International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-4, November 2019

Understanding the Interdependency between the Nifty 50 Future Index and the Advanced Future Stock Market through Econometrics

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Abstract: ***In recent times the stock market is accepted as a tool to measure the economic condition of a nation. It is found that the Indian financial market as highly volatile due to the lower value of rupees in foreign exchange with the dollar. This motivated the researchers to measure the interdependencies of [Nifty 50 future (India), Nikkei 225(Japan), NASDAQ 100 Futures (USA), Dow Jones 30 (USA), SSEC (China), Hang Seng Future (Hong Kong), and FTSE 100 (London)]. The analysis covers monthly stock prices for a period of 10years from April 2008 to March 2018. The measurement of interdependencies is studied through granger causality and correlation after the confirmation of the non-normality of data and stationary of data. The result shows a high degree of correlation between NASDAQ and Dow Jones shows 98.76% followed by 96.89% between Nifty 50 future and NASDAQ. The co-movement result of Nifty 50 future through granger causality states Nifty 50 future can explain the future stock market of Nikkei (Japan) and SSEC (China) and the Hang Seng future (Hong Kong) has a bidirectional movement with Nifty 50 futures. The study is useful for the investors to identify the interdependencies of the indices and understand the movement in a significant manner.***

Keywords: ***Future Market Advanced Country, Correlation, Granger Causality.***

I. INTRODUCTION

The development of new products and services has brought a revolution in the financial markets. This is seen in the performance of stock markets. But it is observed that none of the stock markets act or follow a uniform standard due to this some of the markets are performing better in the case of an advanced country like the USA, UK, and Japan, while few are following them. It is observed that Bombay and Shanghai stock market follows the market information of NASDAQ and Dow Jones. In due course of time, the globalization and liberalization of the foreign exchange made a free flow of capital which leads to cross-country correlation. An increase of movement of capital is possible through a wide range of portfolio that leads to higher earnings and integrates the stock markets. This has motivated many researchers to identify the relationship between stock markets. Many determinants are considered by the researcher to establish the stock market relationship though the world. (Dorodnykh, E. 2014; Raj J. & Dhal S. , 2008; Andjelic G. & Djakovic, V. 2012; Durai R. S. & Bhaduri, 2011; Hiemstra & Jones (1994) Granger *et. al.* (2000) Ajayi *et. al.* (1998) Silvapulle & Choi (1999). The tests are conducted on various stock markets like the Middle East market, Gulf, Asia, and European. But an analysis of the Indian future market with advanced future stock markets has never been considered for the analysis of granger cause.. Dadhich M. et al. (2019) the analysis was carried on to identify the stochastic movement of the indices and explain the interdependencies among the indices. The analysis was carried on by using econometric models i.e. Dickey –Fuller, Johansen Co-integration and Granger Causality. The result confirms the uni-directional as well as bidirectional causality between the indices which is helpful for the investors to predict the movement and understand the interdependencies.

Lee, (1992) the model of VAR is used to identify the causal relationship between return on assets, post-war inflation, and the real activity. The result is generated from the granger causality that the return explains the real action and the differences in inflation are explained through the interest rate. Some of the research are also considered different tool to identify the interdependencies between the stock markets and economic factors Arya et al. (2019) the study was conducted on various economic factors like Forex, gold price and oil prices to identify the association with the BSE 30. The test implemented Granger causality test under VAR and found that the variables Forex, gold and oil does not affect each other but the Sensex has granger cause with Gold, Oil and Forex. Vikneswaran and Wai (2019) the study encompasses the trade balance relationship with different macroeconomic elements of Malaysia like exchange rate, money supply, inflation rate and domestic income. The result shows that the rade balance is affected by inflation rate, domestic income and exchange rate but the money supply has an insignificant impact on trade balance.The study encompasses different stock markets to observe the mutual relation between each other. The study includes both advanced and emerging economies. India is accepted worldwide as an emerging economy due to its continuous growth for the last decade. The research period shows the rise in volume and capital flow of each nation (Zhenbo Hou et al., 2013; Mohanty D., 2012; Karthikeyan & Mohanasundaram, 2012).

Manuscript published on November 30, 2019.
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The present study will highlights that all the future indices considered are useful to predict the Nifty 50 future index.Indian stock market shows a high degree of correlation with major stock market i.e. Hong Kong, Singapore, U.S.A., China. Rajiv Menon, Subha, and Sagaran (2009). Five Asian countries (Korea, Indonesia, Malaysia, Japan, and Hong Kong) are considered for examining the correlation with the Indian stock market and it shows a weak relation. Gupta and Agarwal (2011). Indian stock market explains the stock market of Sri Lanka and Pakistan through Granger causality. Sharma and Bodla (2011). Many kinds of research are conducted between the Asian markets and US markets and it explains that US markets explain almost many Asian markets. Hoque (2007); Lamba (2004); Ibrahim (2005) and Murali Batareddy et al. (2012). The model for the analysis of equilibrium relationship includes all models (Engle and Granger, 1987; Johansen, 1988; Johansen and Juselius, 1990; Johansen, 1995; Hubrich, 2001). The presence of causality between the variable can be clearly stated from the model that shod the deviation from the equilibrium. Hosoya (1991) identified the causality strength. Granger and Lin (1995) state that in the long run, the lack of adjustment to the equilibrium of a variable can be a cause of another variable. Chu, Hsieh, and Tse (1999) measured the discovery of price for the index futures, S&P Depositary Receipts of S&P 500 index markets, and spot index. The research uses four hypotheses based on the security design and market structure of intraday trading data. The tool applied for estimating the co-integration relationship was Johansen's maximum likelihood. The result confirms the presence of con-integration among three price series along with one long-run stochastic trend.The above information motivates the researchers to observe that which future market explains the Nifty 50 future market that will help the investors in the local and international market to predict the movement by following the movement of other related future indices

II. METHODOLOGY AND MATERIAL

A correlation analysis between the stock markets and Granger causality between the European market and American Market has been carried on by various researchers but an analysis to establish the relation and explaining a stock market performance due to another stock market has never been conducted on such a wide range of future stock market i.e. Nifty 50 future (India), Nikkei 225(Japan), NASDAQ 100 Futures (USA), Dow Jones 30 (USA), SSEC (China), Hang Seng Future (Hong Kong), and FTSE 100 (London).

A. Data Collection

This study will use the secondary monthly data of stock future market i.e. Nifty 50 future (India), Nikkei 225(Japan), NASDAQ 100 Futures (USA), Dow Jones 30 (USA), SSEC (China), Hang Seng Future (Hong Kong), and FTSE 100 (London) for a period of 10 years with 120 observations.

B. Research Tools

The analysis is interpreted from the result of correlation and Granger causality. Before that the data series will be tested for non-normality and stationary through Jarque Bera (JB) statistics and Augmented-Dickey Fuller (ADF) and Philips-Perron (PP) test respectively.

Unlike the t-test and F test, the Jarque-Bera test is to measure the normality as it is an assumption for several statistics. To confirm the presence of normality the JB test is run before one of these tests.

JB test gives Skewness and Kurtosis results if the result is normal to it, then the said data is termed as normally distributed. If the result of **Skew** is **0**, (i.e., it's perfectly symmetrical around the mean) and if the result of **kurtosis** is **3;** then the distribution is normal.

Jarque-Bera (JB):

$$JB = \frac{N}{6}S + \frac{N}{24}K$$

or

$$JB = \frac{N-k}{6}\left[S^2 + \frac{1}{4}(K-3)^2\right]$$

A test of stationery is conducted to identify the statistical properties of a time series i.e. mean, autocorrelation, variance are constant throughout the period. It can be measured through the Unit root test. It can be measured through the ADF test and PP test

ADF depends on the following model, where p is the lag.

$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \partial_1 \Delta Y_{t-1} + \ldots\ldots\ldots + \partial_{p-1} \Delta Y_{t-p+1} + \epsilon_t$

Where α= constant, β= coefficient of time trend and the p-value is the autoregressive lag order, ϵt = error term for white noise.

The mathematical formula for the test of Phillips-Perron (PP) describes the regression i.e. AR (1) process.

$$\Delta y_{t-1} = \alpha_0 + \gamma y_{t-1} + e_t$$

Granger (1981) found the existence of a non-stationary and long-run equilibrium relationship; called co-integration. Basing upon this Engle and Granger (1987) made a detailed analysis by adding a test called EG- two-step models to identify the relationship in the long-run equilibrium.

The formula has two equations which as follows:

$SP_t = \alpha + \beta ER_t + \varepsilon_t$ **or** $ER_t = \alpha + \beta SP_t + \varepsilon_t$ $\Delta\varepsilon_t = \rho\varepsilon_{t-1} + \beta_1 \Delta\varepsilon_{t-1} + \beta_2 \Delta\varepsilon_{t-2} + \cdots + \beta_\rho \Delta\varepsilon_{t-\rho} + \mu_t$

Here, the log of the stock price index is ( ), (ER_t) is defined as a log of the exchange rate. (ε_t) the co-integration residual value and (μ_t) refers to ADF residual value which is considered as white noise, Liu W. and Morley B. (2009).

C. Hypothesis

H1: the data series are normally distributed
H2: the data series are non-stationary in nature
H3: the data are correlated to each other
H4: the data has granger causality

III. ANALYSIS AND INTERPRETATION

A test of normality is carried on the stock market of India, Japan, the USA, China, Hong Kong, and London. It is expected that the data series should be non-normal at 5%level of significance. The data will be analyzed through Jarque-Bera.

Table-I: Descriptive Statistics of the Future indices

Descriptive Statistics	Future Indices						
	DOWJONES	*FTSE100*	*HSF*	*NASDAQ*	*NIFTY50*	*NIKKEI*	*SSEC*
Mean	14618.60	6061.608	22601.93	3257.995	6498.461	13672.76	2744.194
Median	14243.00	6118.700	22599.75	2795.313	5877.475	13324.00	2784.198
Maximum	25567.65	7634.913	31664.00	6753.750	10814.38	23184.00	4534.555
Minimum	7236.280	3803.340	12942.25	1167.438	2803.125	7724.000	1828.790
Std. Dev.	4144.368	868.2502	3366.217	1434.004	1932.549	4321.591	551.8841
Skewness	0.429678	-0.444673	-0.065119	0.512625	0.278844	0.382802	0.556678
Kurtosis	2.616968	2.784378	4.422159	2.304562	2.274703	1.827684	3.248059
Jarque-Bera	4.388789	4.095152	11.20018	7.807334	4.181640	9.637578	6.453623
Probability	0.011489	0.028518	0.002887	0.020258	0.012969	0.006877	0.039782
Sum	1741996.	721214.4	2630730.	38758214	772721.9	1626840.	326571.9
Sum Sq. Dev.	2.03E+08	89160717	1.33E+08	2.43E+07	4.41E+08	2.20E+08	35941380
Observations	119	119	119	119	119	119	119

From table-I, it is observed that the data distribution are not normal it means they are following a random walk which rejects the null hypothesis. Even the skewness and kurtosis are expected to be 0 and 3 respectively which are not close to the normality. The Fig. 1, shows the graph of the log of future indices which can easily be interpreted that the data are not normally distributed.

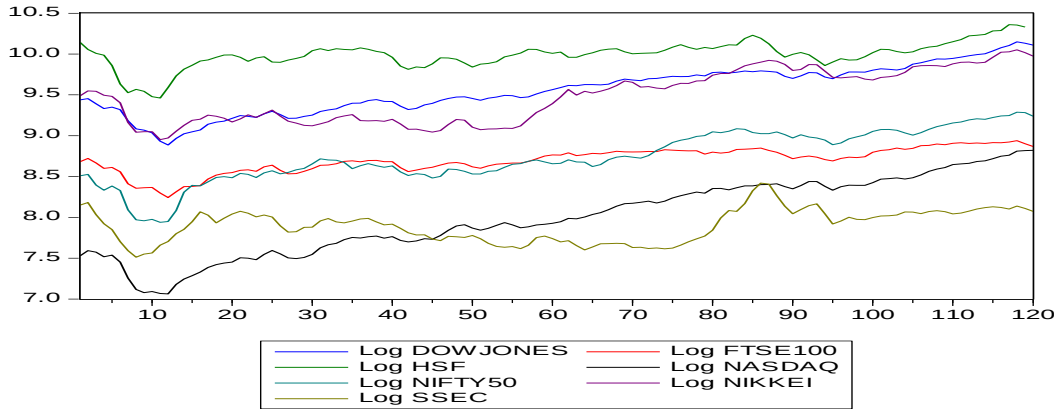

Fig-1, Graphical representation of the log of future indices

As the data is found as non-normal, further analysis is carried on to test the stationary of data through ADF (Augmented Dickey-Fuller) and PP (Philips Perron). Table II, signifies the output of ADF and PP test.

Table –II: Data Stationary of future indices

Data Set	ADF-At level (Trend and Intercept) at 5% level		PP-At level (Trend and Intercept) at 5% level		Null Hypothesis
	t-statistics	*Prob.*	*t-statistics*	*Prob.*	
Dow Jones 30 Future (USA)	-3.448681	0.0000	-3.448348	0.0000	Rejects
FTSE 100 (London)	-3.448348	0.0000	-3.448348	0.0000	Rejects
Hang Seng Future (Hong Kong)	-3.448681	0.0000	-3.448681	0.0000	Rejects
NASDAQ 100 futures (USA)	-3.448681	0.0000	-3.448348	0.0000	Rejects
NIFTY 50 Future (India)	-3.448348	0.0000	-3.448348	0.0000	Rejects
NIKKEI 225 futures (Japan)	-3.448348	0.0000	-3.448348	0.0000	Rejects
SSEC Future (China)	-3.448681	0.0000	-3.448348	0.0000	Rejects

From the table-II, it is observed that all the data are tested at level with the trend and intercept which confirms through significance level at 5% that the data are stationary in nature which in result makes the null hypothesis rejected.

Before applying the models of econometric, a correlation of all the future indices is tested to observe the co-movement between the future indices i.e. Nifty 50 future (India), Nikkei 225(Japan), NASDAQ 100 Futures (USA), Dow Jones 30 (USA), SSEC (China), Hang Seng Future (Hong Kong), and FTSE 100 (London). Table 3- shows the correlation coefficient result of seven stock markets.

Table-III: Matrix of coefficient of correlation

	NIFTY50	NIKKEI	NASDAQ	DOWJONES	SSEC	HSF	FTSE100
NIFTY50	1.000000						
NIKKEI	0.905909	1.000000					
NASDAQ	0.968927	0.926873	1.000000				
DOWJONES	0.953112	0.923594	0.987686	1.000000			
SSEC	0.561065	0.599679	0.475737	0.431800	1.000000		
HSF	0.807277	0.697636	0.735096	0.772172	0.531442	1.000000	
FTSE100	0.896494	0.838662	0.894967	0.935339	0.378476	0.833988	1.000000

From table-III, the result of the correlation coefficient shows a high degree of correlation with each other. The correlation between NASDAQ and Dow Jones shows 98.76% followed by 96.89% between Nifty 50 future and NASDAQ. The third highest correlation is observed between Nifty 50 futures and Dow Jones with 95.31%. This result motivates us to understand the direction of correlation between the future indices of the stock market as the highest degree of correlation between each other will explain the other stock market.To understand the direction of the relationship between the stock market, this analysis will support the prediction of another stock market. As our objective is to find out which future indices explain the Nifty 50 future indices it is useful to measure the Granger causality between them. Table-4, explain the Granger causality between the stock market.

Table-IV: Granger Causality between Nifty 50 future and other Future Stock Market

Pairwise Granger Causality Tests **Lags: 2** **Observation: 118**		
Null Hypothesis	**F-Statistics**	**Prob.**
NIKKEI does not Granger Cause NIFTY50	0.62004	0.5397
NIFTY50 does not Granger Cause NIKKEI	5.57722	0.0049
NASDAQ does not Granger Cause NIFTY50	2.45420	0.0905
NIFTY50 does not Granger Cause NASDAQ	1.15390	0.3191
DOWJONES does not Granger Cause NIFTY50	0.58387	0.5594
NIFTY50 does not Granger Cause DOWJONES	1.58038	0.2104
SSEC does not Granger Cause NIFTY50	2.46150	0.0899
NIFTY50 does not Granger Cause SSEC	3.82495	0.0247
HSF does not Granger Cause NIFTY50	41.1693	4.E-14
NIFTY50 does not Granger Cause HSF	6.07446	0.0031
FTSE100 does not Granger Cause NIFTY50	0.20838	0.8122
NIFTY50 does not Granger Cause FTSE100	2.57328	0.0807

From table IV, it is clear that which stock market explains what i.e. India Nifty 50 future explains the future stock market of Nikkei (Japan) and SSEC (China). A bidirectional movement is also observed between Nifty 50 futures and Hang Seng's future (Hong Kong). Hence this result can help the local and international investors to predict the movement of Nifty 50 future based on the above-mentioned stock market.

IV. CONCLUSION

The paper tried to measure the correlation between the selected top future indices globally with the Nifty 50 future. The result shows a high degree of relation between NASDAQ and Dow Jones. Adding to it, Nifty 50 futures also establishes a high degree of correlation between NASDAQ and Dow Jones. Further analysis of the co-movement through granger causality shows that Nifty 50 future can explain the future stock market of Nikkei (Japan) and SSEC (China) even the Nifty 50 futures shows a bidirectional movement with the Hang Seng future (Hong Kong). It means the directional movement of Nifty 50 future can be understood from the Hang Seng's future. However, the strong correlation of Nifty 50 future with NASDAQ and Dow Jones states an existence of long-run or short-run association which can be considered for further research. From the above study it can be useful for the investors to identify the interdependencies of the indices and predict the movement in a significant manner.

REFERENCES

1. Ajayi, R. A., Friedman, J., & Mehdian, S. M. (1998). On the relationship between stock returns and exchange rates: tests of Granger causality. Global finance journal, 9(2), 241-251.
2. Andjelic, G. & Djakovic, V. 2012. Financial market co-movement betweentTransition economies: A case study of Serbia, Hungary, Croatia and Slovenia. Acta Polytechnica Hungarica, 9(3).
3. Chu, Q. C., Hsieh, W. G., & Tse, Y. (1999). Price discovery on the S&P 500 index markets: An analysis of spot index, index futures, and SPDRs. International Review of Financial Analysis, 8(1), 21-34. doi:10.1016/s1057-5219(99)00003-4
4. Dadhich, M., Chouhan, V., & Adholiya, A. (2019). Stochastic Pattern of Major Indices of Bombay Stock Exchange. International Journal of Recent Technology and Engineering Regular Issue, 8(3), 6774–6779. doi: 10.35940/ijrte.c6068.098319
5. Deepak Mohanty. 2012. Global capital flows and the Indian economy – Opportunities and challenges. BIS central bankers' speeches. Technical and Entrepreneurship Festival of IITK, Kanpur. pp. 1-12.
6. Dorodnykh, E. 2014. Determinants of stock exchange integration: Evidence in worldwide perspective. Journal of Economic Studies, 41(2):292-316.
7. Engle, R. F., & Granger, C. W. (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. Econometrica, 55(2), 251. doi:10.2307/1913236

8. Granger, C. W., Huangb, B. N., & Yang, C. W. (2000). A bivariate causality between stock prices and exchange rates: evidence from recent Asianflu☆. The Quarterly Review of Economics and Finance, 40(3), 337-354.
9. Gupta, N. & Agarwal, V . 2011. Comparative study of distribution of Indian stock market with other Asian markets. International Journal of Enterprise Computing and Business Systems, 1(2):1-20.
10. Hiemstra, C., & Jones, J. D. (1994). Testing for linear and nonlinear Granger causality in the stock price-volume relation. The Journal of Finance, 49(5), 1639-1664.
11. Hoque, Hafiz Al Asad Bin. 2007. Co-movement of Bangladesh stock markets: Cointegration and error correction approach. Managerial Finance, 33(10):810-820.
12. Hubrich, K. (2001). Systems Cointegration Analysis: Tests for the Cointegration Rank. Contributions to Economics Cointegration Analysis in a German Monetary System, 7-82. doi:10.1007/978-3-642-99815-7_2
13. IBRHIM, M.H. 2005. International linkage of stock prices: The case of Indonesia. Management Research News, 28(4):93-115.
14. Janak Raj & Sarat Dhal. 2008. Integration of India's stock market with global and major regional. BIS papers, No 42.
15. Johansen, S. (1988). Statistical analysis of cointegration vectors. Journal of Economic Dynamics and Control, 12(2-3), 231-254. doi:10.1016/0165-1889(88)90041-3
16. Johansen, S. and K. Juselius (1990). "Maximum Likelihood Estimation and Inference on Cointegration with Applications to Demand for Money" Oxford Bulletin of Economics and Statistics 52, 169-210.
17. Karthikeyan, P. & Mohanasundaram, T. 2012. FII flows and Indian equity market performance. Asian Journal of Managerial Science, 1(1):12-16, ISSN:2249-6300.
18. Kumar, A., Biswal, S. K., & Swain, P. K. (2019). A dynamic association between stock markets, Forex, gold and oil prices in Indian context. ESPACIOS, 40(6).
19. Lamba A.S. 2004. An analysis of the dynamic relationships between South Asian and developed equity markets. NSE research working papers - Paper 83.
20. Lee, B. (1992). Causal Relations among Stock Returns, Interest Rates, Real Activity, and Inflation. The Journal of Finance, 47(4), 1591-1603.
21. Manual, V., & San, W. (2019). Dynamic Relationship Between Trade Balance and Macroeconomic Elements: Empirical Evidence From Emerging Economies in Malaysia. International Journal of Recent Technology and Engineering, 7(5S), 47–54.
22. Murali Batareddy, Arun Kumar Gopalaswamy & Chia-Hsing Huang. 2012. The stability of long-run relationships: A study on Asian emerging and developed stock markets (Japan and US). International Journal of Emerging Markets, 7(1):31-48.
23. Raja Sethu Durai, S. & Bhadurai, S.N. 2011. Correlation dynamics in equity markets-evidence from India. Research in International Business and Finance, Elsevier, 25(1):64-74. Available at: http://ideas.repec.org/a/eee/riibaf/v25y2011i1p64-74.html [accessed 2014-04-17].
24. Rajiv Meno, N., Subha, M.V. & Sagaran, S. 2009. Cointegration of Indian stock markets with other leading stock markets. Studies in Economics and Finance, 26(2):87-94.
25. Sharma, G.D. & Bodla, B.S. 2011. Inter-linkages among stock markets of south Asia. Asia-Pacific journal of Business Administration, 3(2):132-148.
26. Silvapulle, P., & Choi, J. S. (1999). Testing for linear and nonlinear Granger causality in the stock price-volume relation: Korean evidence. The Quarterly Review of Economics and Finance, 39(1), 59-76.
27. Zhenbo Hou, Keane, J., Kennan, J., Massa, I. & Te Velde, D.W. 2013. The changing nature of private capital flows to sub-Saharan Africa. Overseas Development Institute, Working Paper, 376:1-42.

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