A STUDY ON STOCK MARKETS OF DEVELOPING COUNTRIES’ INTEGRATION & RELEVANCE WITH DEVELOPED COUNTRIES’ STOCK MARKETS

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ABSTRACT

Globalization and liberalization has made investors to invest and earn more in international stock markets. The trade relationship between the stock markets of developed counties and developing countries are increasing extensively. However, stock markets of those countries’ have some little concern and that’s where the domestic investors have diversification opportunity in international stock markets. So the present study examines the co-integration of stock prices of developed and developing counties and also identifies diversification opportunity for Indian investors. To investigate the relationships, researcher has examined the stock indices of developed counties like United States (S & P 500), United Kingdom (FTSE) and Japan (Nikkei) and developing countries like Brazil (BOVESPA), Russia (RTS), Chine (SSE) and India (NSE). Further, the study employs monthly closing price data which is ranging from 1st January, 2008 to 31st June, 2014. Stock price linkages were examined through Johansen co-integration test to study the long term equilibrium relationships and further tested for VAR (Vector Autoregression). The result shows there is no long term relationship exists among developed and developing markets and further VAR (1) indicates all independent variables are insignificant. However, it is good news for Indian international investor that they will benefit from international diversification.

KEY WORDS: BRIC Stock Markets, Stationary and Non stationary, Correlation and Co-integration

INTRODUCTION

Financial markets have drastically accelerated during the last decades in terms of global business. Further liberalization and deregulation
of stock markets across countries has lead to increasing co-movements of financial assets like equity, mutual funds, debt funds and many more. This process requires investors who portfolios. However, due to the enormous increase of integration of stock markets, the possibility to diversify internationally has decreased significantly. Researcher tries to deal with problem by analyzing the possibility of diversification opportunity across emerging markets and emerged markets through Co-integration analysis. So now let us understand the concept of co-integration.

The concept of co-integration was first introduced by Granger (1981) and elaborated further by Engle and Granger (1987), Engle and Yoo (1987), Phillips and Ouliaris (1990), Stock and Watson (1988), Phillips (1986 and 1987) and Johansen (1988, 1991, 1995), among others. Working in the context of a bivariate system with at most one co-integrating vector, Engle and Granger (1987) give the formal definition of co-integration among two variables as follows:

When two time series that have unit roots co-integrate, meaning that there is a stationary linear combination between them; and this is a nice property to have because it allows us to find equilibrium relationships between two series that have trend behavior. Katrina Juselius (The Co-integrated VAR model, 2006) defines the role of co-integration analysis in the following way: co-integration identifies stationary linear combinations between non stationary variables so that an I (1) model can be reformulated exclusively in stationary variables. In economics, we are always trying to find equilibrium relationships, and that is exactly what co-integration allow us to do with two series that otherwise could not be modeled because of the individual non stationary properties on them.

The remainder of paper is organized as follow. In Chapter 2 represents the literature concerning the problems of integration in line of various international stock markets. Chapter 3 describes the data and methodology for investigating co-integration relation. Chapter 4 dedicated to methodological estimation of empirical co-integration model. Results and their implications are posted in Chapter 5. Finally, conclusion is in Chapter 6.

LITERATURE REVIEW
It was found few studies that have analyzed the co-integration of developed and developing counties stock market for Indian investors. Thus further literature is extended towards co-integration methodology to identify the international diversification opportunity with special reference to Indian investors. Research conducted by Bose S., Mukherjee P., (2005) on A Study of Inter linkages between The Indian Stock Market and Some Other Emerging and Developed Markets. They tried to examine the co-movement of the Indian stock market with developed markets like US, Japan and other Asian market. The degree of integration that is found to be not very high implies that the nature of integration with emerging Asian markets does not yet warranty any immediate concern for India regarding possible contagion and also shows that there is still much scope for reaping benefits of portfolio diversification, by investing in Indian markets. Further research was conducted by Seshiaiah, S. Venkata, (2006) on Indian Capital Market Integration with Selected Developed and Developing Countries. This paper empirically investigates into the long-run equilibrium relationship and short run dynamic linkage between the Indian stock
market indices and the stock markets of seven developed and developing countries. It is concluded that Indian stock market get influenced by most of the developed countries stock markets as well as by most of developing countries stock markets under study barring Japan and Taiwan.

India’s stock market integration may not be complete, a finding attributable to the inadequate role of domestic investors. B J Queensly Jeyanthi & Punithavathy Pandian (2008) analyzed an Empirical Study of Cointegration and Correlation among Indian, Emerging and Developed Markets. The findings suggest that the stock prices in major Asian markets and the United States are weak-form of efficiency, individually and collectively, in the long run. It also implies that international investors can achieve substantial risk diversification benefits in Indian markets.

However most of this research idea was taken from master thesis by Jose Balarezo (2010) on international diversification using co-integration and modern portfolio theory. They argue that investors looking to diversify internationally need to be very selective in reference to which countries they invest into since international diversification will benefit the investor only in the cases that the home country does not co-integrate with the foreign market. The study was also concluded that they did not find any indication that BRIC counties share a long run equilibrium relationship which is excellent news for investors they could invest in any or all of these markets and rip the benefits of being exposed to these emerging economies while being fully diversified. Lian an and Dean Brown (2010) examined the co-movement and indicate that there is some cointegration between the United States and China, while there is no cointegration between the US and the other emerging markets by themselves. Therefore, all of the BRIC stock markets, with the exception of China provide attractive portfolio diversification opportunities for global investors.

Further Raj J. and Dhal S, (2008) analyzed Integration of India’s stock market with global and major regional markets. The lack of evidence of integration of stock markets in terms of local currency gives rise to a concern that

OBJECTIVES & DATA

The study examines co-integration of Indian stock market with other developing countries (Brazil, Russia and China) and developed countries (USA, UK and Japan) through Johansen co-integration test. However, selected indices for each developing country are BOVESPA - Brazilian market, RTS - Russian
Trading System, SSE - Shanghai Stock Exchange for China and NSE - National Stock Exchange for Indian market. For developed countries are S&P 500 – United States, FTSE – United Kingdom and Nikkie – Japan. To conclude upon mentioned objectives, the sample is taken from 1st January, 2008 to 31st June, 2014. Some of adjustments have made in monthly data because different holidays were found in different other developed and developing nations. The whole analysis was carried out in EVIEWs 6. Following are some tools used for the analysis of the study:

- Unit Root Test (ADF Test)
- Johansen Co-integration Test
- VAR Model

However, a series is said to be stationary if the mean and auto-covariance of the series do not depend on time. While performing ADF test we proceed by considering the constant and deterministic trend in the data. The null hypothesis $H_0$: $\gamma = 0$ i.e. presence of unit roots for each of these equations is been tested. The test statistics against the critical values are checked and the null hypothesis is accepted or rejected if $t$-statistics is greater or less than the critical value respectively. Once we get the order of integration using the ADF test, we proceed with the method of co-integration to test the presence of co-movement between the different stock market indices.

The Johansen co-integration test:
The Johansen method is used to determine the presence of co-integrating vectors in non-stationary time series; it can be applied in a bivariate or multivariate setting. In the case of a multivariate setting, it has the advantage of countries stock market. The necessary monthly closing price data have been sourced from Yahoo finance.

METHODOLOGY
To satisfy the above objectives and data collected, various time series econometrics models were applied to study the long term equilibrium relationship between India and other developed and developing nations. The whole analysis was carried out in EVIEWs 6. Following are some tools used for the analysis of the study:

- Unit Root Test (ADF Test)
- Johansen Co-integration Test
- VAR Model

A $(k)$ order VAR has the following representation:

\[ X_t = \mu_0 + \delta t + \pi_1 X_{t-1} + \ldots + \pi_k X_{t-k} + \epsilon_t \]  

(1)
Where \( X_t \) is a \((nx1)\) vector of variables, \( \delta \) a deterministic trend and \( \epsilon_t \) is a white noise process. The Johansen method is based on the error correction representation of the VAR, the so called Vector Equilibrium Correction Model (VECM) that reformulates in terms of differences, lagged differences and levels of the process to obtain:

\[
\Delta X_t = \Gamma \Delta X_{t-1} + \pi X_{t-1} + \epsilon_t \tag{2}
\]

We can see that the left hand side is stationary. Since a stationary variable cannot be equal to a non stationary expression, the only option is that the right hand side also has to be stationary. For this to happen, either \( \pi = 0 \), or it must have a reduced rank. To test the restrictions in \( \pi \), Johansen defines two matrices \( \alpha \) and \( \beta \), both of dimensions \( n \times r \) where \( r \) is the rank of \( \pi \) and \( n \) the number of variables. The properties of \( \alpha \) and \( \beta \) are such that:

\[
\pi = \alpha \beta' \tag{3}
\]

Generally, there are three cases of interest in the \( \pi \) matrix.

- If \( r = n \), then \( X_t \) is stationary and there is no need to express the system as VECM, standard inferences apply.
- If \( r = 0 \), there are not co-integrating relationships between the variables, that is the variables have no stochastic trends in common and do not move together over time.
- If \( n > r > 0 \), there are \( r \) co-integrating relationship among the \( n \) variables. In contrast with the Engle Granger method, the Johansen method can find more than 1 co-integrating relationship between the variables.

VAR MODEL:

Sims (1980) first introduced VAR models as an option to the large scale macro econometric models. Since then the methodology has gained wider application in applied macroeconomic research. Vector autoregressive models (VARs) are widely used further for understanding the effects of monetary policy on the economy. The VAR can be estimated through single equation methods like OLS and here researcher has used NSE as a dependent variables after checking the normality of the errors. The reduced form of final VAR equation is follows:

\[
Z_t = \alpha + \beta^* z_{t-1} + \beta^* z_{t-2} + \ldots + \beta^* z_{t-p} + \epsilon \tag{4}
\]

Finally if the variables are not co-integrated, we can’t use VECM, so further research has been concluded on the basis of VAR model by taking lag values of Indian Stock Market and other developed and developing countries’ stock markets.

EMPIRICAL RESULTS

Results of Stationary – ADF Unit Root Test:

Ho: Unit Root exists (Non Stationary Data)

Ha: Unit Root does not exist (Stationary Data)
Table 1 ADF Unit Root Test Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Levels</th>
<th>First Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBOVESPA</td>
<td>1</td>
<td>-2.5002</td>
</tr>
<tr>
<td>LRTS</td>
<td>1</td>
<td>-2.5224</td>
</tr>
<tr>
<td>LSSE</td>
<td>0</td>
<td>-1.7191</td>
</tr>
<tr>
<td>LNSE</td>
<td>0</td>
<td>-1.9873</td>
</tr>
<tr>
<td>LSP</td>
<td>0</td>
<td>-0.5805</td>
</tr>
<tr>
<td>LFTSE</td>
<td>0</td>
<td>-1.4635</td>
</tr>
<tr>
<td>LNIKKEI</td>
<td>0</td>
<td>-1.1956</td>
</tr>
</tbody>
</table>

The critical values for ADF test is -3.47, significant at 5% level.

The table number 1 shows all the market indices are non-stationary because all ADF test statistics are higher than ADF critical value at level. On the contrary, all probability values are also greater than 0.05. So we fail to reject null hypothesis and interpret that unit root presence in the series which indicate that in first differenced form, all the series are stationary. Therefore, each stock market index is integrated in order one, or I (1). So the following is the result of multivariate Johansen co-integration test which strongly demands that all variables must be in same order.

Table 2 VAR Lag Order Selection Criteria

<table>
<thead>
<tr>
<th>Lag</th>
<th>AIC</th>
<th>SIC</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-12.76119</td>
<td>-12.53985</td>
<td>-12.67307</td>
</tr>
<tr>
<td>1</td>
<td>-23.16317</td>
<td>-21.39243*</td>
<td>-22.45824*</td>
</tr>
<tr>
<td>2</td>
<td>-22.82934</td>
<td>-19.5092</td>
<td>-21.50758</td>
</tr>
<tr>
<td>3</td>
<td>-23.40819</td>
<td>-18.53865</td>
<td>-21.46961</td>
</tr>
</tbody>
</table>
The table number 2 represents the VAR (2) model for optimal lag selection criteria. Maximum 6 lags to be selected where AIC value is minimum while SIC and HQ has selected 1 lag. Further to choose the optimal lag, AIC, SIC and HQ is widely used in literature. So looking to the above result, we can choose 1 lag length for further co-integration analysis which is suggested by SIC and HQ where both the values are minimum at lag one. So finally the further co-integration test carried out with optimal lags one as follows.

RESULTS OF CO-INTEGRATION TEST:

Table 3 Co-Integration Test Statistics

<table>
<thead>
<tr>
<th>No. of CE(s)</th>
<th>Eigen value</th>
<th>Trace Statistics</th>
<th>Critical Value (0.05)</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0.4164</td>
<td>114.0355</td>
<td>125.6154</td>
<td>0.2041</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.2733</td>
<td>73.1085</td>
<td>95.7537</td>
<td>0.6133</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.2663</td>
<td>48.8445</td>
<td>69.8189</td>
<td>0.6871</td>
</tr>
<tr>
<td>At most 3</td>
<td>0.1455</td>
<td>25.3117</td>
<td>47.8561</td>
<td>0.9101</td>
</tr>
<tr>
<td>At most 4</td>
<td>0.1016</td>
<td>13.3606</td>
<td>29.7971</td>
<td>0.8744</td>
</tr>
<tr>
<td>At most 5</td>
<td>0.0647</td>
<td>5.2174</td>
<td>15.4947</td>
<td>0.7853</td>
</tr>
<tr>
<td>At most 6</td>
<td>0.0018</td>
<td>0.1361</td>
<td>3.8415</td>
<td>0.7122</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. of CE(s)</th>
<th>Eigen value</th>
<th>Max-Eigen Statistics</th>
<th>Critical Value (0.05)</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0.4164</td>
<td>40.9270</td>
<td>46.2314</td>
<td>0.1660</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.2733</td>
<td>24.2640</td>
<td>40.0776</td>
<td>0.8115</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.2663</td>
<td>23.5328</td>
<td>33.8769</td>
<td>0.4901</td>
</tr>
<tr>
<td>At most 3</td>
<td>0.1455</td>
<td>11.9511</td>
<td>27.5843</td>
<td>0.9347</td>
</tr>
</tbody>
</table>
The table number 3 shows the results for co-integration and it reveals that there is no significant co-integrating relationship between stock markets under study. Both the Trace and Max-Eigen statistics indicate zero co-integrating ranks which can be seen from probability values. We fail to reject the null at any co-integrating equation where all probability values are greater than 0.05. Further we can prove it from trace statistics which is less than its critical value at 5% and also Max-Eigen Value is less than its critical value at all co-integrating equation. This shows the long run equilibrium relation does not exist between India, Brazil, Russia, China, USA, UK and Japan Stock markets. So further to perform Vector Error Correction Model, all variables needs to be co-integrated but we found from co-integration test that no co-integration exists. So further we can develop VAR Model as follows.

Table 4 Vector Auto-regression

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(1)</td>
<td>0.703583</td>
<td>6.36431</td>
<td>0.0000</td>
</tr>
<tr>
<td>C(2)</td>
<td>-0.083067</td>
<td>-0.478616</td>
<td>0.6337</td>
</tr>
<tr>
<td>C(3)</td>
<td>0.130375</td>
<td>1.57936</td>
<td>0.1188</td>
</tr>
<tr>
<td>C(4)</td>
<td>-0.05349</td>
<td>-0.537463</td>
<td>0.5927</td>
</tr>
<tr>
<td>C(5)</td>
<td>0.014561</td>
<td>0.06426</td>
<td>0.9489</td>
</tr>
<tr>
<td>C(6)</td>
<td>0.248629</td>
<td>0.754207</td>
<td>0.4533</td>
</tr>
<tr>
<td>C(7)</td>
<td>-0.047716</td>
<td>-0.593521</td>
<td>0.5548</td>
</tr>
<tr>
<td>C(8)</td>
<td>1.102513</td>
<td>0.694283</td>
<td>0.4898</td>
</tr>
</tbody>
</table>

Source: E - Views Output

R-squared 0.899658 Durbin-Watson stat 2.007381
Adjusted R-squared 0.889478 Jarque - Bera (P Value) 0.063266
F-statistic 88.37819
Prob. (F-statistic) 0.000000

\[ \text{LNSE} = C(1) \times \text{LNSE}(-1) + C(2) \times \text{LBOVESPA}(-1) + C(3) \times \text{LRTS}(-1) + C(4) \times \text{LSSE}(-1) + C(5) \times \text{LS_P}(-1) + C(6) \times \text{LFTSE}(-1) + C(7) \times \text{LNKKEI}(-1) + C(8) \]
The table number 5 represents the results of VAR (Vector Autoregression) model with one lag. Almost all variables are positive except C(2), C(4) and C(7). But all the variables are statistically insignificant as t statistics are very low and corresponding probability values are greater than 0.05 so here we fail to reject the null hypothesis at 5% significance level. Only first variable i.e. C(1) is statistically significant and it is nothing but one lag value of NSE.

Looking to the diagnostic checks for the model, Adjusted R-Squared value is 0.8895 which means total variance explained by all independent variable to dependent variable is 88.95%. F statistic is 88.37819 with significance value of 0.000 which is less than 0.05 so we reject the null hypothesis and interpret that model can be fit with these independent variables.

Moreover, Durbin-Watson statistic is 2.007381 which is almost 2 that indicates there is no auto-correlation among variables. And further Jerque – Bera Probability value is 0.0632 which is greater than 0.05 that means we fail to reject the null hypothesis that error terms are normally distributed.

CONCLUSION

The study examines the co-integration between the stock prices of India and other developed and developing countries’ stock markets. Based on the multivariate co-integration results, the study concludes that the long term relationship among developed and developing countries’ stock markets does not exists at lag one chosen by SIC and HQ. So we can inferred that the absence of an equilibrium relationship does not the potential benefits from portfolio added that the absence of equilibrium relationship may be due to weaken trade relations among India and the other countries.

REFERENCES


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