"Interrelationship of Indian stocks market with the emerging equity markets"

A Research Submitted in Partial Fulfilment of the Requirements for the Degree of Integrated MBA

Submitted by

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Declaration

I hereby declare that

The research titled, "Interrelationship of Indian stocks market with the emerging equity markets" comprises my original work towards the degree of Integrated Masters of Business Administration at Amrut Mody School of Management, Ahmedabad University and it has not been submitted elsewhere for a degree.

Due acknowledgement has been made in the text to all other material used.

Signature of candidate

Certificate

This is to certify that the dissertation work titled "Interrelationship of Indian stocks market with the emerging equity markets" has been completed by Krishna Patel (1613031) for the degree Integrated MBA at Amrut Mody School of Management, Ahmedabad University under my supervision.

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Acknowledgements

1. Abstract

The effect of globalization and integration among the countries can also be seen on the stock indices of different countries. So to understand the relation between the indices becomes very important for the investors. This research studies the interrelationship of Indian stock market with the equity indices of Mexico, South Korea, Brazil and Indonesia by using the closing data from the period of 17th September 2007 to 13th July 2020. The study employs Johansen co-integration test for understanding the long term co-integration among the selected indices whereas the study employs Pearson correlation and Granger causality test to understand the short term relationship. The results show that there is no co-integration of India's equity market to the other emerging markets in the long run. However in the short-run there is weak level of correlation whereas for some indices there is an indication of moderate level of correlation in the short-run. Moreover all the emerging stock indices considered in this study have a bidirectional relationship with Nifty 50 index.

2. Introduction

Interrelationship means the way in which two or more thing are related to one another. The nations have become much more interrelated to other counties and so the policy change in one country can affect other counties also. Along with the increasing interrelation of the countries, the stock markets have also become much more interrelated. There can be many factors which has made the stock markets more integrated. Due to this co-integration there are chances that stock markets react to the global issues and happenings. There can be different types of relation like some indices can show a very similar trend to a developed stock market whereas some indices are not so strongly related. It is now evident through many different literature that stock indices shows interrelationship. So it is very important to understand the short term and the long term relationship between the equity markets. This studies attempts to find that how the selected indices of different counties are related

This area becomes very significant to be studied as the investors diversifying their portfolio should understand the relationship between different stock markets. The investors looking for diversifying the portfolio should understand the short term as well as the long term relation of the stock indices. The international investors can take the benefit of the price differences if there is low level of co- integration among the stock indices. The crisis in one country may affect the stock market in other country as observed during the corona virus pandemic and during the crisis of 2008. So the investors should also be aware about the stock markets affecting the particular index. There are many research papers available on the co- integration as the international investors are interested in understanding the reason behind such relationship among the indices. The ongoing corona pandemic has created the need to restudy the dynamics behind the relationship.

3. Literature Review

The literature in this area is increasing as the importance to understand the investment strategy is increasing. In literature it has been explored that there is some co-integration in long-run or in short-run between stock indices. The study by S. Plamalai, Kalaivani M., C. Devakumar also found out that there can be co-integration among the stock markets of different countries. The study focused on the emerging Asia-Pacific markets like India, Malaysia, South Korea, Japan, China, and Indonesia. The results shows that there is strong long-run relationship between some stock markets which means that there is a similar force which makes the stock markets integrated in the long run. The study also suggested a diversification strategy for the investors that the benefits of the long-run investments can be limited looking at the test results so the investors should focus of the short-run diversification strategy.

In another study Vinodh Madhavan found that there is no long-run co-integration between emerging equity markets like Mexico, Indonesia, South Korea, Turkey and developed markets. The study uses the bivariate and the multivariate Johansen co-integration test to test the long run relationship. The tests results showed that there is neither a bivariate co-integration nor multivariate co-integration among the chosen indices. Further to understand the short-term relationship among the indices the author employs the dynamic conditional correlation specification of bivariate MGARCH model. The study performed the tests on the data from the year 2002 to the year 2012.

As explored in many literature the co-movement is present between many stock indices of the world. Vanita Tripathi and Shruti Sethi (2010) examined the co-integration of Indian stock market with the stock market of China, United States, Japan and United Kingdom. The study conducted the tests on the data from the year 1998 to the year 2008 using co-integration tests like Johansen and Engle-Granger co-integration whereas using the Granger causality test to understand that which stock market influences the other. The results of this test shows that there is co-integration between the stock market of India and US whereas there is no co-integration between the stock market of India and that of Japan, UK and China. This study shows that there is some level of integration of Indian stock market with the stock market of other nations.

In a study by Ranjan Dasgupta (2014) investigates the short-run and long run relationship between stock market of India and BRIC countries. The study used Johansen-Juselius's, Engle-Granger's co-integration tests and Granger causality test to understand the relationship. The test shows that there is no long-run co-integration among the BRIC stock index according to the JJ co-integration test whereas according to the Engle-Granger test results there is a relationship between the stock market of India and Brazil. The study also notices short-run interrelationship between India and Brazil.

With the growing integration among the nations, the Asian stock markets are also witnesses' integration. A study by Dr. Manu K S and Varsha L Menda (2017) which studies the daily return from the year 2004 to the year 2015 found that there is a very storing correlation of Indian stock market with the global stock market. The study also highlights the importance of such studies for the effective investment diversification strategy.

Due to the changing conditions and the changing relations of the countries the co-integration among the stock markets have to be studied after proper intervals as the results may change. In a study by Malabika Deo and P. Prakaash the co-integration of Indian stock market with the globally leading stock markets was examined. In this study the results show that there is long-term interrelationship between NSE Nifty and the other developed stock markets. The study considered the data from the year 2006 to the year 2015 of stock indices of India, Australia, Switzerland, Germany, Japan, United Kingdom, and United Sates of America. The results suggested that all the Indian stock index had co-integration with all the indices considered in the study. Further the granger causality test shows that there is a bi-directional relationship of NSE with Nikkie 225 and Shanghai.

The study by Shipla and Dr. Anand Bansal focuses on the relationship between the stock market of India and China. The study uses the data of SSE Composite Index and the CNX Nifty from the year 2008 to the year 2015 for the test. After employing the Johansen's co-integration test the test results show that there is a long-term relationship between the stock market of Indian and the stock market of China. If there is a relationship between these stock markets then it opens up the scope to investigate the relationship of Indian stock market with other emerging stock market.

4. Limitation of the study

1. In this study the movements in the BSE index is ignored and not included in the tests. The study only considers the Nifty 50 NSE. To get a wider understanding of the relationship other indices of the Indian market should also be considered for the study.
2. The study has included only some of the emerging countries and compares the Indian index only to chosen emerging stock markets. So the relation of Nifty with other stock markets is not studied in this research. By studying the interrelation of Indian stock market to the chosen stock markets we cannot generalize the results for all the emerging economies so the indices which are not considered in this research should be studied.
3. The study does not further validate the outcomes with more sophisticated models like impulse response functions. The test results should be verified with the help of other tests.

5. Data Utilized

The indices which were considered for this research are Brazilian IBOVESPA Index (Brazil), Jakarta Stock Exchange Composite Index (Indonesia), KOSPI Index (South Korea), Mexican IPC Index (Mexico) and Nifty 50 NSE (India). Selection of the indices was based on the report of MSCI which lists the top emerging countries. The daily closing prices for all these indices were downloaded from "Yahoo Finance". This study uses the data from the period of 17th September 2007 to 13th July 2020. The time series had some missing data so for this study first the Index-Match formula was used to line up the data and then the missing data were filled using linear interpolation. The study uses the closing prices as well as the computed logarithmic returns.

6. Research Problem

AS the nations have become much more integrated in today's world, the stock markets can be affected by the global issues. As India's integration in also increasing, the Indian stock market can avoid the impact of global happenings. Even India's stock market is affected due to the global happenings.

The aim of this study is to:

1. Understand the strength of relationship between the chosen indices.
2. Examine the long term and short-run relationship between the chosen indices
3. Examine the causal relationship between the chosen indices

7. Methodology

Descriptive statistics - This statistics is used mainly to provide the overall summary of the data used in the study. To give the idea of the data used in the study measures like mean, standard deviation, minimum and maximum values will be calculated for all the data series.

Lag selection – The co-integration test and the causality test employed in this study is sensitive to the lag length. So this study uses Akaike Information Criteria (AIC) to select the lag length.

Correlation analysis - This statistical measure is used to understand the strength of the relation between the variables. The relation between NSE and other selected stock indices is understood through this test. To understand the statistical evidence for a relationship among the variables Pearson correlation test is used in this study. Bivariate Pearson Correlation test can be used to understand the short term relation of the variables and so in this study the short term relationships between the variables is judged by this test.

Stationarity test – The stationarity of the tests is tested through the Augmented Dickey-Fuller Unit Root Test in this study. It is used as a preliminary test so that other econometric tools like Johansen co-integration test can be done on the time series. If the econometric tests are carried on the series with unit root then the results can lead to spurious regression and so it is necessary that the series are stationary at the same level. Here if the test results shows that the t-statistic is more than the critical values at 1%, 5% and 10% levels then the null hypothesis cannot be rejected. The stationarity test is done on price as well as on returns.

Causality test – Granger causality test will be used to study the causality among the time series. This test will help in testing if the variables have any short term relation and if one variable will be useful in predicting the other. Through this test we can know that if a variable X helps in predicting variable Y. If X is helpful in predicting variable Y then it is said that X granger causes Y. "Granger cause" does not mean "effect" or "result". This is a bivariate analysis so in this study the relation of different indices with respect to NSE will be studied.

For this test the bivariate regression of the below given form was used:

$$Y_t = \beta_0 + \sum_{i=1}^{n} \alpha_i X_{t-1} + \sum_{i=1}^{n} \beta_i Y_{t-1} + \varepsilon_{1t}$$

$$X_t = \lambda_0 + \sum_{i=1}^{n} \delta_i Y_{t-1} + \sum_{i=1}^{n} \lambda_i X_{t-1} + \varepsilon_{2t}$$

The null hypothesis in this test is that x does not granger cause y in the first equation and in the second equation the null hypothesis is that y does not granger cause x. If α_i is statistically significant then it is said that X granger causes Y. So if the lagged values of on series do not show statistical significance then it can be said that the first series do not granger cause the other.

Co- integration test – To check the co- integrating relation between Indian index and other indices, Johansen co- integration test will be conducted on the time series. In this outcome if the two variables will be co- integrated then it will be assumed that the two variables have long term relation. Bivariate Johansen co-integration test is used in this study to understand the extent of co-integration. Considering an equation:

$$\Delta Y_t = \mu + \sum_{i=1}^{p-1} \theta_i \Delta Y_{t-i} + \pi Y_{t-i} + \varepsilon_t$$

$$where\ \theta_i = -\sum_{j=i+1}^{p} A_j \quad and \quad \pi = -I + \sum_{i=1}^{p} A_i$$

8. Test Results

(A) DESCRIPTIVE STATISTICS

Table 1.1 and 1.2 presents the summary of the descriptive statistics of Nifty 50, IPC, KOSPI, JKSE, IBOVESPA.

Table 1.1: Descriptive Statistics – Closing Price

	Minimum	Maximum	Mean	Std. Deviation
NIFTY 50 NSE	2524.199	12362.2998	7262.96790	2475.023
IPC	16891.029	51713.3789	39295.234	7646.528
KOSPI	938.750	2598.1899	1946.9158	282.3499
JKSE	1111.390	6689.2871	4369.7668	1405.7498
IBOVESPA	29435	119528	64295.36	16717.58

Table 1.2: Descriptive Statistics – Logarithmic Returns

	Minimum	Maximum	Mean	Std. Deviation
NIFTY 50 NSE	-.1301	.0672	.000187	.010269
IPC	-.07266	.098126	.00004269	.00897
KOSPI	-.11171	.112843	.00003315	.009498
JKSE	-.10953	.076231	.000175	.00957
IBOVESPA	-.15993	.13022	.000127	.013439

(B) ADF TEST FOR STATIONARITY

The order of integration for all the time series were studied using the Augmented Dickey Fuller test. The test results show that all the price series were I(1) at levels and I(0) when the price series were converted into logarithmic returns. This means that the daily closing stock prices for all the indices were non stationary at the levels but all the series were stationary at the first difference. All the series to be studied were found at the same level of integration and so it made sense to study the extent of co-integration among the series.

Table 2.1: AUGMENTED DICKEY-FULLER TEST		
VARIABLES (CLOSING PRICE)	**LEVEL**	**FIRST DIFFERENCE**
NIFTY 50 NSE	-0.920232	-13.36995
JKSE	-1.427829	-29.01603
IPC	-1.634918	-23.97338
KOSPI	-2.101165	-15.12582
IBOVESPA	-1.551274	-11.86361

Table 2.2: AUGMENTED DICKEY-FULLER TEST	
VARIABLES (RETURN)	**LEVEL**
NIFTY 50 NSE	-12.18512
JKSE	-11.38192
IPC	-24.01319
KOSPI	-12.5088
IBOVESPA	-11.57958

(C) PEARSON CORRELATION

The Pearson correlation coefficients suggest that there is a weak or a moderate level of correlation between the stock indices considered in the study. The test results shows that there is no strong correlation between any of the stock indices. The correlations of Nifty 50 with IPC, KOSPI, JKSE and IBOVESPA ranges from 0.313 to 0.462. The correlation of IPC with Nifty 50, KOSPI, JSKE, and IBOVESPA ranges from 0.246 to 0.635. IPC has the maximum correlation with IBOVESPA index. The correlation of KOSPI with Nifty 50, IPC, JSKE and IBOVESPA ranges from 0.246 to 0.512. KOSPI has the maximum correlation with JSKE index. The correlation of JSKE with Nifty 50, IPC, KOSPI, and IBOVESPA ranges from 0.216 to 0.512. JSKE has the maximum correlation with KOSPI index. The correlation of IBOVESPA with Nifty 50, IPC, KOSPIA and JSKE ranges from 0.216 to 0.635. IBOVESPA has the maximum correlation with IPC index.

So from the results of Pearson correlation it can be seen that there is a moderate short term linkages between the stock market of South Korea-Indonesia and between the stock market of Brazil-Mexico. However the correlation among other indices are considered to be low. Also there is no evidence of very high level of short term linkages between any of the indices. Test results show that Nifty 50 has low level of correlation with IPC and IBOVESPA whereas Nifty 50 has moderate level of correlation with KOSPI and JKSE. Among all the other indices, the Indian index is most correlated to the Indonesian index.

Table 3: CORRELATIONS

	NIFTY 50 NSE	IPC	KOSPI	JKSE	IBOVESPA
NIFTY 50 NSE	1	.324**	.458**	.462**	.313**
IPC	.324**	1	.294**	.246**	.635**
KOSPI	.458**	.294**	1	.512**	.259**
JKSE	.462**	.246**	.512**	1	.216**
IBOVESPA	.313**	.635**	.259**	.216**	1

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

Index	Level of correlation
Nifty 50 NSE & IPC	Weak
Nifty 50 NSE & KOSPI	Moderate
Nifty 50 NSE & JKSE	Moderate
Nifty 50 NSE & IBOVESPA	Weak

(D) GRANGER TEST FOR CAUSALITY

The Granger causality test identifies the short term causality between the stock markets of India and other emerging economies. This test is carried out to identify which market influences other markets. In this study the granger causality is studied only with respect to Nifty 50 NSE. The results show that there is unidirectional or bidirectional short-run causality among any of the indices with the Nifty 50 index.

The test results shows that the Nifty 50 index granger causes the IBOVESPA index and the IBOVESPA index granger causes Nifty 50 index. So theses series have a bidirectional short-run relationship. The JKSE index granger causes the Nifty 50 index and the Nifty 50 index granger causes the JKSE index. So JKSE and Nifty 50 index have a bidirectional short-run relationship. The IPC index granger causes the Nifty 50 index and the Nifty 50 index granger causes the IPC index. So IPC and Nifty 50 index have a bidirectional short-run relationship. The KOSPI index granger causes the Nifty 50 index and the Nifty 50 index granger causes the KOSPI index. So KOSPI and Nifty 50 index have a bidirectional short-run relationship.

Table 4: GRANGER CAUSALITY TEST

NULL HYPOTHESIS:	OBS	F-STATISTIC	PROB.
Nifty 50 NSE does not Granger Cause IBOVESPA	4667	3.16518	2.00E-05
IBOVESPA does not Granger Cause Nifty 50 NSE		16.2966	8.00E-45
JKSE does not Granger Cause Nifty 50 NSE	4667	3.43988	4.00E-06
Nifty 50 NSE does not Granger Cause JKSE		8.16799	1.00E-19
IPC does not Granger Cause Nifty 50 NSE	4667	21.5211	4.00E-61
Nifty 50 NSE does not Granger Cause IPC		1.70836	0.0383
KOSPI does not Granger Cause Nifty 50 NSE	4667	3.56225	2.00E-06
Nifty 50 NSE does not Granger Cause KOSPI		13.5303	3.00E-36

(E) BIVARIATE JOHANSEN CO-INTEGRATION TEST

The bivariate test results show that the null hypothesis cannot be rejected. For all the bivariate Johansen tests employed the Trace statistic and the Maximum eigen statistics is less than the 5% critical value so this suggests that the null hypothesis cannot be rejected. The test statistics indicates the absence of any co-integration between Nifty 50 and the other emerging indices. This means that there is a lack of long term relation between stock index of India and of other emerging economies. The investors can take the advantage of this lack of co-integration as the markets will not move together and the markets do not have long correlation in the long run.

Table 5: BIVARIATE JOHANSEN CO-INTEGRATION TEST

NIFTY 50 NSE AND IBOVESPA				
Specifications	**Trace statistic**	**5% critical value**	**Maximum eigen statistic**	**5% critical value**
None	4.69631	15.49471	3.639491	14.26460
At most 1	1.056819	3.841465	1.056819	3.841465
NIFTY 50 NSE AND JKSE				
Specifications	**Trace statistic**	**5% critical value**	**Maximum eigen statistic**	**5% critical value**
None	6.503612	15.49471	3.849371	14.26460
At most 1	2.654240	3.841465	2.654240	3.841465
NIFTY 50 NSE AND IPC				
Specifications	**Trace statistic**	**5% critical value**	**Maximum eigen statistic**	**5% critical value**
None	4.501425	15.49471	3.454178	14.26460
At most 1	1.047248	3.841465	1.047248	3.841465
NIFTY 50 NSE AND KOSPI				
Specifications	**Trace statistic**	**5% critical value**	**Maximum eigen statistic**	**5% critical value**
None	10.71310	15.49471	10.12567	14.26460
At most 1	0.587437	3.841465	0.587437	3.841465

(F) MULTIVARIATE JOHANSEN CO-INTEGRATION TEST

The multivariate Johansen test was employed in this study to check test co-integration between Indian stock market and any of the other emerging markets. The multivariate Johansen test results shows there is no co-integration among the stock market indices.

Table 6: MULTI- VARIATE JOHANSEN CO-INTEGRATION TEST

All indices				
Specifications	Trace statistic	5% critical value	Maximum eigen statistic	5% critical value
None	59.63492	69.81889	26.54697	33.87687
At most 1	33.08795	47.85613	16.53411	27.58434
At most 2	16.55384	29.79707	7.911693	21.13162
At most 3	8.642148	15.49471	7.499320	14.26460
At most 4	1.142827	3.841465	1.142827	3.841465
Trace test indicates no co- integration at the 0.05 level **Max-eigenvalue test indicates no co- integration at the 0.05 level**				

9. Conclusion

The main goal of this paper was to examine the long run and the short term relationship between Indian stock market and other emerging stock market. To understand the short term relationship between the indices, Pearson correlation test is employed in this paper. Test results show that Nifty 50 has low level of correlation with IPC and IBOVESPA whereas Nifty 50 has moderate level of correlation with KOSPI and JKSE. Further to understand the direction of the causality, granger causality test is employed in this study. The results of the granger causality test shows that there is a bi-directional relationship of all indices with Nifty 50 index.

Johansen co-integration test is used in this study to understand the long-run interrelationship of Indian stock market with the other emerging indices. The bivariate johansen test indicates the absence of any co-integration between Nifty 50 and the other emerging indices. The multivariate johansen test results show that there is no co-integration integration among the stock markets.

There is no co-integration of Nifty 50 index with the IPC, IBOVESPA, KOSPI and JKSE in the long-run and so this provides an opportunity for the international investors to diversify their investments in these countries. The investors can take the benefit of this lack of co-integration among the stock market indices in the long run.

10. Bibliography

1. Deo, M., & Arun Prakash, P. (2017). A STUDY ON INTEGRATION OF STOCK MARKETS: EMPIRICAL EVIDENCE FROM NATIONAL STOCK EXCHANGE AND MAJOR GLOBAL STOCK MARKETS. *ICTACT Journal on Management Studies*, *03*(02), 479–485. https://doi.org/10.21917/ijms.2017.0065

2. Tripathi, V., & Sethi, S. (2010). Integration of Indian Stock Market with Major Global Stock Markets. *Asian Journal of Business and Accounting, 3*(1), 117-134. Retrieved from https://ajba.um.edu.my/article/view/2225

3. Manu, K. S., & Menda, V. L. (2017b). Dynamics of indian stock market integration with global stock markets. *Asian Journal of Management*, *8*(3), 559. https://doi.org/10.5958/2321-5763.2017.00090.7

4. Palamalai, S., M., K., & Devakumar, C. (2013). Stock Market Linkages in Emerging Asia-Pacific Markets. *SAGE Open*, *3*(4), 215824401351406. https://doi.org/10.1177/2158244013514060

5. Madhavan, V. (2017). How interrelated are MIST equity markets with the developed stock markets of the world? *Cogent Economics & Finance*, *5*(1), 1–16. https://doi.org/10.1080/23322039.2017.1362822

6. Shilpa, & Bansal, A. (2018). Interlinkages between Indian and Chinese Stock Markets. *International Journal of Management Studies*, *5*(1(4)), 41. https://doi.org/10.18843/ijms/v5i1(4)/06

7. Dasgupta, Ranjan. (2014). Integration and dynamic linkages of the Indian stock market with BRIC: An empirical study. Asian Economic and Financial Review. 4. 715-731.