ASIAN STOCK MARKETS INTEGRATION – AN EMPIRICAL APPROACH

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ABSTRACT

Asia is leading digitalization, which promises the world economy to be fundamentally changed. Asian growth faces some fundamental challenges, although the region should be well placed to stay ahead over the next decade and beyond with sustained constructive and sound policy-making. This growth has also brought about dramatic financial-market changes in the Asian region, and stock markets in Asia are no exception. Since 2000, the growth of business on Asian capital markets has led to several national and regional initiatives to promote integration in regional and global capital markets. Taking into account the different dimensions of Asia's growth and degree of integration, it was important to examine the extent to which Asian markets are integrated with a particular focus on India, China, Japan, Hong Kong and Singapore. The integration of these selected Asian markets was evaluated using the Johansen Cointegration Test and an attempt was made to test the causal relationship using Granger Causality test. The results of the study indicate that these markets have strong long-term integration.

Key words: Johansen Cointegration test, Granger Causality test
JEL Classification G15,G17

INTRODUCTION

Since 2000, the increase in operation on Asian capital markets has spawned a slew of national and international initiatives aimed at strengthening regional and global capital market integration. As one of the fastest-growing stock markets, the Chinese market has recently undergone major changes, owing to increased foreign investment interest. Historically, the direct investment by foreign investors in the Chinese mainland stock markets had been limited. It was allowed to invest only in shares denominated in foreign currencies – known as B shares – that were less liquid than shares denominated in Renminbi. A number of programs, like the Qualified Foreign Institutional Investor (QFII) and the Renminbi Qualified Foreign Institutional Investor (RQFII) were launched to provide foreign investors with access to the Chinese market, enabling foreign institutional investors to be involved in the national mainland market.

These two plans, however, are only available to institutional investors and not to individual investors. The Stock Connect programme between the Hong Kong and Shanghai Stock Exchanges was introduced in 2014 as part of a Mutual Market Access Program, offering non-Chinese retail investors access to Chinese mainland stocks.

Tokyo Stock Exchange, the region's largest exchange by total market capitalization at the end of 2017, has also seen an increase in foreign ownership of listed shares. The share of foreign investors, mostly institutional investors, increased from 6% to 30% between 1980 and 2016. Cross-border portfolio investments can be used as an indicator of regional and global integration to broaden the perspective to regional level. Asia's share of both inward and outward portfolio investment is growing steadily. Asia's share of outward portfolio equity investment increased from 7 per cent in 2001 to 15 per cent in 2017, while its inward share increased from 13 per cent in 2001 to 19 per cent in 2017, making Asia a net recipient of foreign portfolio equity investment.

India's promise is driven by key growth drivers, including a favorable demographic profile, a skilled workforce, an emerging middle class, a strong business culture, increased productivity and a resilient private sector. The strong economic fundamentals of the country, high GDP growth rates and long-term potential make it an attractive destination for business and investment across borders. With a growth rate of 7.7 percent in the fourth quarter of 2017-18 (Central Statistics Office), the Indian economy has regained the tag of being the fastest growing economy in the world. With consistently high economic growth rates and enormous potential, the Indian economy has really taken the global center stage

While in recent years the pace of regional integration has increased, Asian stock markets remain more integrated with global stock markets than at regional level. The majority of the intra-regional cross-border holdings are concentrated in several Asian economies, accounting for more than half of the total intra-regional transactions to and from Hong Kong, China or China.

REVIEW OF LITERATURE

Using monthly data from 1 January 2001 to 31 December 2011, **Hunjra et al (2014)** used Cointegration and Granger Causality to investigate the effect of macroeconomic factors such as exchange rates, inflation rates, GDP, and interest rates on Pakistan's stock price. In the short run, their results showed no association between stock price and macroeconomic variables.. To examine the effect of macroeconomic variables such as exchange rates, foreign exchange reserves, industrial output index, interest rate, import, money supply, wholesale price index, and export, **Hussain et al. (2012)** used Augmented Dickey-fuller (ADF) and Kwiatkowski-Phillips-shin (KPSS) unit root tests, Johansen co-integration test, vector correction model (VECM), and Granger causality test.**Mishra (2002**) looked into India's domestic financial market's international integration with the capital market in the United States. He discovered a positive correlation between NASDAQ and BSE using the ordinary least squares (OLS) approach and cointegration technique. He

came to the conclusion that NASDAQ's movements inspired BSE. The BSE and NASDAQ indexes, however, do not have a co-integrating vector. In their study, **Phengpis and Apilado** (2004) looked at how stronger economic interdependence among countries contributes to cointegration. A sample period of 1979 to 2002 was used to look at the five main capital markets in the Economic and Monetary Union (EMU).**Phengpis and Apilado (2004**) in their work analysed how stronger economic interdependence among the countries contributes to cointegration among them. The five largest stock markets in Economic and Monetary Union (EMU) were considered using a sample period from 1979to 2002.. **Park (2010)** discovered that Asian markets travel in lockstep. Countries with more mature financial structures (such as Japan, Singapore, and Hong Kong in Asia) had stronger links to the rest of Asia's markets. Used data from the June 2, 2005 to April 2, 2008 time series. **Richards, A. J. (1995):** In their research paper titled "Movements in National Stock Market Returns: Evidence of Predictability," they examined the comovements in national stock returns but discovered that there is no comovement among the stock returns.

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RESEARCH METHODOLOGY: The Johansen cointegration test was used to determine whether Asian stock markets are integrated in the long run. The study uses monthly closing prices from selected Asian stock exchanges, including the Bombay Stock Exchange, the Hong Kong Stock Exchange, the Japanese Stock Exchange, the Singapore Stock Exchange, and the Shanghai Stock Exchange. The information was obtained from www.yahoofinance.com.. The data was collected from www. yahoo finance.com and money control. The returns of the closing prices are calculated for further analysis. The study covers a period of 10 years from December 2007 to December 2017.The closing prices of the selected Asian Indices are Converted into the log returns for the purpose of analysis. The returns were further tested for stationarity using the Augmented Dickey Fuller (ADF) test and Phillips Perron(PP) test for testing unit root. Johansen cointegration test and granger causality test is used to test whether the selected Asian markets are integrated with each other.

THE JOHANSEN COINTEGRATION TEST: The Johansen test tests for cointegration by examining the number of independent linear combinations (k) for an m time series variables set that yields a stationary process. Cointegration assumes the presence of common non-stationary (i.e. I(1)) processes underlying the input time series variables.

$$X_{1,t} = \alpha_1 + \gamma_1 Z_{1,t} + \gamma_2 Z_{2,t} + \cdots + \gamma_p Z_{p,t} + \epsilon_{1,t}$$
$$X_{2,t} = \alpha_2 + \phi_1 Z_{1,t} + \phi_2 Z_{2,t} + \cdots + \phi_p Z_{p,t} + \epsilon_{2,t}$$
$$\cdots$$
$$X_{m,t} = \alpha_m + \psi_1 Z_{1,t} + \psi_2 Z_{2,t} + \cdots + \psi_p Z_{p,t} + \epsilon_{m,t}$$

So there are three plausible outcomes:

The number of independent linear combinations (k) is related to the assumed number of common non-stationary underlying processes (p) as follows:P=m-k

1. $k=0, p=m$. In this case, time series variables are not cointegrated
2. 0 < k < m, 0 < p < m. In this case, the time series variables are cointegrated.
3. $k=m, p=0$. All time-series variables are stationary ($I(0)$ to start with. Cointegration is not relevant here.

The Johansen test has two forms: the trace test and the maximum eigenvalue test. Both forms/tests address the Cointegration presence hypothesis, but each asks very different questions.

Trace Test

The trace test examines the number of linear combinations (i.e. K) to be equal to a given value (K_o), and the alternative hypothesis for $K$to be greater than K_o

$$H_o : K = K_o$$

$$H_o : K > K_o$$

To test for the existence of Cointegration using the trace test, we set $K_o = 0$(no cointegration), and examine whether the null hypothesis can be rejected. If this the case, then we concludes there is at least one cointegration relationship. In this case, we need to reject the null hypothesis to establish the presence of Cointegration between the variables.

Maximum Eigenvalue Test

With the maximum eigenvalue test, we ask the same central question as the Johansen test. The difference, however, is an alternate hypothesis:

$$H_o : K = K_o$$

$$H_o : K = K_o + 1$$

So, starting with $K_o = 0$and rejecting the null hypothesis implies that there is only one possible combination of the non-stationary variables to yield a stationary process. What if we have more than one? The test may be less powerful than the trace test for the same $K_o$values.

***GRANGER CAUSALITY TEST*:** Granger causality test is always applied on a stationary series. After making the data stationary by applying the unit root test Granger causality test was applied to determine whether one time series is significant enough to forecast the another series and is also used to know whether the past values of a variable are able to give explanation of another one. In this study, it is used to test the causality between the selected Asian stock market indices and the causality of stock market returns on select macro economic variables and vice versa.

Here, X and Y=variables, β=coefficient of variables at lag,ε=residual.

The null hypothesis that β=0 can be tested by using the standard F-test. For Granger causality test, E-views 10 software has been used. Suppose there are two variables A and B and after applying Granger causality test on them four outcomes of cause and effect are possible:

1. From A to B there is a unidirectional causality that means A causes B.

2. From B to A there is a unidirectional causality that means B causes A.

3. When both A and B causes each other that means there is a bilateral causality between them.

4. When none cause each other independence is suggested.

In Granger Causality test lag length is very important. There are many lag length selection criteria such as Akaike Information Criterion, Schwarz Information Criterion, Hannan-Quinn Criterion and Final Prediction Error. On the basis of Akaike Information Criterion lag length is determined.

ANALYSIS AND INTERPRETATION

In order to analyze if the Asian stock markets are integrated in the long run Johansen cointegration test has been applied. The objective has been examined after checking for stationarity of Data with ADF Test and PP test and Analysis of the Co-integration between the Asian markets is tested with Johansen's Co-integration model.

The problem of unit root occurs when non-stationary variables are present. Non stationary variables provide spurious regression results. There is a need to check the order of integration of each variable in order to avoid the issue of spurious regression in order to determine if this data is not stationary. In this study, the ADF and PP tests were used to assess stationarity for the selected Asian stock returns.

The ADF and PP results of the returns of selected Asian markets under the study are given in table 1.The ADF statistic value in case of BSE is -10.028, -10.046,-10.003 and PP test values are 10.0773,-10.092,-10.070 and it associated P value is 0.000 in case of constant, constant and trend and none levels and its associated P value is 0.000 in all the three cases, similarly in case of Nikkei 225 the ADF and the PP test values are -9.176. -9.341, -9.166 and -9.190,9.314,-9.187 , for SSE Composite the values are -9.993, -10.105, -10.030 and 10.079, -10.175, -10.112 , in case of Hong Kong it is -9.681, -9.743, -9.713 and- 9.728, -9.781, -9.760 and finally for STI the ADF values are -9.070, -9.064, -9.108 and the PP test values are -9.159,-9.150,-9.196 . Interestingly all the indices associated P-Values are 0.000. Hence it is evident from the ADF and PP test that the hypothesis of presence of unit root in rejected at 1%, 5%and 10% level of significance for all the Asian stock markets, hence the returns are stationary at their level .Thus, the variables are stationary and integrated of the same orders, i.e., I (0), which is the main criterion for continuing with the co integration test.

As the unit root test result highlights the fact that all the time series variables of the selected Asian stock markets under consideration are stationary or, instead, all of the stock market closing value is first stationary difference, hence there is a possibility of co-integration among them. The multivariate VAR (p) for Johansen test included the five stock prices selected in the analysis where the linear deterministic trends are also permitted.

The lag length of the VAR is calculated according to the minimum value of the Schwartz Information Criterion (SIC), the Akaike Information Criterion (AIC) and the Hannan- Quinn Information Criterion (HQIC) and is found to be 2.The results of the

Johansen co integration test is given in the table 2. The Co-integration between the stationary variables has been tested using the Johansen's Trace and Maximum Eigen value tests.

The results of the Johansen co integration test is represented in table 2..The results show that p value are significant as it is 0.0000 and trace value (273.4888) is also more than the critical value (69.81889)which represents that there is a co -integration between the Asian markets. This means that the selected Asian markets are moving together or co-integrated. The other value that helps in identifying the Co-integration in all the markets is Maximum Eigen value, if Maximum Eigen value is more than critical value it represents a Co-integration between two variables. The above result showed that Maximum Eigen value (93.40534) is more than the critical value (33.87687), this represents that the returns of India, Japan, China, Hong Kong and Singapore markets, are co-integrated. There is hence a long-term relationship between the selected Asian markets. Such markets share a common pattern among themselves; therefore, this relationship may in the long run reduce or remove the gains from the diversification of foreign portfolios. Loss in one stock market will also mean loss in another market as they pass over time together.

At the same time the investment risk will not be hedged by investing in a group of co-integrated markets. This does not assume, however, that short-run gains and earnings are exempt. Through co-integration of stock markets, it appears that the diversification of portfolios has less assets available for portfolio diversification. Therefore, co-integration could force investors to reconsider allocating their capital when investing in international stock markets. It is desirable to invest in non-co-integrated stock markets in order to maximize the advantages of diversification.

TABLE NO: 1 RESULTS OF ADF AND PP TEST FOR STATIONARITY

ASIAN INDICES		ADF *t*-values	PP *t*-value	Prob values	Accept\reject H0	Interpretation
BSE	Constant Constant &trend None	-10.0288 -10.046 -10.003	-10.0773 -10.092 -10.070	0.0000 0.0000 0.0000	Reject H0	The time series is stationary
NIKKEI225	Constant Constant &trend None	-9.176 -9.341 -9.166	-9.190 -9.314 -9.187	0.0000 0.0000 0.0000	Reject H0	The time series is stationary
SSE COMPOSITE	Constant Constant &trend None	-9.993 -10.105 -10.030	-10.079 -10.175 -10.112	0.0000 0.0000 0.0000	Reject H0	The time series is stationary
HANGSENG	Constant Constant &trend None	-9.681 -9.743 -9.713	-9.728 -9.781 -9.760	0.0000 0.0000 0.0000	Reject H0	The time series is stationary
STI	Constant Constant &trend None	-9.070 -9.064 -9.108	-9.159 -9.150 -9.196	0.0000 0.0000 0.0000	Reject H0	The time series is stationary

Source: Researcher's output from Eviews10

TABLE 2: Johansen's Co- Integration Test Results for the Asian Markets

Unrestricted Cointegration Rank Test(Trace)				
Hypothesized No of CE(s)	Eigen Value	Trace Statistic	0.05 critical value	Prob .**
None*	0.546868	273.4888	69.81889	0.000
At most 1*	0.456453	180.0835	47.85613	0.000
At most 2*	0.35046	108.146	29.79707	0.000
At most 3*	0.236867	57.23001	15.49471	0.000
At most 4*	0.193198	25.33187	3.841466	0.000
Unrestricted Cointegration Rank Test(Maximum Eigen Value)				
Hypothesized No of CE(s)	Eigen Value	(Maximum Eigen value)	0.05 critical value	Prob. **
None*	0.546868	93.40534	33.87687	0.000
At most 1*	0.456453	71.93745	27.58434	0.000
At most 2*	0.35046	50.916	21.13162	0.000
At most 3*	0.236867	31.89813	14.2646	0.000
At most 4*	0.193198	25.33187	3.841466	0.000

Trace test and Max Eigen values indicates 5 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level,
**MacKinnon-Haug-Michelis (1999) p-values
Source :Researcher's output from E views 10

GRANGER CAUSALITY MODEL

An attempt has been made to test the causal relationship between the selected Asian stock market returns. A pairwise Granger Causality Test has been performed to find out the cause and effect relationship between the five Asian markets. The Granger causality

test is a statistical hypothesis test to determine whether one time series is useful in forecasting another. The results of the test at lags 2 are given in the following table

Table 3.Table showing the results of the Granger Causality Model for the selected Asian Indices

Null Hypothesis:	Obs	F-Statistic	Prob.
NIKKEI225 does not Granger Cause BSESENSEX	118	22.6194	5.E-09
BSESENSEX does not Granger Cause NIKKEI225		0.95007	0.3898
SSECOMPOSITE does not Granger Cause BSESENSEX	118	10.0428	0.0001
BSESENSEX does not Granger Cause SSECOMPOSITE		0.15160	0.8595
HANGSENG does not Granger Cause BSESENSEX	118	67.0175	6.E-20
BSESENSEX does not Granger Cause HANGSENG		1.23837	0.2938
STI does not Granger Cause BSESENSEX	118	0.71526	0.4913
BSESENSEX does not Granger Cause STI		0.65177	0.5231
SSECOMPOSITE does not Granger Cause NIKKEI225	118	3.58913	0.0308
NIKKEI225 does not Granger Cause SSECOMPOSITE		0.75270	0.4734
HANGSENG does not Granger Cause NIKKEI225	118	3.66354	0.0287
NIKKEI225 does not Granger Cause HANGSENG		1.39378	0.2524
STI does not Granger Cause NIKKEI225	118	2.35593	0.0994
NIKKEI225 does not Granger Cause STI		2.41154	0.0943
HANGSENG does not Granger Cause SSECOMPOSITE	118	0.58268	0.5601
SSECOMPOSITE does not Granger Cause HANGSENG		0.15901	0.8532
STI does not Granger Cause SSECOMPOSITE	118	5.16474	0.0071
SSECOMPOSITE does not Granger Cause STI		6.44770	0.0022
STI does not Granger Cause HANGSENG	118	5.94838	0.0035
HANGSENG does not Granger Cause STI		2.42755	0.0928

Source :Researcher's output from E views 10

The null hypothesis of no causal relationship is accepted in case of Bse Sensex in relation with Nikkei225, SSE Composite, Hang Seng and STI. But we fail to accept the null hypothesis in case of Nikkei225, SSE Composite, and Hang Seng. Hence there Nikkei225, SSE Composite, Hang Seng Granger causes BSE Sensex. But BSE Sensex does not Granger cause Nikkei225, SSE Composite, Hang Seng. And in case of STI we accept the null hypothesis that STI does not granger cause BSE Sensex and vice versa. Hence the relationship is unidirectional in case of BSE Sensex. Whereas the null hypothesis of no causal relationship is rejected in case Nikkei 225 on BSE Sensex and accepted in case of Nikkei225 on SSE Composite, Hang Seng and STI. Null hypothesis of SSE Composite and Hang Seng does not cause BSE Sensex is rejected and SSE Composite does not granger cause Nikkei 225 and STI does not granger cause Hang Seng is rejected at 0.05%level of significance and accepted in all other cases.

CONCLUSION

The results of the Johansen cointegration test also reflect that there is integration in the long run hence this relationship can reduce or remove gains from international portfolio diversification. Especially in case of India, China and Hong Kong, the legal and regulatory environment followed by political uncertainty and government intervention in markets may act as a major reason for the investors and companies to shift their investment option from these markets to other developed markets. Hence investors can rely on the results of technical analysis to arrive at better investment decisions. Hence policy makers in these economies need to prepare a well-defined framework which will withstand disruptions and lead the financial markets towards growth and progression. While institutional ownership in Asian emerging stock markets is still limited, a number of initiatives are underway that will alter the landscape. These include the stock connect programs between mainland Chinese markets and the Hong Kong exchange providing international investors access to the mainland market and mainland investors access to trade companies that are listed in Hong Kong. It is apparent that the growth of Asian stock markets will have global implications. From an economic perspective, the most obvious one is that corporations in the region will be able to source capital from a much larger pool of investors. And the mirror image is of course that institutions from advanced economies can seek investment opportunities and diversification possibilities on a grander, global scale. Asian stock market growth will also bring a range of additional business opportunities related to capital markets, something that will further drive integration and international interdependence.

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