

Causal Relationship among the Emerging Asian Economies: An Exploration

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Abstract

The present paper explores the extent of causality among four emerging Asian economies. It aims at finding the causal linkages between the National Stock Exchange (NIFTY), Singapore Stock Exchange (SGX), Taiwan stock Exchange (TWII) and South Korea Stock Exchange (KS11). The data set span for a period of eleven years from April 2007 to March 2018. Using daily data for the sample, time series properties have been diagnosed using ADF Unit Root test. Moving forward with the analysis, the presence of any causal linkages among the markets have been investigated using the Granger Causality Test. The results of the pair-wise Granger causality test assert bi-directional linkage between 'National Stock Exchange (NIFTY) & Singapore Stock Exchange (SGX)', 'National Stock Exchange (NIFTY) & South Korea Stock Exchange (KS11)' and between 'Taiwan Stock Exchange (TWII) & South Korea Stock Exchange (KS11)'. A strong uni-directional relationship between 'National Stock Exchange (NIFTY) & Taiwan Stock Exchange (TWII)' and a weak uni-directional relationship between 'Singapore Stock Exchange (SGX) & South Korea Stock Exchange (KS11)' as well as between 'Singapore Stock Exchange (SGX) & Taiwan Stock Exchange (TWII)' is also found. Thus, it can be concluded that India and Singapore are the most influential exchange among all the markets and South Korea is moderately influential whereas Taiwan stock market does not report any significant influence on other market.

Keywords: Causal Relationship among the Emerging Asian Economies: An Exploration

Introduction

Market integration and market linkages has gained a considerable significance in the past decades as more and more economies liberated and deregulated their markets. Further, economic and financial turbulences across the globe also contributed to such importance. Once the multi-dimensional benefits of market integration were known, more and more markets made policy measures to gain from such integration. With the passage of time, more and more markets are integrated with each other which consequently made the financial markets globally more correlated and interdependent. [Bose & Mukherjee (2005), Joshi, Phylkites & Ravazallo (2004)]. Study of interdependence between markets is of utmost importance and use as policy makers and investors learn about the implications on the portfolio diversification.

Previous studies documented the increased cointegration among markets. Emerging Asian markets were also studied and are found to be integrated with both the global and the regional market. However, the extent and depth of the linkages vary depending upon the time in consideration and the method adopted. [Pagano (2007), Yang et. al. (2005), Nath & Verma (2003), Wong et. al. (2004), Park and Lee (2011)]. One of the interesting relationship aspect studied earlier is the direction of linkages i.e. which market

exerts stronger influence on the other market. In other words, it can be termed as the causal relationship among markets. Previous studies indicated that the Asian markets have causal linkages from the US markets and also among themselves to some considerable extent. [Yoshida (2010), Bekeart & Harvey (1997), Ng (2000), Bose & Mukherjee (2005), Palamalai et. al. (2013)].

The existence of long run relationship among markets is better understood when the market exerting greater influence is known. Merely, tracing the long run relationship does not give a clear picture of the interdependence. However, studying the causal linkages or informational linkages helps to better comprehend the lead lag relationship between markets. Whenever two markets are cointegrated, there must be a causal linkage in at least one direction. As the long run relationship has been studied in both the global and regional perspective, likewise causality relationships were also studied in both perspectives. In the global perspective, studies found that the US market exerts significant influence on other markets, however in some instances bi-directional linkages were also recorded. Studies examining the causal linkages between the US and the Asian markets found that mostly the US market had a highly influential uni directional linkages with the Asian markets. Conversely, some Asian markets also exerted significant influence on the US market. Yoshida (2010) found that the US market had a uni-direction effect on Hong Kong, the Philippines, and Singapore whereas the Taiwan market influenced the US market. Likewise, Bekeart & Harvey (1997), Ng (2000), Chen et. al. (2008) found a uni-directional affect running from the US market towards the Asian market.

In the regional perspective, active Asian markets like Singapore, South Korea, China and India were highly influential on other Asian markets. Nath & Verma (2003) examined linkages between the stock markets of India, Singapore and Taiwan and revealed that there exists a uni directional linkage from India and Singapore towards Taiwan market. Lamba (2004) studied the relationship between the US, the UK, Japan and Asian stock markets and found a uni directional linkage from the US, UK and Japan only towards India. Bose & Mukherjee (2005) examined long run relationship among the US, UK and Asian markets. The study revealed that Japan, Hong Kong, South Korea and Singapore affect the Indian market whereas the Indian market affects the Japan, South Korea and Taiwan market. Thereby indicating a bi-directional linkage between India, South Korea and Japan stock market. Das & Bhunia (2012) stated that the Indian Stock Market was highly influential and affects the South East Asian markets. Patel (2013) found a uni directional linkage running from Sri Lanka, South Korea, Singapore and China towards India and from India towards Pakistan. Srinivasan & Kalaivani (2013) studied the Asia pacific markets and found that India is influential in affecting Japan, Hong Kong, Taiwan, and South Korea markets. Palamalai et. al. (2014) examined the linkages between the emerging Asia pacific stock markets and revealed that China, Indonesia and Singapore affect India, whereas the Indian market affects Japan, Hong Kong, Taiwan, Indonesia, South Korea and Singapore. Thus, a bi-directional linkage exists between India, Indonesia and Singapore.

However, the causality and its directions among stock markets are conditional upon the informational linkages and span of time as such issues are highly vulnerable to informational efficiency and its dynamics. The present study is aimed at revisiting the issue of causality and its direction by considering four stock markets of South Asian region.

Objective

The present study examines the extent of causal relationship among the stock markets of the emerging Asian economies viz. India, Singapore, Taiwan and South Korea. As each stock market's linkages with

other markets varies extensively. This study explores the direction of any such causality among the selected stock exchanges.

Data

The study concentrates on investigating the dynamic causal relationship between the four emerging Asian economies namely, India, Taiwan, Singapore and South Korea. The study accommodated indices like CNX NIFTY representing National Stock Exchange, SGX representing Singapore Stock Exchange, TWII representing Taiwan Stock Exchange and KS11 representing South Korea Stock Exchange. The frequency of data has been kept on daily basis. The data set span for a period of eleven years from April 2007 to March 2018. The stock indices were collected from the official website of National Stock Exchange (NSE) of India-www.nseindia.com for India and for all other markets from the Yahoo Finance.

Methodology

Before proceeding with the application of the econometric models and measures for the empirical examination of any causal linkage among the stock markets of the four emerging Asian economies, the daily stock market data set for the study period from April 2007 to March 2018 is compiled and transformed into log return using the following formula:

$$R_t = \text{Log} (P_t / P_{t-1})$$

Testing the presence of unit root in the time series is important as most of the time, the data is not stationary and using a non-stationary data to forecast may lead to erroneous situations like spurious regression. Thus, to confirm the stationarity of the variables, ADF test have been applied. The ADF test examines the null hypothesis of presence of unit root or non-stationarity against an alternative of stationarity.

In order to understand the dynamic relationship among variables, more specifically to know whether one variable is useful in forecasting the other variable or not, Granger Causality test is applied. Granger proposed that if a pair of time series is cointegrated, then one time series must be useful in forecasting the other and thus there must be a causation in either direction. The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another. Finally, we formulate the regression equation for each set of variables to test the hypothesis. As the hypothesis are tested bi-directionally, to test each hypothesis two equations are formulated. In total six models are formulated with a pair of equation in each model.

Model 1: Tests the presence of causal linkages between National Stock Exchange (NIFTY) and Singapore Stock Exchange (SGX).

$$SGX_t = \alpha_0 + \sum_{i=1}^n \alpha_i NIFTY_{t-i} + \sum_{i=1}^n \beta_i SGX_{t-i} + \varepsilon_{t1}$$

$$NIFTY_t = \omega_0 + \sum_{i=1}^n \gamma_i SGX_{t-i} + \sum_{i=1}^n \theta_i NIFTY_{t-i} + \varepsilon_{t2}$$

Model 2: Tests the presence of causal linkages between National Stock Exchange (NIFTY) and Taiwan Stock Exchange (TWII).

$$TWII_t = \alpha_0 + \sum_{i=1}^n \alpha_i NIFTY_{t-i} + \sum_{i=1}^n \beta_i TWII_{t-i} + \varepsilon_{t1}$$

$$NIFTY_t = \omega_0 + \sum_{i=1}^n \gamma_i TWII_{t-i} + \sum_{i=1}^n \theta_i NIFTY_{t-i} + \varepsilon_{t2}$$

Model 3: Tests the presence of causal linkages between National Stock Exchange (NIFTY) and South Korea Stock Exchange (KS11).

$$KS11_t = \alpha_0 + \sum_{i=1}^n \alpha_i NIFTY_{t-i} + \sum_{i=1}^n \beta_i KS11_{t-i} + \varepsilon_{t1}$$

$$NIFTY_t = \omega_0 + \sum_{i=1}^n \gamma_i KS11_{t-i} + \sum_{i=1}^n \theta_i NIFTY_{t-i} + \varepsilon_{t2}$$

Model 4: Tests the presence of causal linkages between Singapore Stock Exchange (SGX) and Taiwan Stock Exchange (TWII).

$$TWII_t = \alpha_0 + \sum_{i=1}^n \alpha_i SGX_{t-i} + \sum_{i=1}^n \beta_i TWII_{t-i} + \varepsilon_{t1}$$

$$SGX_t = \omega_0 + \sum_{i=1}^n \gamma_i TWII_{t-i} + \sum_{i=1}^n \theta_i SGX_{t-i} + \varepsilon_{t2}$$

Model 5: Tests the presence of causal linkages between Singapore Stock Exchange (SGX) and South Korea Stock Exchange (KS11).

$$KS11_t = \alpha_0 + \sum_{i=1}^n \alpha_i SGX_{t-i} + \sum_{i=1}^n \beta_i KS11_{t-i} + \varepsilon_{t1}$$

$$SGX_t = \omega_0 + \sum_{i=1}^n \gamma_i KS11_{t-i} + \sum_{i=1}^n \theta_i SGX_{t-i} + \varepsilon_{t2}$$

Model 6: Tests the presence of causal linkages between Taiwan Stock Exchange (TWII) and South Korea Stock Exchange (KS11).

$$KS11_t = \alpha_0 + \sum_{i=1}^n \alpha_i TWII_{t-i} + \sum_{i=1}^n \beta_i KS11_{t-i} + \varepsilon_{t1}$$

$$TWII_t = \omega_0 + \sum_{i=1}^n \gamma_i KS11_{t-i} + \sum_{i=1}^n \theta_i TWII_{t-i} + \varepsilon_{t2}$$

Where, α_0 and ω_0 are constant, n signifies lag length and ε_i is the error term.

Empirical Findings

Based on the methodological framework, this section contains the empirical test results of the variables of study i.e., NIFTY, SGX, TWII and KS11. The analysis starts with the testing of basic unit root properties of the variables.

Table 1: Unit Root Test of CNX Nifty, SGX, KSII and TWII

Indices		Intercept		Trend & Intercept		Result
		Level	1 st Diff	Level	1 st Diff	
CNX NIFTY	<i>t- Statistics</i>	(2.261559)	(46.18381)	(2.740135)	(46.17435)	I(1)
	<i>P-Value</i>	0.6494	0.0001	0.2203	0.0000	
SGX	<i>t- Statistics</i>	(3.160239)	(46.62470)	(3.211113)	(46.61640)	I(0)
	<i>P-Value</i>	0.0226	0.0001	0.0824	0.0000	
KS11	<i>t- Statistics</i>	(2.048478)	(47.40971)	(2.855476)	(47.39996)	I(1)
	<i>P-Value</i>	0.2661	0.0001	0.1775	0.0000	
TWII	<i>t- Statistics</i>	(1.544200)	(47.07399)	(2.355989)	(47.07263)	I(1)
	<i>P-Value</i>	0.5111	0.0001	0.4028	0.0000	

Source: Computed

To confirm the stationarity of the variables, ADF test have been applied. The test has been conducted at level and at first difference and the results are documented in Table 1. The output of ADF test reveals that only the SGX (Singapore Stock Exchange) is stationary at level and all the other variables are non-stationary at level and stationary at first difference. Thus, these variables are integrated of different order i.e. SGX of order I (0), CNX NIFTY, KS11, and TWII of order I (1).

Further, Granger Causality Test has been applied on the available data from the four sample markets to investigate about the presence of any causal linkages among the markets and the results are documented in Table 2.

Table 2: Granger Causality Test (NIFTY, SGX, KS11, TWII)

Model		Null Hypothesis	F-Statistic	Probability	Result
1	H ₀₁	SGX does not cause NIFTY	5.94962	7.E-07	Reject Null Hypothesis
	H ₀₂	NIFTY does not cause SGX	2.74489	0.0077	Reject Null Hypothesis
2	H ₀₃	TWII does not cause NIFTY	2.60455	0.0741	Cannot reject Null Hypothesis
	H ₀₄	NIFTY does not cause TWII	50.3628	4.E-22	Reject Null Hypothesis
3	H ₀₅	KS11 does not cause NIFTY	5.67591	7.E-06	Reject Null Hypothesis
	H ₀₆	NIFTY does not cause KS11	13.7856	2.E-15	Reject Null Hypothesis
4	H ₀₇	TWII does not cause SGX	0.55197	0.7369	Cannot reject Null Hypothesis
	H ₀₈	SGX does not cause TWII	5.67332	3.E-05	Reject Null Hypothesis
5	H ₀₉	KS11 does not cause SGX	1.11089	0.3531	Cannot reject Null Hypothesis

	H ₀₁₀	SGX does not cause KS11	3.81077	0.0004	Reject Hypothesis	Null
6	H ₀₁₁	KS11 does not cause TWII	5.31332	7.E-05	Reject Hypothesis	Null
	H ₀₁₂	TWII does not cause KS11	3.52191	0.0036	Reject Hypothesis	Null

Source: Computed

The results of Granger Causality test suggest that all the markets are not equally influential on each other i.e. not every market is significant in predicting the future of other market. Some of them are influential whereas the others are not. Results also suggest that one market may have a causal linkage with one particular market but may not have any effect on any other market. The results of the pair-wise Granger causality test indicate that there exist a bi directional linkage between ‘National Stock Exchange (NIFTY) & Singapore Stock Exchange (SGX)’ with F-statistics of 5.94962 and 2.74489 respectively and the p-value is also significant. Results further suggest that Singapore Stock Exchange (SGX) is slightly more influential in this linkage.

Further, a bi-directional linkage is present between ‘National Stock Exchange (NIFTY) & South Korea Stock Exchange (KS11)’ with F-statistics 5.67591 and 13.7856 respectively and having significant p-value at 1 percent level of significance. Results further suggest that National Stock Exchange (NIFTY) is more influential in this set of linkage. A bi-directional linkage is also evident between ‘South Korea Stock Exchange (KS11)’ & Taiwan Stock Exchange (TWII)’ with F-statistics 5.31332 and 3.52191 respectively and having significant p-value at 1 percent level of significance. For ‘National Stock Exchange (CNX NIFTY) & Taiwan Stock Exchange (TWII)’, there exists strong unidirectional relationship having F-statistic of 50.3628 and statistically significant at 1 percent level of significance. However, for ‘Singapore Stock Exchange (SGX) & South Korea Stock Exchange (KS11)’ and ‘Singapore Stock Exchange (SGX) & Taiwan Stock Exchange (TWII)’, the results represent weak unidirectional relationship running from Singapore Stock Exchange (SGX) towards South Korea Stock Exchange (KS11) and Taiwan Stock Exchange (TWII).

Conclusion

The present paper explores the extent of causality among four emerging Asian economies. It aims at finding the causal linkages between the National Stock Exchange (NIFTY), Singapore Stock Exchange (SGX), Taiwan stock Exchange (TWII) and South Korea Stock Exchange (KS11). The data set span for a period of eleven years from April 2007 to March 2018. Using daily data for the sample, time series properties have been diagnosed using ADF Unit Root test. Moving forward with the analysis, the presence of any causal linkages among the markets have been investigated using the Granger Causality Test. The results of the pair-wise Granger causality test assert bi-directional linkage between ‘National Stock Exchange (NIFTY) & Singapore Stock Exchange (SGX)’, ‘National Stock Exchange (NIFTY) & South Korea Stock Exchange (KS11)’ and between ‘Taiwan Stock Exchange (TWII) & South Korea Stock Exchange (KS11)’. A strong uni-directional relationship between ‘National Stock Exchange (CNX NIFTY) & Taiwan Stock Exchange (TWII)’ and a weak uni-directional relationship between ‘Singapore Stock Exchange (SGX) & South Korea Stock Exchange (KS11)’ as well as between ‘Singapore Stock Exchange (SGX) & Taiwan Stock Exchange (TWII)’ is also found. Thus, it can be concluded that India

and Singapore are the most influential exchange among all the markets and South Korea is moderately influential whereas Taiwan stock market does not report any significant influence on other market.

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