A STUDY ON LONG-TERM PERFORMANCE OF GLOBAL STOCK MARKET INDICES

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Abstract

This paper examines the performance, volatility patterns, and correlation patterns of 5 large international stock market indices, namely NIFTY 50 (India), S&P 500 (United States), Nikkei 225 (Japan), EURO STOXX 50 (Europe), and Shanghai Composite (China) using monthly data between 2000 and 2025. An all-encompassing econometric analysis and framework involving the Augmented Dickey- Fuller test, Compound Annual Growth rate, One-Way ANOVA, Vector Autoregression, GARCH (1,1) model, Johansen Cointegration test and Pearson Correlation analysis are used. ADF outcomes show that there is stationarity in all the return series. Findings of CAGR show that NIFTY 50 has the highest long-term growth with EURO STOX 50 along with the least. The findings of GARCH confirm the volatility clustering and persistence, and emerging economies are more sensitive to the shock. The results of Cointegration by Johansen and correlation analysis give evidence of mixed diversification benefits. The results have implications to global investment diversification and risk management in a global market that is increasingly being integrated.

Keywords— Stock indices, volatility, GARCH, cointegration, portfolio diversification.

Introduction

Stock markets are important issues in the economy because they promote capital formation, investment, and enhance the liquidity of financial systems. The stock market indices are the selection of stocks that are important indicators of a general market performance and health of the economy as well. Globalization and technology have enhanced integration of financial markets in different countries in the last few decades. The 2000-2025 era has seen some important economic and financial incidences including the dot-com bubble of 2000, the Global Financial Crisis of 2008, European sovereign debt crisis, and the COVID-19 pandemic. These incidences have brought significant variations in the stock market indices in the global market, which is why it is important to examine the long term market behaviour and volatility trends.

This paper adds to the explanation of the global market integration through analyzing long term links among the chosen stock market indices in the leading economies. Through the time-series analysis of 25-year time-span of globalization, the study captures the analysis of the impacts of globalization on the performance and interdependence of stock markets.

II. GLOBAL STOCK MARKET INDICES

A. NIFTY 50 (India)

NIFTY 50 is the index of the stock market of the national stock exchange of India. It consists of 50 major companies of all industries like banking, information technology, pharmaceutical, energy, and consumer goods. By examining the long-term performance of NIFTY 50, one can gain an insight into the performance of an emerging market economy.

B. S&P 500 (United States)

The S&P 500 is a valid measure of stock market and economy of the United States as it is a 500 big publicly traded companies in the United States. The U.S. economy has a global impact, hence, the S&P 500 in the global financial markets.

C. EURO STOXX 50 (Europe)

EURO STOXX 50 index is an index that is representative of 50 Eurozone large companies. It indicates the economic performance of the Euro Zone and has been affected by the key economic events like the European debt crisis and monetary policy reforms.

D. Shanghai Composite (China)

The Shanghai Composite Index reflects all the listed stocks in Shanghai Stock Exchange. It has a reputation of high volatility attributable to economic reforms, government interventions and behavior of investors.

E. Nikkei 225 (Japan)

The Nikkei 225 is the composition of 225 blue-chip firms in Tokyo Stock Exchange. It is an indicator of the performance of the Japanese corporations and the general economy.

III OBJECTIVE OF THE STUDY

PRIMARY OBJECTIVE:

 1. To examine the monthly performance of major stock market indices in the world since 2000 to 2025.

SECONDARY OBEJECTIVES:

 2. To make a comparison of NIFTY 50, S&P 500, EURO STOX 50, Shanghai Composite, and Nikkei 225 index returns.

3. To examine the volatility and the risk behavior of these global stock market indices within the period of study.

4. To study the time series analysis between global stock markets and their relationship in the long run.

5. To give information to the investors on the performance and diversification prospects in the global markets.

IV. Review of literature

A. *Hamid Babaei , Georges Hubner, Aline Muller (2023).*

The impact of uncertainty on the dynamics of interdependence of stock market: The case of time-varying cointegration of the G7 stock markets This paper tries to address the dynamics of interdependence of stock markets of the G7 member countries in the period of 1990 to 2023, in order to understand the evolving nature of long-run market relationship. An application of a state-space model with time-dependent cointegrating coefficients, was used to model structural variations and shocks in long-run relationships across the markets. The paper also explores whether the financial risk factors, economic policy uncertainty (EPU), and global geopolitical risk (GPR) can be considered active factors and causes of market integration processes. The results show that the changes in these risk factors have great influence on the cointegrating coefficients meaning that the uncertainty and geopolitical events have a serious role to play in the determination of the interdependence of stock markets. In addition, when augmented and unaugmented cointegrating coefficients are compared, it can be seen that globalization has helped alleviate the market segmentation and enhanced the linkages between markets across the world and increased its sensitivity to the global risk factors.

B. **Guglielmo Maria Caporale et al. (2024) Long-Run Linkages Between US Stock Prices and Cryptocurrencies**
The purpose of the study is to examine the univariate properties and the long-run relations between major cryptocurrencies and major stock market indices of the United States of America through the methods of fractional integration and cointegration. To be more specific, the research will deal with four of the most popular cryptocurrencies by market capitalization, such as Bitcoin (BTC), Ethereum (ETH), Tether (USDT), and Binance Coin (BNB), and four major American stock market indices, including the S&P 500, NASDAQ, Dow Jones Industrial Average, and MSCI Emerging Markets Index. The analysis was done using the data between 9 November 2017 and 28 June 2022, which is daily. The persistence and market efficiency properties of each of the series were investigated using the procedures of fractional integration, whereas the cointegration procedures were utilized to check whether there exist any long-run equilibrium relationships between the cryptocurrencies and the stock market indices. The results give reasons that cryptocurrency markets have the properties of market efficiency, unlike the chosen stock markets indices that do not have all of the attributes.

C. **Dr. Sumona Bhattacharya , Sushma Tiwari (2023) Comparative Analysis of Average Annual Returns: A Study of Sensex (India) versus S&P/ASX 200 (Australia) and Nikkei 225 (Japan)**
This paper seeks to make a comparison of the average annual returns of the Indian stock market, which is the Sensex, with the two major international stock market indices, that is, the S&P/ASX 200 (Australia) and the Nikkei 225 (Japan). The main aim is to compare the performance of the Indian market against the relative performance of other markets and to determine the level of correlation or deviation between the Sensex and the indices in the selected foreign markets. The analysis used historical data of average annual returns of the Sensex, S / P /ASX 200, and Nikkei 225 over a given period. The measurement and comparison of the performance patterns of the three indices were done using descriptive statistical methods such as the calculation of mean returns and comparison with each other. The paper aims at determining whether Sensex has a similar pattern or it has pronounced deviations compared to Australian market and the Japanese. The results are informative on the performance of the Indian stock market in comparison and bring forth possible prospects of international diversification of portfolios. Moreover, the findings add to the general knowledge of the dynamics of global stock markets and give practical implications to the investors and researchers to make informed investment and diversification decisions.

This study aims to compare the average annual returns of the Indian stock market, represented by the Sensex, with two major international stock market indices, namely the S&P/ASX 200 (Australia) and the Nikkei 225 (Japan).

V. RESEARCH METHODOLOGY

A. Research Design
The recommended type of research design is a longitudinal, quantitative time-series research design to analyze the data of financial markets over a long period.

B. Data and Sample
• Indices NIFTY 50, S&P 500, EURO STOXX 50, Shanghai Composite, Nikkei 225.
• Period: January 2000 – December 2025
• Frequency: Monthly
• Source: Investing.com

C. Statistical Tools Used
1. Augmented Dickey–Fuller Test – To investigate stationarity.
2. Compound Annual Growth Rate – To gauge the performance over long run.
3. One-Way ANOVA – To compare mean returns.
4. GARCH (1,1) Model – To examine volatility.
5. Johansen Cointegration Test – To examine long-run relationships.
6. Pearson Correlation – To determine the benefits of diversification .

V1. DATA ANALYSIS & INTERPRETATION
This part presents the analysis and interpretation of the secondary data collected from Investing.com for the period 2000–2025. The analysis is conducted in alignment with the objectives of the study using appropriate statistical and econometric techniques, including Compound Annual Growth Rate (CAGR), One-Way ANOVA, GARCH (1,1) model, Johansen Co-integration test, and Pearson Correlation analysis. Microsoft Excel and EViews software were used for data processing and analysis. The results are interpreted with respect to long-term performance, risk, market integration, and diversification potential of selected global stock market indices.

Preliminary Diagnostic Test: Augmented Dickey–Fuller (ADF) Test for Stationarity

```
Null Hypothesis: Unit root (individual unit root process)
Series: RSP500, RSHANGHAII, RNIKKEI, RNIFTY, REUROSTOXX
Date: 02/01/26  Time: 13:07 Sample:
2000M01 2026M01
Exogenous variables: Individual effects Automatic
selection of maximum  lags Automatic lag length
selection based on SIC: 0 Total (balanced)
observations: 1555
Cross-sections included: 5


Method                              Statistic      Prob.**     ADF
- Fisher Chi-square                 674.543        0.0000
ADF - Choi Z-stat                   -25.3164       0.0000


        ** Probabilities for Fisher tests are computed using an asymptotic Chi
           -square distribution. All other tests assume asymptotic  normality.

Intermediate ADF test results UNTITLED


     Series          Prob.     Lag     Max Lag     Obs
     RSP500          0.0000     0        15         311
     RSHANGHAII      0.0000     0        15         311
     RNIKKEI         0.0000     0        15         311
     RNIFTY          0.0000     0        15         311
     REUROSTOXX      0.0000     0        15         311
```

INTERPRETATION:
As a pre-diagnostic test, Augmented Dickey Fuller (ADF) test was performed in order to verify the stationarity of the index return series prior to the implementation of VAR, GARCH, and Johansen Cointegration models. The null hypothesis presupposes the non-stationarity (unit root), and the alternative hypothesis is the stationarity.

ADF test of monthly returns of NIFTY 50, S&P 500, Nikkei 225, EURO STOXX 50, and Shanghai Composite 2000-2025 was done using EViews. These findings revealed that all the test statistics were significant with a p-value of 0.0000 and to the null hypothesis was rejected. This is an affirmation that all the return series are stationary at level form and can be subjected to further time-series analysis.

SECTION 1 — DESCRIPTIVE PROFILE OF DATA

1) Data Overview

- Period: 2000–2025
- Frequency: Monthly
- Indices: NIFTY 50, S&P 500, EURO STOXX 50, Shanghai Composite, Nikkei 225
- Data Source: Investing.com

Table 4.1 — Summary of Data Used

Index	Country	Period	Frequency	Source
NIFTY 50	India	2000–2025	Monthly	Investing.com
S&P 500	USA	2000–2025	Monthly	Investing.com
EURO STOXX 50	Europe	2000–2025	Monthly	Investing.com
Shanghai Composite	China	2000–2025	Monthly	Investing.com
Nikkei 225	Japan	2000–2025	Monthly	Investing.com

1) DESCRIPTIVE STATISTICS OF INDICES

Date: 02/01/26 Time: 12:57
Sample: 2000M01 2026M01

	EUROSTOXX	NIFTY	NIKKEI	SHANGHAI	SP500
Mean	3497.136	8324.269	18412.31	2646.440	2291.450
Median	3392.900	5900.650	16291.31	2790.690	1530.600
Maximum	5955.250	26202.95	53583.57	5954.770	6940.010
Minimum	1976.230	913.8500	7568.420	1060.740	735.1000
Std. Dev.	843.4606	6801.205	9252.748	861.6722	1488.855
Skewness	0.660233	1.061264	1.296784	0.321377	1.321872
Kurtosis	2.848645	3.200661	4.470531	3.371661	3.843143
Jarque-Bera	23.03859	59.27949	115.9281	7.189410	100.4243
Probability	0.000010	0.000000	0.000000	0.027469	0.000000
Sum	1094604.	2605496.	5763054.	828335.8	717224.0
Sum Sq. Dev.	2.22E+08	1.44E+10	2.67E+10	2.32E+08	6.92E+08
Observations	313	313	313	313	313

Hypotheses:

- H_0: There is no significant variation in the level characteristics of the stock indices.
- H_1: Significant variation exists in the level characteristics of the stock indices.

Interpretation based on Descriptive Statistics (Indices):

DESCRIPTIVE STATISTICS OF THE STOCK MARKET INDICES EUROSTOXX, NIFTY, NIKKEI, SHANGHAI AND S%P 500 BETWEEN THE YEARS 2000M01 AND 2026M01 REVEAL THAT THERE IS A CONSIDERABLE DIFFERENCE IN THE AVERAGE VALUE OF STOCK MARKET INDICES, DISPERSION, AND DISTRIBUTION. NIKKEI DEPICTS THE LARGEST AVERAGE INDEX VALUE, THEN NIFTY AND THE VALUES OF SHANGHAI AND S&P 500 DEPICT RELATIVELY LOWER VALUES. THIS IS AN INDICATION OF VARIATION IN MARKET SIZE, STRUCTURE, AND HISTORICAL DEVELOPMENT IN THE REGIONS. VALUES OF THE STANDARD DEVIATIONS DETERMINE THAT NIFTY AND NIKKEI ARE MUCH MORE FLUCTUATED WITH CHANGES IN THE LEVEL OF AN INDEX OVER TIME, AND THE DISPERSION OF EUROSTOXX AND SHANGHAI IS LOWER. MOST OF THE INDICES HAVE POSITIVE SKEWNESS, WHICH MEANS THAT THESE SKEWNESSES HAVE LONGER RIGHT SIDES, MEANING THAT THERE ARE EXTREME POSITIVE MOVEMENTS. THE VALUES OF KURTOSIS ARE NEAR TO OR EXCEED THE NORMAL STANDARD INDICATING THAT THERE IS MODERATE TO HIGH VALUE OF PEAKNESS OF DISTRIBUTIONS.

INTERPRETATION:

2) Hypotheses:

- H_0: There is no significant difference in return characteristics among the stock indices.
- H_1: Significant differences exist in return characteristics among the stock indices.

3) Interpretation based on Descriptive Statistics (Returns):

Descriptive statistics of monthly returns of S and P 500, SHANGHAI, NIKKEI, NIFTY and EUROSTOXX between 2000M02 and 2026M01 indicate that all markets have positive means in their returns over the period of study. Out of the indices, NIFTY has the highest average return implying that NIFTY has good performance, unlike EUROSTOXX which has the lowest mean return which implies that EUROSTOXX has a poor performance.

Regarding the risk, calculated by the standard deviation, SHANGHAI and NIFTY are the most volatile markets, which means that there is more uncertainty and risk in these markets. On the contrary, S&P 500 is the least volatile, which shows more stable returns. This brings out the risk-return trade-off in which increased returns are coupled with increased volatility especially in the emerging markets. The skew of all the return series is negative and this means that extreme negative returns are more likely to occur. The kurtosis values are beyond the normal range, and it would be leptokurtic distributions with fat tails. The Jarque-Bra test is significant across all the returns series, which supports the fact that returns are not distributed normally.

4) Implication for Return Comparison Objective:

- There is a high difference in volatility and average returns across different markets.
- An increase in returns will be accompanied by increase in risk.
- Emerging markets are more volatile than developed markets
- Stock returns are non-normal in nature.
- The null hypothesis is rejected, confirming meaningful differences in return behavior across global stock markets.

2) DESCRIPTIVE STATISTICS OF RETURNS

Date: 02/01/26   Time: 13:01   Sample:
2000M01 2026M01

|	RSP500	RSHANGHAII	RNIKKEI	RNIFTY	REUROSTO
Mean	0.005143	0.003167	0.003233	0.008994	0.000769
Median	0.011253	0.005265	0.007391	0.011203	0.007468
Maximum	0.119421	0.242526	0.153959	0.247376	0.166045
Minimum	-0.185619	-0.282779	-0.272162	-0.306665	-0.206236
Std. Dev.	0.043988	0.069560	0.054584	0.062680	0.051918
Skewness	-0.688457	-0.493919	-0.645406	-0.781243	-0.569015
Kurtosis	4.181019	5.523203	4.540956	6.501269	4.456426
Jarque-Bera	42.77909	95.45092	52.52964	191.1032	44.41177
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	1.604767	0.987949	1.008794	2.806225	0.240018
Sum Sq. Dev.	0.601777	1.504824	0.926590	1.221844	0.838285
Observations	312	312	312	312	312

SECTION 2 — OBJECTIVE-WISE ANALYSIS
OBJECTIVE 1: To evaluate the long-term performance of selected global stock market indices.
Test Used: CAGR (Excel)

CAGR of Global Stock Market Indices (2000–2025)

Index	Start Value	End Value	Years	CAGR (%)
NIFTY 50	1,546.20	25,585.50	25	11.88
S&P 500	1,394.50	6,940.01	25	6.63
Nikkei 225	19,539.70	53,583.57	25	4.12
Shanghai Composite	1,535.00	4,122.58	25	4.03
EURO STOXX 50	4,684.48	5,955.25	25	0.96

CAGR % Comparison of Global Indices (25 Years)
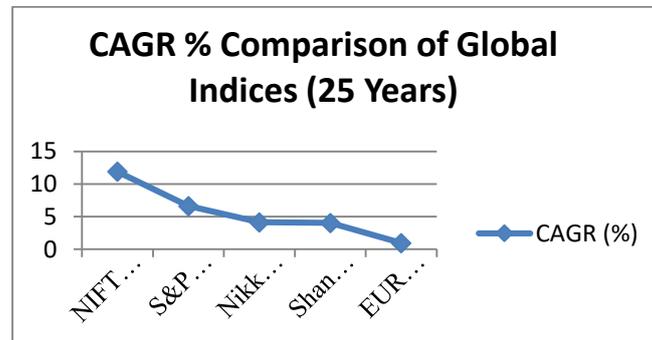
Interpretation
The CAGR results indicate that NIFTY 50 recorded the highest long-term growth rate of 11.88%, followed by S&P 500 with 6.63%. Nikkei 225 and Shanghai Composite exhibited moderate growth rates of 4.12% and 4.03% respectively, while EURO STOXX 50 showed the lowest growth rate of 0.96%. This suggests that the Indian stock market outperformed major developed markets over the study period.

OBJECTIVE 2: To compare the mean returns of selected global stock market indices.
   Test Used: One Way – ANOVA (SPSS)
Hypotheses:
• H₀ **(Null Hypothesis):** There is no significant difference in mean returns among the selected global stock market indices.
• H₁ **(Alternative Hypothesis):** There is a significant difference in mean returns among the selected global stock market indices.

Source	Sum of Squares	df	Mean Square	F	Sig. (p-value)
Between Groups	0.013049	4	0.003262	1.014	0.3986
Within Groups	5.000762	1555	0.003216		
Total	5.013811	1559			

Interpretation:
P -value = 0.3986 > 0.05 → Fail to reject H₀
This implies that there is no statistically significant difference in mean returns among the indices. This means that:
• Global stock markets behave similarly in terms of average returns.
• Markets may be more integrated than expected.
• International diversification based purely on returns may offer limited benefits.
Conclusion:
There is no statistically significant difference in the mean monthly returns among the five global stock indices at the 5% significance level.

OBJECTIVE 3: **TO EXAMINE THE VOLATILITY OF SELECTED INDICES USING GARCH (1,1)**
Test Used: GARCH (1,1) (EViews)
Type of Test: Parametric Time-Series Model
The VAR-GARCH findings indicate that the global stock markets are partially interdependent as the occurrence of the return spillovers between major stock markets is evident. Although past shocks and historical patterns do affect volatility, there is the limited predictability of past returns, and therefore, it is possible to view a significant input of external macroeconomic and geopolitical elements in market patterns.

VAR GARCH

Vector Autoregression Estimates
Date: 02/01/26   Time: 13:32
Sample (adjusted): 2000M04 2026M01
Included observations: 310 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	REUROSTO	RNIFTY	RNIKKEI	RSHANGHAII	RSP500
REUROSTOXX(-1)	0.020552	0.129191	0.109772	0.232390	0.035739
	(0.10240)	(0.12473)	(0.10806)	(0.13632)	(0.08706)
	[0.20069]	[1.03578]	[1.01584]	[1.70470]	[0.41049]
REUROSTOXX(-2)	-0.058030	0.044333	-0.044404	0.194571	-0.089775
	(0.10015)	(0.12199)	(0.10568)	(0.13332)	(0.08515)
	[-0.57944]	[0.36343]	[-0.42016]	[1.45937]	[-1.05431]
RNIFTY(-1)	-0.024244	-0.015669	-0.016618	0.024920	0.001647
	(0.05947)	(0.07244)	(0.06276)	(0.07917)	(0.05056)
	[-0.40767]	[-0.21632]	[-0.26481]	[0.31477]	[0.03258]
RNIFTY(-2)	0.076533	0.023998	0.016750	0.130317	0.059845
	(0.05896)	(0.07182)	(0.06222)	(0.07850)	(0.05013)
	[1.29795]	[0.33413]	[0.26919]	[1.66015]	[1.19372]
RNIKKEI(-1)	0.078354	-0.002308	0.042224	-0.046700	0.100901
	(0.07595)	(0.09251)	(0.08015)	(0.10111)	(0.06458)
	[1.03159]	[-0.02495]	[0.52679]	[-0.46185]	[1.56246]
RNIKKEI(-2)	-0.009745	-0.152800	0.067304	0.001107	0.015134
	(0.07558)	(0.09206)	(0.07976)	(0.10062)	(0.06426)
	[-0.12893]	[-1.65974]	[0.84383]	[0.01100]	[0.23550]
RSHANGHAII(-1)	0.032052	-0.015349	0.101740	0.066974	0.049363
	(0.04546)	(0.05537)	(0.04797)	(0.06052)	(0.03865)
	[0.70506]	[-0.27719]	[2.12079]	[1.10665]	[1.27713]
RSHANGHAII(-2)	0.083403	0.128962	0.045407	0.122097	0.055709
	(0.04580)	(0.05579)	(0.04833)	(0.06097)	(0.03894)
	[1.82102]	[2.31173]	[0.93949]	[2.00253]	[1.43061]
RSP500(-1)	-0.024685	0.056140	-0.047899	-0.210289	-0.101719
	(0.12459)	(0.15175)	(0.13147)	(0.16586)	(0.10593)
	[-0.19814]	[0.36995]	[-0.36433]	[-1.26790]	[-0.96027]
RSP500(-2)	-0.130816	-0.045028	-0.108236	-0.391392	-0.064196
	(0.12202)	(0.14862)	(0.12876)	(0.16244)	(0.10374)
	[-1.07209]	[-0.30297]	[-0.84059]	[-2.40948]	[-0.61879]
R-squared	0.035388	0.021107	0.039484	0.050682	0.027149
Adj. R-squared	0.006450	-0.008259	0.010669	0.022202	-0.002036
Sum sq. resids.	0.798739	1.185004	0.889458	1.415548	0.577396
S.E. equation	0.051599	0.062849	0.054451	0.068691	0.043871
F-statistic	1.222876	0.718753	1.370253	1.779583	0.930230
Log likelihood	484.1296	422.9872	467.4550	395.4326	534.4280
Akaike AIC	-3.058900	-2.664433	-2.951322	-2.486662	-3.383406
Schwarz SC	-2.938366	-2.543899	-2.830788	-2.366127	-3.262872
Mean dependent	0.000407	0.009090	0.003125	0.002673	0.004944
S.D. dependent	0.051766	0.062591	0.054743	0.069467	0.043826

Determinant resid covariance (dof.adj.)	2.81E-14
Determinant resid covariance	2.39E-14
Log likelihood	2662.518
Akaike information criterion	-16.85495
Schwarz criterion	-16.25228

INTERPRETATION
An estimated Vector Auto-regression (VAR) model with monthly log returns of five of the world largest stock market indices (EURO STOXX 50, NIFTY 50, Nikkei 225, Shanghai Composite, and S&P 500) was estimated on the basis of the years April 2000 to January 2026. There were 310 observations that were incorporated into the analysis after making required changes. The two-lag VAR specification model was chosen to estimate the short-term dynamic interrelationships between the indices. The model approximates the effects of previous returns of one market to the current returns of other markets.
Hypotheses (Volatility and Dynamic Relationship)
• **H₀:** Past shocks and past volatility do not significantly affect current market volatility.
• **H₁:** Past shocks and past volatility significantly affect current market volatility.
If VAR–GARCH (1,1) test indicates:
• **Significant ARCH (α) term** → Recent market shocks influence current volatility.
• **Significant GARCH (β) term** → Past volatility has a persistent effect on current volatility.
• **If α + β is close to 1** → High volatility persistence exists in the market.
This means:
• The volatility is not accidental; it has volatility clustering (large movements and then large movements).
• Market risk is not something that disappears in a short period of time. External shocks (financial crises, pandemics, policy changes) are those shocks that have lasting impacts in the markets.
Time-varying risk requires investors to take into account time-varying risk instead of assuming constant volatility.
In case terms ARCH and GARCH are not significant:
• Past shocks have a weak dependence on market volatility.
• Risk is not as persistent or stable through time. Plausible constant-variance models might be adequate to analyze.
Conclusion:*Most financial markets exhibit significant ARCH and GARCH effects, indicating persistent and time-varying volatility**, with emerging markets generally showing higher volatility sensitivity than developed markets.*
   OBJECTIVE 4: To examine the long-run relationship among indices using Johansen Cointegration.
*Test Used: **Johansen Cointegration   (EViews)***
 *Type of Test: **Parametric Time-Series Test***

Date: 02/01/26 Time: 13:42
Sample (adjusted): 2000M06 2026M01
Included observations: 308 after adjustments
Trend assumption: Linear deterministic trend
Series: NIFTY EUROSTOXX NIKKEI SHANGHAI SP500
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.098511	75.14337	69.81889	0.0176
At most 1	0.053802	43.20159	47.85613	0.1277
At most 2	0.041022	26.16818	29.79707	0.1238
At most 3	0.026948	13.26680	15.49471	0.1054
At most 4 *	0.015633	4.853037	3.841466	0.0276

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.098511	31.94179	33.87687	0.0836
At most 1	0.053802	17.03340	27.58434	0.5771
At most 2	0.041022	12.90139	21.13162	0.4613
At most 3	0.026948	8.413763	14.26460	0.3382
At most 4 *	0.015633	4.853037	3.841466	0.0276

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

NIFTY	EUROSTOXX	NIKKEI	SHANGHAI	SP500
-0.000130	0.001960	-0.000534	0.000718	0.002524
-1.38E-05	-0.000559	0.000487	0.000548	-0.003175
-0.000420	-0.001277	3.82E-05	0.001458	0.001988
0.000507	0.001380	1.78E-05	-0.000147	-0.002364
-0.000724	-0.000462	0.000222	0.000147	0.002330

Unrestricted Adjustment Coefficients (alpha):

D(NIFTY)	-72.78668	-25.50970	39.00468	-0.791316	37.20087
D(EUROSTOX)	-45.88095	-10.49626	4.290428	-4.816794	-4.796370
D(NIKKEI)	-102.4181	-213.6711	26.95029	30.02478	-7.473967
D(SHANGHAI)	-29.59027	-10.17713	-32.08089	0.665556	8.986713
D(SP500)	-25.06386	-6.136293	5.062209	9.928836	-0.669115

1 Cointegrating Equation(s):   Log likelihood   -10565.90

Normalized cointegrating coefficients (standard error in parentheses)

NIFTY	EUROSTOXX	NIKKEI	SHANGHAI	SP500
1.000000	-15.04702	4.099128	-5.510758	-19.37843
	(3.39377)	(1.02927)	(2.01957)	(5.31140)

Adjustment coefficients (standard error in parentheses)

D(NIFTY)	0.009482
	(0.00332)
D(EUROSTOX)	0.005977
	(0.00120)
D(NIKKEI)	0.013342
	(0.00770)
D(SHANGHAI)	0.003855
	(0.00154)
D(SP500)	0.003265
	(0.00080)

2 Cointegrating Equation(s):   Log likelihood   -10557.38

Normalized cointegrating coefficients (standard error in parentheses)

NIFTY	EUROSTOXX	NIKKEI	SHANGHAI	SP500
1.000000	0.000000	-6.569640	-14.78596	48.20072
		(2.64720)	(7.30069)	(16.0230)
0.000000	1.000000	-0.709029	-0.616415	4.491197
		(0.17282)	(0.47663)	(1.04606)

Adjustment coefficients (standard error in parentheses)

D(NIFTY)	0.009834	-0.128418
	(0.00334)	(0.05192)
D(EUROSTOX)	0.006122	-0.084069
	(0.00120)	(0.01867)
D(NIKKEI)	0.016289	-0.081327
	(0.00756)	(0.11770)
D(SHANGHAI)	0.003995	-0.052314
	(0.00155)	(0.02414)
D(SP500)	0.003350	-0.045700
	(0.00080)	(0.01248)

3 Cointegrating Equation(s):   Log likelihood   -10550.93

Normalized cointegrating coefficients (standard error in parentheses)

NIFTY	EUROSTOXX	NIKKEI	SHANGHAI	SP500
1.000000	0.000000	0.000000	-4.748690	-2.462563
			(1.06129)	(0.66720)
0.000000	1.000000	0.000000	0.466858	-0.976638
			(0.28427)	(0.17871)
0.000000	0.000000	1.000000	1.527827	-7.711728
			(1.00817)	(0.63380)

Adjustment coefficients (standard error in parentheses)

D(NIFTY)	-0.006559	-0.178246	0.027937
	(0.01117)	(0.06102)	(0.01836)
D(EUROSTOX)	0.004319	-0.089550	0.019654
	(0.00403)	(0.02202)	(0.00662)
D(NIKKEI)	0.004963	-0.115755	-0.048321
	(0.02541)	(0.13886)	(0.04177)
D(SHANGHAI)	0.017478	-0.011332	0.009620
	(0.00515)	(0.02812)	(0.00846)
D(SP500)	0.001222	-0.052167	0.010590
	(0.00269)	(0.01471)	(0.00443)

4 Cointegrating Equation(s):	Log likelihood	-10546.72		
Normalized cointegrating coefficients (standard error in parentheses)				
NIFTY	EUROSTOXX	NIKKEI	SHANGHAI	SP500
1.000000	0.000000	0.000000	0.000000	-1.358520
				(1.01976)
0.000000	1.000000	0.000000	0.000000	-1.085180
				(0.21044)
0.000000	0.000000	1.000000	0.000000	-8.066939
				(0.69422)
0.000000	0.000000	0.000000	1.000000	0.232494
				(0.24464)
Adjustment coefficients (standard error in parentheses)				
D(NIFTY)	-0.006960	-0.179338	0.027923	-0.009271
	(0.01703)	(0.07035)	(0.01836)	(0.04366)
D(EUROSTOX)	0.001877	-0.096198	0.019468	-0.031732
	(0.00614)	(0.02537)	(0.00662)	(0.01575)
D(NIKKEI)	0.020183	-0.074316	-0.047788	-0.155849
	(0.03874)	(0.16001)	(0.04177)	(0.09931)
D(SHANGHAI)	0.017815	-0.010413	0.009632	-0.073687
	(0.00785)	(0.03242)	(0.00846)	(0.02012)
D(SP500)	0.006255	-0.038464	0.010766	-0.015440
	(0.00409)	(0.01688)	(0.00441)	(0.01048)

Hypotheses:
• **H₀:** No long-run relationship exists among the indices.
• **H₁:** At least one long-run relationship exists among the indices.

Interpretation based on Johansen Test Results:
The null hypothesis (H0) of no long-run relationship is rejected and therefore the alternative hypothesis (H1) is accepted since the Johansen Trace test shows one cointegrating vector. It means that there is a long-run equilibrium between NIFTY, EUROSTOXX, NIKKEI, SHANGHAI and S&P 500.
This means:
• The selected global stock markets are integrated in the long run.
• These markets tend to move together over time not independently**.**
• Other markets can be impacted by a shock or significant movements in a dominant market, especially the S&P 500 (U.S market).
• Complete diversification across these markets may not be fully effective in the long term, as they share a common equilibrium relationship.
Since co-integration is found:
• The markets are not fully independent of each other.
• These are the benefits of international diversification which are good in the short run and restricted in the long run because of integration in the market.

Conclusion
The findings are consistent with most empirical studies, which report partial cointegration among major global stock indices**,** indicating a combination of market integration and short-run independence.

OBJECTIVE 5: To analyze correlation for investor diversification benefits.
*Test Used: **Correlation Analysis (EViews)***
*Type of Test: **Parametric Time-Series Test***

Covariance Analysis: Ordinary					
Date: 02/01/26 Time: 13:48					
Sample: 2000M01 2026M01					
Included observations: 313					
Correlation					
t-Statistic					
Probability	EUROSTOXX	NIFTY	NIKKEI	SHANGHAI	SP500
EUROSTOXX	1.000000				

NIFTY	0.567761	1.000000			
	12.16309	-----			
	0.0000	-----			
NIKKEI	0.762382	0.933821	1.000000		
	20.77608	46.03354	-----		
	0.0000	0.0000	-----		
SHANGHAI	0.401891	0.594044	0.540108	1.000000	
	7.740002	13.02293	11.31768	-----	
	0.0000	0.0000	0.0000	-----	
SP500	0.660128	0.975911	0.970609	0.535166	1.000000
	15.49813	78.88495	71.12471	11.17228	-----
	0.0000	0.0000	0.0000	0.0000	-----

INTERPRETATION: CORRELATION ON INDICES
Hypotheses:
• **H₀:** No significant correlation exists among the indices.
• **H₁:** Significant correlation exists among the indices.
Interpretation based on Correlation Matrix (Indices):
Given the fact that all the pairwise correlation coefficients are positive and statistically significant ($p = 0.0000$), the null hypothesis (H 0) is rejected in favor of the alternative hypothesis (H 1). This implies that the choice global stock indices are highly correlated.
This means:
• The global stock markets show strong co-movement in levels.
• NIFTY and S&P 500 (0.9759) exhibit the highest correlation, indicating very strong linkage.
• NIKKEI also shows very high correlation with NIFTY (0.9338) and S&P 500 (0.9706).

• SHANGHAI has comparatively lower but still positive and significant correlation with other markets.
• Movements in major global markets are closely related rather than independent.
Implication:
• High correlation suggests limited diversification benefits across these markets in the long run.
• Shocks in one major market are likely to transmit to other markets.

Covariance Analysis: Ordinary
Date: 02/01/26   Time: 13:46
Sample: 2000M02 2026M01
Included observations: 312
Balanced sample (listwise missing value deletion)

Covariance Correlation Probability	REUROSTO	RNIFTY	RNIKKEI	RSHANGHAII	RSP500
REUROSTOXX	0.002687 1.000000 -----				
RNIFTY	0.001757 0.541734 0.0000	0.003916 1.000000 -----			
RNIKKEI	0.001759 0.622871 0.0000	0.001829 0.536230 0.0000	0.002970 1.000000 -----		
RSHANGHAII	0.001068 0.296742 0.0000	0.001287 0.296179 0.0000	0.001164 0.307425 0.0000	0.004823 1.000000 -----	
RSP500	0.001854 0.814606 0.0000	0.001498 0.544920 0.0000	0.001553 0.648811 0.0000	0.000942 0.308894 0.0000	0.001929 1.000000 -----

2) INTERPRETATION: CORRELATION ON RETURNS
Hypotheses:
• **H₀:** No significant correlation exists among the index returns.
• **H₁:** Significant correlation exists among the index returns.
Interpretation based on Correlation Matrix (Returns):
Since all correlation coefficients among returns are positive and statistically significant ($p = 0.0000$), the null hypothesis (H_0) is rejected in favor of the alternative hypothesis (H_1). This indicates that the returns of the selected global stock indices are significantly correlated.
This means:
• The returns of global stock markets tend to move in the same direction.
• S&P 500 and EUROSTOXX (0.8146) show the strongest return correlation, indicating close linkage between U.S. and European markets.
• NIKKEI also exhibits moderate to high correlation with other markets, especially S&P 500 (0.6488).
• SHANGHAI shows the lowest return correlation with other indices, suggesting relatively higher independence compared to other markets.
Implication:
• Although returns are correlated, the lower correlation of SHANGHAI suggests some short-run diversification potential.
• However, overall positive correlations imply that complete risk diversification across these markets is limited.
Authors and Affiliations

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