International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Study on the Stock Markets Correlation Among Major Global Economies During the Post-Global Recession Period

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Abstract

As global financial systems become increasingly interconnected, understanding the linkages between Indian stock indices and international markets has become vital for investors aiming to navigate and capitalize on evolving market dynamics. The study delves into the intricate dynamics among India's S&P BSE SENSEX and 21 prominent stock indices from Asia, America, and Europe over the period spanning April 20, 2009 to December 30, 2019. Utilizing descriptive statistical analysis of the calculated return series derived from daily adjusted index closing values, alongside the non-parametric Spearman Rank Correlation method, the research provides an exhaustive exploration of global market correlation. The findings reveal weak correlations between the S&P BSE SENSEX and sample global indices, underscoring India's limited financial integration with international markets and its significant potential for portfolio diversification. In contrast, moderate correlations among American and European indices signal sensible regional association, reflecting shared economic frameworks and suggesting constrained diversification opportunities within these regions. The analysis further highlights heterogeneous financial interdependency, with India's S&P BSE SENSEX maintaining a distinctive detachment from American and European indices, underscoring unique market dynamics. Asian markets exhibit moderate intra-regional cohesion and selective global linkages, whereas European indices demonstrate robust interdependence, indicative of cohesive economic and financial policies. Notably, China's SSE emerges as minimally integrated, while select transcontinental relationships, such as between Mexico's IPC and the Netherlands' EURONEXT 100, underscore targeted global interdependencies. This nuanced examination sheds light on the structural and regional factors shaping global financial integration.

KEYWORDS: Stock Market Correlation, S&P BSE SENSEX, Asian Markets, American Markets, European Markets, Post-recession

1. The Background of the Study

Over the past few decades, globalization has fundamentally transformed economic and financial systems, driven unprecedented liberalization and enabling cross-border capital mobility. The dismantling of trade barriers and regulatory hurdles, coupled with investors' increasing pursuit of diversification, has intensified global market participation and fostered deeper financial integration. This growing interdependence is reflected in the synchronized behavior of global stock indices and the heightened interconnectedness of economies. Concurrently, technological breakthroughs—such as advanced trading

platforms, seamless information dissemination etc.—have revolutionized financial markets. By enhancing transparency, liquidity, and operational efficiency, these innovations have reduced informational asymmetries and bolstered investor confidence, laying the foundation for a more integrated and dynamic global financial system. However, the degree of financial integration is shaped by a complex interplay of structural and temporal factors, including trade dependencies, capital market openness, macroeconomic linkages, and regional economic alignments. Emerging markets like India, in particular, exhibit evolving integration patterns influenced by their growing role in global value chains and expanding economic stature. Analyzing the correlations between India's stock markets and major global indices provides insights into financial interdependence, systemic risks, and opportunities for portfolio diversification. This analysis is particularly valuable for policymakers, as it helps inform strategies to strengthen market resilience, enhance economic stability, and mitigate the effects of external shocks. By examining the interactions among India's financial markets and their global counterparts, this study aims to uncover evolving patterns of co-movements, offering critical insights into the implications of financial integration for risk management, market efficiency, and economic stability. These findings can guide strategic decisions to boost investor confidence, promote sustainable growth, and enhance the resilience of emerging economies within an interconnected global financial ecosystem.

2. Past Studies and Research Gap

Panda (2015) investigated the integration dynamics of the Indian stock market (SENSEX) with major global indices, including the US (S&P 500), UK (FTSE 100), Japan (Nikkei), Singapore (STI), Hong Kong (HIS), Korea (SE Composite), Malaysia (Kuala Lumpur Composite), Taiwan (TSE), and China (SSE), over the period from January 2001 to November 2008. The study employed correlation analysis, the Johansen Cointegration test, and the Vector Error Correction Model (VECM) to evaluate both short-term interdependencies and long-term equilibrium relationships. **Juneja (2017)** considered the volatility dynamics of BRIC stock markets—Brazil (BOVESPA), Russia (RTSI), India (SENSEX), and China (SCI)—over a 10-year period from April 2007 to March 2017 using calculated returns from daily index closing values. Employing statistical methods such as the Unit Root Test, Correlation Test, Johansen's Cointegration Test, and Granger Causality Test, the study highlighted significant insights into inter-market relationships. **Khan et al. (2018)** explored the interlinkages and co-movements between Pakistan's PSX and eleven global stock indices, including India (BSE), Malaysia (KLSE), Indonesia (JCI), Hong Kong (HIS), China (CSE), Japan (NIKKEI), the USA (NYSE), the UK (FTSE 100), Germany (DAX), France (CAC 40), and Australia (AORD) over the period from August 1997 to October 2014. Monthly index values were converted into natural logarithms to calculate compounded returns, and the study employed correlation analysis, Johansen cointegration tests, and Granger causality techniques to evaluate market relationships. The correlation analysis indicated weak associations between India's BSE and other indices, with a negative correlation observed with the UK's FTSE 100. **Raj and Marcus (2019)** examined the linkages and volatility dynamics between the Indian stock market (BSE) and global indices, including the European Stock Exchange (ENX), Hong Kong (HIS), USA (S&P 500), China (SSE), and Japan (TOPIX), from April 2000 to March 2018. Employing daily market return series derived from index data, the study utilized correlation analysis to evaluate primary interlinkages, Granger causality and cointegration tests to explore short run and long-term linkages, and the GARCH model to estimate volatility patterns and persistence. **Vodwal (2021)** analyzed the stock market relationships among indices from the USA (S&P 500), UK (FTSE 100), France (CAC 40), and five South Asian countries: India (Nifty), China (SSE), Hong Kong (Hang Seng), Japan (Nikkei 225), and Taiwan (TSEC). The existing literature reveals notable

gap in the examination of stock market correlations, particularly in studies encompassing a diverse range of countries. Few have systematically analyzed global markets during the post-global financial crisis era, prior to the emergence of the COVID-19 pandemic. Moreover, limited attention has been given to essential pre-statistical diagnostics, such as normality testing, which are crucial for determining the suitability of parametric or non-parametric methodologies. This study seeks to address these gaps by undertaking a thorough analysis of the correlation dynamics between the Indian stock market and those of 21 countries worldwide during the post-recession period.

3. Objectives

The sole purpose of this study is to insight and analyze the statistical properties of the estimated return series of the sample of 22 indices across three continental regions, and observe the nature and strength of correlation association among India's S&P BSE SENSEX and the chosen indices of 21 other nations during the Post-global Recession period, covering interval from April 20, 2009 to December 30, 2019.

4. Data and Methodological Approach

4.1 Sample Design & Study Period

This study examines the interconnections among stock markets in India and 21 prominent global indices representing three continents: America, Asia-Pacific, and Europe. The selection of sample countries follows a judgment sampling approach, considering nations with the highest nominal GDP rankings as per the 2019 World Bank report. From the actual list the sample countries were finalized based on data availability and a thorough review of existing literature. Details of the select indices and their corresponding nations are provided in Table 1. The research focuses on the period from April 20, 2009, to December 30, 2019—a timeframe postdating the 2008–09 global financial crisis and preceding the onset of the COVID-19 pandemic. This interval is strategically chosen to analyze market associations during a relatively stable period following significant global disruptions. This critical phase captures the onset of the global financial crisis, its peak disruptions, and the stabilization efforts following the pivotal G20 summit. The delineation of this crisis period aligns with prior research, including studies by Dooley and Hutchison (2009) Chudik and Fratzscher (2011), Wang (2014), etc.

Table-1: List of Select Sample Nations and Select Stock Indices

Regions	Sl. No.	Country	Name of Stock Index (Abbreviation)
America	1	US	S&P 500
	2	Canada	S&P/TSX Composite index (TSX)
	3	Brazil	IBOVESPA
	4	Mexico	IPC MEXICO (IPC)
	5	Argentina	MERVAL
Asia-Pacific	6	India	S&P BSE SENSEX (SENSEX)
	7	Australia	S&P/ASX 200 (ASX)
	8	Israel	TA-125 (TA)
	9	Japan	Nikkei 225 (Nikkei)
	10	Hong Kong	HANG SENG INDEX (HIS)
	11	Taiwan	TSEC weighted index (TSEC)
	12	China	SSE Composite Index (SSE)

	13	Singapore	FTSE Singapore (FTSE-Sin)
	14	Indonesia	Jakarta Composite Index (JCI)
	15	South Korea	KOSPI Composite Index (KOSPI)
	16	Russia	MOEX Russia Index (MOEX)
Europe	17	Germany	DAX PERFORMANCE-INDEX (DAX)
	18	UK	FTSE 100 (FTSE-100)
	19	France	CAC 40
	20	Netherland	EURONEXT 100 (EURO 100)
	21	Belgium	BEL 20
	22	Italy	FTSE MIB

The study considers the daily returns from the select twenty-two indices, calculated from the daily adjusted index closing observations, using the formula for returns as, $R_t = \ln(P_t) - \ln(P_{t-1})$,, where R_t denotes the logarithmic return, and P_t and P_{t-1} signify the current and previous day's adjusted market closing values, respectively. The secondary data for index closing values were sourced from credible online platforms such as www.yahoofinance.com and www.investing.com and also the official websites of the sample indices.

4.2 Statistical Tools Used

To ensure the robustness of the methodology, preliminary normality tests are performed using the Shapiro-Wilk test to determine the suitability of parametric versus non-parametric correlation methods after the detailed analysis of descriptive statistical properties of the return series. All statistical analyses, including descriptive statistics and correlation testing among the 22 indices, are conducted using SPSS software (version 21). This comprehensive approach aims to uncover nuanced insights into stock market linkages across continents, providing a robust framework for understanding global financial interconnectedness.

When a violation of the normality assumption is identified, the Spearman Rank Correlation is employed as a robust non-parametric alternative. The correlation coefficient always varies between -1 and +1. A positive value signifies a direct relationship, indicating that the variables move in the same direction, whereas a negative value implies an inverse relationship, where the variables move in opposite directions. To assess the significance of the observed correlation, hypothesis testing is employed to determine if the sample correlation accurately reflects the true population correlation. The null hypothesis (H_0) posits that there is no monotonic relationship, with a population correlation coefficient (ρ) equal to zero, while the alternative hypothesis (H_1) suggests the existence of such a relationship. SPSS (version 21) has been used for analysis of data. If the p-value is below 0.05, the null hypothesis of no significant correlation is rejected, indicating statistical significance at the 5% level.

5. Empirical Results and Interpretations

5.1 Descriptive Statistics

The descriptive statistics table is presented here:

Table-5: A Summary of Descriptive Statistics

Countries and Index Returns	Sample Size	Minimum Statistics	Maximum Statistics	Mean Value	Standard Deviation	Skewness		Kurtosis	
						statistics	Standard Error	statistics	Standard Error
US (S&P 500)	1271	-0.07258	0.054275	0.001034	0.012816743	-0.719	0.069	4.187	0.137
Canada (S&P/TSX)	1271	-0.05898	0.066612	0.000475	0.011446461	-0.38	0.069	3.962	0.137
Brazil (IBOVESPA)	1271	-0.09211	0.086029	0.000727	0.019920612	-0.043	0.069	1.822	0.137
Mexico (IPC)	1271	-0.08	0.074363	0.000532	0.013406929	-0.243	0.069	3.609	0.137
Argentina (MERVAL)	1271	-0.30323	0.147134	0.002756	0.032404011	-0.832	0.069	9.629	0.137
India (SENSEX)	1271	-0.07847	0.144126	0.001038	0.01516689	0.987	0.069	10.529	0.137
Australia (ASX)	1271	-0.07032	0.055475	0.000463	0.012494051	-0.274	0.069	2.828	0.137
Israel (TA-125)	1271	-0.08662	0.05621	0.000621	0.012326994	-0.811	0.069	5.518	0.137
Japan (Nikkei)	1271	-0.11543	0.083576	0.000789	0.019496762	-0.714	0.069	5.842	0.137
Hong Kong (HSI)	1271	-0.09252	0.103756	0.00047	0.017780249	0.054	0.069	3.408	0.137
Taiwan (TSEC)	1271	-0.11799	0.09243	0.000549	0.014613162	-0.861	0.069	8.873	0.137
China (SSE)	1271	-0.13239	0.124048	0.000143	0.02119185	-0.64	0.069	6.197	0.137
Singapore (FTSE Sin)	1271	-0.0782	0.168212	0.000427	0.013628251	1.035	0.069	21.482	0.137
Indonesia (JCI)	1271	-0.10827	0.105067	0.001066	0.01560622	-0.334	0.069	8.675	0.137
S Korea (KOSPI)	1271	-0.10076	0.049	0.000391	0.013585081	-0.939	0.069	5.927	0.137

Russia (MOEX)	1271	-0.08476	0.129583	0.000944	0.019430377	0.114	0.069	5.134	0.137
Germany (DAX)	1271	-0.10132	0.067325	0.000831	0.017261237	-0.788	0.069	3.941	0.137
UK (FTSE 100)	1271	-0.0765	0.050379	0.000493	0.013516306	-0.654	0.069	4.021	0.137
France (CAC 40)	1271	-0.10263	0.074555	0.000533	0.017237099	-0.745	0.069	4.345	0.137
Netherland (EURO 100)	1271	-0.09978	0.06923	0.000627	0.015724513	-0.833	0.069	4.96	0.137
Belgium (BEL 20)	1271	-0.10762	0.067806	0.00059	0.015570033	-0.755	0.069	5.052	0.137
Italy (FTSE MIB)	1271	-0.17356	0.079464	0.000203	0.021843 47	-1.068	0.069	6.464	0.137

The descriptive statistics table shows that all return series consist of 1,271 observations, with no missing data. Among the indices, Singapore's FTSE yields the highest return, while Argentina's MERVAL records the lowest one. The low standard deviation values across the series suggest that the return observations are tightly grouped around their means, indicating minimal variability. Most return series exhibit negative skewness, meaning they have longer left tails and a concentration of values on the right. However, Singapore's FTSE and Russia's MOEX show positive skewness, indicating longer right tails with values concentrated on the left. The skewness values, deviating from zero, signal significant asymmetry in the data.

Notably, the returns from Singapore (FTSE) exhibit skewness values exceeding 1, reflecting highly pronounced right-tailed distributions. The kurtosis analysis reveals that all return series, except for Brazil's IBOVESPA, have kurtosis values greater than 3, characteristic of leptokurtic distributions. These distributions are marked by sharper peaks and heavier tails, suggesting a higher likelihood of extreme outliers compared to a normal distribution. This indicates that, although most returns tend to cluster around the mean, large deviations are more frequent. In contrast, Brazil's IBOVESPA returns exhibit kurtosis values below 3, suggesting platykurtic distributions with flatter tails and broader peaks, which imply more stable returns and fewer extreme movement.

5.1.1 Shapiro-Wilk Test of Normality

The Shapiro-Wilk test results with p-value, decision rule and test implications are as follows:

Table-6: Result of the Shapiro-Wilk Test of Normality

Name of Stock Index	Statistic	P−Value	Decision Rule	Decision on H_0 (H_0: The return series are normally distributed.)	Inferences
US (S&P 500)	0.937	0.000	P<0.05	Rejected	Non-normal series

Canada (S&P/TSX)	0.941	0.000	P<0.05	Rejected	Non-normal series
Brazil (IBOVESPA)	0.979	0.000	P<0.05	Rejected	Non-normal series
Mexico (IPC)	0.954	0.000	P<0.05	Rejected	Non-normal series
Argentina (MERVAL)	0.915	0.000	P<0.05	Rejected	Non-normal series
India (SENSEX)	0.914	0.000	P<0.05	Rejected	Non-normal series
Australia (S&P/ASX)	0.965	0.000	P<0.05	Rejected	Non-normal series
Israel (TA-125)	0.93	0.000	P<0.05	Rejected	Non-normal series
Japan (Nikkei)	0.918	0.000	P<0.05	Rejected	Non-normal series
Hong Kong (HSI)	0.955	0.000	P<0.05	Rejected	Non-normal series
Taiwan (TSEC)	0.908	0.000	P<0.05	Rejected	Non-normal series
China (SSE)	0.904	0.000	P<0.05	Rejected	Non-normal series
Singapore (FTSE Sin)	0.874	0.000	P<0.05	Rejected	Non-normal series
Indonesia (JCI)	0.892	0.000	P<0.05	Rejected	Non-normal series
S Korea (KOSPI)	0.931	0.000	P<0.05	Rejected	Non-normal series
Russia (MOEX)	0.932	0.000	P<0.05	Rejected	Non-normal series
Germany (DAX)	0.942	0.000	P<0.05	Rejected	Non-normal series
UK (FTSE 100)	0.942	0.000	P<0.05	Rejected	Non-normal series
France (CAC 40)	0.94	0.000	P<0.05	Rejected	Non-normal series
Netherland (EURONEXT 100)	0.933	0.000	P<0.05	Rejected	Non-normal series
Belgium (BEL 20)	0.936	0.000	P<0.05	Rejected	Non-normal series
Italy (FTSE MIB)	0.929	0.000	P<0.05	Rejected	Non-normal series

All p-values are found below the 0.05 threshold, rejecting the null hypothesis of normality and confirming that the return series do not follow normal distribution. As a result, the analysis shifted to a non-parametric approach, using the Spearman Rank Correlation test.

5.1.2 Spearman Rank Correlation

The Spearman rank correlation matrix is organized into three panels to capture inter-regional and cross-continental dynamics. The first panel highlights correlations between Asian and American markets, the second explores the relationships between Asian and European markets, and the third examines correlations within and between American and European markets, emphasizing cross-continental integration. The detailed matrices are provided below:

Table-6-Panel A: The Spearman Rank Correlation Matrix of the calculated Returns from select Asia-Pacific and the American Indices

Countries (Indices)	US (S&P 500)	Canada (S&P/TSX)	Brazil (IBOVESPA)	Mexico (IPC)	Argentina (MERVAL)	India (SENSEX)	Australia (S&P/ASX)	Israel (TA-125)	Japan (Nikkei)	Hong Kong (HIS)	Taiwan (TSEC)	China (SSE)	Singapore (FTSE Sin)	Indonesia (JCI)	S Korea (KOSPI)	Russia (MOEX)
US (S&P 500)	1.000	.721** (0.000)	.539** (0.000)	.598** (0.000)	.471** (0.000)	.355** (0.000)	.304** (0.000)	.444** (0.000)	.143** (0.000)	.364** (0.000)	.321** (0.000)	.165** (0.000)	.365** (0.000)	.248** (0.000)	.323** (0.000)	.418** (0.000)
Canada (S&P/TSX)	.721** (0.000)	1.000	.525** (0.000)	.544** (0.000)	.435** (0.000)	.341** (0.000)	.324** (0.000)	.347** (0.000)	.142** (0.000)	.356** (0.000)	.317** (0.000)	.194** (0.000)	.363* (0.000)*	.257* (0.000)*	.293** (0.000)	.449** (0.000)
Brazil (IBOVESPA)	.539** (0.000)	.525** (0.000)	1.000	.521** (0.000)	.528* (0.000)*	.322** (0.000)	.230** (0.000)	.286** (0.000)	.050 (0.074)	.341** (0.000)	.269** (0.000)	.160** (0.000)	.303** (0.000)	.243** (0.000)	.270** (0.000)	.411** (0.000)
Mexico (IPC)	.598**	.544** (0.000)	.521** (0.000)	1.000	.415** (0.000)	.299** (0.000)	.266**	.312**	.103**	.335**	.295**	.218**	.332** (0.000)	.280** (0.000)	.277**	.380**

	(0.000)						(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			(0.000)	(0.000)
Argentina (MERVAL)	.471** (0.000)	.435** (0.000)	.528** (0.000)	.415** (0.000)	1.000	.213** (0.000)	.192** (0.000)	.285** (0.000)	.090** (0.001)	.261** (0.000)	.244** (0.000)	.149** (0.000)	.254** (0.000)	.175** (0.000)	.195** (0.000)	.361** (0.000)
India (SENSEX)	.355** (0.000)	.341** (0.000)	.322** (0.000)	.299** (0.000)	.213** (0.000)	1.000	.186** (0.000)	.191** (0.000)	.049 (0.084)	.228** (0.000)	.214** (0.000)	.079** (0.000)	.187** (0.000)	.185* (0.000)*	.207** (0.000)	.225** (0.000)
Australia (S&P/ASX)	.304** (0.000)	.324** (0.000)	.230** (0.000)	.266** (0.000)	.192** (0.000)	.186** (0.000)	1.000	.335** (0.000)	.157** (0.000)	.545** (0.000)	.505** (0.000)	.267** (0.000)	.551** (0.000)	.383** (0.000)	.496** (0.000)	.301** (0.000)
Israel (TA-125)	.444** (0.000)	.347** (0.000)	.286** (0.000)	.312** (0.000)	.285** (0.000)	.191** (0.000)	.335** (0.000)	1.000	.090** (0.000)	.394** (0.000)	.335** (0.000)	.187** (0.000)	.383** (0.000)	.306** (0.000)	.355** (0.000)	.389** (0.000)
Japan (Nikkei)	.143** (0.000)	.142** (0.000)	.050 (0.074)	.103** (0.000)	.090** (0.001)	.049 (0.084)	.157** (0.000)	.090** (0.001)	1.000	.148** (0.000)	.162** (0.000)	.115** (0.000)	.170** (0.000)	.068* (0.015)	.178** (0.000)	.097** (0.001)
Hong Kong (HIS)	.364** (0.000)	.356** (0.000)	.341** (0.000)	.335** (0.000)	.261** (0.000)	.228** (0.000)	.545** (0.000)	.394** (0.000)	.148** (0.000)	1.000	.623** (0.000)	.541** (0.000)	.692** (0.000)	.490** (0.000)	.618** (0.000)	.432** (0.000)
Taiwan	.321**	.317**	.269**	.295**	.244**	.214**	.505**	.335**	.162**	.623**	1.000	.343**	.571**	.457**	.656**	.377**

(TSEC)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
China (SSE)	.165** (0.000)	.194** (0.000)	.160** (0.000)	.218** (0.000)	.149** (0.000)	.079** (0.000)	.267** (0.000)	.187** (0.000)	.115** (0.000)	.541** (0.000)	.343** (0.000)	1.000	.344** (0.000)	.248** (0.000)	.307** (0.000)	.252** (0.000)
Singapore (FTSE Sin)	.365** (0.000)	.363** (0.000)	.303** (0.000)	.332** (0.000)	.254** (0.000)	.187** (0.000)	.551** (0.000)	.383** (0.000)	.170** (0.000)	.692** (0.000)	.571** (0.000)	.344** (0.000)	1.000	.488** (0.000)	.576** (0.000)	.384** (0.000)
Indonesia (JCI)	.248** (0.000)	.257** (0.000)	.243** (0.000)	.280** (0.000)	.175** (0.000)	.185** (0.000)	.383** (0.000)	.306** (0.000)	.068* (0.015)	.490** (0.000)	.457** (0.000)	.248** (0.000)	.488** (0.000)	1.000	.462** (0.000)	.344** (0.000)
S Korea (KOSPI)	.323** (0.000)	.293** (0.000)	.270** (0.000)	.277** (0.000)	.195** (0.000)	.207** (0.000)	.496** (0.000)	.355** (0.000)	.178** (0.000)	.618** (0.000)	.656** (0.000)	.307** (0.000)	.576** (0.000)	.462** (0.000)	1.000	.361** (0.000)
Russia (MOEX)	.418** (0.000)	.449** (0.000)	.411** (0.000)	.380** (0.000)	.361** (0.000)	.225** (0.000)	.301** (0.000)	.389** (0.000) (0.000)	.097** (0.000) (0.000)	.432** (0.000)	.377** (0.000)	.252**	.384** (0.000)	.344** (0.000)	.361** (0.000)	1.000
**** Correlation is significant at the 0.01 level (2-tailed) / P values are in parenthesis**																

The correlation matrix discloses intricate inter-regional linkages between Asian and American stock markets during the study period. Among the Asian indices, the returns from Russia's MOEX series demonstrates the strongest associations with American markets, notably with the U.S. (S&P 500) and Canada (S&P/TSX), although, the associations were moderate, recording correlation coefficients greater than 0.3. This suggests moderate financial interdependence driven by factors such as trade dynamics,

resource interlinkages, and investor sentiment, highlighting Russia's substantial integration into global financial ecosystems. Additionally, Brazil and Mexico exhibit significant correlations with MOEX, reinforcing the hypothesis of Russia's strategic alignment with key American economies. India's SENSEX displays moderate positive correlations across all American markets, peaking with the U.S. (S&P 500) at 0.355 and followed closely by Canada (S&P/TSX) at 0.341. This pattern signifies India's growing financial interconnectedness with the Americas, potentially reflecting the influence of foreign direct investments, portfolio flows, and economic reforms. While these associations underline India's pivotal role in global markets, they also suggest potential diversification benefits for investors seeking exposure across uncorrelated markets.

Other Asian markets such as Hong Kong (HIS**)** and Singapore (FTSE Sin) emerge as key players with relatively high correlation coefficients with American indices. For instance, the correlations of Hong Kong's HIS with the U.S. (S&P 500) and Canada (S&P/TSX) are 0.364 and 0.356, respectively, underscoring Hong Kong's position as a critical financial hub bridging Asian and American economies. Similarly, Singapore (FTSE Sin) maintains a strong financial linkage with the U.S. market at 0.365, indicating its role as a global financial intermediary. On the contrary, China's SSE exhibits weaker correlations compared to its Asian peers, with coefficients of 0.165 and 0.194 for the U.S. (S&P 500) and Canada (S&P/TSX), respectively. While statistically significant, these lower correlations may reflect China's relatively insulated financial policies and the distinct characteristics of its equity market.

The weaker yet consistent interdependence underscores China's strategic positioning as a semi-integrated market with both global and regional linkages. Interestingly, Japan's Nikkei reflects modest correlations, with the highest being 0.143 with the U.S. (S&P 500), indicating a more subdued interaction with American markets despite its status as a major global economy. This could be attributed to structural differences, unique market dynamics, and differing investment climates. Overall, the findings emphasize the differentiated nature of financial interdependence across Asian and American markets. While some indices like Russia (MOEX) and Hong Kong (HIS) display stronger integration with American counterparts, others such as China (SSE) and Japan (Nikkei) exhibit relatively lower correlations. These insights are critical for understanding regional market dynamics and have significant implications for portfolio diversification and risk management strategies. The p-values, indicated in parentheses beneath the coefficients in the correlation matrix, are all below 0.05 and 0.01, confirming statistical significance at the 5%, and 1% significance levels under a two-tailed test.

Table-6-Panel B: The Spearman Rank Correlation Matrix of the calculated Returns from select Asia-Pacific and the European Indices

Indices (Countries)	India (S&P BSE SENSEX)	Australia (S&P/ASX 200)	Israel (TA-1	Japan (Nikkei 225)	Hong Kong (Hang Sang Index)	Taiwan (TSE	China (SSE Composite Index)	Singapore (FTSE Singapore)	Indonesia (Jakarta Composite Index)	S Korea (KOSPI Composite Index)	Russia (MOEX Russia)	Germany (DAX Performance Index)	UK (FTSE 100)	France (CAC 40)	Netherland (EURONEXT 100)	Belgium (BEL 20)	Italy (FTSE MIB)

			25)			**C)**										
India (S&PBSESENSEX)	1.000	.186** (0.000)	.191** (0.000)	.049 (0.084)	.228** (0.000)	.214** (0.000)	.079** (0.000)	.187** (0.000)	.185** (0.000)	.207** (0.000)	.225** (0.000)	.280** (0.000)	.291** (0.000)	.285** (0.000)	.290** (0.000)	.289** (0.000)	.252** (0.000)
Australia (S&P/ASX 200)	.186** (0.000)	1.000	.335** (0.000)	.157** (0.000)	.545** (0.000)	.505** (0.000)	.267** (0.000)	.551** (0.000)	.383** (0.000)	.496** (0.000)	.301** (0.000)	.365** (0.000)	.415** (0.000)	.390** (0.000)	.403** (0.000)	.378** (0.000)	.316** (0.000)
Israel (TA-125)	.191** (0.000)	.335** (0.000)	1.000	.090** (0.001)	.394** (0.000)	.335** (0.000)	.187** (0.000)	.383** (0.000)	.306** (0.000)	.355** (0.000)	.389** (0.000)	.541** (0.000)	.502** (0.000)	.541** (0.000)	.554** (0.000)	.538** (0.000)	.481** (0.000)
Japan (N	.049	.157**	.090**	1.000	.148** (0.000)	.162**	.115** (0.000)	.170** (0.000)	.068** (0.015)	.178** (0.000)	.097**	.150** (0.000)	.135**	.124**	.133** (0.000)	.128**	.100**

ikkei225)	(0.084)	(0.000)	(0.000)			(0.000)					(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
HongKong(HangSangIndex)	.228** (0.000)	.545** (0.000)	.394** (0.000)	.148** (0.000)	1.000	.623** (0.000)	.541** (0.000)	.692** (0.000)	.490** (0.000)	.618** (0.000)	.432** (0.000)	.424** (0.000)	.463** (0.000)	.435** (0.000)	.455** (0.000)	.434** (0.000)	.376** (0.000)
Taiwan(TSEC)	.214** (0.000)	.505** (0.000)	.335** (0.000)	.162** (0.000)	.623** (0.000)	1.000	.343** (0.000)	.571** (0.000)	.457** (0.000)	.656** (0.000)	.377** (0.000)	.391** (0.000)	.408** (0.000)	.383** (0.000)	.402** (0.000)	.386** (0.000)	.337** (0.000)
China(SSECompositeIndex)	.079** (0.005)	.267** (0.000)	.187** (0.000)	.115** (0.000)	.541** (0.000)	.343** (0.000)	1.000	.344** (0.000)	.248** (0.000)	.307** (0.000)	.252** (0.000)	.188** (0.000)	.225** (0.000)	.191** (0.000)	.203** (0.000)	.197** (0.000)	.173** (0.000)

Singapore (FTSE Singapore)	.187** (0.000)	.551** (0.000)	.383** (0.000)	.170** (0.000)	.692** (0.000)	.571** (0.000)	.344** (0.000)	1.000	.488** (0.000)	.576** (0.000)	.384** (0.000)	.408** (0.000)	.462** (0.000)	.433** (0.000)	.449** (0.000)	.422** (0.000)	.370** (0.000)
Indonesia (Jakarta Composite Index)	.185** (0.000)	.383** (0.000)	.306** (0.000)	.068* (0.015)	.490** (0.000)	.457** (0.000)	.248** (0.000)	.488** (0.000)	1.000	.462** (0.000)	.344** (0.000)	.301** (0.000)	.334** (0.000)	.306** (0.000)	.316** (0.000)	.316** (0.000)	.242** (0.000)
Korea (KOSPI Com	.207** (0.000)	.496** (0.000)	.355** (0.000)	.178** (0.000)	.618** (0.000)	.656** (0.000)	.307** (0.000)	.576** (0.000)	.462** (0.000)	1.000	.361** (0.000)	.375** (0.000)	.403** (0.000)	.364** (0.000)	.381** (0.000)	.356** (0.000)	.298** (0.000)

positive Index)																
Russia (MOEX Russia)	.225** (0.000)	.301** (0.000)	.389** (0.000)	.097** (0.001)	.432** (0.000)	.377** (0.000)	.252** (0.000)	.384** (0.000)	.344** (0.000)	.361** (0.000)	1.000	.509** (0.000)	.525** (0.000)	.502** (0.000)	.510** (0.000)	.476** (0.000)	.461** (0.000)
Germany (DAX Performance Index)	.280** (0.000)	.365** (0.000)	.541** (0.000)	.150** (0.000)	.424** (0.000)	.391**	.188** (0.000)	.408** (0.000)	.301** (0.000)	.375** (0.000)	.509** (0.000)	1.000	.785** (0.000)	.907** (0.000)	.912** (0.000)	.841** (0.000)	.791** (0.000)
UK (FTSE	.291** (0.000)	.415** (0.000)	.502** (0.0	.135** (0.000)	.463** (0.000)	.408** (0.0	.225** (0.000)	.462** (0.000)	.334** (0.000)	.403** (0.000)	.525** (0.000)	.785** (0.000)	1.000	.821** (0.0	.841** (0.000)	.765** (0.000)	.698** (0.000)

100)			00)			00)								00)			
France (CAC 40)	.285** (0.000)	.390** (0.000)	.541** (0.000)	.124** (0.000)	.435** (0.000)	.383** (0.000)	.191** (0.000)	.433** (0.000)	.306** (0.000)	.364** (0.000)	.502** (0.000)	.907** (0.000)	.821** (0.000)	1.000	.985** (0.000)	.880** (0.000)	.848** (0.000)
Netherland (EURONEXT 100)	.290** (0.000)	.403** (0.000)	.554** (0.000)	.133** (0.000)	.455** (0.000)	.402** (0.000)	.203** (0.000)	.449** (0.000)	.316** (0.000)	.381** (0.000)	.510** (0.000)	.912** (0.000)	.841** (0.000)	.985** (0.000)	1.000	.907** (0.000)	.837** (0.000)
Belgium (BEL 20)	.289** (0.000)	.378** (0.000)	.538** (0.000)	.128** (0.000)	.434** (0.000)	.386** (0.000)	.197** (0.000)	.422** (0.000)	.316** (0.000)	.356** (0.000)	.476** (0.000)	.841** (0.000)	.765** (0.000)	.880** (0.000)	.907** (0.000)	1.000	.805** (0.000)
Italy (FTSE	.252** (0.000)	.316** (0.000)	.481** (0.0	.100** (0.000)	.376** (0.000)	.337** (0.0	.173** (0.000)	.370** (0.000)	.242** (0.000)	.298** (0.000)	.461** (0.000)	.791** (0.000)	.698** (0.0	.848** (0.0	.837** (0.000)	.805** (0.000)	1.000

MIB)			0 0)			0 0)							0 0)	0 0)			
**** Correlation is significant at the 0.01 level (2-tailed) / P values are in parenthesis**																	

The correlation analysis underscores significant financial interlinkages between Asian and European equity markets, highlighting the growing impact of globalization on these regions. The positive correlations observed across all markets indicate strong interconnectedness, driven by cross-border trade, capital flows, and synchronized investor sentiments. Notable correlations are observed between South Korea, Hong Kong, and Taiwan with major European indices such as the UK's FTSE, Germany's DAX, and France's CAC 40. For example, South Korea's KOSPI exhibits a robust correlation with Germany's DAX, reflecting the countries' deep trade ties and shared reliance on export-driven economies. Similarly, the strong association between Hong Kong's Hang Seng Index and the UK's FTSE illustrates enduring historical and financial linkages, further bolstered by London's prominence as a global financial hub. India's BSE SENSEX demonstrates moderate correlations with European indices, including the FTSE, DAX, and CAC 40. This reflects India's expanding economic and investment connections with the European Union, alongside the influence of global market shocks that affect these markets simultaneously. China's SSE Composite shows weaker correlations with European markets compared to its Asian counterparts, likely due to China's more gradual financial integration during the period under review.
However, the positive correlations still underscore Europe's sensitivity to economic developments in China, albeit to a lesser extent. The kurtosis and skewness features of the return series also contribute to the observed correlations. European indices like the DAX and FTSE, characterized by higher kurtosis and positive skewness, are more responsive to global economic shocks. This responsiveness amplifies their influence on Asian markets, particularly during periods of heightened volatility. The statistical significance of these correlations at 1%, and 5% significance levels ($p < 0.01$) confirms their reliability and highlights the systemic nature of these interregional financial linkages. These results offer valuable insights into the interconnected structure of global equity markets, emphasizing the need for investors and policymakers to consider such relationships when formulating strategies for risk management and economic policy. In summary, the study reveals that Asian and European markets are increasingly integrated, with varying degrees of interdependence shaped by trade relationships, financial openness, and global economic conditions. This evolving dynamic underscore the critical role of transcontinental linkages in influencing market behavior and shaping global financial stability.

Table-6-Panel C: The Spearman Rank Correlation Matrix of the calculated Returns from select American and the European Indices

Indices (Countries)	**US (S&P 500)**	**Canada (S&P/TSX Composite Index)**	**Brazil (IBOVESPA)**	**Mexico (IPC Mexico)**	**Argentina (MERVAL)**	**Germany (DAX Performance Index)**	**UK (FTSE 100)**	**France (CAC 40)**	**Netherland (EURONEXT 100)**	**Belgium (BEL 20)**	**Italy (FTSE MIB)**
US (S&	1.000	.721** (0.000)	.539**	.598** (0.000)	.471** (0.000)	.640** (0.000)	.629**	.653**	.665** (0.000)	.600**	.564**

P 500)			(0.000)				(0.000)	(0.000)		(0.000)	(0.000)
Canada (S&P/TSX Composite Index)	.721** (0.000)	1.000	.525** (0.000)	.544** (0.000)	.435** (0.000)	.555** (0.000)	.577** (0.000)	.576** (0.000)	.579** (0.000)	.531** (0.000)	.498** (0.000)
Brazil (IBOVESPA)	.539** (0.000)	.525** (0.000)	1.000	.521** (0.000)	.528** (0.000)	.405** (0.000)	.454** (0.000)	.432** (0.000)	.436** (0.000)	.394** (0.000)	.379** (0.000)
Mexico (IPC Mexico)	.598** (0.000)	.544** (0.000)	.521** (0.000)	1.000	.415** (0.000)	.441** (0.000)	.462** (0.000)	.463** (0.000)	.475** (0.000)	.441** (0.000)	.417** (0.000)
Argentina (MERVAL)	.471** (0.000)	.435** (0.000)	.528** (0.000)	.415** (0.000)	1.000	.382** (0.000)	.371** (0.000)	.374** (0.000)	.378** (0.000)	.369** (0.000)	.363** (0.000)
Germany (DAX Performance Index)	.640** (0.000)	.555** (0.000)	.405** (0.000)	.441** (0.000)	.382** (0.000)	1.000	.785** (0.000)	.907** (0.000)	.912** (0.000)	.841** (0.000)	.791** (0.000)
UK (FTSE 100)	.629** (0.000)	.577** (0.000)	.454** (0.000)	.462** (0.000)	.371** (0.000)	.785** (0.000)	1.000	.821** (0.000)	.841** (0.000)	.765** (0.000)	.698** (0.000)

France (CAC 40)	.653** (0.000)	.576** (0.000)	.432** (0.000)	.463** (0.000)	.374** (0.000)	.907** (0.000)	.821** (0.000)	1.000	.985** (0.000)	.880** (0.000)	.848** (0.000)
Netherland (EURONEXT 100)	.665** (0.000)	.579** (0.000)	.436** (0.000)	.475** (0.000)	.378** (0.000)	.912** (0.000)	.841** (0.000)	.985** (0.000)	1.000	.907** (0.000)	.837** (0.000)
Belgium (BEL 20)	.600** (0.000)	.531** (0.000)	.394** (0.000)	.441** (0.000)	.369** (0.000)	.841** (0.000)	.765** (0.000)	.880** (0.000)	.907** (0.000)	1.000	.805** (0.000)
Italy (FTSE MIB)	.564** (0.000)	.498** (0.000)	.379** (0.000)	.417** (0.000)	.363** (0.000)	.791** (0.000)	.698** (0.000)	.848** (0.000)	.837** (0.000)	.805** (0.000)	1.000
**** Correlation is significant at the 0.01 level (2-tailed) / P values are in parenthesis**											

The correlation matrix highlights significant global stock market linkages, with the United States (S&P 500) showing strong positive correlations with developed markets like Canada, Germany, and France, underscoring its central role in global finance. Regional dynamics within the Americas reveal moderate interconnections, such as between Canada and Mexico, while South America exhibits regional clustering, evidenced by moderate correlations between Brazil and Argentina. European markets display cohesive linkages within the Eurozone, with strong correlations between Germany, France, and the Netherlands, although weaker associations with peripheral economies like Italy reflect market heterogeneity. Lower correlations between certain emerging and developed markets present diversification opportunities, while high correlations within developed markets indicate limited scope for intra-regional diversification. Statistically significant correlations reinforce the interdependence of global markets, offering critical insights for international investment strategies and risk management. All p-values, presented in parentheses beneath the correlation coefficients, are less than 0.05 and 0.01, demonstrating statistical significance at the 5%, and 1%, thresholds for a two-tailed test.

6. Conclusion

The correlation matrix reveals intricate global financial linkages, emphasizing the growing interconnectedness between Asian, American, and European equity markets. Notable correlations include Russia's MOEX with U.S. (S&P 500) and Canada (S&P/TSX), reflecting moderate interdependence influenced by trade and investor sentiment. India's BSE SENSEX shows moderate correlations with

American indices, led by S&P 500, underscoring India's increasing global integration through foreign investments and economic reforms. Similarly, Hong Kong's HSI and Singapore's FTSE exhibit strong connections with American markets, affirming their roles as financial hubs. Conversely, China's SSE and Japan's Nikkei demonstrate weaker correlations, attributed to distinct financial policies and market dynamics. European markets, such as the UK's FTSE and Germany's DAX, display robust associations with Asian indices like South Korea's KOSPI and Hong Kong's HSI, driven by trade ties and synchronized economic activities. India's SENSEX shows moderate alignment with European markets, highlighting deepening investment and trade relationships. However, China's SSE exhibits weaker correlations with Europe, reflecting gradual financial integration. High kurtosis and skewness in European indices amplify their responsiveness to global shocks, reinforcing their influence on Asian markets. Statistically significant correlations at 1%, or 5% significance levels confirm the reliability of these relationships. While strong correlations within developed markets limit diversification, weaker associations between emerging and developed markets offer diversification potential. These findings highlight the systemic interdependence of global markets, with implications for risk management, investment strategies, and economic policy formulation.

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