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Return Spillovers and Market Integration: Assessing the Impact of Belt and Road Initiative in Emerging Asia

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ABSTRACT

This paper studied the return spillover dynamics among Asian emerging equity markets before and after Chinese Belt and Road Initiative (BRI) was launched. We used daily closing prices data from 2005-2023 of the representative national equity indices of 10 emerging Asian markets. The data sample is divided into pre-BRI and post-BRI periods for capturing structural changes. Using Spillover Index method based on Generalized Forecasted Error Variance Decomposition proposed by Diebold and Yilmaz (2012), we note that averaged dynamic return spillover is relatively stable as total return spillover index slightly decreased from 28.99 % in pre-BRI to 27.27% in post-BRI period. Malaysia, India and Philippine respectively dominate both the pre-BRI and post-BRI spillovers. Thailand and India consistently appeared as major receivers of return spillovers in both the period. The findings on one side highlight the changing role of BRI on regional stock market integration while on other bears important implications for policy coordination and portfolio management.

Keywords: *Belt and Road Initiative, Emerging Equity Markets, Generalized Forecast Error Variance Decomposition, Return Spillovers, Spillover Index.*

INTRODUCTION

Emerging markets have increasingly drawn attention of researchers due to their growing contribution to Global GDP and Increased financial integration. Particularly Asian emerging economies are primary destinations for investors and act as key shocks centers during turbulent periods. Return Spillovers- the transmission of stock markets return spillovers across different markets play important role in understanding how spillover shocks transmit from one market to the other, paving the way for market integration and contagion effect (Forbes & Rigobon, 2002).

The Belt and Road Initiative started by China in 2013 represent one of the most important project for connectivity and regional economic development in the history. Besides ensuring deeper economic ties, trade relations and infrastructural investments, BRI has an indirect effect on financial markets integration (Yu, Chen & Hu, 2021; Huang 2020). Despite enormous literature on spillover dynamics, little attention has been paid to comparative analysis of spillover among emerging Asian countries before and after BRI. This study tries to fill this gap by quantifying and comparing return spillovers in two distinct periods; Pre-BRI (2005-2012) and Post-BRI (2013-2023). This paper contributes to existing literature in three different ways. First it captures both crises driven and policy driven phases of Asian market integration.

Second, it identifies the major transmitters and receivers of return spillover shocks in the emerging Asia. Third, it provides guidelines to investors for portfolio management and regulators for policy coordination.

LITERATURE REVIEW

The study of spillovers among financial markets gained importance in the wake of major global crises. Preliminary studies of Kaminsky and Reinhart (2000) and Forbes and Rigobon (2002) focused on the amplification of spillover contagion during crises episodes. Bekaert and Harvey (2002) find out varying degrees of stock market integration attributable to capital flows and Investor's behaviors. Moreover, Phylaktis and Ravazzolo (2005) and Narayan *et al.* (2014) find out that cross-market linkages strengthen during Asian financial crises of 1997 and Global financial crises of 2008 respectively.

Studies conducted on Asian stock market integration report robust and diverse spillovers. Lee and Jeong (2016) came across strong co-movement among ASEAN markets. Aslam *et al.* (2023) found the increased influence of Chinese markets post 2008 crises. Likewise, Wu (2020) studied the rising interconnectedness among East Asian and South Asian markets. Patel (2022) found that diversification benefits decreases with increased regional market integration. Moreover, Baele (2005) and Kim and Ryu (2015) find out that policy-led initiative ASEAN +3, NAFTA and EU integration have a profound impact on changing return spillover dynamics. Research on Belt and Road Initiative mainly focus on infrastructural development and trade (Yang *et al.*, 2020) and Zou *et al.* (2022). Yang et al. (2025) found that BRI projects have a positive impact on investor's confidence and stock market linkages.

Similarly, Lu Gao and Huang (2019) found bilateral linkages of volatility spillovers between stock markets of China and all Belt and Road countries. Roni, Abbas and Wang (2018) examined the extent of interdependence and contagion using GARCH model. Moreover, Ali, Khan, and Shah, (2025) studies that Volatility Spillovers among Emerging Asian Stock Markets along Chinese Belt and Road Initiative. Huang (2024) used E-GARCH model to study return and volatility spillover dynamics and found moderate spillovers and no significant deviation from results noted in earlier periods. Ali, Khan and Shah (2025) analyzed return spillovers among emerging Asian stock markets and found moderate interdependence for an extended sample.

A number of studies examine windows around crises episodes, however ignored long term structural developments which are caused by policy initiatives. Despite growing attention, a direct comparison among return spillovers in emerging stock markets before and after BRI is still unexplored. Current study has tried to fill this gap by systematically comparing pre and post BRI return spillovers in emerging Asian countries.

DATA AND METHODOLOGY

We used closing prices of daily stock market indices of 10 emerging Asian countries along Belt and Road Initiative; Turkey (BIST), India (BSE), Sri Lanka (CSE), Malaysia (KLCI), Indonesia (JKSE), Pakistan (KSE), Philippine (PSEi), Thailand (SET), China (SHCOM), and Vietnam (VNI). These stock indices are widely accepted as benchmarks of national stock markets and are used in different research studies. The sample period ranges from May 2005 to December 2023. To assess the Belt and Road effect, the sample is further sub divided into pre-BRI period; May 2005 to August 2013 and post-BRI period; September 2013 to December 2023. For homogeneity in the time series the daily closing prices of equity indices are converted into return series through the following formula,

$$Rt = ln (Pi / Pi\text{-}1)$$

Where ***Rt*** shows returns**, *ln*** is natural log, ***Pi*** represent today's price and ***Pi-1*** shows lag price or previous day's price. Figure 1 and 2 shows the graphical presentation of daily returns for both the samples i.e pre-BRI and post-BRI of considered emerging stock markets along BRI.

We used Diebold and Yilmaz (2012) Spillover Index methodology for analysis and quantifying various measures of return spillovers. This method is based on Forecast Error Variance Decomposition providing results independent on ordering of variables. The framework decomposes forecast error variance into two components; own market or idiosyncratic shocks and cross market shocks. It gives separate measure for Total Spillovers, Directional Spillovers and Net Spillovers.

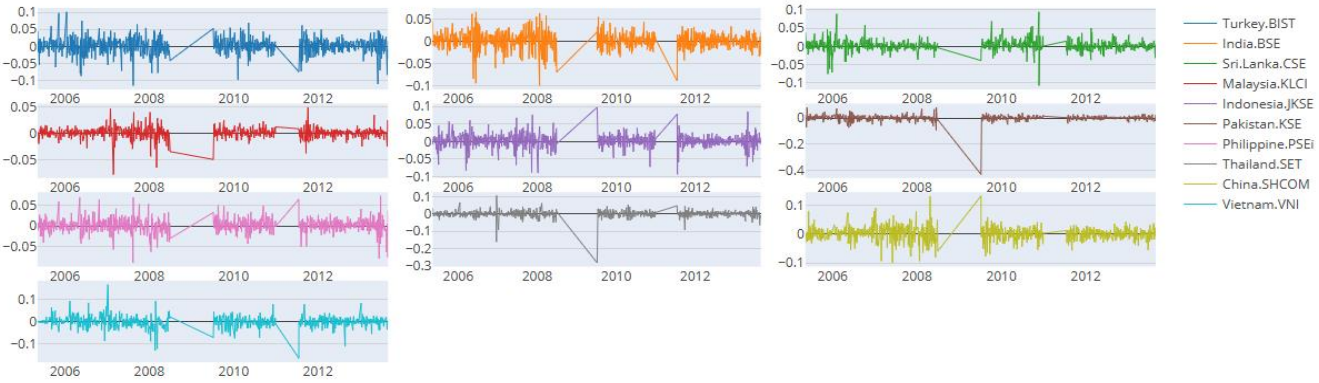

Figure 1 Graphs of Return Series of 10 Representative BRI Equity Markets during Pre-BRI Sample

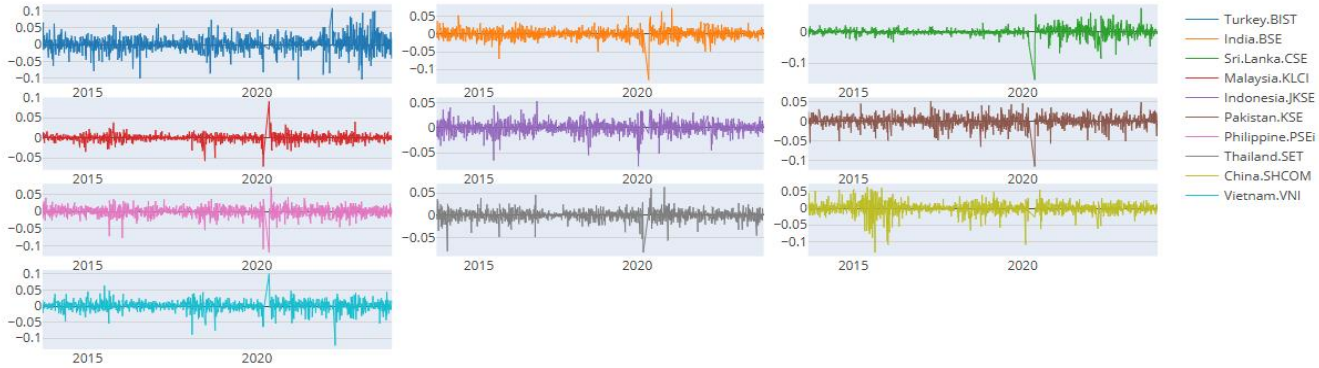

Figure 2 Graphs of Return Series of 10 Representative BRI Equity Markets during Post-BRI Sample

First of all, a pth order Vector Auto-regressive (VAR) model was estimated;

$$\mathbf{R}_t = \sum_{i=1}^{p} \mathbf{A}_i \mathbf{R}_{t-i} + \varepsilon_t$$

Where Rt represent the N×1 vector of returns series at time t, Ai are used for parameter matrices, and εt, the error tem is a vector of innovations. The generalized FEVD is not dependent on the ordering of variables and is written as as:

$$\theta_{ij}(H) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} \left(e_i' \Psi_h \Sigma e_j\right)^2}{\sum_{h=0}^{H-1} \left(e_i' \Psi_h \Sigma \Psi_h' e_i\right)}$$

Where Ψh denotes the moving average coefficients, Σ is the variance-covariance matrix of errors, and σjj is the standard deviation (SD) of the error term for variable j. The variance decompositions are normalized so that the sum across all sources of spillovers equals 100% for each market:

$$\tilde{\theta}_{ij}(H) = \frac{\theta_{ij}(H)}{\sum_{j=1}^{N} \theta_{ij}(H)} \times 100$$

The Total Spillover Index is written as:

$$TSI = \frac{\sum_{i,j=1, i \neq j}^{N} \tilde{\theta}_{ij}(H)}{N} \times 100$$

The return spillovers transmitted from stock market i to all other markets (TO), and received by market i from all others (FROM):

$$TO_i = \sum_{j=1, j \neq i}^{N} \tilde{\theta}_{ji}(H)$$

$$FROM_i = \sum_{j=1, j \neq i}^{N} \tilde{\theta}_{ij}(H)$$

The difference between return spillovers transmitted and received:

$$NET_i = TO_i - FROM_i$$

For capturing time varying nature of return spillovers, we used a rolling window of 200-days. Whereas static spillover tables provides a scalar quantity of total directional and net spillovers, dynamic connectedness helps in outlining how systematic linkages among markets changes over time or strengthen during crises periods. We also pictured the net directional return spillovers through network plots for actual interpretation. A network plot contains nodes and edges. Whereas nodes are dotes representing a particular stock market, the edges are arrows pointed towards nodes. The magnitude of the node and thickness of edge define the size of spillover being transmitted or received.

RESULTS AND DISCUSSION

Total Spillover Index

Table 1 and 2 shows results for average spillovers in pre-BRI and post-BRI periods respectively. Total Spillover Index slightly decreased from 28.99% pre-BRI to 27.27% post-BRI period. It portray that total spillovers did not intensified due to BRI effect. This suggest that BRI has only enhanced economic linkages, it played little role in magnifying return co-movement across regional stock markets.

Directional Spillovers (TO)

Malaysia, India and Philippine remained the major transmitters in both the periods with Malaysia (42.70) acting as top transmitter in pre BRI sample. Its leading role was replaced by India (43.34) in post BRI period. Sri Lanka appeared as least transmitter in both the periods. Figure 3 and 4 also confirms the results of table 1 and 2.

Directional Spillovers (FROM)

Thailand and India appeared as the top receivers in both the periods. Just like top transmitters in both the periods, these top receivers also exchanged leading roles. Figure 5 and 6 shows the same pattern of spillovers across the region in emerging Asia.

Table 1 Averaged Dynamic Spillover Table during pre-BRI Sample

	Turkey.BIST	India.BSE	Sri.Lanka.CSE	Malaysia.KLCI	Indonesia.JKSE	Pakistan.KSE	Philippine.PSEi	Thailand.SET	China.SHCOM	Vietnam.VNI	FROM
Turkey.BIST	63.28	11.29	1.74	5.44	2.04	2.30	5.96	2.10	2.73	3.11	36.72
India.BSE	10.26	63.68	1.52	6.68	1.55	2.22	4.85	2.56	3.01	3.66	36.32
Sri.Lanka.CSE	2.88	3.05	77.54	2.72	2.41	2.43	2.13	2.89	2.06	1.89	22.46
Malaysia.KLCI	2.32	2.22	2.17	73.27	2.12	4.68	5.07	2.71	2.23	3.21	26.73
Indonesia.JKSE	2.00	2.84	2.03	2.01	77.43	2.52	2.74	2.67	2.13	3.64	22.57
Pakistan.KSE	1.60	2.51	2.17	3.42	2.57	74.79	2.43	5.78	1.99	2.74	25.21
Philippine.PSEi	3.32	3.39	2.10	9.68	2.50	2.89	68.10	2.73	2.35	2.94	31.90
Thailand.SET	4.84	6.17	3.09	4.73	1.59	5.54	5.57	62.70	3.47	2.32	37.30
China.SHCOM	3.10	3.49	1.58	4.73	1.96	2.88	3.69	2.59	72.98	3.02	27.02
Vietnam.VNI	2.56	3.56	2.02	3.29	2.47	2.23	2.12	2.48	2.89	76.38	23.62
TO	32.88	38.51	18.42	42.70	19.21	27.70	34.56	26.51	22.87	26.52	289.87
Inc.Own	96.16	102.18	95.96	115.96	96.64	102.49	102.66	89.20	95.85	102.90	cTCI/TCI
NET	-3.84	2.18	-4.04	15.96	-3.36	2.49	2.66	-10.80	-4.15	2.90	32.21/28.99
NPT	3.00	6.00	2.00	7.00	4.00	5.00	6.00	3.00	3.00	6.00	

Table 2 Averaged Dynamic Spillover Table during post-BRI Sample

	Turkey.BIST	India.BSE	Sri.Lanka.CSE	Malaysia.KLCI	Indonesia.JKSE	Pakistan.KSE	Philippine.PSEi	Thailand.SET	China.SHCOM	Vietnam.VNI	FROM
Turkey.BIST	75.10	6.96	1.21	3.33	1.92	1.17	3.72	2.46	1.94	2.18	24.90
India.BSE	6.19	63.36	1.49	4.88	3.46	1.76	6.48	4.46	3.69	4.23	36.64
Sri.Lanka.CSE	2.12	2.10	79.47	2.86	1.27	1.86	2.51	2.01	2.38	3.41	20.53
Malaysia.KLCI	2.26	3.28	1.28	72.86	2.44	2.24	3.06	3.30	2.21	7.07	27.14
Indonesia.JKSE	2.12	4.43	1.24	2.74	79.74	1.34	1.82	2.98	1.67	1.93	20.26
Pakistan.KSE	1.16	3.00	1.64	3.29	1.28	79.63	2.51	2.24	2.61	2.65	20.37
Philippine.PSEi	3.40	7.57	1.41	5.06	2.39	1.90	67.75	3.98	3.18	3.37	32.25
Thailand.SET	4.32	7.99	2.01	4.03	3.22	1.63	5.98	63.84	3.78	3.20	36.16
China.SHCOM	2.03	4.45	2.43	3.27	1.64	2.60	3.41	3.51	72.46	4.21	27.54
Vietnam.VNI	1.81	3.57	1.92	7.55	1.69	3.05	2.94	2.27	2.11	73.08	26.92
TO	25.40	43.34	14.63	37.02	19.30	17.54	32.42	27.21	23.58	32.26	272.70
Inc.Own	100.50	106.70	94.11	109.88	99.05	97.17	100.17	91.05	96.04	105.34	cTCI/TCI
NET	0.50	6.70	-5.89	9.88	-0.95	-2.83	0.17	-8.95	-3.96	5.34	30.30/27.27
NPT	4.00	7.00	1.00	9.00	3.00	4.00	5.00	2.00	3.00	7.00	

Net Spillovers

Malaysian equity market maintains the influence throughout the region and appeared as top net transmitter in both the samples. While Thailand exerting least influence appeared consistently as top net receiver in pre and post BRI samples. Findings suggest that no leading structural shift has been seen in regional spillover dynamics with the onset of Belt and Road Initiatives. Our results are consistent with findings of Huang (2024) that return spillover did not deviated from those observed before 2013 level. Return Spillover network plots for both the periods are given in figure 7. These plots are calculated on the basis of net spillovers measures and help to see markets visually as dominant transmitters and receivers.

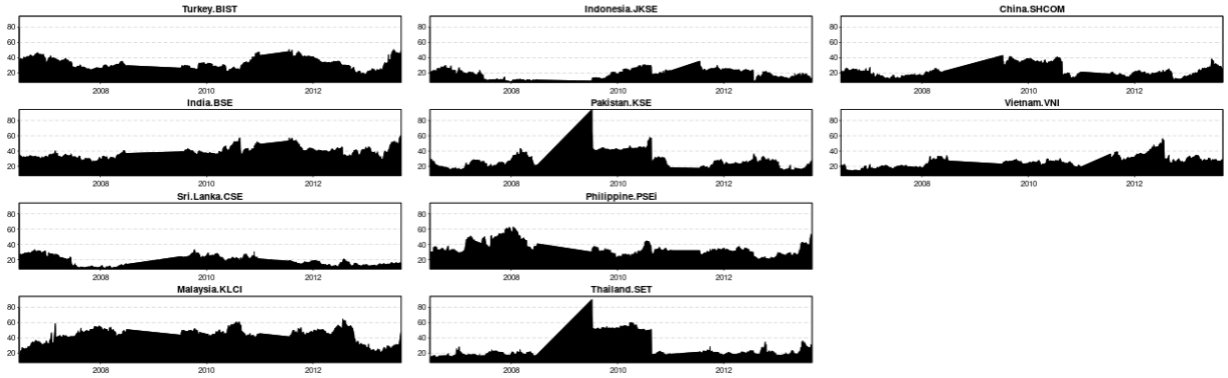

Figure 3 Directional Spillovers (TO) during pre-BRI sample

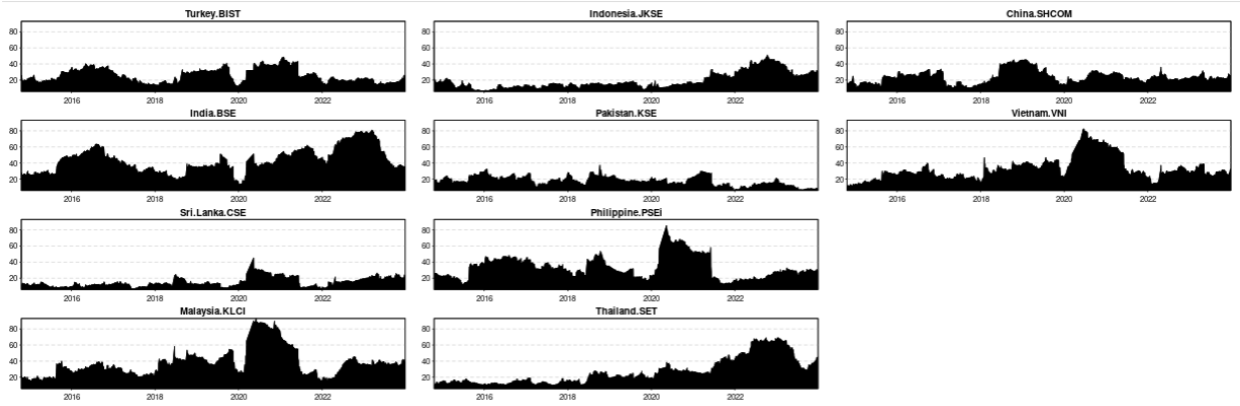

Figure 4 Directional Spillovers (TO) during post-BRI Sample

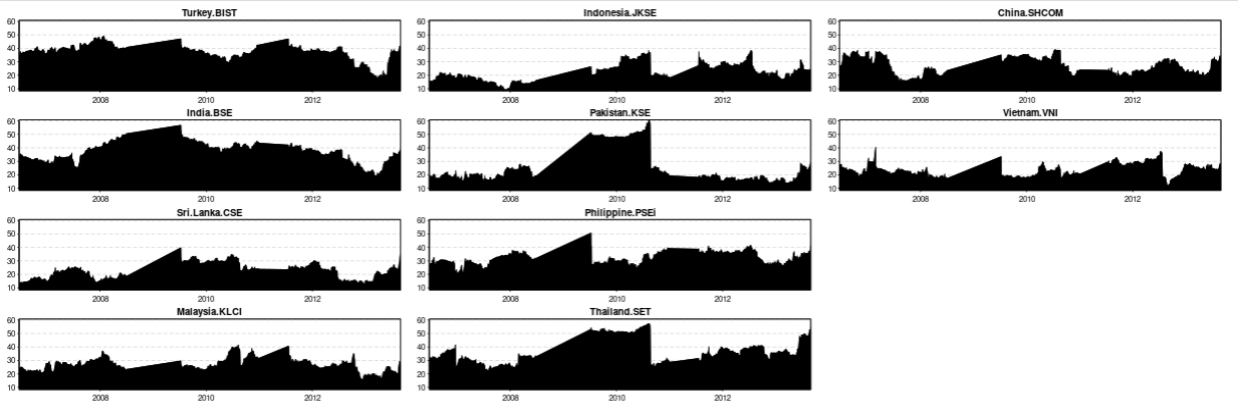

Figure 5 Directional Spillovers (FROM) during pre-BRI Sample

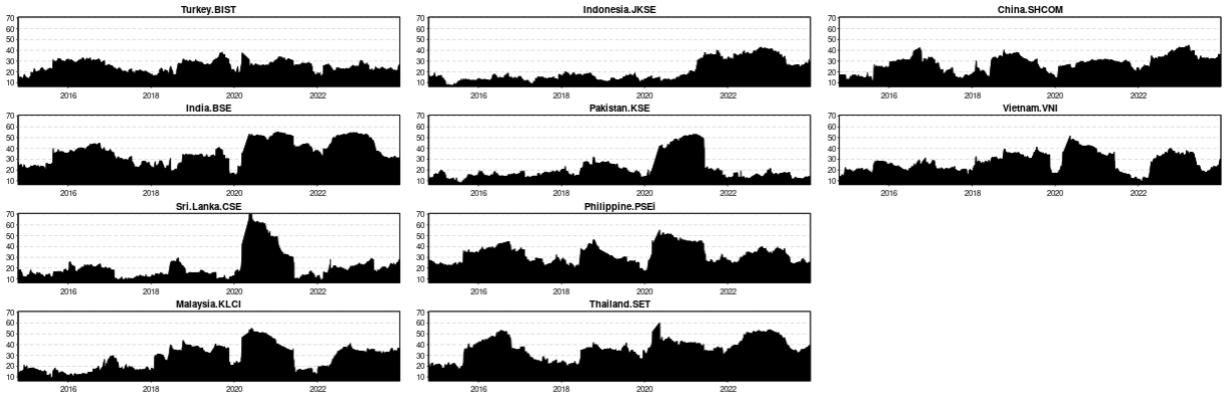

Figure 6 Directional Spillovers (FROM) during post-BRI Sample

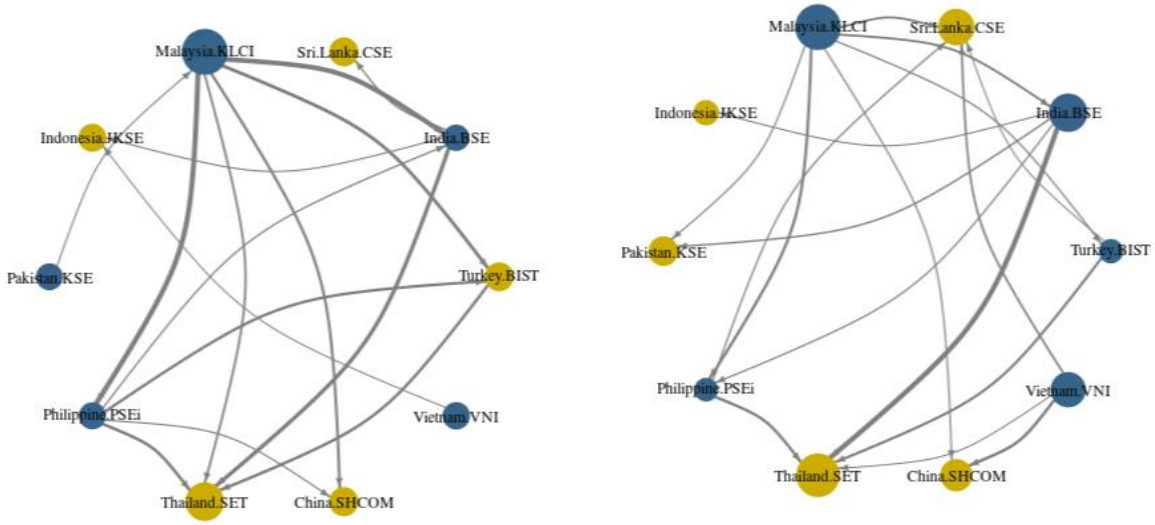

Figure 7 Return Spillover Network plot during pre and post BRI Samples

CONCLUSION AND POLICY IMPLICATIONS

The study investigated various dynamics of return spillovers among 10 emerging Asian stock markets for a period of 18 years from 2005-2023 focusing on the structural developments associated with Chinese Belt and Road Initiative 2013. Using the spillover index methodology proposed by Diebold and Yilmaz (2012) based on forecast error variance decomposition, the analysis discovered that total spillovers among considered markets is relatively stable in both the pre- BRI and post-BRI sample. On directional spillover front, Malaysia, India and Philippine appeared as major contributors of return spillover transmissions. In pre-BRI sample Malaysia acted as leading transmitter while in post-BRI sample India became leader in shock transmission across the region. Besides transmitter position, Indian stock market appeared as major receiver of return spillovers along-with Thailand in both the periods.

Findings of the study present significant implication to both investors and policy makers of emerging Asia. Diversification benefits are available to investors due to stable return spillover structure in BRI emerging markets. Policy makers in these economies are advised to oversee the cross border risk more effectively as spillover dynamics may strengthen overtime. Future researchers may extend the analysis to volatility spillovers, frequency-domain interconnectivity and cross market contagion during recent shocks like Covid-19 pandemic and trade tensions between US and its major Asian partners.

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