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Return Spillovers among Emerging Asian Stock Markets along the Belt and Road Initiative: Evidence from 2005-2023

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Abstract
This study investigated the magnitude and directions of return spillovers among 10 emerging Asian equity markets along Belt and Road Initiative from 2005–2023. We measured total, directional, and net Spillovers across these markets by applying Diebold and Yilmaz (2012) spillover index framework on daily stock index returns. The results show significant return interdependence, with substantial time varying fluctuations, particularly during major world crises like Global Financial Crises of 2008 and COVID-19 pandemic. The findings demonstrate that Indian BSE and Malaysian KLCI are net transmitters of return spillovers as they transmit more shock than they receive. Thailand's SET, Sri Lanka's CSE and Pakistan's KSE largely function as net recipients of return shocks. This study is helpful in understanding regional financial integration among emerging markets along Chinese Belt and Road initiative. It also provides valuable insights in order to facilitate efficient portfolio diversification strategies and policy formulation in emerging Asian countries.

Keywords: *Belt and Road Initiative, Covid-19 Pandemic, Global Financial Crises, Return Spillovers, Stock Markets.*

1. Introduction

Financial reforms, information and communication technology, and significant cross-border capital movement have all contributed to the increased integration of financial markets in this global age. Both developed and emerging economies' stock markets are significantly impacted by these trends. Furthermore, financial markets are now more closely connected as a result of economic globalization. Return spillovers can be used to understand the connections between financial markets (Yousaf & Hassan, 2019). According to Didier et al. (2012), spillover occurs when a country's shocks or policy changes have a major effect on another. During times of economic instability, spillovers became stronger and more noticeable, which reduced the advantages of international portfolio diversification. Technological advancements have

exacerbated this effect, making foreign information easily accessible to local investors (Yarovaya et al., 2016).

Financial development determines the extent of interdependence and spillover among financial markets. Links and spillovers exhibit distinct behaviors when financial development differs from country to country (Baumohl et al., 2018). In this sense, developed countries are more interconnected than underdeveloped countries. As investors in mature financial markets earn steady but constant returns, diversity loses appeal as a result of increased financial integration. Investors and portfolio managers in such markets are eager to investigate new financial markets where they might earn the highest returns (Phylaktis & Ravazzolo, 2005). Investors from developed markets may include developing market companies in their portfolios to take advantage of international diversity if there are little linkages between developed and emerging markets.

Numerous studies demonstrate that during times of unrest and market crises, spillover becomes more intense (Yousaf & Hassan, 2019). Accordingly, the majority of research shows how financial crises affect the co-movement of financial markets (Mollah et al., 2016). Contagion is the term used to describe market co-movement or integration during or following crises (Karolyi, 2003). In its original use, the term "contagion" was used in medical field; it refers to the spread of any disease. Contagion is characterized by Claessens and Forbes (2001) as a notable growth in cross-market connections during times of crisis. Return spillover, or the spread and transmission of negative shocks from one financial market to other financial markets in other nations, is a phenomenon brought on by financial crises (Gamba-Santamaria et al., 2017).

Belt and Road Initiative has positive impact on the economic progress of member countries. It is clear from the rise in international trade and the creation of jobs. According to the BRI's official website, 244,000 new jobs were generated and trade between member nations exceeded $6 trillion USD. Serious stock market shocks are caused by this rise in international collaboration (Geng & Guo, 2021; Hajilee & Chen, 2019). According to Huang et al. (2021) and Lu et al. (2019) Stronger trade relations between BRI nations result in greater financial market integration. Numerous sectors of the domestic economy are affected by this increase in spillover transmission. It has important ramifications for both foreign and local investors who invest in these markets to diversify their portfolios. Moreover, the COVID-19 pandemic has a significant impact on return spillover in financial markets. Aslam et al. (2021), Ali, Alam, and Rizvi (2020), and Ali et al. (2020) claim that, in contrast to the previous 10 years, spillover in a variety of markets peaked during COVID-19. There is, however, still little evidence explicitly addressing the return connectivity between Asian economies connected by the BRI. By offering a thorough empirical evaluation of return spillovers across chosen emerging Asian equities markets over an 18-year period, this study seeks to address this gap. The purpose of this research is to investigate the magnitude and direction of return spillovers among developing Asian stock markets connected to the Belt and Road Initiative. Main objectives of the study are: to determine the net spillover roles of individual markets as either net transmitters or net recipients, to measure the directional spillovers transmitted and received by each market, to quantify the total spillover index reflecting the overall interdependence among the selected markets, to analyze the time-

varying nature of return connectedness, especially during major financial crises, and to make policy and investment implications regarding regional financial integration and systemic risk.

2. Literature Review

Particularly in light of globalization and regional economic projects like the Belt and Road Initiative (BRI), the research on return spillovers among global equity markets has emerged as an important field of empirical finance. The influence of liberalization measures and cross-border capital flows on stock market correlations was the main focus of early research on emerging market integration. According to research by Bekaert and Harvey (1997), financial deregulation made emerging equities markets more volatile and co-moving, underscoring their susceptibility to outside shocks.

Engle *et al.* (2012) modeled spillovers before, during and after Asian Currency Crises in 8 equity markets of east Asian countries. Similarly, Neaime (2012) explored the dynamics of inter-regional financial linkages and associations between MENA stock markets and their connectivity with developed markets during global financial crises of the 2008. Furthermore, Graham *et al.* (2013) showed that stock markets of MENA region are modestly integrated with US stock market as modest degree of co-movement was observed at higher frequencies. In the same manner, Bekiros (2014) explored that US, Eurozone and BRICS equity markets showed greater international integration during the US and Eurozone crises. Syriopoulos *et al.* (2015) exhibited the presence of shocks, Asymmetric dependencies and volatility transmission between US and BRICS markets. Hsu and Chien (2021) examined the effect of BRI on integration between international financial markets. Li, Karim, Khalid and Zaidi (2022) used a Panel Vector Auto regression model and found that Chinese stock market shocks were positively affecting macroeconomic variables of BRI member countries.

According to empirical research, returns of individual securities fluctuate in tandem with market returns (Alhenawi, Elkhal & Li, 2022). Securities from financial markets that are not well integrated in terms of return spillovers should be taken into account by investors (Jouini, 2013). Badhani (2009) discovered that the advantages of diversity are diminished when return spillover between global markets rise. Bugan, Cevik, and Dibooglu (2022) studied the advantages of low correlation between developed and emerging markets for portfolio diversification.

The transmission of return spillover among established financial markets has been studied by scholars such as Elghini and Saidi (2015), Hemche et al. (2016), and Zeng et al. (2021). Similarly, other researches like Chow (2017), Hung (2019) and Hsu & Chien (2022) concentrated on the spillover from established to emerging markets. A comprehensive review of pertinent literature revealed that little attention had been paid to return spillovers from emerging economies to other emerging markets (Tian, Lai, and Wong, 2022).

3. Data and Methodology

This study has used Diebold and Yilmaz (2012) Spillover Index method to measure different dynamic of spillovers transmission among prominent Asian emerging stock markets along Chinese Belt and Road Initiative between 2005 and 2023. This model characterize 3 main steps; preparation of data, estimating the model and computation of spillover measures. For this purpose secondary time series data on representative stock indices of following 10 countries i.e Turkey (BIST), India (BSE), Sri Lanka (CSE), Malaysia (KLCI), Indonesia (JKSE), Pakistan (PSX),

Philippine (PSEi), Thailand (SET), China (SHCOM) and Vietnam (VNI) were taken from the website of Investing.com, Federal Reserve Economic Data (FRED) and Wall street Journal. The data period ranges from May 11, 2005 to December 12, 2023 and totaled to 2989 observations. All the estimations are carried out in R combined with Gabauer and Gabauer (2022) connectedness platform. All price series were converted into continuously compounded daily returns, computed as:

Rt = ln (Pi / Pi-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 shows the graphical presentation of daily return series of 10 national stock indices of emerging Asian countries along BRI covering Turkey, India, Sri Lana, Malaysia, Indonesia, Pakistan, Philippine, Thailand, China and Vietnam approximately for the period 2005 to 2023. The plotted return series of considered stock markets provide sufficient evidence of the presence of Stationarity which is commonly observed in financial return data.

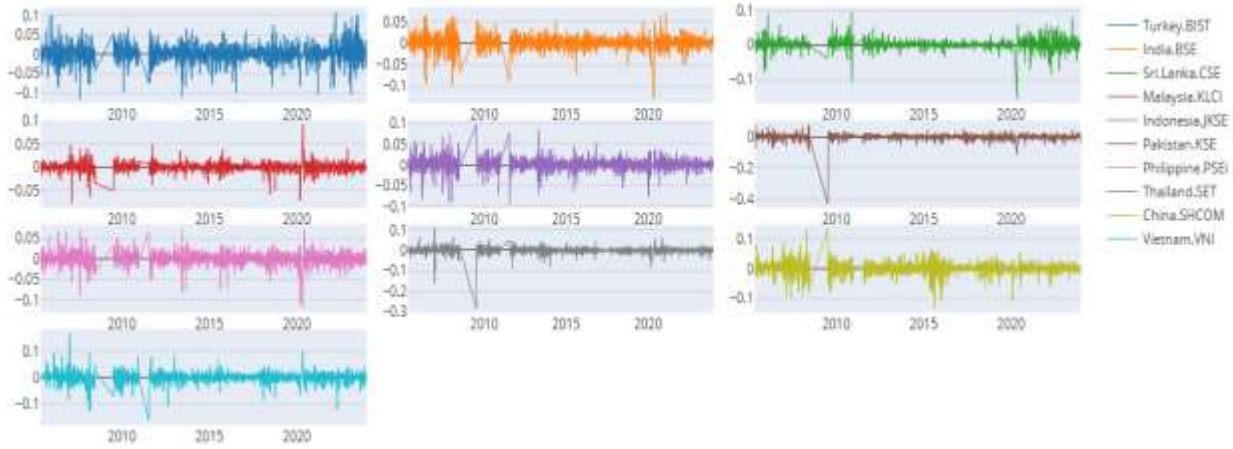

Figure 1 Graphs of the Return Series of Emerging Asian Stock Markets along BRI for the period 2005 to 2023

The summary statistics of returns of all considered stock indices are given in table 1. The average returns for Turkish stock market is highest, followed by Indian and Pakistani stock markets in full sample period. Malaysian Stock market exhibits lowest average returns followed by Thailand and China. Turkish stock market is a viable option for return sensitive investors and portfolio managers. However, if we look at the standard deviation of returns, Turkish stock markets again exhibit the highest share, followed by Chinese and Vietnamese stock markets. Turkish stock is not attractive to risk sensitive investors. Malaysian Stock market shows the lowest volatility of average returns. Moreover on both fronts, Malaysian Stock represents the lowest return as well as risk characteristics as compare to other markets. Vietnam stock market reaches highest peaks on maximum front followed by Chinese stock market. While Pakistan stock market reaches the lowest on it minimum return value. Skewness is negative for all stock markets while Kurtosis is highest for Pakistan stock market.

Table 1 Descriptive Statistics of Log Returns of 10 Emerging BRI Stock Markets from 2005-23

	Turkey BIST	India BSE	Sri Lanka CSE	Malaysia KLCI	Indonesia JKSE	Pakistan KSE	Philippine PSEi	Thailand SET	China SHCOM	Vietnam VNI
Mean	0.0012	0.0008	0.0006	0.0002	0.0006	0.0007	0.0004	0.0003	0.0003	0.0005
Standard Deviation	0.0197	0.0138	0.0126	0.0084	0.0134	0.0158	0.0132	0.0133	0.0178	0.0171
Kurtosis	4.6670	8.0470	16.9932	14.4435	8.2011	189.3089	7.9858	79.7716	7.6152	11.9549
Skewness	-0.339	-0.732	-0.8124	-0.5597	-0.5886	-7.1752	-0.6914	-3.9772	-0.5074	-0.5632
Minimum	-0.114	-0.129	-0.1536	-0.0779	-0.0930	-0.4315	-0.1191	-0.2831	-0.1324	-0.1636
Maximum	0.1085	0.0731	0.0945	0.0916	0.0972	0.0825	0.0720	0.1058	0.1323	0.1670
Count	2989.0	2989.0	2989.0	2989.0	2989.0	2989.0	2989.0	2989.0	2989.0	2989.0

Source: Compiled by Author

VAR Model and Forecast Error Variance Decomposition

To quantify spillovers, a vector Autoregression (VAR) model of order p was estimated:

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

Where Rt is the N×1 vector of returns at time t, Ai are parameter matrices, and εt is a vector of innovations. Following Diebold and Yilmaz (2012), the generalized forecast error variance decomposition (FEVD) was computed to capture the proportion of the H-step-ahead forecast error variance of each variable attributable to shocks in all other variables in the system. The generalized FEVD is invariant to the ordering of variables and defined as:

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

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

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

Three key spillover measures were computed:

1. **Total Spillover Index (TSI)**: The overall degree of return connectedness in the system:

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

2. **Directional Spillover Measures**: The spillovers transmitted from market i to all other markets (TO), and received by market i from all others (FROM):

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

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

3. **Net Spillover (NET)**: The difference between spillovers transmitted and received:

$$NET_i = TO_i - FROM_i$$

Rolling Window Estimation

To capture time-varying dynamics, the connectedness measures were estimated using a rolling window approach with a window length of 200 observations and forecast horizon H=10 days. This allowed examination of how spillovers evolved during major episodes, including the 2008 global financial crisis and the COVID-19 pandemic.

4. Results and Discussion

This section presents and interprets the empirical results of the return spillover analysis among emerging Asian stock markets over the period 2005–2023. Table 2 summarizes the spillover matrix, including the pairwise directional spillovers, total spillovers transmitted and received by each market, and net spillover measures.

Table 2 Averaged Dynamic Connectedness Table (Return Spillovers among Emerging Asian Stock Markets along BRI during period May 2005 – December 2023)

	Turkey.BIST	India.BSE	Sri.Lanka.CSE	Malaysia.KLCI	Indonesia.JKSE	Pakistan.KSE	Philippine.PSEi	Thailand.SET	China.SHCOM	Vietnam.VNI	FROM
Turkey.BIST	67.88	8.51	1.63	5.16	2.26	1.95	4.56	2.56	2.32	3.16	32.12
India.BSE	7.70	61.84	1.62	6.12	2.83	2.17	5.91	3.96	3.56	4.28	38.16
Sri.Lanka.CSE	2.69	2.62	75.12	3.25	2.10	2.45	2.72	2.66	2.64	3.75	24.88
Malaysia.KLCI	2.69	3.06	1.99	71.42	2.53	3.46	3.67	3.17	2.29	5.72	28.58
Indonesia.JKSE	2.18	3.84	1.74	2.76	76.75	2.07	2.54	2.92	2.03	3.17	23.25
Pakistan.KSE	1.79	3.09	2.34	3.25	2.13	75.56	2.68	3.64	2.67	2.85	24.44
Philippine.PSEi	3.44	5.92	1.90	8.19	2.66	2.61	64.59	3.75	2.94	4.01	35.41
Thailand.SET	4.93	7.31	2.80	5.15	2.85	3.18	5.96	60.82	3.68	3.32	39.18
China.SHCOM	2.77	4.19	2.51	4.25	2.14	2.85	3.21	3.27	70.27	4.54	29.73
Vietnam.VNI	2.40	3.98	2.19	5.88	2.29	2.68	2.98	2.52	2.47	72.61	27.39
TO	30.58	42.52	18.72	44.02	21.79	23.42	34.24	28.46	24.60	34.80	303.14
Inc.Own	98.47	104.36	93.84	115.44	98.54	98.97	98.83	89.28	94.87	107.41	cTCI/TCI
NET	-1.53	4.36	-6.16	15.44	-1.46	-1.03	-1.17	-10.72	-5.13	7.41	33.68/30.31
NPT	3.00	7.00	1.00	8.00	5.00	4.00	5.00	2.00	2.00	8.00	

Total Spillover Index

With an estimated Total Spillover Index (TSI) of 30.31%, cross-market shocks account for over one-third of the forecast error variance in these markets' returns. This level of spillover is in line with earlier research of Diebold & Yilmaz (2012) and Khan *et al*. (2023) showing that emerging economies have moderate to high return connectivity. Given that shocks in one market can spread extensively to others, the comparatively moderate to high interdependence emphasizes the significance of keeping an eye on regional transmission pathways.

Directional Spillovers Transmitted (TO) and Received (FROM)

Markets that served as net sources or recipients of return shocks can be inferred from the directional spillover measures. Return spillovers to others are highest in the Malaysian stock market (TO = 44.02%), closely followed by the Indian market (42.52%) and the Philippine market (34.24%). These results imply that markets with greater size and liquidity typically have a leading role in disseminating shocks and information. On the other hand, because of their smaller size and less connectivity into regional financial networks, markets like the Indonesian JKSE and Sri Lanka's CSE show lesser spillovers communicated (TO = 21.79% and 18.72%, respectively).

Thailand (39.18%) and India (38.16%) are the receiving markets most impacted by external shocks (highest FROM). The high FROM values for Thailand and India demonstrate their dual function as both senders and recipients of spillovers, a feature frequently seen in hub markets with high trading volumes and cross-border connections.

Net Spillovers

The disparity in the direction of return transmission is further revealed by net spillover measurements. India's BSE is a net transmitter of return shocks to other regional markets, as seen by its positive net spillover (NET = +4.36). Similarly, Malaysia's KLCI highlights its impact on regional price discovery by recording the top net transmitter role (NET = +15.44). On the other hand, Thailand’s equity market appeared as top net receiver of the return spillover shocks of -10.72 followed by Sri Lanka’s CSE and Pakistan’s KSE with negative NET values of -6.16 and -1.03, respectively. These trends support the theoretical prediction that external shocks from larger economies are more likely to affect smaller, less liquid markets.

Market-Specific Interpretation

India stands out as a key node in the network of regional connectivity due to its large TO and FROM spillovers. Its function as a net transmitter implies that changes in the Indian stock market have a big impact on nearby markets. In line with its status as a regional financial center and its significant involvement in investment flows linked to the Belt and Road Initiative, the Malaysian market exhibits robust spillover effects in both directions. Highlighting its relative isolation and reliance on external shocks, Sri Lanka has the lowest TO and a negative net spillover. Thailand shows significant FROM spillovers, demonstrating a keen awareness of both local and international events. The country mostly receives spillovers, indicating little outbound influence on nearby markets. The Chinese market plays a considerable yet intricate role in regional return dynamics, as seen by the significant return spillovers received (FROM = 29.73%) and transmitted (TO = 24.80%).

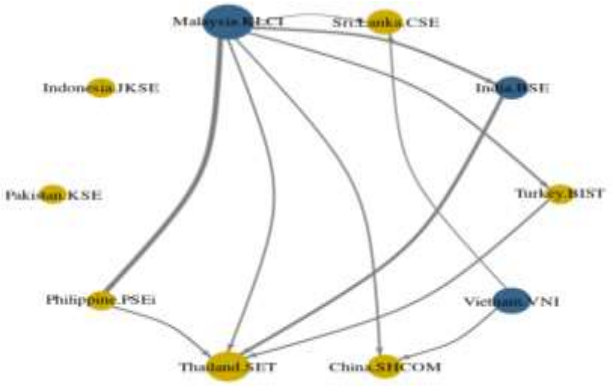

Figure 2 Return spillover network plot

Time-Varying Spillovers

Although the rolling window analysis in figure 4 below shows noticeable spikes in connection during important incidents, such the COVID-19 epidemic and the global financial crisis of 2008–2009, this work reports average spillover metrics throughout the whole sample period. These times are associated with increased market volatility and consequent price changes. These temporal fluctuations support the pro cyclical nature of spillovers, as highlighted by Baruník and Křehlík (2018) and Umar and Gubareva (2020).

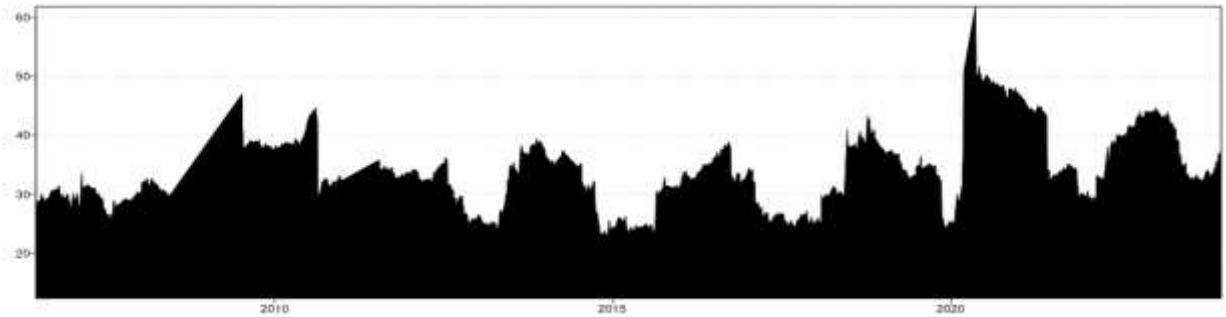

Figure 3 Graph of the Dynamic Total Connectedness (Return Spillovers among Emerging Asian Stock Markets along BRI during period May 2005 – December 2023)

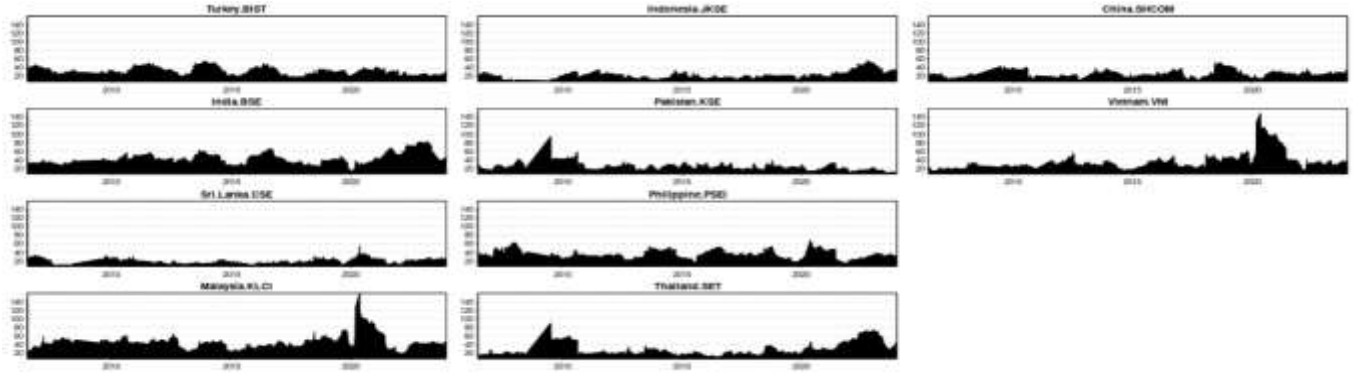

Figure 4 Graphs of Directional Spillovers "TO"

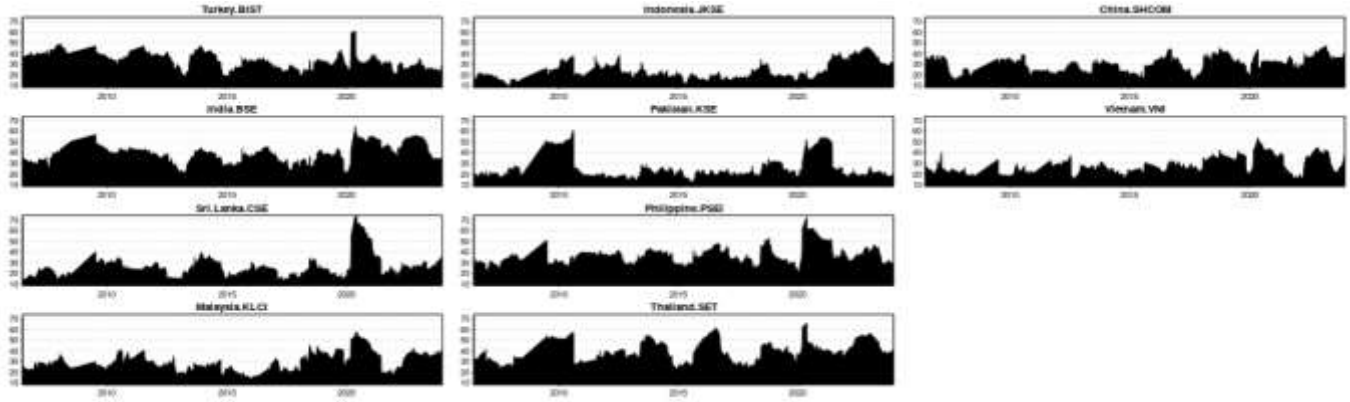

Figure 5 Graphs of Directional Spillovers "FROM"

Implications for Investors and Policymakers

These findings have significant ramifications. The high degree of return connectivity suggests that the benefits of diversification within the BRI region are limited for investors, particularly in times of crisis. When creating allocation strategies, portfolio managers need to take systemic co-movements into account. The existence of large directional spillovers emphasizes to policymakers the necessity of better regional coordination of frameworks for crisis management and financial supervision.

5. Conclusion

The scope, direction, and evolution of return spillovers among the 10 emerging Asian stock markets taking part in the Belt and Road Initiative (BRI) between 2005 and 2023 are all thoroughly documented in this paper. By using the Diebold and Yilmaz (2012) spillover index framework on daily return data, we show that cross-market shocks account for almost one-third of return variance in these markets, highlighting the region's significant interdependence. Because of their bigger economies, greater liquidity, and closer ties to regional financial networks, India and Malaysia appeared as the main net transmitters of return spillovers. On the other hand, Thailand, Sri Lanka and Pakistan show up as net recipients of shocks, demonstrating their relative susceptibility to changes in the external market. Consistent with the research on contagion and financial integration, time-varying analysis also shows that the intensity of spillover increases significantly during periods of systemic stress, such as the COVID-19 pandemic and the global financial crisis of 2008.

These results have a number of significant ramifications. The high degree of connectivity suggests that the benefits of diversification in the BRI region are constrained for investors at times of crisis, requiring more advanced risk management strategies that take dynamic co-movements into consideration. The data emphasizes to policymakers the necessity of enhancing regional collaboration and creating systems to track and lessen the spread of systemic risk. To increase resilience against external shocks, regulators should think about implementing macro-prudential instruments, especially in smaller markets that are more susceptible to spillovers.

Future studies could investigate how macroeconomic and policy factors influence connectedness, and using frequency-domain techniques to separate short- and long-term spillover components. Furthermore, analyzing how return dynamics are affected by recent policy

developments and geopolitical changes relating to the Belt and Road Initiative would offer important insights into how Asian financial integration is evolving.

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