns related to India's S&P BSE SENSEX and the indices of ten Asia-Pacific economies during the post-financial crisis period

Descriptive Statistics

The descriptive statistics table of the calculated return series of the daily adjusted stock market closing values of eleven stock indices, including India's S&P BSE SENSEX is as follows:

Table 7: A Summary of Descriptive Statistics

Parameters	Sample Size	Minimum Statistics	Maximum Statistics	Mean Value	Standard Deviation	Variance	Skewness		Kurtosis	
							statistics	Standard Error	statistics	Standard Error
India (S&P BSE SENSEX)	1271	–0.07847	0.144126	0.001038	0.01516689	0.000	0.987	0.069	10.529	0.137
China (SSE Composite)	1271	–0.13239	0.124048	0.000143	0.02119185	0.000	–0.64	0.069	6.197	0.137
Israel (TA-125)	1271	–0.08662	0.05621	0.000621	0.012326994	0.000	–0.811	0.069	5.518	0.137
Japan (Nikkei225)	1271	–0.11543	0.083576	0.000789	0.019496762	0.000	–0.714	0.069	5.842	0.137
Hong Kong (Hang Seng Index)	1271	–0.09252	0.103756	0.00047	0.017780249	0.000	0.054	0.069	3.408	0.137
Taiwan (TSEC weighted Index)	1271	–0.11799	0.09243	0.000549	0.014613162	0.000	–0.861	0.069	8.873	0.137
Indonesia (Jakarta Composite Index)	1271	–0.10827	0.105067	0.001066	0.01560622	0.000	–0.334	0.069	8.675	0.137
S Korea (KOSPI Composite Index)	1271	–0.10076	0.049	0.000391	0.013585081	0.000	–0.939	0.069	5.927	0.137
Australia (S&P/ASX 200)	1271	–0.07032	0.055475	0.000463	0.012494051	0.000	–0.274	0.069	2.828	0.137
Singapore (FTSE Singapore)	1271	–0.0782	0.168212	0.000427	0.013628251	0.000	1.035	0.069	21.482	0.137
Russia (MOEX Russia Index)	1271	–0.08476	0.129583	0.000944	0.019430377	0.000	0.114	0.069	5.134	0.137

Source: Compilation of secondary data using SPSS 21.0

Findings

The descriptive statistics offer a foundational perspective into key data features, such as central tendency, dispersion, and skewness, of the return series for the eight indices. The table reveals a total of 1271 observations per series, with no missing values identified. The highest return is observed in the FTSE Singapore index, while the SSE Composite Index (China) registers the lowest return. Low standard deviation values suggests that most data points cluster closely around the mean, indicating less variability within these series. Positive skewness—seen in the FTSE Singapore, Hang Seng Index (Hong Kong), and S&P BSE SENSEX (India)—signals distributions with elongated right tails, while the remaining indices exhibit negative skewness. Furthermore, higher kurtosis values (greater than 3) across most indices point to leptokurtic distributions, characterized by fatter tails. Based on these statistics, it is clear that none of the return series adhere to a normal distribution, as confirmed by the underlying distributional properties.

The Test of Normality

The results of the Shapiro-Wilk test, including the p-values, decision criteria, and corresponding inferences, are presented as follows:

Table 8: Result of the Shapiro-Wilk Test of Normality

Countries (Stock Index)	Statistic	P−Value	Decision Rule	Decision on H_0 (*H_0: The return series are normally distributed.*)	Inferences
India (S&P BSE SENSEX)	0.914	0.002	P<0.05	Rejected	Non-normal series
China (SSE Composite)	0.904	0.011	P<0.05	Rejected	Non-normal series
Israel (TA-125)	0.930	0.000	P<0.05	Rejected	Non-normal series
Japan (Nikkei225)	0.918	0.000	P<0.05	Rejected	Non-normal series
Hong Kong (Hang Seng Index)	0.955	0.000	P<0.05	Rejected	Non-normal series
Taiwan (TSEC weighted Index)	0.908	0.000	P<0.05	Rejected	Non-normal series
Indonesia (Jakarta Composite Index)	0.892	0.000	P<0.05	Rejected	Non-normal series
S Korea (KOSPI Composite Index)	0.931	0.000	P<0.05	Rejected	Non-normal series
Australia (S&P/ASX 200)	0.965	0.000	P<0.05	Rejected	Non-normal series
Singapore (FTSE Singapore)	0.874	0.000	P<0.05	Rejected	Non-normal series
Russia (MOEX Russia Index)	0.932	0.000	P<0.05	Rejected	Non-normal series

Source: Compilation of secondary data using SPSS 21.0

Findings

The results from the Shapiro-Wilk test table clearly demonstrate that all perceived p-values are less than 0.05, leading to the rejection of the null hypothesis, which posits that all the return series do not follow the normal distribution. Consequently, the alternative hypothesis of non-normality is accepted. Given this outcome, the appropriate analytical approach is to apply a non-parametric correlation method. Accordingly, the Spearman Rank Correlation test is employed to measure the correlation among the return series.

Spearman Rank Correlation Test

The Spearman rank correlation matrix is given as follows:

Table 9: The Spearman Rank Correlation Matrix of the Return of adjusted market closing Series among India and the select ten sample countries' Stock Indices belong to the Asia-Pacific Region during Post-Crisis Period

Countries (Indices)	India (S&P BSE SENSEX)	China (SSE Composite)	Israel (TA-125)	Japan (Nikkei225)	Hong Kong (Hang Seng Index)	Taiwan (TSEC weighted Index)	Indonesia (Jakarta Composite Index)	S Korea (KOSPI Composite Index)	Australia (S&P/ASX 200)	Singapore (FTSE Singapore)	Russia (MOEX Russia Index)
India (S&P BSE SENSEX)	1.000	0.079** (0.005)	0.191** (0.000)	0.049 (0.084)	0.228** (0.000)	0.214** (0.000)	0.185** (0.000)	0.207** (0.000)	0.186** (0.000)	0.187** (0.000)	0.225** (0.000)
China (SSE Composite)	0.079** (0.005)	1.000	0.187** (0.000)	0.115** (0.000)	0.541** (0.000)	0.343** (0.000)	0.248** (0.000)	0.307** (0.000)	0.267** (0.000)	0.344** (0.000)	0.252** (0.000)
Israel (TA-125)	0.191** (0.000)	0.187** (0.000)	1.000	0.090** (0.001)	0.394** (0.000)	0.335** (0.000)	0.306** (0.000)	0.355** (0.000)	0.335** (0.000)	0.383** (0.000)	0.389** (0.000)
Japan (Nikkei225)	0.049 (0.084)	0.115** (0.000)	0.090** (0.001)	1.000	0.148** (0.000)	0.162** (0.000)	0.068* (0.0150	0.178** (0.000)	0.157** (0.000)	0.170** (0.000)	0.097** (0.001)
Hong Kong (Hang Seng Index)	0.228** (0.000)	0.541** (0.000)	0.394** (0.000)	0.148** (0.000)	1.000	0.623** (0.000)	0.490** (0.000)	0.618** (0.000)	0.545** (0.000)	0.692** (0.000)	0.432** (0.000)
Taiwan (TSEC weighted Index)	0.214** (0.000)	0.343** (0.000)	0.335** (0.000)	0.162** (0.000)	0.623** (0.000)	1.000	0.457** (0.000)	0.656** (0.000)	0.505** (0.000)	0.571** (0.000)	0.377** (0.000)
Indonesia (Jakarta Composite Index)	0.185** (0.000)	0.248** (0.000)	0.306** (0.000)	0.068* (0.000)	0.490** (0.000)	0.457** (0.000)	1.000	0.462** (0.000)	0.383** (0.000)	0.488** (0.000)	0.344** (0.000)
S Korea (KOSPI Composite Index)	0.207** (0.000)	0.307** (0.000)	0.355** (0.000)	0.178** (0.000)	0.618** (0.000)	0.656** (0.000)	0.462** (0.000)	1.000	0.496** (0.000)	0.576** (0.000)	0.361** (0.000)
Australia (S&P/ASX 200)	0.186** (0.000)	0.267** (0.000)	0.335** (0.000)	0.157** (0.000)	0.545** (0.000)	0.505** (0.000)	0.383** (0.000)	0.496** (0.000)	1.000	0.551** (0.000)	0.301** (0.000)
Singapore (FTSE Singapore)	0.187** (0.000)	0.344** (0.000)	0.383** (0.000)	0.170** (0.000)	0.692** (0.000)	0.571** (0.000)	0.488** (0.000)	0.576** (0.000)	0.551** (0.000)	1.000	0.384** (0.000)
Russia (MOEX Russia Index)	0.225** (0.000)	0.252** (0.000)	0.389** (0.000)	0.097** (0.000)	0.432** (0.000)	0.377** (0.000)	0.344** (0.000)	0.361** (0.000)	0.301** (0.000)	0.384** (0.000)	1.000
**** Correlation is significant at the 0.01 level (2-tailed)**											

Source: Compilation of secondary data using SPSS 21.0

Findings

The correlation matrix reveals that the return series from the S&P BSE SENSEX (India) exhibited only weak correlations with the returns from other stock indices in the Asia-Pacific region. Furthermore, not all of these correlation coefficients are statistically significant at the 0.01 level, indicating limited interdependence. In examining the correlations among the remaining indices, excluding India, the associations also appear relatively weak, suggesting that strong financial linkages between the indices of these countries are generally absent. This suggests a degree of financial segmentation within the region's stock markets during the study period.

Conclusion

The findings reveal that the returns from the S&P BSE SENSEX (India) show very weak correlations with the returns from the other indices in the sample, indicating limited co-movement during the crisis and post-crisis periods. This weak association persisted across the two study intervals. While, the correlation strength among the returns from sample indices of India and ten Asia-Pacific nations increased from the crisis to the post-crisis period, the coefficients did not indicate any robust or substantial association. Despite some growth in inter-market linkages over time, the data ultimately showed limited strength in these connections in both the intervals. The absence of strong correlations suggests that these markets were not highly integrated, offering significant opportunities for investors to diversify their portfolios. Limited correlation reduces the likelihood of synchronized losses across different markets, especially during periods of financial instability, enabling investors to mitigate risk by holding assets in less interconnected markets. This diversification potential enhances portfolio resilience and can improve risk-adjusted returns, making it an essential strategy in volatile economic environments.

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