Integration among Selected Asian Stock Markets

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Abstract: The purpose of present study is to investigate the integration among selected Asian stock markets (India, Japan, H.K., China, South Korea, S. Lanka, Pakistan, Philippines, Taiwan and Indonesia). Daily closing prices of representative indices of selected stock exchanges of Asia for the period from 1 Jan. 2001 to 28th Feb. 2023 have been used for the purpose of analysis. Statistical tools namely descriptive statistics and correlation analysis and econometric techniques such as Augmented Dickey Fuller test, Granger Causality test and Johansen's cointegration test have been used. The results of granger causality test found that both bidirectional and unidirectional causality occurs in most of the cases and also found long run equilibrium relationship as well as short run relationship among the selected stock markets of Asia. It concludes that investors cannot get abnormal gains by portfolio diversification in Asian stock markets under the study.

Keywords: Stock market integration, portfolio diversification and Granger causality.

INTRODUCTION

Financial market reforms in international market during last decades break up the boundaries of world market for international investors. The globalization of the world stock markets is the most significant development that has occupied during the last years. Various factors such as liberalization of financial policies, increased transparency, deregulation of stock markets and change in political and economic environment of international market increased confidence of investors in stock market to invest. Because of the revolution of IT with high speed internet, the information is available to one at any place at any time at low cost. Capital markets are dependent on information and the information revolution has transformed these markets world over. Investors can now keep track of the movements of capital market and they react to the flow of information from around the world. These dealing sometime create huge waves of panic actions and reactions affecting global markets one by one. Investors, Govt. and institutions are concerned about the visible linking of geographically separated markets. The topic of stock market integration is an emerging issue in financial research now a days and it is also important for economist, researchers, investors, government and policy makers. The benefits of portfolio diversification may be reduced if the stock markets are found to be integrated with each other. If stock markets move together then investing in various markets would not generate any long term gain to portfolio diversification. So it is important to know for both investors and academicians the existence of integration among stock markets. The fundamental objective of diversification of portfolio is to minimize systematic risk. For an investor, diversification of portfolio in the international market is justifiable if and only if the gains from it exceed those from diversification in the domestic market. Stock market integration not only have implications for portfolio diversification, but also have importance for macroeconomic policies that influence trade and fiscal balances of countries and the financial policies of different agents within the capital improving economy. The issue is important for policy makers for the following reasons too: if stock markets are found to be closely linked then there is a danger that shocks in one market may spill over to other markets. The benefits due to stock market integration as it enables capital accumulation, skill and technology transfer through foreign direct invests. The present study is a humble attempt to analyze the integration among selected Asian stock markets to reap abnormal gains by the portfolio diversification in Asia. If integration exits, the strategy of diversifying one's portfolio may no longer apply.

REVIEW OF EMPIRICAL EVIDENCE

The integration among stock markets is a subject that has attracted worldwide concern. This section of paper presents a detailed review of the studies concentrating on Asian economies. These studies are reviewed for the purpose of the current study and are included herein. A study by Bahng (2003) found positive correlation between Indian stock market and other Asia's emerging markets. Indian stock market move towards the integration with other Asian markets. Nath and Verma (2003) showed no long run relationship between the stock markets of South Asia (India, Taiwan and Singapore). Narayan, Smyth and Nandha (2004) found a long run relation between the stock prices of four countries (Bangla-

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desh, India, Pakistan and Sri Lanka). There was unidirectional causality from stock prices in Pakistan to India, Sri Lanka to India and from Pakistan to Sri Lanka. The impulse response function showed that Bangladesh was the most exogenous of the four markets. Azad found long run relationship between the three markets (China, Japan and South Korea). Raju and Khanpuri (2009) revealed that all Asian stock markets (China, India, Thailand, Malaysia, Indonesia and South Korea) share positive but low correlations. They also found that international investors can get maximum benefits by investing in China, India and S.K. Gupta and Aggarwal (2011) found very weak correlation between the Indian stock market and H.K., Indonesia, Malaysia and Japan. They also found that Indian stock market offer diversification benefits to international investors looking for investment in the Asia Pacific Region. Sharma and Bodla (2011) found the existence of opportunity for diversification among South Asian countries (India, Pakistan and S. Lanka). Saha and Bhunia (2012) found the short run relationship among Asian stock markets and also found the existence of portfolio diversification opportunity for international investors in South Asian countries. Roa (2014) investigated the interrelationship among Indian stock market and selected stock prices of the Asia pacific region (India, Australia, Hong Kong, Indonesia, Japan, Malaysia, South Korea, Singapore and Taiwan) by taking monthly closing prices for the period from April 2004 to March 2014. The author used econometric tools and found both bidirectional and unidirectional causality among the selected indices and also the presence of long run equilibrium relationship between the SENSEX and other selected market indices. Babu, Hariharan and Srinivasan (2016) investigated the integration of Asian stock markets (Australian, India, China, Hong Kong and Japan) by using daily data from April 2009 to March 2014 and found long run relationship among the selected indices. Also found unidirectional causal relationship between Australia, Hong Kong and China. Between Indian, H.K., witnessed unidirectional causation with China. Patel R.J. (2017) found that BSE does not have a significant correlation with rest of the markets. Long term association and co integration was also found between related 14 stock exchanges. BSE was integrated with other markets in short run as well as in long run. Saji T.G. (2022) reinvestigated stock market linkages in Asian region (Japan, Singapore, South Korea, India and China) using monthly data over the period 1999-2019. By using VECM the author found weak price convergence among Asian markets and suggest several opportunities for global investors to optimize returns through portfolio diversification across leading stock markets of the region (Asia). On the basis of review of literature, we see that different methods of analysis have been used by the researchers about integration of stock markets of world. Correlation analysis, ADF test, Granger Causality test, Johansen's cointegration test have been used to analyze the data about stock market integration. Only one or at the most two methods were used in different researchers. *Bodla and Turan (2004), Chang et al (2006), Raju and Khanpuri (2009), Sharma and Gupta (2011)* and *Tripathi et al (2013)* used correlation analysis in their studies. *Yang et al. (2003), Hoque (2007), Nath and Verma (2003), Ibrahim (2005), Cheign and Glascock (2005) and Palamalai (2013)* were used cointegration test for data analysis. Granger Causality test has been used by many researchers in their studies to find the cause and effect relationship among different stock markets such as *Wong et al (2004), Tripathi and Sethi (2010), Iqbal et al (2011), Roa (2014)* and *Seth* and *Sharma (2015)*. So, we also use these econometric methods in our study.

The current study is the attempt to further investigate the long run, short run and causal relationship among the Asian stock markets for the period from Jan. 2001 to Feb. 2023. We will try to find out the existence of enough opportunities for diversification among the stock exchanges of Asia. Specifically, the aim of the present study is to achieve the following objectives:

1. To examine the correlation among the selected stock markets of Asia.
2. To study the long run equilibrium relationship among the selected stock markets.
3. To study the short run relationship among the selected Asian stock markets.
4. To investigate the cause and effect relationship among selected stock indices.

RESEARCH METHODOLOGY

Database

There were many studies on integration among international stock markets but very few studies are there on Asian stock market integration. The present study will fill this research gap. The proposed research is a study of the integration among Asian stock markets namely India, Japan, Hong Kong, China, South Korea, Sri Lanka, Pakistan, Philippines, Taiwan and Indonesia. The study used one stock exchange from each of the ten countries as a representative of the respective country. Bombay stock exchange, Colombo stock exchange, Karachi stock exchange, Shanghai stock exchange, Tokyo stock exchange, Hong Kong stock exchange, Korea stock exchange, Taiwan stock exchange, Indonesia stock exchange and Philippines stock exchange are selected as the benchmark stock exchange of India, Sri Lanka, Pakistan, China, Japan, Hong Kong, South Korea, Taiwan, Indonesia and Philippines respectively. BSE SENSEX index, All Share Price Index, KSE 100 index, SSE Composite index, NIKKIE 225, Hang Seng Index, Korea Composite Stock Price Index, Taiwan Capitalization Weighted Stock index, IDX Composite index and PSEi index are used as the representative index of above mentioned stock exchanges. This study was based on secondary data on the daily closing prices of the selected indices for the period started from 1 Jan. 2001 to 28th Feb. 2023 collected from www.yahoofinance.com and also verified from websites of different stock markets of the selected countries. E-Views and SPSS software were used to apply different econometric tools and statistical methods. Out of the time for which the data about stock indices were taken, it is observed that on few days, one or two of the exchanges were open while other(s) was (were) closed. The data for all the days on which any of the stock exchanges under reference were open, has been taken. As a result, there were missing values in the data of some of the stock exchanges for some days. These missing values have been

filled-up by taking average of the two nearest cases[1]. The total number of observations were 5781.

METHODOLOGY

Tools and techniques

Natural log of selected series gave the daily return of the given indices under the study. The formula of calculating the natural log of indices/closing prices was given as follows:

$$R_t = \ln (P_t / P_{t-1}) \quad (1)$$

Where:

R_t = Return on day 't',

P_t =Index closing value on day 't'

P_{t-1} = Index closing value on day 't-1'

ln= Natural log

Descriptive statistics was used to get an insight in to the data. The descriptive statistics included mean percent return (over the entire reference period), maximum and minimum return, and standard deviation, skewness, kurtosis and Jarque bera statastics. Karl Pearson's coefficient of correlation was used to see the correlation among selected stock markets. The modern portfolio theory propounded by Markowitz (1952), said that the benefits of diversification of portfolio can be reaped when the return on assets in which funds are invested have low correlation. It two stock markets have low correlation; making investment in them can lead the reduction of the systematic risk of the portfolio. If the correlation coefficient was more than 0.05, the correlation was significant otherwise not. The formula of correlation coefficient was as follows:

$$r = \frac{\sum(x-\bar{x})(y-\bar{y})}{N\sigma_x\sigma_y}. \quad (2)$$

Econometric analysis can be performed on stationary series. In order to check the stationary nature of all series, the augmented dickey fuller test was performed under the unit root test. The ADF test was used at level and at first difference on closing prices. In order to make the series stationary, we took log of the selected series and arrive at the daily returns of selected series. A process was said to be stationary if it's mean and variance remain unchanged over time. In other words, a time series was said to be stationary if it's probability distribution remains unchanged as time proceeds. To test the unit root problem, the most widely used test was ADF. The general form of ADF test can be written at level and first difference were as follows:

$$\Delta Y_t = \alpha + \beta t + \delta Y_{t-1} + \sum_{i=1}^{k} \gamma i \Delta Y_{t-i} + \mu_t \quad (3)$$

$$\Delta\Delta Y_t = \alpha + \beta t + \delta \Delta Y_{t-1} + \sum_{i=1}^{k} \gamma i \, \Delta\Delta Y_{t-i} + \mu_t \quad (4)$$

Hence, if the hypothesis, $\delta = 0$ is rejected for the above equations then it can be concluded that the time series did not have a unit root and is integrated of order zero I(0) i.e. it has stationary properties.

Johansen's cointegration test was applied on closing prices of the selected indices (which are not stationary in nature) to see the long run relationship among selected indices. The Johansen (1988) (1991, 1995) procedure tests the presence of long run relationship between the variables and to perform the cointegration analysis. If the two or more series were found to be co-integrating, then they were said to have common stochastic trend. They tend to move together in the long run. EViews supports VAR-based cointegration tests using the methodology developed in Johansen (1991, 1995) performed using a Group object or an estimated Var object. Consider a VAR of order :

$$Y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + B x_t + \varepsilon_t \quad (5)$$

where y_t is a k-vector of non-stationary I(1) variables, x_t is a d-vector of deterministic variables, and ε_t is a vector of innovations. If there was not the existence of any long run comovement among the indices, then VAR model has been used. [2]If the cointegration exists, Vector Error Correction Model (VECM) is appropriate for further econometric analysis to discover the short run relationships. If the variables were cointegrated than VECM would be used for further analysis (Dhanraj, Gopalaswamy and Suresh, 2013, Aggarwal and Khurana, 2018). At the stationary log series, we applied granger causality test to see whether any indices granger causes other indices or not or to see the cause and effect relationship between the selected indices. The Granger (1969) approach to the question of whether x causes y is to saw how much of the current y can be explained by past values of y and then to see whether adding lagged values of x can improve the explanation. y is said to be Granger-caused by x if x helps in the prediction of y , or equivalently if the coefficients on the lagged x 's was statistically significant. It is pertinent to note that two-way causation is frequently the case; x Granger causes y and y Granger causes x. It was important to note that the statement "x Granger causes y" did not imply that y is the effect or the result of x. Granger causality measures precedence and information content but did not by itself indicate causality in the more common use of the term. In Granger's Causality, there were bi variate regressions of the under-mentioned form:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \ldots + \alpha Y_{t-1} + X_{t-1} + \ldots + \beta X_{t-1} + \varepsilon_t \quad (6)$$

$$X_t = \alpha_0 + \alpha_1 X_{t-1} + \ldots + \alpha X_{t-1} + {}_1 Y_{t-1} + \ldots + \beta Y_{t-1} + \mu_t \quad (7)$$

for all possible pairs of (X, Y) series in the group. Where ε_t and μ_t are two white noise random disturbance terms. In equation (6), the study took lags ranging from 1 to l. In Granger's model, one can pick a lag length, l that corresponds to reasonable beliefs about the longest time over which one of the variables could help to predict the other. The reported F-statistics were the Wald statistics for the joint hypothesis:

$$\beta 1 = \beta 2 = \beta 3 = \beta t = 0 \quad (8)$$

[1] Sharma G. D. and Bodla B.S., *"Interlinkages Among Stock Markets of South Asia",* Asia Pacific Journal of Business Administration, 2011, Vol. 3, No. 2, pp. 136.

[2] Vardhan H., Sinha P. and Vij M., *"Behavior of Indian Sectoral Stock Price Indices in the Post Sub Prime Crises Period",* Journal of Advances in Management Research, 2015, Vol. 12, No.1, pp. 15-29 (17).

Table 1. Descriptive Statistics.

	India	Japan	H.K.	China	S.K.	Sri Lanka	Pakistan	Philippines	Taiwan	Indonesia
Mean daily % return	0.046	0.01	0.004	0.007	0.02	0.052	**0.056**	0.025	0.02	0.48
Median daily % return	0.07	0.03	0.01	0	0.05	0.008	0.065	0.008	0.03	0.06
Maximum daily % return	15.99	9.56	13.4	9.4	11.28	13.3	8.25	16.17	12.19	7.6
Minimum daily % return	-14.1	-12.1	-13.5	-9.25	-12.8	-13.9	-7.7	-13.08	-12.29	-10.9
Std. Dev. daily % return	1.34	1.39	1.40	**1.447**	1.3	1.11	1.23	1.23	1.22	1.22
Skewness	-0.42	-0.49	0.007	-0.35	-0.49	-0.49	-0.39	-0.28	-0.23	-0.65
Kurtosis	14.25	9.24	11.43	8.56	10.5	26.73	6.7	14.96	9.59	10.3

Source: Data Processed through E-Views Software.

Table 2. Correlation Analysis.

	India	Japan	H.K.	China	S.K.	Sri Lanka	Pakistan	Philippines	Taiwan	Indonesia
India	1									
Japan	0.34	1								
H.K.	0.48	**0.55**	1							
China	0.19	0.24	0.42	1						
S.K.	0.41	**0.58**	**0.60**	0.23	1					
Sri Lanka	0.06	0.07	0.06	0.02	0.05	1				
Pakistan	0.12	0.09	0.1	0.07	0.11	0.02	1			
Philippines	0.27	0.33	0.34	0.15	0.34	0.06	0.1	1		
Taiwan	0.34	0.47	**0.52**	0.22	**0.6**	0.07	0.10	0.33	1	
Indonesia	0.41	0.36	0.46	0.19	0.43	0.05	0.1	0.39	0.4	1

Source: Data Processed through E-Views Software.

The null hypothesis was that x does not Granger-cause y in the first regression and that y did not Granger-cause x in the second regression.

Results of the Study

The results of descriptive statistics (applied on return series) are as follows:

The descriptive statistics shows that highest mean return is 0.07% of Pakistan. The std. dev. of China is highest (1.44%) which show the highest risk factor. All the series are negatively skewed except Hong Kong and all series are leptokurtic in nature.

Table **2** shows the results of correlation analysis (applied on return series) and found significant correlation of Japan with South Korea and Hong Kong. Hong Kong stock market was found highly correlated with South Korea and Taiwan. There are also a significant positive correlation between South Korea and Taiwan.

Table **3** shows the results of ADF test (applied on closing prices). It shows that the series are non stationary in nature at level but at first difference, the t-statistics is more than the test critical value (irrespective of sign) in all the cases, which confirms that all the series are stationary in nature at first difference.

The optimum Lag test is very important for further analysis and the next step is to select the optimum lag length before we conduct the Johansen co integration test.

A total of five criteria are taken in to account in the study. LR sequential modified LR test statistic, final prediction error, Akaike information criterion, Schwarz information criterion and Hannan Quinn information criterion are used, -

Table 3. Augmented Dickey Fuller Test.

	At Level			At First Difference		
	Intercept	Trend	None	Intercept	Trend	None
India	0.75	-1.83	2.44	-31.51	-31.51	-31.41

Japan	0.65	-2.44	0.55	-52.37	-52.38	-52.36
H.K.	-1.99	-2.59	-0.31	-78.05	-78.05	-78.06
China	-2	-2.53	-0.33	-34.83	-34.83	-34.83
S.K.	-1.7	-2.85	0.57	-51.58	-51.58	-51.58
S. Lanka	-1.1	-2.89	0.51	-17.59	-17.59	-17.55
Pakistan	-0.79	-2.04	0.89	-68.3	-68.29	-68.26
Philippines	-1.19	-1.8	0.44	-75.61	-75.6	-75.6
Taiwan	-0.51	-2.25	1.14	-74.72	-74.72	-74.7
Indonesia	-0.64	-3.11	1.44	-74.5	-74.49	-74.45

Source: Data Processed through E-Views Software

		Intercept	trend	None
Level of significance	1%	-3.43	-3.95	-2.56
	5%	-2.862	-3.41	-1.94
	10%	-2.567	-3.127	-1.61

Table 4. VAR Lag Order Selection Criteria.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-491771	NA	4.51E+61	170.3432	170.3547	170.3472
1	-336440	310069.5	2.01E+38	116.5743	116.7012	116.6185
2	-335962	952.8386	1.76E+38	116.4433	116.6856*	116.5276*
3	-335863	196.1741	1.76E+38	116.4438	116.8014	116.5682
4	-335743	239.4241	1.75E+38	116.4367	116.9097	116.6012
5	-335625	232.9546	1.74e+38*	116.4306*	117.019	116.6353
6	-335539	170.6868	1.75E+38	116.4354	117.1391	116.6802
7	-335440	196.2209	1.75E+38	116.4356	117.2547	116.7206
8	-335351	175.5765*	1.75E+38	116.4394	117.3738	116.7645

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 5. Johansen's Cointegration Test.
Unrestricted Cointegration Rank Test.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob.**	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.0139	261.38	239.23	0.0033	81.22	64.5	0.0006
At most 1	0.008	180.16	197.37	0.25	47.23	58.43	0.399
At most 2	0.0061	132.92	159.52	0.53	35.68	52.36	0.75
At most 3	0.0046	97.24	125.61	0.68	26.47	46.23	0.92
At most 4	0.0044	70.49	95.75	0.70	25.47	40.07	0.73
At most 5	0.00279	45.01	69.81	0.83	76.18	33.87	0.94
At most 6	0.0023	28.83	47.85	0.77	13.79	27.58	0.83

At most 7	0.0016	15.03	29.79	0.77	9.56	21.1	0.78
At most 8	0.0009	5.47	15.49	0.75	5.35	14.26	0.69
At most 9	0.00001	0.11	3.84	0.73	0.11	3.84	0.73

Source: Data Processed through E-Views Software.

Trace statistics and Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level.

* denotes rejection of the hypothesis at the 0.05 level.

**MacKinnon-Haug-Michelis (1999) p-values.

which are shown that in the table **4**. The FPE and AIC tests show the lag length 5, which is very high. So, if we take such a high lag length, there is more risk. Therefore, lag length 2 as recommended by SC and HQ would be adopted in the present study. We will further proceed for Johansen's Cointegration test now.

Table **5** shows the results of cointegration test (applied on closing prices) and indicate that there is only one cointegrating equation at trace statistics and maximum eigenvalue statistics which prove the existence of long run equilibrium relationship between Asian stock markets. Now, we will proceed for VECM for further analysis.

Table **6** shows the VECM results. In the Indian stock equation, 1 period lagged changes in Hong Kong, Chinese, South Korean, Philippines and Taiwan stock prices are significant. In the Japanese and Hong stock equation, at 1 period lagged changes in all the countries stock prices are significant except Sri Lanka, Pakistan and Indonesian stock prices. In the Chinese stock equation, 1 period lagged changes in Indian, H.K., South Korean, Philippines and Taiwan stock prices are significant. In the South Korean stock equation, 1period lagged changes in Indian, H.K., Chinese, Sri Lanka and Taiwan stock prices are significant. In the Pakistan stock equation, 1 period lagged changes in Chinese stock prices are significant. In the Philippines stock equation, 1 period lagged changes in H.K, S.K., Taiwan and Indonesian stock prices are significant. In the Taiwan stock equation, 1 period lagged changes in Indian, Chinese, Philippines and Indonesian stock prices are significant. In the Indonesia stock prices, 1 period lagged changes in Indian, S.K., Philippines and Taiwan stock prices are significant. So, we can conclude that there is a short run relationship among the stock indices of Asia.

Now, we proceed for granger causality test for further analysis. We accept the null hypothesis for the cases with probability value above 0.05, we reject the ones with lesser than 0.05. The table **7** shows the results of granger causality test (applied on returns) as follows:

Table 6. (Vector Error Correction Model).

Error Correction:	D(Ind)	D(Japan)	D(HK)	D(China)	D(SK)	D(SL)	D(Pak)	D(Phil.)	D(TW.)	D(Indo.)
CointEq1	-0.32	0.29	0.43	0.19	0.39	0.02	0.01	0.12	-0.11	0.07
	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
	[-17.3]*	[15.2]*	[23.2]*	[9.2]*	[22.4]*	[1.46]	[0.36]	[7.10]*	[-6.60]*	[4.14]*
D(India(-1))	-0.30	-0.05	-0.15	-0.06	-0.14	0.00	0.02	0.01	0.13	0.05
	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01
	[-19.1]*	[-3.26]*	[-9.01]*	[-3.51]*	[-9.05]*	[0.26]	[1.53]	[0.59]	[8.75]*	[3.11]*
D(Japan(-1))	-0.02	-0.54	0.05	0.00	0.02	0.01	0.02	0.02	-0.02	-0.02
	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	[-1.50]	[-38.2]*	[3.79]*	[0.18]	[1.31]	[1.12]	[1.26]	[1.85]	[-1.29]	[-1.61]
D(H.K.(-1))	-0.14	0.15	-0.33	0.13	0.17	0.01	0.01	0.09	0.01	0.02
	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
	[-8.50]*	[8.2]*	[-19.2]*	[6.67]*	[10.3]*	[0.54]	[0.38]	[5.87]*	[0.53]	[1.21]
D(China(-1))	-0.04	-0.03	-0.05	-0.51	-0.02	0.00	-0.02	0.01	-0.03	-0.01
	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	[-3.13]*	[-2.47]*	[-4.33]*	[-39.8]*	[-2.20]*	[-0.48]	[-2.20]*	[1.06]	[-2.70]*	[-0.50]
D(SK(-1))	-0.09	0.17	0.24	0.08	-0.32	-0.01	0.02	0.09	-0.03	0.05

	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
	[-5.10]*	[9.12]*	[13.1]*	[4.06]*	[-18.8]*	[-0.37]	[1.21]	[5.74]*	[-1.57]	[3.09]*
D(SL(-1))	-0.02	0.02	0.02	0.01	0.03	-0.43	0.00	-0.01	0.00	-0.02
	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	[-1.32]	[1.36]	[1.59]	[0.84]	[1.95]*	[-35.6]*	[0.25]	[-0.76]	[0.09]	[-1.22]
D(Pak(-1))	-0.02	0.01	0.00	0.01	0.01	0.00	-0.47	-0.01	0.02	-0.01
	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	[-1.7]	[0.87]	[0.15]	[0.57]	[0.41]	[0.30]	[-40.1]*	[-0.61]	[1.9]*	[-1.1]
D(Phill.(-1))	-0.09	-0.04	-0.04	-0.03	-0.02	0.01	0.00	-0.50	-0.03	-0.05
	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	[-6.32]*	[-2.97]*	[-2.81]*	[-1.99]*	[-1.58]	[0.68]	[-0.03]	[-40.1]*	[-2.2]*	[-3.7]*
D(Taiwan(-1))	0.10	-0.17	-0.29	-0.12	-0.22	-0.01	-0.03	-0.11	-0.53	-0.07
	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
	[5.5]*	[-9.2]*	[-16.2]*	[-6.31]*	[-13.3]*	[-0.87]	[-1.78]	[-6.64]*	[-33.1]*	[-4.66]*
D(Indonesia(-1))	-0.01	0.02	0.00	0.02	0.02	0.00	0.00	0.05	0.04	-0.46
	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	[-0.59]	[0.98]	[0.13]	[1.14]	[1.41]	[0.13]	[-0.1]	[3.49]*	[2.74]*	[-33.0]*
C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	[-0.01]	[0.004]	[0.01]	[-0.006]	[-0.003]	[-0.005]	[-0.02]	[0.003]	[0.007]	[0.007]

Table 7. Pair wise Granger Causality Test (Lag 2).

Null Hypothesis	F-stat	Prob.	Direction of Causality
Japan does not granger cause India	4.75	**0.008**	Japan granger cause India
India does not granger cause Japan	65.7	**6.00E-29**	India granger cause Japan
H.K. does not granger cause India	5.24	**0.005**	H.K. granger cause India
India does not granger cause H.K.	32.5	**9.00E-15**	India granger cause H.K.
China does not granger cause India	3.3	**0.033**	China granger cause India
India does not granger cause China	8.44	**0.0002**	India granger cause China
S.K. does not granger cause India	9.51	0.14	------
India does not granger cause S.K.	7.25	**0.0007**	India granger cause S.K.
S. Lanka does not granger cause India	1.9	0.14	------
India does not granger cause S. Lanka	7.25	**0.0007**	India granger cause S. Lanka
Pakistan does not granger cause India	0.65	0.51	--------
India does not granger cause Pakistan	13.76	**1.00E-06**	India granger cause Pakistan
Philippines does not granger cause India	3.85	**0.02**	Philippines granger cause India
India does not granger cause Philippines	106.1	**5.00E-46**	India granger cause Philippines
Taiwan does not granger cause India	5.34	**0.004**	Taiwan granger cause India

India does not granger cause Taiwan	76.6	**1.00E-33**	India granger cause Taiwan
Indonesia does not granger cause India	1.06	0.34	----------
India does not granger cause Indonesia	33.2	**4.00E-15**	India granger cause Indonesia
H.K. does not granger cause Japan	19.8	**2.00E-09**	H.K. granger cause Japan
Japan does not granger cause H.K.	0.92	0.39	----------
China does not granger cause Japan	1.21	0.29	------
Japan does not granger cause China	0.66	0.51	--------
S.K. does not granger cause Japan	13.2	**2.00E-06**	S.K. granger cause Japan
Japan does not granger cause S.K.	1.71	0.18	------
S. Lanka does not granger cause Japan	1.69	0.18	-------
Japan does not granger cause S. Lanka	2.53	0.07	-------
Pakistan does not granger cause Japan	2.55	0.07	------
Japan does not granger cause Pakistan	8.39	**0.0002**	Japan granger cause Pakistan
Philippines does not granger cause Japan	0.64	0.52	-----
Japan does not granger cause Philippines	30.45	**7.00E-14**	Japan granger cause Philippines
Taiwan does not granger cause Japan	2.29	0.1	-------
Japan does not granger cause Taiwan	16.14	**1.00E-07**	Japan granger cause Taiwan
Indonesia does not granger cause Japan	10.87	**2.00E-05**	Indonesia granger cause Japan
Japan does not granger cause Indonesia	4.83	**0.008**	Japan granger cause Indonesia
China does not granger cause H.K.	11.11	**2.00E-05**	China granger cause H.K.
H.K. does not granger cause China	2.09	0.12	--------
S.K. does not granger cause H.K.	4.42	**0.012**	S.K. granger cause H.K.
H.K. does not granger cause S.K.	6.6	**0.001**	H.K. granger cause S.K.
S. Lanka does not granger cause H.K.	0.88	0.41	-------
H.K. does not granger cause S. Lanka	3.73	**0.02**	H.K. granger cause S. Lanka
Pakistan does not granger cause H.K.	0.64	0.52	------.
H.K. does not granger cause Pakistan	7.23	**0.0007**	H.K. granger cause Pakistan
Philippines does not granger cause H.K.	0.97	0.37	-------
H.K. does not granger cause Philippines	73.11	**4.00E-32**	H.K. granger cause Philippines
Taiwan does not granger cause H.K.	3.31	**0.03**	Taiwan granger cause H.K.
H.K. does not granger cause Taiwan	52.67	**2.00E-23**	H.K. granger cause Taiwan
Indonesia does not granger cause H.K.	1.61	0.19	-------
H.K. does not granger cause Indonesia	3.11	**0.04**	H.K. granger cause Indonesia
S.K. does not granger cause China	0.85	0.42	------
China does not granger cause S.K.	2.78	0.06	------
S. Lanka does not granger cause China	2.09	0.12	------
China does not granger cause S. Lanka	.0007	0.99	------
Pakistan does not granger cause China	1.03	0.35	-----
China does not granger cause Pakistan	3.15	**0.04**	China granger cause Pakistan

Philippines does not granger cause China	1.6	0.2	------
China does not granger cause Philippines	11.8	**7.00E-06**	China granger cause Philippines
Taiwan does not granger cause China	2.5	0.08	-----
China does not granger cause Taiwan	0.17	0.84	------
Indonesia does not granger cause China	4.34	**0.01**	Indonesia granger cause China
China does not granger cause Indonesia	0.28	0.75	----
S. Lanka does not granger cause S.K.	1.45	0.23	------
S.K. does not granger cause S. Lanka	9.86	**5.00E-05**	S.K. granger cause S. Lanka
Pakistan does not granger cause S.K.	1.75	0.17	------
S.K. does not granger cause Pakistan	12.6	**3.00E-06**	S.K. granger cause Pakistan
Philippines does not granger cause S.K.	2.76	0.06	------
S.K. does not granger cause Philippines	65.1	**1.00E-28**	S.K. granger cause Philippines
Taiwan does not granger cause S.K.	1.62	0.19	-----
S.K. does not granger cause Taiwan	35.3	**6.00E-16**	S.K. granger cause Taiwan
Indonesia does not granger cause S.K.	6.48	**0.0015**	Indonesia granger cause S.K.
S.K does not granger cause Indonesia	9.5	**7.00E-05**	S.K. granger cause Indonesia
Pakistan does not granger cause S. Lanka	0.28	0.75	-----
S. Lanka does not granger cause Pakistan	1.98	0.13	-----
Philippines does not granger cause S. L.	1.5	0.2	-----.
S. Lanka does not granger cause Philip.	1.5	0.2	-------
Taiwan does not granger cause S. Lanka	3.05	**0.04**	Taiwan granger cause S. Lanka
S. Lanka does not granger cause Taiwan	1.2	0.28	----
Indonesia does not granger cause S.L.	5.17	**0.005**	Indonesia granger cause S. Lanka
S. L. does not granger cause Indonesia	0.53	0.58	------
Philippines does not granger cause Pak.	3.77	**0.02**	Philippines granger cause Pakistan
Pak. does not granger cause Philippines	1.67	0.18	-----
Taiwan does not granger cause Pakistan	10.4	**3.00E-05**	Taiwan granger cause Pakistan
Pakistan does not granger cause Taiwan	6.82	**0.0011**	Pakistan granger cause Taiwan
Indonesia does not granger cause Pak.	7.69	**0.0005**	Indonesia granger cause Pakistan
Pak. does not granger cause Indonesia	0.25	0.77	------
Taiwan does not granger cause Philipp.	24.6	**2.00E-11**	Taiwan granger cause Philippines
Philipp. does not granger cause Taiwan	12.16	**5.00E-06**	Philippines granger cause Taiwan
Indonesia does not granger cause Philipp.	75.9	**3.00E-33**	Indonesia granger cause Philippines
Philipp. does not granger cause Indonesia	6.7	**0.001**	Philippines granger cause Indonesia
Indonesia does not granger cause Taiwan	21.6	**4.00E-10**	Indonesia granger cause Taiwan
Taiwan does not granger cause Indonesia	6.5	**0.001**	Taiwan granger cause Indonesia

Source: Data Processed through E-Views Software Level of significance 5%.

There are some cases of bidirectional causal relationship of India with Japan, H.K., China, Philippines and Taiwan, of Taiwan with Pakistan, Indonesia, H.K. and Philippines, of S. K. with H.K. and Indonesia and of Indonesia with Japan and

Philippines. There exist unidirectional relationship between India and S.K., S. Lanka, Pakistan, and Indonesia. Also, there exist unidirectional relationship of Japan with H.K., S.K., Pakistan, Philippines and Taiwan, of H.K. with China, S.L., Pakistan, Philippines and Indonesia, of China with Pakistan, Philippines and Indonesia, of S.K. with S.L., Pakistan, Philippines and Taiwan, of S.L. with Taiwan and Indonesia and of Pakistan with Philippines and Indonesia. In the remaining cases, there are no cause and effect relationship between each other.

RESULTS AND DISCUSSIONS

The highest % mean return is 0.07% of Pakistan and the most risky stock exchange is of Japan (with the std. dev. of 1.44%). All the series are negatively skewed and leptokurtic in nature. We observe significant correlation of Japan with South Korea and Hong Kong. Hong Kong stock market is highly correlated with South Korea and Taiwan. There are also a significant positive correlation between South Korea and Taiwan.

All the series are stationary in nature at Ist difference. There are some cases of bidirectional causal relationship of India with Japan, H.K., China, Philippines and Taiwan, of Taiwan with Pakistan, Indonesia, H.K. and Philippines, of S. K. with H.K. and Indonesia and of Indonesia with Japan and Philippines. There exist unidirectional relationship between India and S.K., S. Lanka, Pakistan, and Indonesia. Also there exist unidirectional relationship of Japan with H.K., S.K., Pakistan, Philippines and Taiwan, of H.K. with China, S.L., Pakistan, Philippines and Indonesia, of China with Pakistan, Philippines and Indonesia, of S.K. with S.L., Pakistan, Philippines and Taiwan, of S.L. with Taiwan and Indonesia and of Pakistan with Philippines and Indonesia. The outcome of Johansen cointegration test indicates that there is also long run relationship among Asian stock markets. The study can be used in taking investment decisions keeping in mind the international portfolio diversification opportunities. But we see that there is cause and effect relationship in most of the cases and also exist long run as well as short term equilibrium relationship among the Asian stock markets so the investors cannot get abnormal gain by portfolio diversification. It concludes that there is no benefit of portfolio diversification in Asian stock markets.

The present work is not free from limitations. Firstly, because of lack of time only closing prices are included in the current study. Opening prices can also be taken in this study. All the limitations associated with various techniques used in the present study. The time period could also be extended in order to have a broader view of the scenario. Other macroeconomic variable factors can also be taken for future study. The future study can also be done to examine the short run relationship among Asian stock markets by using further econometric techniques namely Variance decomposition and Impulse response. It is also recommended to investigate integration among more markets of different regions.

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Received: Mar 20, 2023 Revised: Mar 25, 2023 Accepted: May 22, 2023