Inter-linkages Among Selected Stock Markets of South Asia: Revisit

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Abstract

The present study investigates the inter linkages among South Asian stock markets namely India, Sri Lanka and Pakistan. The topic is important for international investors because if the stock markets are found integrated with each other then they cannot reap profits from portfolio diversification or reduction in risk. Daily closing prices of the bench mark indices of three countries are taken for a period from 1 Jan. 2001 to 23th Feb. 2023. The paper used statistical tools such as descriptive statistics and correlation analysis and on the other hand, the econometric techniques namely Johansen's Co integration test, VAR, Variance Decomposition Analysis, Impulse response function and Granger causality test and the selected stock markets are found interlinked in long run as well as in short run .

Keywords: stock market integration, portfolio diversification, VAR, Granger causality

JEL Classification: F15, C5, G11, G15

1. Introduction to the Study

International stock markets become more interdependent due to financial globalization and liberalization. Modern portfolio theory said that if the returns in different stock markets are not correlated then there are chances of gains through international portfolio diversification. Investors can reduce risk by investing in markets which are less correlated. If correlation between the stock markets of two countries is less, then the investors can get profits and reduce systematic risk through international portfolio diversification. In the present time, the integration between stock markets becomes unavoidable due to revolution in information technology, high internet speed, free flow of trade and information between different countries. The study of stock market integration is very important for international investors in taking decisions regarding portfolio diversification and also important for policy makers and academicians. The current studies on the topic of stock market integration among South Asian countries are very few although the selected countries under the present study have dominance in terms of trade in South Asian region. The paper covers introduction, objectives of the study, review of literature, research methodology, results of the study, conclusion, limitations and future research implications.

2. The Objectives of the Study

The objectives of the present study are as follows:

1. To examine the correlation among South Asian stock markets.
2. To investigate the cause and effect relationship among selected stock market indices.
3. To study the long run equilibrium relationship among the selected stock markets.
4. To find out the short run linkages among stock markets under the study.

3. The Present State of Art

The available literature on interlinkages among South Asian stock markets is as follows:

Nath and Verma (2003) examined the interdependence among stock markets of South Asia (India, Singapore and Taiwan) and found no long run relationship between these three markets. Bodla and Turan (2004) examined indices of selected Asian countries (India, Taiwan and Singapore) and found the correlation between the returns of Asian countries was subsequently less than unity. Stock returns of India have shown the lowest level of correlation with various countries of Asia. Narayan, Smyth and Nandha (2004) examined the dynamic linkages between the stock

market of Bangladesh, India, Pakistan and Sri Lanka. The study observed that in long run, stock prices in Bangladesh, India and Sri Lanka granger cause the prices in Pakistan. In short run, there was unidirectional granger causality from stock prices in Pakistan to Sri Lanka. The impulse response function showed that Bangladesh was the most exogenous of the four markets. Lamba (2005) analyzed the short run and long run relationship between South Asian equity markets (India, Pakistan and Sri Lanka) and found that these three South Asian equity markets became more integrated with each other**.** Sharma and Bodla (2011) examined the interlinkages among the stock markets of South Asia and found the existence of the benefits of portfolio diversification among the South Asian countries (India, Pakistan and Sri Lanka). Subhani *et al.* (2011) analyzed the co integration among major south Asian equity markets (India, Pakistan and Nepal) and found no evidence of co integration among the stock prices of all equity markets except of equity markets of Karachi- Pakistan and Dhaka-Bangladesh. Naveen I. (2013) examined the relationship between the South Asian capital markets and found positive moderate correlation between Sri Lanka and Paksitan. The study also found long run cointegraion among south Asian countries but no causal relationship was found between India and Sri Lanka. The share price index of Indi and Sri Lanka cause that of Pakistan. Shahzad *et al.* (2016) examined the diversification potential among South Asian stock markets (India, Pakistan and Sri Lanka) and found that South Asian stock markets were closely linked with each other. Singh and Srivastav (2017) examined the inter linkages between stock market of India and Sri Lanka and found that return at CSE does not granger cause at Indian stock market and vice versa and also found no co integration between India and Sri Lanka. Kuruiawan B. (2022), examined the linkages among South Asian stock markets. Daily market price index of Bangladesh, India, Pakistan and Sri Lanka was covered. The results show that global financial crises has strengthened the linkages among South Asian stock markets but this seen before crises only India has influenced other South Asian countries but after crises not only India but also other countries.

On the basis of review of literature we see that different methods have been used by the researchers about integration of stock markets of world. Correlation analysis, ADF test, Granger causality test, Johansen's cointegration test and VAR model have been used to analyze the data about stock market integration. Only one or at the most two methods are 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), Palamalai (2013) 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). Wang *et al.* (2003), Chuang *et al.* (2007), Sharma and Bodla (2011) and Singh and Singh (2016) apply the VAR model to conduct their research. As most of the studies used only one or two methods in their studies but in current study the author used more than two econometric methods to achieve the objectives of the study.

4. Research Methodology

4.1 Database

The present study is conducted to find out the integration among South Asian stock markets (India, Pakistan and Sri Lanka). The countries are selected on the basis of significant trade relationship in South Asian region. One stock exchange each of the three countries is selected as a representative of the respective country. The Bombay stock exchange, Colombo stock exchange and the Karachi stock exchange are used as the benchmark stock exchange of India, Sri Lanka and Pakistan respectively. BSE SENSEX Index, All Share Price Index (ASPI) and the KSE 100 index are used as the representative index for Bombay stock exchange, Colombo stock exchange and Karachi stock exchange respectively for the present study. The daily closing prices of the three representing indices for the period started from 1 Jan. 2001 through 23rd Feb. 2023 is considered as the reference period. There are the stock exchanges for some days because on a few days, one or two of the exchanges were open while others were closed and we took data for all the days on which either of the three stock exchanges were open, We fill the missing values by taking average of two of the preceding cases and two of the succeeding cases. We follow the study of Sharma and Bodla (2011) to fill missing values. The data source is yahoo finance and E views 7.0 software and Microsoft excel are used or the purpose of analysis.

4.2 Tools and Techniques

Natural log of selected series gives the daily return of the given indices under the study. The formula of calculating the natural log of indices/closing prices is 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 is used to get on insight in to the data. Correlation analysis and econometric tools have been used for data analysis. The descriptive statistics includes mean percent return (over the entire reference period), maximum and minimum return, standard deviation, skewness, kurtosis and Jarque bera statastics. Karl Pearson's coefficient of correlation is used to see the correlation among selected stock markets. If the correlation coefficient is more than 0.05, the correlation is significant otherwise not. The formula of correlation coefficient is as follows:

$$r = \frac{\Sigma \quad (x-\underline{x})(y-\underline{y})}{N\sigma_x\sigma_y} \tag{2}$$

Augmented Dickey Fuller Test under the unit root test perform to see the series are stationary or not. A process is said to be stationary if its mean and variance remain unchanged over time. In other words, a time series is said to be stationary if its probability distribution remains unchanged as time proceeds. To test the unit root problem, the most widely used test is ADF. The general form of ADF test can be written at level and first difference are as follows:

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

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

Hence, if the hypothesis, $\delta = 0$ is rejected for the above equations then it can be concluded that the time series does not have a unit root and is integrated of order zero I(0) i.e. it has stationary properties. In order to make the series stationary, log of selected series have been taken and arrive at the daily return of selected series. At the stationary log series of three stock indices, we apply granger causality test. The Granger (1969) approach to the question of whether x causes y is to see 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 are 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 is important to note that the statement "x Granger causes y" does not imply that y is the effect or the result of x. Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term. In Granger's Causality, there are bi variate regressions of the under-mentioned form:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \ldots + \alpha Y_{t-1} + X_{t-1} + \ldots + \beta X_{t-1} + \varepsilon_t \tag{5}$$

$$X_t = \alpha_0 + \alpha_1 X_{t-1} + \ldots + \alpha X_{t-1} + {}_1Y_{t-1} + \ldots + \beta Y_{t-1} + \mu_t \tag{6}$$

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 (5), the study takes 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 predict the other. The reported F-statistics are the Wald statistics for the joint hypothesis:

$$\beta_1 = \beta_2 = \beta_3 = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots = \beta_t = 0 \tag{7}$$

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

We apply Johansen's cointegration test 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 are found to be co-integrating, then they are 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:

$$Y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + Bx_t + \varepsilon_t \tag{8}$$

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 the coefficient matrix Π has a reduced rank $r < k$, there exists k x r matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ are stationary. The number of co-integrating relations is given by r, and each column of β

is a cointegrating vector. The VAR is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. The VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. The mathematical representation of a VAR is:

$$Y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + B\ x_t + \varepsilon_t \quad (9)$$

where yt is a k vector of endogenous variables, xt is a d vector of exogenous variables, A1, . . ., Ap and B are matrices of coefficients to be estimated, and 1t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables.

We apply the variance decomposition analysis in order to finally quantify the extent up to which the three indices are influenced by each other. While impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR. Impulse response show the effect of shocks for different days separately the cumulative effect of shocks the variance decomposition of the stock indices is based on the analysis of responses of the variables to shocks.

Returns of closing prices have been used in descriptive statistics, correlation analysis, Granger causality test, VAR, Variance decomposition and impulse response. But for the Augmented Dickey Fuller test and Johansen's Cointegration test we used closing prices of the selected indices which are non stationary in nature.

5. Results of the Study

A graphical presentation of daily closing prices and returns of daily closing prices of three indices over the study period is given in Figures 1 and 2. Table 1 presents the descriptive statistics of the return series of BSE, CSE and KSE.

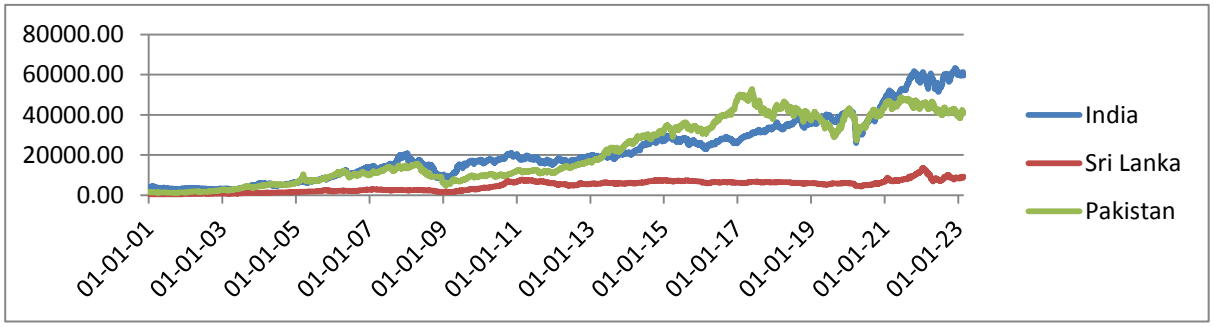

Figure 1. Daily Closing Prices Movement (Jan. 2001 -Feb. 2023)

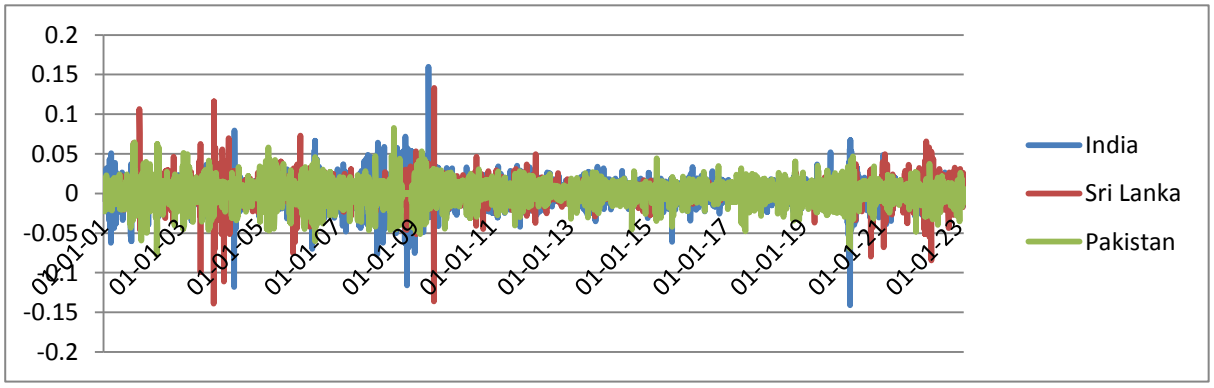

Figure 2. Daily Returns (Jan. 2001- Feb. 2023)

Table 1. Descriptive Statistics

	India	Sri Lanka	Pakistan
Mean daily % return	0.0468	0.0525	**0.057**
Median daily % return	0.0777	0.0086	0.065
Maximum daily % return	15.99	13.31	8.25
Minimum daily % return	-14.1	-13.31	-7.74
Std. Dev. daily % return	**1.34**	1.11	1.23
Skewness	-0.42	-0.49	-0.39
Kurtosis	14.24	26.73	6.78
Jarque B.	30630.9	135893.5	3595.5
Probability	0	0	0
Observations	5778	5778	5778

Source: Computed

Table 1 show descriptive statistic, highest mean % return is 0.057 percent of Pakistan. The standard deviation of India is highest which is 1.34 followed by Sri Lanka and Pakistan. So, the stock market of India found most risky stock market. All the stock indices are negatively skewed. The value of kurtosis in all the cases is more than 3 which indicate that all the series are leptokurtic in nature. To reduce risk, it is necessary to avoid a portfolio whose markets are highly correlated with each other. So in this regard we apply correlation analysis on return series to see correlation among the selected indices.

Table 2. Correlation Analyses

	India	Sri Lanka	Pakistan
India	1		
Sri Lanka	0.061	1	
Pakistan	**0.121**	0.025	1

Source: computed

Table 2 shows the results of correlation analysis (applied on returns). The results of correlation analysis show that the stock markets of India and Pakistan are significantly correlated with each other. Further to check the stationary of data we perform Augmented Dickey fuller test on closing prices.

Table 3. Augmented Dickey Fuller Test at level

	Intercept	Trend	None
India	0.83	-1.76	2.51
Sri Lanka	-1.12	-2.88	0.54
Pakistan	-0.77	-2.59	0.91

		Intercept	Trend	None
Level of significance	1%	-3.43	-3.960	-2.56
	5%	-2.862	-3.41	-1.94
	10%	-2.567	-3.127	-1.61

Table 4. Augmented Dickey Fuller Test at 1st difference

	Intercept	Trend	None
India	-31.53	-31.57	-31.42
Sri Lanka	-17.57	-17.57	-17.52
Pakistan	-68.27	-68.26	-68.23

		Intercept	Trend	None
Level of significance	1%	-3.4318	-3.9603	-2.565
	5%	-2.8620	-3.41095	-1.9409
	10%	-2.5671	-3.1272	-1.6160

The results of Table 3 show that the series are non stationary in nature at level but in Table 4, at the first difference in all the cases t-statistics is more than the test critical value (irrespective of sign), this implies that the null hypothesis is rejected and the variable does not have a unit root, which confirms that the series are stationary after differencing one. So, the results of ADF test confirm that all the series are stationary in nature at first difference. After confirming the stationarity of series, now we proceed for Granger Causality test for further analysis which is shown in Table 5.

Table 5. Pair wise Granger Causality Test (Lag 2)

Null Hypothesis	Observation	F-stat	Probability
Sri Lanka does not granger cause India	5776	1.91	0.148
India does not granger cause Sri Lanka		7.25	**0.0007**
Pakistan does not granger cause India	5776	0.64	0.522
India does not granger cause Pakistan		13.73	**0.0001**
Pakistan does not granger cause Sri Lanka	5776	0.289	0.749
Sri Lanka does not granger cause Pakistan		1.978	0.138

Source: Computed Level of Significance 5%

We accept the null hypothesis for the cases with probability value above 0.05, we reject the ones with lesser than 0.05 probability value. Going by this rule, the results fail to reject the following null hypotheses:

R Sri Lanka does not granger cause R India

R Pakistan does not granger cause R India

R Pakistan does not granger cause R Sri Lanka

R Sri Lanka does not granger cause R Pakistan

But we support the under mentioned alternative hypotheses:

1. R India granger cause R Sri Lanka
2. R India granger cause R Pakistan

So, there exists only a unidirectional causal relationship of India with Sri Lanka and Pakistan.

Now we use Johansen's cointegration test to see the long run relationship among selected indices. It may be noted that the cointegration test will be implemented on closing prices (which are non stationary in nature).

Table 6. Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob.**
None *	0.001867	16.117	29.79707	0.704
At most 1	0.000922	5.3266	15.49471	0.7732
At most 2	0.0000002	0.00152	3.841466	0.9669

Trace test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

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

Table 7. Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob.**
None	0.001867	10.79	21.13	0.7668
At most 1	0.000922	5.325	14.26	0.7004
At most 2	0.0000002	0.00152	3.841	0.9669

Max-eigenvalue test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

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

Tables 6 and 7 shows the results of Johansen's cointegration tests which indicate no cointegration among selected series at trace and maximum eigen value. So, we conclude that there is no long run relationship among the South Asian stock markets. Further we implement VAR model to test the short run linkages among the selected indices. By the application of the VAR model, we observe that the integration of a stock exchange with the other can be established if the t-value is more than 1.96 (irrespective of sign).

Table 8. Vector Auto Regression Estimates

Standard errors in ( ) & t-statistics in [ ]

	India	Sri Lanka	Pakistan
India(-1)	0.02418	0.03464	0.05393
	0.01328	0.01095	0.0121
	[1.8212]	**[3.1628]**	**[4.4571]**
India(-2)	-0.004866	0.02245	0.02935
	0.01331	0.01098	0.01213
	[-0.36551]	**[2.0444]**	**[2.419]**
Sri Lanka(-1)	0.1786	0.1419	0.01441
	0.01598	0.01319	0.0145
	[1.11791]	**[10.766 4]**	[0.9897]
Sri Lanka(-2)	0.02236	-0.0038 12	0.01598
	0.01597	0.01317	0.01455
	[1.40058]	[-0.289 3]	[1.09853]
Pakistan(-1)	0.002235	0.00178	0.08478
	0.01453	0.01199	0.01324
	[0.1537]	[0.1484]	**[6.4014]**
Pakistan(-2)	0.015586	-0.0080 05	0.02914
	0.0145	0.01196	0.01321
	[0.1537]	[- 0.669]	**[2.2055]**
C	0.000425	0.00010 4	0.000568
	0.00018	0.00015	0.01321
	[2.395]	[2.93]	[2.7618]

Source: Computed

The Table 8 shows that the returns in India at lag 0 moves independently. The returns in Sri Lanka, at the lag of 0 is influenced by the return in India at lag 1 and 2, returns in Sri Lanka at lag 1. Returns in Pakistan at lag 0 are influenced by the returns in India at the lag 1 and 2, returns in Pakistan at the lag 1 and 2. The study of the VAR leads us to the conclusion that in short run India influenced to Sri Lanka and Pakistan but is not influenced by others. Further, we will proceed to VDC. The Variance decomposition is also used to see the short run dynamic relationship selected stock markets. The following tables decompose the returns at the selected stock exchanges for a period ranging from 1 to 10:

Table 9. Variance Decomposition of India

Period	S.E.	India	Sri Lanka	Pakistan
1	0.013420	100.0000	0.000000	0.000000
2	0.013426	99.97789	0.021700	0.000409
3	0.013430	99.91309	0.065931	0.020975
4	0.013431	99.91161	0.067179	0.021206
5	0.013431	99.91157	0.067217	0.021216
6	0.013431	99.91156	0.067219	0.021217
7	0.013431	99.91156	0.067220	0.021217
8	0.013431	99.91156	0.067220	0.021217
9	0.013431	99.91156	0.067220	0.021217
10	0.013431	99.91156	0.067220	0.021217

Source: Computed

Table 10. Variance Decomposition of Sri Lanka

Period	S.E.	India	Sri Lanka	Pakistan
1	0.011072	0.341562	99.65844	0.000000
2	0.011197	0.583633	99.41599	0.000373
3	0.011205	0.697740	99.29524	0.007020
4	0.011206	0.699976	99.29287	0.007159
5	0.011206	0.699982	99.29286	0.007159
6	0.011206	0.699982	99.29286	0.007159
7	0.011206	0.699982	99.29286	0.007159
8	0.011206	0.699982	99.29286	0.007159
9	0.011206	0.699982	99.29286	0.007159
10	0.011206	0.699982	99.29286	0.007159

Source: Computed

Table 11. Variance Decomposition of Pakistan

Period	S.E.	India	Sri Lanka	Pakistan
1	0.012231	1.414090	0.012412	98.57350
2	0.012305	1.881519	0.031548	98.08693
3	0.012327	2.070685	0.065774	97.86354
4	0.012328	2.076365	0.069287	97.85435
5	0.012328	2.077019	0.069772	97.85321
6	0.012328	2.077063	0.069804	97.85313
7	0.012328	2.077067	0.069807	97.85313
8	0.012328	2.077067	0.069807	97.85313
9	0.012328	2.077067	0.069807	97.85313
10	0.012328	2.077067	0.069807	97.85313

Source: Computed

Table 9 reveals that in case of India stock market, there is no impact of Sri Lanka and Pakistan. Table 10 shows that the returns of CSE is composed by the returns of BSE for the period from 1 to 10. Table 11 shows that the returns of Pakistan are influenced by returns at BSE for the period from 1 to 10. So, VDC confirm the results of VAR. At last we proceed for impulse response. The impulse response analysis investigates the influence of random shock on the markets. Impulse responses of returns in various markets to a shock in their own and other market innovations are also examined. Figure 3 presents the impulse response function for three series (India(ser01), Sri Lanka (ser02), Pakistan (ser03). The results of figure 3 depict the impulse response exhibit the number of days on X-axis, and the shock response on Y-axis. The figure exhibits how many days the shock at the other stock exchange cools down. However, the stock market of India exerting some impact on Sri Lanka and Pakistan.

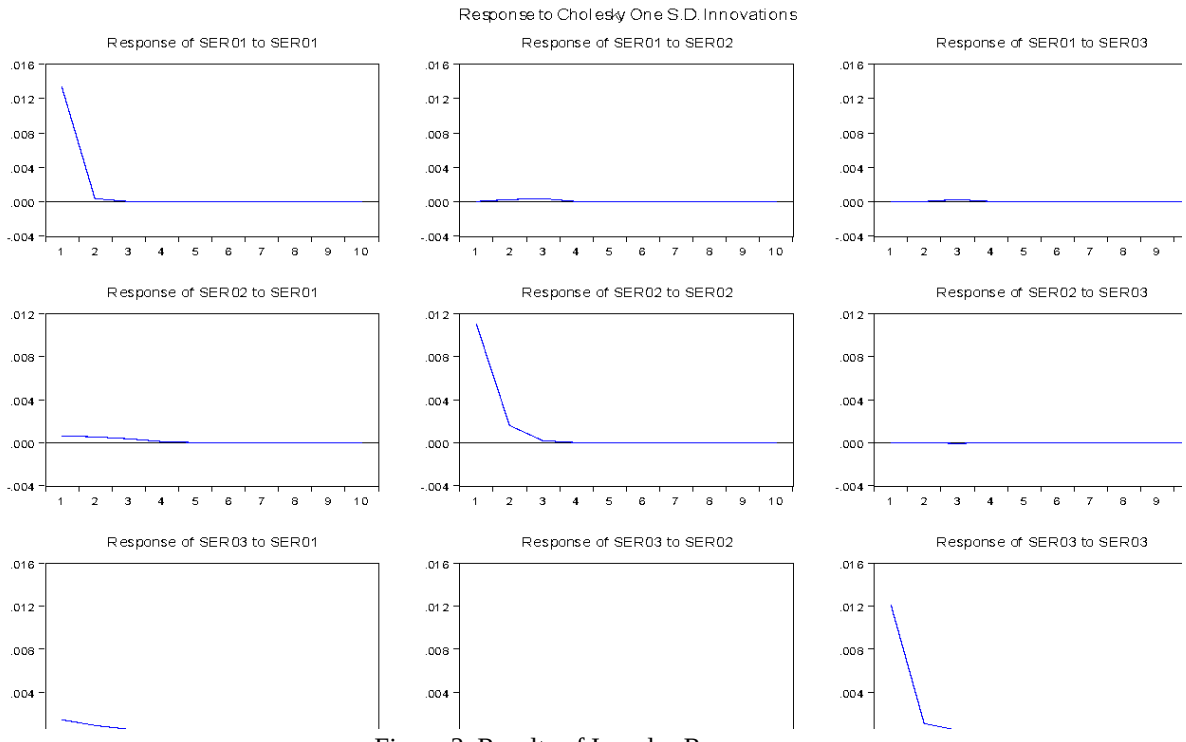

Figure 3. Results of Impulse Response

6. Conclusion

The present study investigate the integration among South Asian stock markets (India, Sri Lanka and Pakistan).The study conclude that the highest return is of Pakistan stock market but Indian stock market is found most risky. There is a positive and significant correlation between the stock markets of India and Pakistan. A unidirectional causal relationship is found between India- Sri Lanka and India- Pakistan. There is no long run equilibrium relationship among the selected indices. The study of the VAR leads us to the conclusion that in short run India influenced to Sri Lanka and Pakistan but is not influenced by others. VDC confirm the results of VAR. According to Impulse response, the stock market of India exerting some impact on Sri Lanka and Pakistan. So, portfolio diversification benefits are available for international investors in selected stock markets under the study in long run as well as in short run.

7. Limitations and Future Research Implications

The current study is also 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. 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 macro economic variable factors can also be taken for future study. It is also recommend to investigate interlinkages among more markets of different regions.

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Authors' contributions

I collected data. Dr. Gagandeep Sharma from Delhi helped me to arrange data according to study. He also helped me in my analytical work also. I analyse data and do interpretation too. Finally I revise it.

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Obtained.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

References

Adebiyi, M. A., & Adeyemi, S. B. (2008). Inflation targeting in developing economies: The case of Nigeria. In Toggins, W. N. (Ed.), *New Econometric Modeling Research* (Chapter 3, p. 100). Nova Science Publishers.

Aggarwal, S., & Khuren, S. (2018, Jan.). Empirical examination of stock market volatility: An international comparison. *Indian Journal of Finance*, 47-60. https://doi.org/10.17010/ijf/2018/v12i1/120741

Bhunia, A. (2013). Cointegration and Causal Relationship among Crude Price, Domestic Gold Price and Financial Variable: An Evidence of BSE and NSE. *Journal of Contemporary Issues in Business Research, 1*(2), 1-10. https://doi.org/10.4236/tel.2018.815211

Bodla, B. S., & Turan, M. S. (2004). Risk and Rewards in Asian Stock Markets: An Empirical Evidence. *Delhi Business Review*, *5*(2), 47-65.

Hasan, A., & Saleem, H. M. N. (2008). Long-Run Relationships between An Emerging Equity Market and Equity Markets of the Developed World An Empirical Analysis of Karachi Stock Exchange. *International Research Journal of Finance and Economics, 16*, 52-63.

Kurniawan, B., *et. al.*. (2022). The linkages of the South Asian stock market movements before, during and after 2007-2009 crises. *American International Journal of Business Management*, *5*(12), 22-31.

Lamba, A. S. (2005). An analysis of the short term and long run relationship between South Asian and developed equity markets. *International Journal of Business, 10*(4), 383-402.

Meric, G., Pati, N., & Meric, I. (2011). Co movement of the Indian stock market with other stock markets: Implications for portfolio diversification. *Indian Journal of Finance, 5*(10), 13-20.

Narayan, P., *et al.*. (2004). Interdependence and Dynamic Linkages between the Emerging Stock Markets of South Asia. *Accounting and Finance, 44*(3), 419-439. https://doi.org/10.1111/j.1467-629x.2004.00113.x

Naveen, I. (2013). The Dynamics of integration of Capital markets in South Asia. *Financial Markets and Services Emerging Trends*, 62-70.

Rao, K. M. (2014). Interrelationship among stock market of India and selected stock price indices of the Asia Pacific Region. *The India Journal of Commerce, 67*(3), 13-20.

Seth, N., & Sharma, A. K. (2015). International stock market efficiency and integration: Evidence from Asian and US markets. *Journal of Advances in Management Research, 12*(2), 88-106. https://doi.org/10.1108/JAMR-07-2011-0010

Shahzad, *et al.*. (2016). Relationship between developed, European and south Asian stock markets: A multivariate analysis. *South Asian Journal of Global Business Research, 5*(3), 385-402. https://doi.org/10.1108/SAJGBR-01-2015-0002

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. https://doi.org/10.1108/17574321111169821

Sharma, G. D., & Bodla, B. S. (2012). Rewards and Risks in stock markets: A case of south Asia. *International Journal of Applied economics and Finance, 4*, 37-52. https://doi.org/10.3923/ijaef.2012.37.52

Sharma, G. D., & Mahendru, M. (2013). Are the stock exchanges of emerging economies inter-linked: Evidence from BRICS. *Indian Journal of Finance*, 7(1), 1-25.

Singh, A. K., & Shrivastav, R. K. (2017). Study of interlinkages and interdependence between stock market of India and Sri Lanka. *Business Analyst*, *37*(2), 197-207.

Singh, A., & Singh, M. (2016). Cross country co-movement in equity markets after the US financial crises: India and major economic giants. *Journal of Indian Business Research, 8*(2), 98-121. https:/doi.org/10.1108/JIBR-08-2015-0089

Singh, S. (2011). Causality between Total Expenditure on Education and Economic Growth: A Case Study of Haryana. *The Indian Journal of Economics, XIIC*(I)(364), 1-8.

Singh, S. (2013). Public Expenditure and Growth. *The Indian Journal of Commerce, 66*(1), 15-22.

Subhani, M. I., *et al.*. (2011). Are the major south Asian equity markets co integrated?. *International Journal of humanities and Social Science, 1*(12), 117-121.

Suman, & Warne, D. P. (2013). Global stock market integration: A Review. *Asia Pacific Journal of Research in Business Management, 4*(8-9), 18-28.

Suman, & Warne, D. P. (2015). Inter linkages between Indian and United States stock market indices. *International Journal of Information & Futuristic Research, 2*(9), 3190-3195.

Suman. (2016). Inter-linkages of Indian stock market with Hong Kong stock market. *Asian Journal of Management Applications and Research, 6*(1), 58-63.

Tripathi, V., Seth, R., & Kumar, M. (2013, July- Sept.). Inter-linkages, co integration and global financial crises: India's Experience and Preparedness. *The Indian Journal of Commerce, 66*(3), 173-188. https://doi.org/10.2139/ssrn.2179896

Valdkhani, A., & Chancharat, S. (2008). Dynamic linkages between Thai and International Stock Markets. *Journal of Economic Studies, 35*(5), 425-441. https://doi.org/10.1108/01443580810903572

Vardhan, H., Sinha, P., & Vij, M. (2015). Behavior of Indian sectoral stock price indices in the post subprime crises period. *Journal of Advances in Management Research, 12*(1), 17. https://doi.org/10.1108/JAMR-10-2014-0061

Warne, D. P., & Kavita. (2018). Association of Indian stock market with developed stock markets: An Empirical Evidence. *Emperor International Journal of Finance and Management Research, IV,* 242-249.

Warne, D. P., & Suman. (2017). Integration of Indian stock market with selected global stock markets. *Indian Journal of Accounting, XLIX*(2), 59-68.

Warne, D. P., & Suman. (2018). Integration among south East Asian stock market. *Management of Financial Services*, 712-723.

Warne, D. P., & Suman. (2018). Interlinkages among stock markets of East Asia. *Assemblage*, 40-55.

Warne, D. P., & Suman. (2023). Integration among Selected Asian stock markets. *Review of Economics and Finance, 21*, 669-779.

Wong, W. K., Aggarwal, A., & Du, J. (2004). Financial Integration for Indian stock market: A Fractional Co-integration Approach. *Finance India*, *18*(4), 1581-1604.