# Financial Integration between Colombo Stock Exchange and Developed Stock Markets

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**Abstract:** Regional financial integration enables the attractiveness of that particular region to external investors. High financial integration limits the gains from international portfolio diversification, which encourages investors to focus on less integrated regions for their diversification purposes and the region would become more appealing to foreign investors.

This paper investigates the financial integration of the Colombo Stock Exchange with the seven developed stock markets, USA, UK, Japan, China, Hong Kong, Canada, and Germany for the seven years from 2010. The long-term relationships are tested by using Johansen's co integration test. Impulse response function analyses use to identify the short-term integration of the Colombo stock exchange with other developed stock markets.

Findings confirm both the long-term and short-term financial integration of the Colombo Stock Exchange with the seven developed stock markets. Hence international portfolio diversification in Colombo Stock Exchange for investors in the USA, UK, Japan, Hong Kong, Canada, and Germany will not be provided additional benefits. The existence of financial integration relationships generates some challenges for policymakers because it enhances the competitiveness and efficiency among regional and global stock markets. Policymakers should consider integration levels among countries to protect and recover their markets from shocks that arise in foreign countries.

Keywords: Financial integration, Johansen's co integration test, Colombo Stock Exchange, Developed stock markets

### 1. Introduction

The consequences of the global financial crisis in 2007-2008, proved to the world that there are no longer independent national stock markets and all stock markets are interrelated and interdependent to each other. It increased the interest of academic scholars, investors, portfolio managers, and policymakers towards the identification of financial integration among global economies. Two markets become perfectly integrated if investors can freely move from one market to another and if there are no arbitrage opportunity, which makes stock prices to be indifferent to both markets, (Jawadi and Arouri, 2008). When stock markets are highly integrated or have high correlations, investors do not receive any long-term extra gain through international portfolio diversification.

Stock market integration is a common research area for developed and emerging markets in the world but as a frontier market,CSE has received less attention in the empirical world also provided mixed results. Degree financial integration among financial markets measured based on price, news, and quantity. Consistent with most of the financial integration studies, the long-term and short-term financial integration of the Colombo Stock Exchange (CSE) with developed stock markets is tested based on stock prices, and employing Johannsen's Co integration test and impulse response function analysis. (See Bhunia (2017), Seth and Sharma (2015), Perera&Wickramanayake, (2012), Elyasiani, Perera, and Puri, (1998)). Though financial integration has been tested for developed and emerging markets in the world, the frontier markets such as CSE have been received less attention in the existing literature. For instance see Nashier (2015), Alvi and Chughtai (2014), Batareddy, Gopalaswamy and Huang (2012), and Singh (2010). As per the study conducted by Thomas, Kashiramka, and Yadav (2017)on financial integration among developed markets (Japan, Australia, Singapore, Hong Kong), emerging markets (China, India, Indonesia, South Korea, Malaysia, Philippines, Thailand, Taiwan) and frontier stock markets. This encourages investors to consider China and Thailand for their international portfolio diversification purposes. Results were further indicated that CSE does not financially integrate with both

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developed and emerging stock markets in the Asia Pacific region. However, in the long-term, stock prices in Bangladesh, India, and the CSE Granger-cause stock prices in Pakistan, and in the short-term, there is a unidirectional Granger causality running from stock prices in Pakistan to India, stock prices in CSE to India, and from stock prices in Pakistan to CSE, (Narayan, Smyth and Nandha, 2004). Also could see a significant correlation in stock returns and volatility and a high degree of regional integration between India, Pakistan, and Sri Lanka, (Kumar and Dhankar, 2017). However, the analysis of the integration of these frontier markets with developed and emerging markets does not provide adequate information for investors in developed stock markets to take their international portfolio diversification decisions. Further, a short-term analysis of financial integration among Asian frontier markets seems like the still untouched area in the existing literature. Hence, it is important to identify the financial integration relationship of the CSE with other developed stock markets because it indicates whether there are opportunities for investors in developed markets to diversify their investment portfolios by investing in CSE or not. The objective of this study is to contribute to the existing knowledge from two aspects. First, it identifies whether there are opportunities for investors in developed countries to diversify their investment portfolios in CSE or not by identifying long-term financial integration. Secondly, it assesses whether the CSE is susceptible to shocks arise in the developed stock markets and what are the reactions of CSE for them in the short-run by identifying short-term financial integration. This section has explained the background of the study. The rest of the paper is arranged as follows. The second section describes the data used and the methodology. The third section analyzes and discussion of the empirical results. Finally, the conclusion will be the fourth section.

#### 2. Statistical Method

This research investigates the long-term and short-term financial integration of CSE with developed stock markets. The Morgan Stanley Capital International (MSCI) market classification framework categorizes global stock markets as developed, emerging, and frontier markets. According to this classification, the CSE is categorized as a frontier market. Though there were 23 developed equity markets according to the MSCI market classification framework in the year 2017, this study used seven stock markets based on the criteria of highest market capitalization. As per Elyasiani, Perera, and Puri (1998) in stock markets, there are temporary stock price reactions which only observable through daily, weekly, and monthly closing stock prices. However, daily stock price data are more suitable compared to weekly and monthly prices because when investors make changes to their portfolio allocations, it immediately represents daily stock price changes, (Kim, et al., 2005). Hens daily closing stock prices were used to analyze integration relationships. Considering more recent periods for the integration analysis is more important for foreign investors to take their future portfolio diversification decisions, (Thomas, Kashiramka and Yadav, (2017), Alvi and Chughtai, (2014)). Hense 2082 observations and stock prices of each selected country in terms of their domestic currencies were collected for seven years starting from the year 2010. After tested the stationarity of each data series using the Augmented Dicky Fuller, Johansen's Co integration Test and impulse response function analyses were used to test the long-term and short-term integration relationships respectively between the CSE with other developed stock markets.

#### 3. Data Analyses and Discussion

Descriptive statistics of daily closing stock prices of CSE and other developed stock markets for the period of 1 January 2010 to 31 December 2017 are presented in Table 1.

### Table 1: Descriptive statistics

This table shows the descriptive statistics of daily closing stock price indices in natural logarithm form for each stock market. It includes mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera probability to describe the dataset. SL, USA, UK, JPN, CHN, CAN, HK CAN, and GER abbreviated Sri Lanka, United States of America, United Kingdom, Japan, China, Canada, Hong Kong, Canada, and Germany respectively.

	SL	USA	UK	JPN	CHN	HK	CAN	GER
Mean	8.73	8.24	8.74	9.52	7.90	10.02	9.51	9.06
Median	8.76	8.31	8.75	9.59	7.92	10.03	9.51	9.12
Maximum	8.96	8.85	8.95	10.04	8.55	10.31	9.69	9.51

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Minimum	8.15	7.65	8.48	9.01	7.58	9.70	9.31	8.53		
Std. Dev.	0.15	0.33	0.10	0.31	0.20	0.10	0.10	0.25		
Skewness	-1.50	-0.05	-0.15	-0.14	0.33	0.28	0.02	-0.10		
Kurtosis	5.52	1.74	2.16	1.52	2.61	3.20	1.74	1.79		
Jarque-Bera	1335.75	137.91	68.64	198.10	50.66	31.50	137.13	130.26		
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Observations	2085	2085	2085	2085	2085	2085	2085	2085		

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Source: Author compiled based data

As per Table 1, the summary statistics of each stock market show a similar pattern. During the sample period, Hong Kong represents the highest mean and median stock prices of 10.02 and 10.03 compared to the other stock markets. The standard deviation is higher for the USA (0.33) and Japan (0.31), while UK, Hong Kong, and Canada represent the lowest standard deviation of 0.10. This indicates that the stock prices of the USA and Japan have more variations than the stock prices in other markets. Regarding the measure of skewness stock markets of China, Hong Kong, and Canada exhibit a positive skewness or the right tail of the stock price distribution is longer implying that these three markets are very likely to have lower stock prices. On the other hand, Sri Lanka, the USA, UK, Japan and Germany exhibit a negative skewness or the left tail of the stock price distribution is longer indicating that these markets are more likely to have higher stock prices. The kurtosis values of Sri Lanka and Hong Kong are greater than 3, which means that the distribution of these markets is leptokurtic or produces more outliers than the normal distribution. USA, UK, Japan, China, Canada, and Germany exhibit the kurtosis is less than 3 indicating fewer or less extreme outliers than the normal distribution. The probability values of the Jarque-Bera test reject the null hypothesis of normal distribution at a 5% level of significance. This concludes that these stock price distributions are not normally distributed.

Figure 1 exhibits the movements of stock price indices of Sri Lanka, USA, UK, Japan, China, Hong Kong, Canada, and Germany for the period of 1 January 2010 to 31 December 2017



Figure 4.1: Trend Graphs stock price indices

As Figure 1 indicates, except for the Chinese stock market, every other stock market has an increasing trend over the period. The stock markets of the USA, Japan, and Germany have performed well because they show less fluctuations compared to the other stock markets. However, there are various fluctuations in stock price indices of Sri Lanka, the UK, China, Hong Kong, and Canada The Augmented Dicky-Fuller (ADF) has been used to test the stationarity. Table 2 demonstrates the results of the ADF test for daily closing stock price indices of each market in the form of a natural logarithm.

### Table 2: Results of Augmented Dickey-Fuller Test Results

This table shows the ADF test results for each stock market obtained using daily closing stock price indices data in natural logarithm form.

Country	At levels				First differ	rence		
	p-value	t-stat	c-value	conclusion	p-	t-stat	c-value	conclusion
		value			value	value		
SL	0.065	-3.304	-3.412	Non-stationary	0.000*	-11.747	-3.412	Stationary
USA	0.042*	-3.47	-3.412	Stationary	0.000*	-22.136	-3.412	Stationary
UK	0.032*	-3.573	-3.412	Stationary	0.000*	-18.088	-3.412	Stationary
JPN	0.351	-2.456	-3.412	Non-stationary	0.000*	-24.085	-3.412	Stationary
CHN	0.457	-2.256	-3.412	Non-stationary	0.000*	-8.511	-3.412	Stationary
HK	0.33	-2.496	-3.412	Non-stationary	0.000*	-44.876	-3.412	Stationary
CAN	0.287	-2.587	-3.412	Non-stationary	0.000*	-22.603	-3.412	Stationary
GER	0.137	-2.984	-3.412	Non-stationary	0.000*	-22.566	-3.412	Stationary

Source: Author compiled based on Eviews 8 ADF test results

As Table 2 indicates, except for the stock price indices of the USA and UK all other stock price indices are not stationary at levels, as the null hypothesis of non-stationary cannot be rejected at a 5% level of significance. However, all the time series become stationary when they are first differenced. Therefore, all the stock price indices are first-order integrated series and perform co integration analysis to examine the long-run relationship between CSE and other developed stock markets.

## 3.1: Long-run Co integration Test

As the first step, the long-term financial integration relationships between CSE with developed stock markets were tested using the Pair-wise Johansen and Juselius Co-integration test. Table 3 presents the results in terms of both trace and maximum eigenvalue statistics. In situations where trace statistics or maximum eigenvalues statistics are greater than the critical values, the null hypothesis of there is no co integration relationship will be rejected. As per Table 3, except for the SL- USA case, all other cases exhibit both trace and maximum eigenvalue statistics are greater than the critical values. In Sri Lanka and the USA case, maximum eigenvalue statistics are higher than the critical value even though the trace statistic lowers than the critical value by a little margin. These findings reveal the financial integration between CSE with developed stock markets.

## Table 3: Co integration Test Results

This table shows the pair-wise Johansen's Co integration test results obtained using daily closing stock price indices data in natural logarithm form.

Country	No. of	Trace test			Max. Eigen valu	ie test	
	hypothesized	Test stat	Crit. value	Prob.	Test stat	Crit.	Prob.
	CE(s)					value	
USA	None	14.986	15.495	0.059	14.945	14.265	0.039*
	At most 1	0.041	3.841	0.839	0.041	3.841	0.839
UK	None	17.943	15.495	0.021*	15.259	14.265	0.034*
	At most 1	2.684	3.841	0.101	2.684	3.841	0.101
JPN	None	15.791	15.495	0.045*	15.705	14.265	0.029*
	At most 1	0.086	3.841	0.769	0.086	3.841	0.769
CHN	None	22.050	15.495	0.004*	19.030	14.265	0.008*
	At most 1	3.019	3.841	0.082	3.019	3.841	0.082

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НК	None	22.289	15.495	0.004*	19.857	14.265	0.005*
	At most 1	2.433	3.841	0.118	2.433	3.841	0.119
CAN	None	19.452	15.495	0.012*	17.743	14.265	0.014*
	At most 1	1.709	3.841	0.191	1.709	3.841	0.191
GER	None	16.139	15.495	0.040*	15.606	14.265	0.030*
	At most 1	0.532	3.841	0.466	0.532	3.841	0.466

Source: Author compiled based Johansen's Co integration test results

In situations where trace statistics or maximum eigen-values statistics are greater than the critical values, the null hypothesis of there is no co integration relationship will be rejected. As per Table 3, except for the SL - USA case, all other cases exhibit both trace and maximum eigen-value statistics that are greater than the critical values. In Sri Lanka and the USA case, maximum eigen value statistics are higher than the critical value even though the trace statistic lower than the critical value by a little margin. Therefore, the pair-wise co integration test results conclude that there are long-term integration relationships between Sri Lanka and other developed stock markets. It indicates there are no potential benefits of international portfolio diversification in CSE for investors in the USA, UK, Japan, China, Hong Kong, Canada, and Germany. Because these integration relationships are due to a similar trend over time and they reach an equilibrium point in the long-run where there are no differences in stock price indices. These co integration results are similar to the results of Perera and Wickramanayake (2012) and Narayan,



Figure 4.2: Impulse Response Function Analysis graphs

Smyth, and Nandha (2004) who found financial integration relationships between CSE and other South Asian stock markets, however, this research significantly different from these previous studies because it considers the developed stock markets.

### 3.2: Impulse Response Function

The impulse response function displays the short-term relationships of time series data, especially beyond the sample period. This research uses the impulse response function to estimate the expected responses of CSE to the shocks (impulses) in other developed stock markets. Figure 2 presents the responses of price indices of CSE to one standard deviation shock in stock prices in other developed stock markets in graph format for 30 days.

Impulse response function for Sri Lanka to stock price shocks in the USA initially create a rise in Sri Lankan stock prices and then starts to gradually decline. A sri Lankan stock price immediately increase for shocks in UK stock price indices and then flattens out and decrease at a very low rate. The response of CSE to shocks in Japanese stock price indices exhibits a sudden decrease in stock price indices and then after 1-2 months, it starts to gradually increase. An impulse response function for Sri Lanka to stock price shocks in China initially create a rise in Sri Lankan stock prices and then flattens out. The reactions of Sri Lankan stock prices to shocks in stock price indices of Hong Kong and Canada exhibit a similar pattern. They initially increase at a higher rate and after 5-6 months tend to gradually decrease. Sri Lankan stock prices immediately increase for shocks in Germany stock price indices and after 6-7 months it flattens out.

Interdependence and dynamic linkages South Asian countries estimated by Narayan, et al., (2004). In this research, they use the impulse response function and find shocks to stock prices in Bangladesh and Pakistan have a positive effect (increase) on stock prices in Sri Lanka, while shocks to stock prices in India have a positive effect for the first 50 days and then have a negative effect (decrease). According to their findings stock prices in Sri Lanka respond to stock price shocks in Pakistan, Bangladesh, and India. This research expands the above finding by identifying that the Sri Lankan stock price indices respond not only to the shocks in stock price indices in regional stock markets but also to the developed stock markets.

## **3.3 Discussion**

According to the existing literature few researchers have to consider financial integration for frontier markets such as Sri Lanka, Bangladesh, and Vietnam. Therefore, this research intended to investigate the long-term financial integration of CSE with developed stock markets; USA, UK, Japan, China, Hong Kong, Canada, and Germany. Another distinctive feature of this study is it considers the short-term financial integration relationships between Sri Lanka and other developed stock markets as well. The advantage of an integrated market is it makes access easier for foreign capital markets and provides foreign capital at a low cost. But one of the main disadvantages is it reduces the potential benefits of international portfolio diversification in the long-run. Further, it makes stock markets more sensitive to a shock in another market importantly in crisis periods. Thus, this research aims to contribute to the existing body of knowledge from two aspects. First, it identifies whether there are opportunities for investors in developed countries to diversify their investment portfolios in CSE or not. Secondly to assess whether the CSE is susceptible to shocks arise in the developed stock markets and what are the reactions of CSE for them in the short-run. This study conducts Johansen's Co integration test and Impulse Response Function analysis to identify short-term and long-term integration relationships of CSE with developed stock markets respectively. The findings of Johansen's Co integration test indicate that the CSE has financial integration relationships with the USA, UK, Japan, China, Hong Kong, Canada, and Germany in the long-run. These integration relationships indicate selected variables in this case stock markets have a similar trend over time and they reach an equilibrium point in the long-run (Johansen, 1988).

The pair-wise co integration test results conclude that there are long-term integration relationships between Sri Lanka and other developed stock markets. It indicates that there are no potential benefits of international portfolio diversification in CSE for investors in the USA, UK, Japan, Hong Kong, Canada, and Germany. Because these integration relationships are due to a similar trend over time and they reach an equilibrium point in the long-run where there are no differences in stock price indices. This finding is somewhat contrasting to the findings of Elyasiani Perera and Puri (1998). They investigate the financial interdependence and dynamic linkages of the stock market of Sri Lanka and its major trading partners named the USA, India, Japan, South Korea, Hong Kong, and Singapore for the period of 1 January 1989 to 10 June 1994 and found that the impact of stock markets of trade partners on CSE is negligible. It also a highlight CSE behaves independently according to its internal factors and forces. But this finding is based on a data set that is beyond 1995 and this research considers the period of 2010-2017. Therefore, some different findings can observe in this study due to the new trends and developments in the

selected stock markets during this period. The findings of this research similar to the works done by Perera and Wickramanayake (2012) and Narayan, Smyth, and Nandha (2004) who found Financial integration relationships between CSE and other South Asian stock markets, however, this research significantly different from these previous studies because it considers the developed stock markets.

This research analyses the short-term relationships of CSE and developed stock markets using Impulse response function analysis. According to the findings of this analysis CSE immediately react to shocks (impulse) that arise in the USA, UK, Japan, China, Hong Kong, Canada, and Germany. The reactions of CSEs to shocks that arise in stock markets of the UK, Hong Kong, and Canada are more powerful and the response to the USA stock market is very low compared to other markets. According to Narayan, Smyth, and Nandha (2004)stock prices in Sri Lanka respond to stock price shocks in Pakistan, Bangladesh, and India. This study expands the above finding by identifying that the Sri Lankan stock price indices respond not only to the shocks in stock price indices in regional stock markets but also to the developed stock markets.

## 4. Conclusion

Based on the Co integration test and Impulse response function test, it is concluded that the CSE has both a longterm and short-term financial integration relationship with the selected developed stock markets. Hence, in the long-run, there are no potential international portfolio diversification opportunities for investors in developed stock markets in CSE. This means investors who willing to invest in Sri Lanka could only gain limited benefits in the future.

This financial integration information is important not only to investors but also to policymakers and regulators. The existence of financial integration relationships generates some challenges for policymakers because it enhances the competitiveness and efficiency among regional and global stock markets. Policymakers should consider integration levels among countries to protect and recover their markets from shocks that arise in foreign countries. On the other hand, advantages of integrated markets such as easy access to foreign markets and low-cost capital would receive only when there are relevant structural and institutional adjustments in their respective capital markets. Therefore, policymakers and regulators should take sufficient measures to improve the financial market, financial instruments, and infrastructure to get the maximum benefits of an integrated market.

This research uses daily closing stock price indices data to investigate the integration relationships and further research could use weekly, monthly closing stock indices data to identify the differences in findings due to the higher frequency data. Further can conductto identify the impacts of long-term short-term financial integration relationships on stock market efficiency. It will provide findings on how financial integration enhances CSE efficiency.

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