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International Diversification: Nifty 50 and Other Indices

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ABSTRACT

Purpose: This article seeks to examine the interrelationship between the NSE and other prominent global markets.

Design/Methodology/Approach: An empirical study has been undertaken to assess the cointegration and causation across stock market indexes using Johansen's Cointegration and VAR Test. Daily data points covering one financial year (FY22-23) have been used for empirical analysis.

Findings: The VAR test findings indicate that NIFTY50 is influenced only by Merval. Moreover, the regression model findings indicate that only the FTSE100 and KOSPI are statistically significant. The findings indicate the lack of multicollinearity and autocorrelation.

Research Limitations: The data period taken for this study is less and can be increased.

Managerial Implications: The findings of this article may be very beneficial to investment firms, portfolio managers, and foreign institutional investors.

Originality/Value: The study highlighted the importance of studying cointegration between the markets.

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Introduction

The term "stock market integration" or "stock market interlinkages" describes how daily stock index results from different national equity markets are dependent on one another. Higher levels of linkages between the major markets are indicated by greater price comovements in two different markets on the same day and/or a more noticeable lead/lag connection across days. Following the establishment of worldwide portfolio diversification, both institutional and individual investors from developed and developing nations have shown heightened interest in overseas stock markets.

The examination of interconnections across economies is particularly pertinent in today's landscape of extensive liberalization and increasing international engagements among nations. Stock markets have grown more crucial since they are essential instruments for capital generation and liquidity management. This has resulted in global researchers exhibiting significant interest in the links across stock markets since the 1960s, culminating in a substantial body of work. The dynamic linkages between economies need longitudinal studies on this topic due to the ever-evolving global environment. The examination of stock market interconnections has significant ramifications for both investors and policymakers.

Markowitz's (1952) portfolio theory posits that portfolio diversification is advantageous only when the correlation among the invested assets is low or ideally negative. This observation indicates that in interrelated markets exhibiting large correlations, diversification advantages are absent. Consequently, analyzing the link between the two stock markets will assist global investors in making more informed investment decisions. To get a favourable position, one should invest in markets that are not interconnected.

This research aims to analyze the interconnectedness of the Indian equity market, three emerging stock markets, and one established market, focusing only on the near term. The three emerging stock markets are Mexico, South Korea, and Argentina, with their respective indexes being the S&P/BMV IPC, KOSPI, and S&P Merval. The only developed market is the United Kingdom, with the selected index being the FTSE100 (London).

Review of Literature

The existing literature on global market interconnectedness may be classified into two primary areas. The first category assesses the degree of interdependence among a certain set of stock markets and how this interdependence fluctuates over time and in response to specific events, such as stock market crises. Research by Philippe (1986), Neal (1987), Taylor (1989), Becker (1990), Campbell & Hervey (1991), Chung (1992), Smith (1992), Campbell (1992), Arshanapalli (1993), Choudhury (1994), Lin (1994), Arshanapalli (1995), Werner (1996), Choudhury (1997), Masih & Masih (1997), and Fraser (2003) has concentrated solely on both the short and long-term interdependence of stock markets in developed countries. Studies of a similar kind that include both established and rising nations globally include the works of Sharma (1977), Janakiramanan (1998), Elyas (1998), Liu (1998), Masih & Masih (1999), Hsiao (2000), Christopher (2001), among others. Research concerning established markets has shown inconclusive results. Campbell & Hamao (1992), Lin et al. (1994), and Choudhury (1994) asserted that a bi-directional reliance existed between the stock markets of the United States and Japan. Nonetheless, the studies by Harvey (1991) and Chan et al. (1992) confirm the lack of dependence between the US and other major Asian markets. Research by Becker (1990), Chung (1992), Arshanpalli (1993), Masih & Masih (1997), Janakiramanan (1998), Kiran (2002), and among others, demonstrates the influence of the US market on both developed and developing countries. Elyas (1998) demonstrated the absence of a correlation between the equity market of Sri Lanka and that of the United States and other Asian countries. Paul and Timoty (1991) demonstrated the increasing interconnection inside the national market and between markets, extending beyond a 24-hour timeframe.

A different category has sought to analyze the aspects that elucidate the reasons for such dependency over a certain timeframe and how it is influenced by particular occurrences. King (1990), Roll (1992), Bracker (1999), Serra (2000), and Pretorius (2002), have investigated the extent of interconnection across national stock markets and identified potential variables influencing this interdependence. Their findings indicated that industry similarities, bilateral trade practices, disparities in industrial output growth, and exchange rate

differentials are significant elements elucidating stock market interconnectedness. Disregarding the effects of industry variables, Serra (2000) demonstrated the significance of national factors in the comovements of stock markets. Roll (1988), Hamao et al. (1990), King (1990), and Yung (1994), Meric & Meric (1997) have demonstrated that the October 1987 stock market crash and other market bubbles significantly heightened the interdependence and volatility transmission among national equity markets. Additionally, efforts are undertaken to ascertain the ramifications of such reliance on various sectors of the nation's economy. The benefits of portfolio diversification are negatively correlated with the comovements of securities returns across various stock markets. The benefits of international diversification, stemming from the minimal interconnectedness between established and developing stock markets, have been well shown in research by Resnick (1984), Padmanabhan (1988), Wheatly (1988), Meric & Meric (1989), Smith (1992), Christopher (2001), and others. Taylor & Tonks (1989) showed that investors in the US market were unable to attain long-term profits by diversifying their portfolios into the stock markets of Germany, the Netherlands, and Japan. Although the integration of established and emerging equities markets is well documented, there has been a lack of emphasis on the long-term comovements of the Indian stock market with global markets. The lack of long-term dependency between India and other developed stock markets, such as the US, Hong Kong, Singapore, and Taiwan. Amanulla and Kamaiah (1995) examined the interconnectedness of India's primary regional stock markets, providing evidence supporting the integration of the Bombay, Madras, and Calcutta stock exchanges, hence highlighting the inefficiencies of these regional exchanges.

According to earlier research, especially in the Indian context, the prevailing approach has been done to evaluate the immediate and long-term relationships between the Indian equities market and a few established nations, ignoring the importance of developing economies to the Indian economy. By examining how the Indian equity market is interdependent with other Asian, European, and Latin American markets, this study aims to improve the body of knowledge on the convergence of capital markets in emerging as well as developed nations. It does this by identifying possible diversification advantages for foreign investors in India.

Data and Research Methodology

The research method has two components to achieve the desired objectives. The study starts with an initial examination of the dataset, including the identification of descriptive statistics and the assessment of unit root characteristics for each data series. The authors used a standard formula for calculating the return series. Moreover, the authors employed ADF test statistics to determine the stationarity properties of the chosen time series variables. The most popular test to ascertain if the data is stationary is the ADF test.

Data

The daily data spanning from 1st April 2022 to 31st March 2023 (FY22-23) has been collected from investing dot com for all the five indices – S&P/BMV IPC, FTSE100, KOSPI, S&P Merval, and NIFTY 50.

MLR

NIFTY50 is considered to be the dependent factor, while the other global indexes, including S&P/BMV IPC, FTSE100, KOSPI, and S&P Merval, serve as the explanatory variables. Furthermore, the R-square value elucidates the extent of variation in the dependent variable accounted for by the explanatory factors. The regression formula presented in (1) has been employed for modelling objectives.

$$RNIFTY50 = \beta_0 + \beta_1 RBMV + \beta_2 RFTSE100 + \beta_3 RKOSPI + \beta_4 RMerval + £ \quad (1)$$

Where, *RNIFTY50* is the return series of the NSE Nifty while *RBMV*, *RFTSE100*, *RKOSPI*, and *RMerval* are the return series of S&P/BMV IPC, FTSE100, KOSPI, and S&P Merval respectively. β_0 is the beta constant and β_1, β_2, β_3, and β_4 are the regression coefficients and £ is the error term.

JC Test

This method serves as the main approach for assessing the presence of cointegration among variables. A series exhibits cointegration when it integrates two or more non-stationary series, resulting in a stationary series. Furthermore, external factors frequently lead to long-term co-movement in cointegrated series, despite potential divergence in the short term. The null assumption of the JC test asserts that a cointegrating vector is not present. The null assumption is rejected when the critical value is lower than the significance threshold, and conversely. Equation (2) below illustrates the order VAR model.

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{i-1}^{k-1} \Gamma_i \Delta Y_{t-1} + \varepsilon_t \qquad (2)$$

"where $\Delta Y_t = Y_t = Y_{t-1}$ difference operator, Π = first lag coefficient matrix, Γ_i = differenced lag matrices and ε_t = noise term and there are two likelihood ratios to test for cointegration under Johansen's approach. These statistics are λ_{trace}, and λ_{max} eigenvalue, . In case of conflicts, we should prefer trace statistics" (Johansen and Juselius, 1990).

VAR (Vector Auto Regression) Test

VAR (Vector Auto Regression) models serve as a statistical approach for examining the dynamic interconnections between multiple time series variables. The underlying premise of VAR models is that every component in the framework is impacted by both its historical values and the historical values of other factors in the system. VAR models serve as a robust instrument for examining causal links across variables and have been used across several disciplines, including economics, finance, and sociology. VAR models may be used to evaluate if alterations in one index are consistently followed by modifications in another index within the framework of causality analysis of several indices.

Factual Findings

Table 1 displays the results of the statistical analyses for all factors. The results also provide the values of "kurtosis and skewness", together with the results of the *JB probability test*, which evaluates the uniformity of a data series. The "skewness and kurtosis" values indicate that the distribution deviates from uniformity. A series is considered symmetrical if the skewness is 0 and

Table 1: Descriptive Statistics

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> # for more detailed statistical values
> basicStats(data.frame(BMV, FTSE100, KOSPI, Merval, NIFTY50))
                   BMV       FTSE100          KOSPI         Merval       NIFTY50
nobs      2.610000e+02  2.610000e+02     261.000000  2.610000e+02  2.610000e+02
NAs       0.000000e+00  0.000000e+00       0.000000  0.000000e+00  0.000000e+00
Minimum   4.462680e+04  6.826150e+03    2155.490000  8.224355e+04  1.529350e+04
Maximum   5.660954e+04  8.014310e+03    2759.200000  2.614988e+05  1.881250e+04
1. Quartile 4.755851e+04  7.264310e+03    2356.730000  9.323624e+04  1.692960e+04
3. Quartile 5.269166e+04  7.587700e+03    2483.160000  2.010606e+05  1.793635e+04
Mean      5.019672e+04  7.440168e+03    2437.283592  1.532934e+05  1.734450e+04
Median    5.042626e+04  7.469280e+03    2420.242500  1.427776e+05  1.753085e+04
Sum       1.310134e+07  1.941884e+06  636131.017500  4.000957e+07  4.526915e+06
SE Mean   1.790654e+02  1.677558e+01       8.454436  3.542371e+03  5.032188e+01
LCL Mean  4.984412e+04  7.407135e+03    2420.635708  1.463180e+05  1.724541e+04
UCL Mean  5.054933e+04  7.473201e+03    2453.931476  1.602688e+05  1.744359e+04
Variance  8.368813e+06  7.345067e+04   18655.626062  3.275131e+09  6.609282e+05
Stdev     2.892890e+03  2.710178e+02     136.585600  5.722876e+04  8.129749e+02
Skewness -1.997800e-02 -3.837000e-03       0.403323  5.381850e-01 -5.862090e-01
Kurtosis -1.152849e+00 -4.315660e-01      -0.259190 -1.030337e+00 -4.597800e-01
>
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Source: *Authors' Calculations*

the kurtosis is 3. Additionally, the table below presents the figures of the average, mid-value, and variation for all factors.

ADF test results

The stationarity test is used to ascertain the static nature of the chosen factors. Tests were performed on all variables at both the levels indicated in Table 2 and the initial differences shown in Table 3.

Tables 2 and 3 present the ADF Test results in both original and different forms for all factors, respectively. All variables were found to have a trend at the level, suggesting that the chosen global indices and NIFTY50 demonstrate the characteristics of nonstationarity. Consequently, the null assumption cannot be rejected at a 5% level of significance. All selected sample markets were found to be static after the application of their initial difference. Table 3 indicates that all variables exhibit stationarity at the 1% significance level. Consequently, the authors concluded that all the chosen countries are integrated of 1st order.

MLR Results

31.88% of the variance in the variable being studied (NIFTY50) was explained by the chosen explanatory variables. This suggests that many other factors also affect the movement of the dependent variable. Only the FTSE100 and KOSPI were determined to be significant at the 5% level, whereas the other variables, namely BMV and Merval, had no significant influence on NIFTY50 at the same level of significance. Furthermore, the model was assessed for multicollinearity and autocorrelation, revealing no substantial evidence of either. Consequently, the following regression equation may be used (3)

$$RNIFTY50 = 0.00006 + (0.0338)\ RFTSE100 + (0.0334)\ RKOSPI \quad (3)$$

Where, RNIFTY50, RFTSE100 and RKOSPI are the log returns of NIFTY50, FTSE100 and KOSPI indices respectively.

JC test Results

The JC test was used to ascertain the short-run relationship between the other indices and NIFTY50. According to AIC, optimal lags were 2.

Table 2: ADF Test Results at Level

Markets	*Test Form*	*Test Stat.*	*Critical Value*
NIFTY50	ß	1.525	-2.872
	Ø	-2.004	-3.427
MERVAL	ß	0.077	-2.872
	Ø	-2.224	-3.427
KOSPI	ß	-2.338	-2.872
	Ø	-1.856	-3.427
FTSE100	ß	-1.932	-2.872
	Ø	-2.282	-3.427
BMV	ß	-1.986	-2.872
	Ø	-2.766	-3.427

Notes: *= Intercept and ¯ = Trend and Intercept*
Source: *Authors' Calculations*

Table 3: ADF Test Results at First Difference

Markets	*Test Form*	*Test Stat.*	*Critical Value*
NIFTY50	ß	-15.689	-2.872
	Ø	-15.671	-3.427
MERVAL	ß	-14.57	-2.872
	Ø	-14.576	-3.427
KOSPI	ß	-15.993	-2.872
	Ø	-16.103	-3.427
FTSE100	ß	-15.837	-2.872
	Ø	-15.821	-3.427
BMV	ß	-15.344	-2.872
	Ø	-15.584	-3.427

Notes: ** Significant results at 1% level of Significance*
= Intercept and ¯ = Trend and Intercept
Source: *Authors' Calculations*

Table 4: Johansen Cointegraion Results

Null hypothesis	*Eigen value*	*Trace test*		*Max eigen value test*	
		Statistics	*p-value*	*Statistics*	*p-value*
r=0 (none)	0.0975	61.49 (69.82)	0.19	26.27 (33.88)	0.30
r<=1 (at most 1)	0.0649	35.22 (47.86)	0.44	17.18 (27.58)	0.56
r<=2 (at most 2)	0.0414	18.04 (29.80)	0.56	10.83 (21.13)	0.66
r<=3 (at most 3)	0.0173	7.21 (15.49)	0.55	4.46 (14.26)	0.81
r<=4 (at most 4)	0.0107	2.75 (3.84)	0.10	2.75 (3.84)	0.10

Notes: *The null hypothesis is accepted when test statistic < critical value (at 5%).*
Source: *Authors' Calculations*

The findings demonstrate an absence of a cointegrating relationship between the selected global indexes and NIFTY50. In other words, there is no short-term correlation between the selected variables, nor do they exhibit simultaneous movement in the near term. Consequently, the null assumption can be accepted at a 5% level of significance.

VAR Test Results

The findings demonstrate a substantial causal association from Merval to NIFTY50 at lag 2, indicating a unidirectional influence. No substantial causal relationship existed between NIFTY50 and KOSPI, FTSE100, and BMV.

Research Implications

This research has significant implications for individual investors, investment firms, portfolio managers, DIIs, FIIs, hedge funds, and private equity firms. This research and its findings will empower people andcorporations to make investment choices that facilitate risk mitigation in an international portfolio.

Conclusions

Our findings indicate that there are no short-term price comovements between Indiana and other national equities markets. The share prices are not cointegrated in the short term and, thus, may

Vector Autoregression Estimates
Date: 11/26/23 Time: 16:38
Sample (adjusted): 4/05/2022 3/31/2023
Included observations: 259 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LNIFTY50	LMERVAL	LKOSPI	LFTSE100	LBMV
LNIFTY50(-1)	0.961109	0.027092	0.067439	0.046369	-0.173685
	(0.07233)	(0.19000)	(0.08348)	(0.07409)	(0.08395)
	[13.2878]	[0.14259]	[0.80781]	[0.62583]	[-2.06898]
LNIFTY50(-2)	0.008723	-0.005733	-0.071043	-0.051693	0.164288
	(0.07203)	(0.18921)	(0.08313)	(0.07378)	(0.08360)
	[0.12110]	[-0.03030]	[-0.85457]	[-0.70063]	[1.96528]
LMERVAL(-1)	0.063330	1.087680	0.031454	0.063871	0.021747
	(0.02586)	(0.06794)	(0.02985)	(0.02649)	(0.03002)
	[2.44852]	[16.0085]	[1.05364]	[2.41074]	[0.72446]
LMERVAL(-2)	-0.059559	-0.105476	-0.037532	-0.058477	-0.019153
	(0.02570)	(0.06751)	(0.02966)	(0.02632)	(0.02983)
	[-2.31763]	[-1.56248]	[-1.26538]	[-2.22146]	[-0.64216]
LKOSPI(-1)	-0.042174	0.044122	0.794279	0.113284	0.108568
	(0.05852)	(0.15372)	(0.06754)	(0.05994)	(0.06792)
	[-0.72067]	[0.28702]	[11.7596]	[1.88982]	[1.59849]
LKOSPI(-2)	0.040630	-0.177347	0.139464	-0.087996	-0.138051
	(0.05762)	(0.15136)	(0.06650)	(0.05902)	(0.06687)
	[0.70515]	[-1.17171]	[2.09710]	[-1.49091]	[-2.06437]
LFTSE100(-1)	0.032874	-0.140012	0.236531	0.770586	0.039092
	(0.07265)	(0.19085)	(0.08386)	(0.07442)	(0.08432)
	[0.45247]	[-0.73362]	[2.82067]	[10.3542]	[0.46360]
LFTSE100(-2)	-0.068032	0.230704	-0.211558	0.118970	-0.064205
	(0.07317)	(0.19222)	(0.08446)	(0.07496)	(0.08493)
	[-0.92973]	[1.20021]	[-2.50491]	[1.58720]	[-0.75600]
LBMV(-1)	0.159213	0.199394	0.315909	0.187886	0.962305
	(0.06182)	(0.16240)	(0.07136)	(0.06333)	(0.07175)
	[2.57529]	[1.22777]	[4.42719]	[2.96683]	[13.4113]
LBMV(-2)	-0.157129	-0.170618	-0.268210	-0.155870	0.036650
	(0.06250)	(0.16417)	(0.07213)	(0.06402)	(0.07253)
	[-2.51425]	[-1.03929]	[-3.71832]	[-2.43482]	[0.50529]
C	0.239803	-0.032505	-0.050136	0.186170	0.228317
	(0.09128)	(0.23978)	(0.10535)	(0.09350)	(0.10594)
	[2.62718]	[-0.13556]	[-0.47589]	[1.99111]	[2.15520]

Source: *Authors' Calculations*

not exhibit synchronized movement over an extended duration. The findings from the VAR test suggest that, apart from Merval (Argentina), international investors can enhance their portfolio diversification in the short term. It is imperative to note that our analysis is limited to examining the interdependence among the selected stock markets to evaluate potential diversification advantages, rather than assessing the profitability of the Indian equities market or that of other markets.

The VAR test reaffirms the unidirectional association between Merval and NIFTY50, indicating that causation flows from Merval to NIFTY50 throughout the duration of one Indian financial year. There is no substantial lead/lag connection between the Indian and other equities markets.

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