



Navigating the Economic Landscape in the Asian Pacific: A Study of Climate, Security, and Economic Spillovers across Stock Markets

Qingmei Tan

*College of Economics and Management,
Nanjing University of Aeronautics and
Astronautics*

Muhammad Haroon Rasheed

*College of Economics and Management,
Nanjing University of Aeronautics and Astronautics
Email: haroon.rasheed@nuaa.edu.cn
(Corresponding Author)*

Muhammad Shahid Rasheed

*College of Economics and Management,
Nanjing University of Aeronautics and
Astronautics*

Kamran Ali

*College of Economics and Management,
Nanjing University of Aeronautics and
Astronautics*

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Abstract: The Asian Pacific region is spearheading the post-pandemic economic revival, and exploring regional dynamics is becoming increasingly relevant for researchers. In this regard, stock markets have always profoundly influenced a country's economic health, and its behavior varies significantly globally. This indicates stock markets' contextualized nature and response to varying incoming information. Therefore, the study examines the interplay of behavioral and developmental factors in selected stock markets from South Asia. This study draws upon data from 2014 to 2023 and utilizes VAR-based connectedness models to analyze the dynamics of stock market connectedness in the region. This study also considers the influence of pertinent regional climate, security, and economic challenges on stock market behavior. The findings indicate the presence of moderate spillovers among stock markets and from economic, environmental, and security information. Further, most of this spillover is attributed to the markets in developed nations and the economic news sentiments, while climate information's contagion is increasingly becoming relevant. These findings explain the intricate dynamics of these pertinent variables, significantly adding to the understanding of the region.

Keywords: South Asia, stock markets, spillover, sustainability, terrorism, sentiments.

JEL Classifications: E44, F21, G14, O11, O44.

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1. Introduction

Stock market movements are a well-established predictor of economic growth and development (Levine & Zervos, 1999). A substantial body of literature has documented the link between financial development (stock markets) and economic growth by capturing market and economic sentiments (Durusu-Ciftci et al., 2017; Levine, 1991; Levine & Zervos, 1999; Rasheed et al., 2021). The reasons for focusing on stock markets go beyond this aspect, as several important considerations warrant their inclusion in the current investigation. First, stock markets can instantly reflect available information (Rasheed et al., 2021). Second, they generate high-frequency data, allowing for a comprehensive exploration and understanding of the time-varying dynamics of contagion and spillovers within an economy (Peng & Ng, 2012). Given these foundational factors and the established relationship with economic growth and development, the current study examines interactions of stock market behavior across the region.

Traditionally, stock market behavior is viewed as perfectly rational and efficient (Fama, 1991). Consequently, market behavior is expected to be entirely random and adhere to a random walk (Bloomfield & Hales, 2002). However, existing literature on stock market efficiency has reported the presence of market anomalies and inefficiencies (Bannigidadmath & Narayan, 2016; Lehtinen & Kuorikoski, 2007; Ngene et al., 2020). Furthermore, the interconnectedness of stock markets is a well-established phenomenon that challenges the traditional notion of a random walk (Rasheed et al., 2021; Tan et al., 2024; Xue & Zhang, 2017). As a result, conventional ideas of rational and uniform actions are frequently questioned and considered unrealistic in the modern literature (Lehtinen & Kuorikoski, 2007). This has triggered a shift away from traditional rational finance and fostered a willingness to examine the contextual nature of stock market behavior (Lehtinen & Kuorikoski, 2007; Tan et al., 2024). This paradigm shift can be traced back to the emergence of behavioral financial models. The field originated with the groundbreaking work of Kahneman and Tversky's prospect theory in 1979, which proposed that individuals are inherently irrational and assess gains differently from losses. Thaler (2015) suggested broadening behavioral models by emphasizing collective differences across

economies. Since then, studies have shown that stock market behavior varies significantly across regions and macroeconomic factors (Rasheed et al., 2023; Tan et al., 2024; Veronesi, 1999). The extent and dynamics of this comovement differ based on various contextual influences, including regions, development, and behavioral factors (Tan et al., 2024).

The current study examines the interconnections among representative markets in the Asia-Pacific region, focusing on macro-level development and behavioral factors. This region is home to nearly 60 percent of the global population, which totals 4.3 billion people. Economically, it has the largest GDP and a significant investment landscape (Adnan, 2023). Recently, the region has experienced rapid economic expansion post-pandemic, contributing almost 70 percent of global GDP growth in 2023, led by China (Biswas, 2024). With almost half of the world's population, studying regional dynamics is crucial for understanding economic growth and development. Therefore, to explore the region's economic resilience, this investigation aims to analyze the impact of the most pertinent macroeconomic indicators (climate, security, and economics) and the interconnectedness across various economic classifications (developed, developing, and frontier) within the region. The concept of stock market connectedness is not new, as extensive literature has focused on it due to its hedging and diversification potential for investors (Al-Nassar, 2023; Iwanicz-Drozdzowska et al., 2021; Sell, 2001). The introduction of the Diebold and Yilmaz (2009) model to study connectedness and spillovers, along with financial innovations such as blockchain, cryptocurrencies, and green finance, has reinvigorated researchers' interest globally (Abdullah et al., 2023; Ali et al., 2023; Broadstock et al., 2022; Gharbi et al., 2023). However, none of the existing literature has explored the regional, developmental, and behavioral aspects of stock market behavior.

The conventional view of individual and market behavior suggests that economic information is the only significant determinant of stock market behavior (Fama & French, 2006). However, substantial evidence in the existing literature connects stock market movements to other macro and microeconomic behavioral factors (Kudryavtsev et al., 2013; Rasheed et al., 2018). The collective social mood of a society, influenced by these factors, is consistently found to play a crucial role (Rasheed et al., 2021). Global economic news sentiments are considered the most significant among macroeconomic factors, as they substantially influence stock market movements (Beckmann et al., 2011; Shapiro et al., 2020). Therefore, this study will also examine the influence and spillover effects of global

economic news sentiments to understand their time-varying significance and impact on selected Asian stock markets.

Additionally, the study examined macroeconomic factors specific to the region, including the security situation. Beyond its economic significance, this issue is particularly pertinent due to the region-specific dynamics within the global struggle against terrorism, as nations such as Afghanistan, Pakistan, and India grapple with challenges related to extremism. Terrorism significantly affects stock markets and economic growth globally (Akash, 2023; United Nations, 2022). It is crucial to tackle regional security challenges while understanding the dynamics of countries' economic resilience. This research examines how terrorism impacts regional stock markets, providing insight into these dynamics.

Lastly, one of the most pressing global and regional concerns is the exponential increase in greenhouse gas emissions, which is driving the climate crisis. As the largest population center in the world, the Asian region experiences a significantly higher impact from environmental changes (Akash, 2023; Manish et al., 2006). The recent surge in climate-related disasters across Asia also necessitates an examination of the region's sensitivity to climate factors. Therefore, this study aims to investigate the effects of climate challenges on regional markets, particularly through the influence of the global carbon emission index. Investors worldwide are becoming increasingly aware of the negative effects of climate challenges (Hunjra et al., 2023). The growth in green finance indicates that investors are looking beyond immediate economic benefits and are prioritizing the creation of a sustainable future for the planet (Berrou et al., 2019). Given the heightened vulnerability of the Asia-Pacific region, the collective response and influence of regional markets to global carbon emissions will need to be substantive.

Secondly, the study model also considers the level of economic development across the Asia Pacific. Existing literature indicates that a more integrated and developed market leads to higher global connectedness (Inaba, 2020; Iwanicz-Drozowska et al., 2021; Rasheed et al., 2023). Developed markets are associated with greater financial literacy, security, and sustainability awareness compared to their less developed counterparts. In contrast, most security challenges are primarily linked to frontier and less developed economies. Based on this premise, the current investigation also examines regional markets according to their economic development to identify any distinguishable differences and enhance the current understanding of stock market behavior in the region. By following the

examples of Ameer et al. (2023) and Tan et al. (2024), market selection is based on Morgan Stanley Capital International's (MSCI) categorization of stock market development. This study incorporates three representative markets from each of the MSCI classifications of developed (Japan), emerging (China), and frontier (Pakistan) stock markets in the Asia Pacific region.

2. Literature Review

The current study explores the dynamics of pre-pandemic behavior and post-pandemic economic resilience in the Asia-Pacific region. Since stock markets act as catalysts and indirect measures of economic growth and development (Rasheed et al., 2018), we focus on them for this investigation. The study will examine how stock markets, as indicators of economic health, behaved during the sampled period. This financial contagion among stock markets has been a key research topic, particularly regarding economic crises and behavioral economics (Sell, 2001). Research on connectedness has significant implications for investment hedging, diversification, and, on a macro level, coordinated regional economic cooperation and policymaking, while also serving as a predictor of economic crises (Ali et al., 2023; Minoiu et al., 2015). In the context of the Asia-Pacific region, Park (2019) concluded that connectedness among stock markets increased following the global financial crisis of 2008. Concerning the dynamics of connectedness, the literature suggests that developed economies are more resilient and less volatile, integrating more with their developed counterparts, while developing economies are significantly influenced by developed economies (Bostanci & Yilmaz, 2020; Rasheed et al., 2018; Tan et al., 2024). Therefore, based on evidence from the existing literature, this study will utilize the MSCI classification of economic development to compare the connectedness of stock markets across the full spectrum of market development in the Asia-Pacific region.

2.1. *Economic Sentiments and Stock Markets*

Contrary to traditional economic models, the relationship between economic sentiments and stock markets can be traced back to the prospect theory by Kahneman and Tversky (1979) as well as the socioeconomic theory of finance (Prechter, 2016). Researchers' interest in this interlinkage stems from its ability to predict market movements, resulting in value creation for investors. Sentiment analysis plays a significant role in determining future movements of the stock markets (Pang & Lee, 2008). Research by Gigerenzer and Gaissmaier (2011) and Rasheed et al. (2018) on heuristic biases concluded that market participants rely on the most recent and readily available relevant

information and react accordingly. Furthermore, studies by Rasheed et al. (2021 & 2023) and Tan et al. (2024) also found significant differences in collective behavior based on investors' sentiments. Hence, it can be inferred that economic mood or sentiments also play a crucial role, and analyzing this data can provide critical insights into the overall collective dynamics of economies (Shah et al., 2018).

2.2. Terror Events and Stock Markets

Terrorism is defined as the use of force and violence to achieve illegal objectives through fear, intimidation, and the exercise of power by non-state actors (Lutz & Lutz, 2020). The consequences of terrorism range from damage to precious lives and property to long-term macroeconomic impacts (Kong et al., 2021). Any increase in terrorist activities poses a threat to global economic stability and integration (Hobbs et al., 2016). Existing literature consistently reports terrorist activities as a significant determinant of stock market movements (Chaudhry et al., 2018; Papakyriakou et al., 2019; Seabra et al., 2020). The sudden decline or overreaction of stock markets also stems from prospect theory by Kahneman and Tversky (1979). This theory posits that investors' desire to avoid losses is equivalent to their desire to gain, and this tendency nearly doubles with the representativeness of any event, as only relevant news triggers such behavior (Rasheed et al., 2018). Therefore, the literature indicates a negative influence of terror attacks on stock market returns and a positive impact on stock market volatility (Ahmad et al., 2022; Levy & Galili, 2006). Demographically, this influence is observed to be stronger in developing markets than in developed nations (Arin et al., 2008).

2.3. Climate Change and Stock Markets

The world is witnessing an exponential rise in climate-related catastrophes globally. The frequency of environmental issues has risen over the last ten years (Jangid & Bhardwaj, 2023). Financial markets worldwide are aligning with various stakeholders to mitigate these environmental challenges. Enormous challenges and opportunities exist for financial systems worldwide (Beatty & Shimshack, 2010). In the wake of the 2016 Paris Agreement, significant efforts are underway to address this impending danger, such as establishing the Sustainable Development Goals (SDGs) for 2030 and incorporating Nationally Determined Contributions (NDCs) into the Paris Agreement (Ozili, 2021). Literature suggests that stock markets can either contribute to the problem or become part of the solution (Rasheed et al., 2022). Achieving sustainability requires substantial monetary resources; projections indicate that between USD 5

and USD 7 trillion will be necessary over the next 15 years to meet SDG ambitions (Jangid & Bhardwaj, 2023). Additionally, investors worldwide are increasingly concerned about the risks associated with climate issues (Bender et al., 2019; Krueger et al., 2020). Innovative financial instruments have the potential to meet this future demand, making it essential to study the relationship between climate information and stock market movements. Dunz et al. (2018) found that investor sentiment influenced by climate-related information can affect stock market behavior and amplify the impact of climate data on economic activities.

3. Methodology

The current study employs the volatility spillover method initially introduced by Diebold and Yilmaz (2009) and later updated by Diebold and Yilmaz (2012) to include various macroeconomic factors such as economic news sentiments, terrorism, and climate change when analyzing stock market behavior across the Asia-Pacific region. This updated method has broadened researchers' ability to incorporate data from both within and across datasets for returns, assets, markets, and other similar series. This methodology is well-established and widely accepted, with current researchers using it in both conventional and modern applications of financial linkages (Abdullah et al., 2023; Can, Ergün et al., 2023; Diebold & Yilmaz, 2012; Khoury et al., 2023).

This vector autoregression-based model also provides a comprehensive mechanism to calculate variance and results for total spillover, spillover to, spillover from, net spillover, and net spillovers for each time series under consideration, respectively. The underlying calculations of the model are reported in Table 1.

Table 1: Connectedness Model

1-Variance share of each asset	4-Spillover from an asset
$\tilde{\theta}_{ij}^g(H) = \frac{\theta_{ij}^g(H)}{\sum_{j=1}^N \theta_{ij}^g(H)}$	$FROM_i^g(H) = \frac{\sum_{j=1, j \neq i}^N \tilde{\theta}_{ji}^g(H)}{N} \cdot 100$
2-Total average spillover	5-Net average spillover from an asset
$TCI^g(H) = \frac{\sum_{i,j=1, i \neq j}^N \tilde{\theta}_{ij}^g(H)}{N} \cdot 100$	$NET_i^g(H) = FROM_i^g(H) - TO_i^g(H)$
3- Spillover to an asset	6-Net pairwise spillover from an asset
$TO_i^g(H) = \frac{\sum_{j=1, j \neq i}^N \tilde{\theta}_{ij}^g(H)}{N} \cdot 100$	$PAIR_{ij}^g(H) = \frac{(\tilde{\theta}_{ji}^g(H) - \tilde{\theta}_{ij}^g(H))}{N} \cdot 100$

Source: Diebold and Yilmaz (2009), and Diebold and Yilmaz (2012).

4. Sample

The sample includes the Nikkei Stock Exchange from Japan (developed), the Shanghai Stock Exchange from China (emerging), and the Pakistan Stock Exchange (frontier). The data comprises daily stock index returns from each respective exchange. A market index is chosen for its ability to reflect the overall vitality of a country's economic health (Rasheed et al., 2023). The sample adopts one representative stock market index from each MSCI category based on its economic development from 2014 to 2023. This period provides sufficient statistical reliability to observe the pre- and post-pandemic behavior of stock markets. Following the methodologies of Ameer et al. (2023) and Tan et al. (2024), market selection is based on Morgan Stanley Capital International's (MSCI) categorization of stock market development.

The data on global economic news is based on the established measure of economic news sentiment by Shapiro et al. (2020). It consists of a high-frequency time series calculated using articles focused on economics through lexical analysis and is widely used in the literature.

The IHS Markit global carbon index is a proxy for the economic impact of climate change. As a benchmark for the global carbon credit market, its movement can be considered an indirect reflection of the global sensitivity to climate change.

To assess the impact of security and terrorism-related news on the stock market, we utilize daily death tolls from terrorist attacks in the region, sourced from the dataset provided by the Institute for Conflict Management India. The variable used does not account for the steady occurrence of terrorist attacks in Afghanistan throughout the sample period.

Table 2 below presents a descriptive overview of the dataset. The data is explored for normality and stationarity through the Jarque Bera and Augmented Dickey-Fuller tests, respectively. The final analysis was conducted through R studio, and the model utilized four lags based on the Akaike information criterion (AIC).

Table 2: Descriptive Statistics

	JAPAN	CHINA	PAKISTAN	SENTIMENTS	CARBON	TERRORISM
Mean	0.0004	0.0001	0.0001	-0.0149	0.0004	6.2400
Median	0.0008	0.0000	0.0000	0.0140	0.0000	3.0000
Maximum	0.0773	0.0560	0.0468	0.3359	0.0453	160.0000
Minimum	-0.0825	-0.0887	-0.0710	-0.6694	-0.0679	0.0000
Std. Dev.	0.0126	0.0131	0.0105	0.1885	0.0086	10.5767
Skewness	-0.1117	-1.1427	-0.6365	-1.0232	-0.4915	5.9139
Kurtosis	7.6302	11.4957	7.8699	4.5459	8.8739	58.6750
JB	01932.2	06959.5	02278.1	00591.4	03189.3	291294.5
ADF	-47.227	-45.155	-41.531	-03.252	-47.407	-07.383

ADF= Augmented Dickey–Fuller, JB= Jarque Bera, **Bold**=Significant ($p < 0.01$)

Source: Authors' estimates from Sampled Data.

5. Results

The findings regarding the average spillover among model variables are reported in Table 2 below. We omit meaningless associations among variables to maintain objectivity. Overall, a weak spillover is noted between the sampled markets and informational inflow related to economics, climate, and terrorism at a corrected total connectedness index (cTCI) level of 22.56%.

Table 3: Connectedness across the Asia Pacific

	Japan	China	Pakistan	Sentiment	Carbon Index	Terrorism	FROM
Japan	75.88	09.70	03.97	03.28	04.57	02.59	24.12
China	10.19	78.95	02.76	02.57	02.98	02.55	21.05
Pakistan	04.79	03.20	83.06	02.40	03.73	02.82	16.94
Sentiments	09.47	03.59	02.88	79.22	03.29	01.54	20.78
Carbon Index	03.59	03.62	03.11	02.53	84.45	02.70	15.55
Terrorism	03.00	02.52	02.90	02.19	03.74	85.64	14.36
TO	31.05	22.63	15.61	12.97	18.32	12.21	cTCI/TCI
NET	06.93	01.58	-01.32	-07.81	02.77	-02.15	22.56/18.80

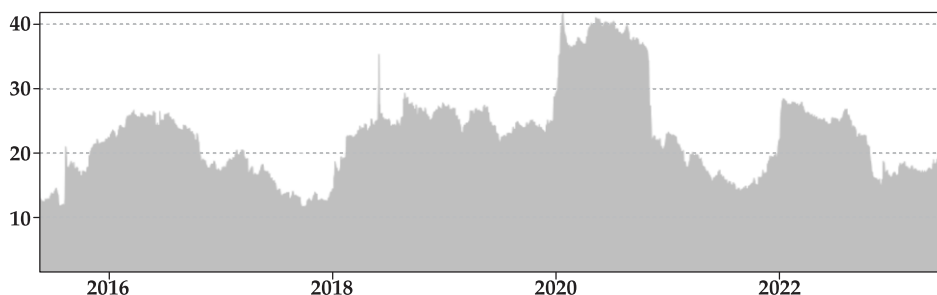
Source: Authors' estimates from Sampled Data.

Individual results suggest that most of the movement in these stock markets is due to their internal shocks, as illustrated by the diagonal values of 75.88% (Japan), 78.95% (China), and 83.06% (Pakistan), respectively. These findings also indicate a stronger connection between developed markets and external financial contagion, and vice versa. While the interrelationship among economic sentiments, the carbon index, and terrorism is not the focus of the current model, the results show that they have a negligible association with one another. This supports the

independent nature of these factors and justifies their incorporation and study. These factors independently and significantly influence stock market movements across the Asia Pacific.

The time-varying analysis of aggregate connectedness is presented in Figure 1. It can be observed that the connectedness among markets and macroeconomic variables related to economic, climate, and security information rose significantly to 40% during the recent pandemic crisis. Meanwhile, during the periods before and after the pandemic, connectedness remained significantly lower. These findings highlight a higher degree of connectedness and contagion during times of crisis compared to normal economic conditions.

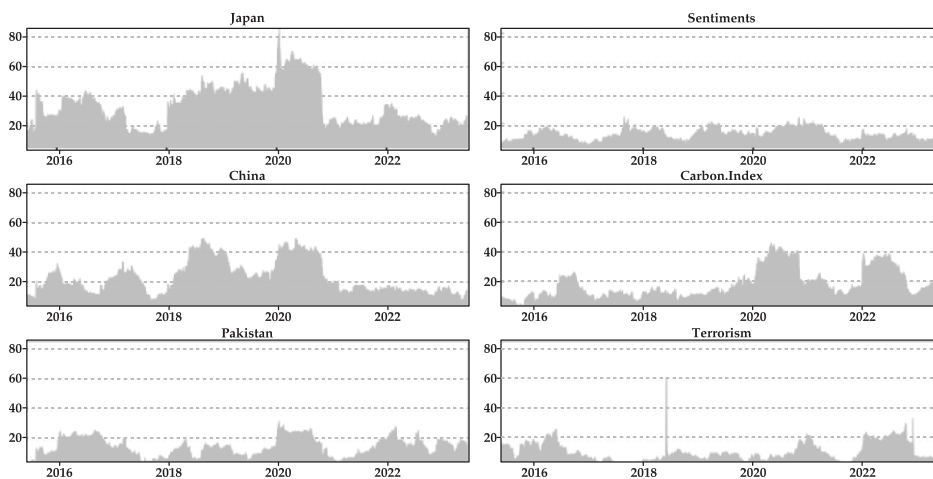
Figure 1: Aggregate Connectedness



Source: Authors' estimates.

Next, Figure 2 presents the individual *spillovers* from each market and macroeconomic variable. In terms of stock markets, the largest contributor to spillovers over time is the Japanese stock market. Additionally, there is a direct relationship between the size of the spillover and level of economic development. The spillovers from Japan and China remains significantly high, while the spillovers from Pakistan remains consistently modest throughout the sample. The second set of variables representing climate, security, and economic information indicates moderate spillovers into Asian Pacific stock markets over the sampled period. The global carbon index shows an increase in spillovers throughout the sampled timeframe. Meanwhile, the spillover from economic news sentiments is consistently distributed over time and exerts a moderate influence. Lastly, there is a moderate spillover from terrorism-related news across stock markets. However, this spillover is dependent on terrorism news, making its impact highly volatile throughout the sampled period. Overall, security conditions in the Pacific region are steadily improving, and spillovers are decreasing in the post-pandemic context era.

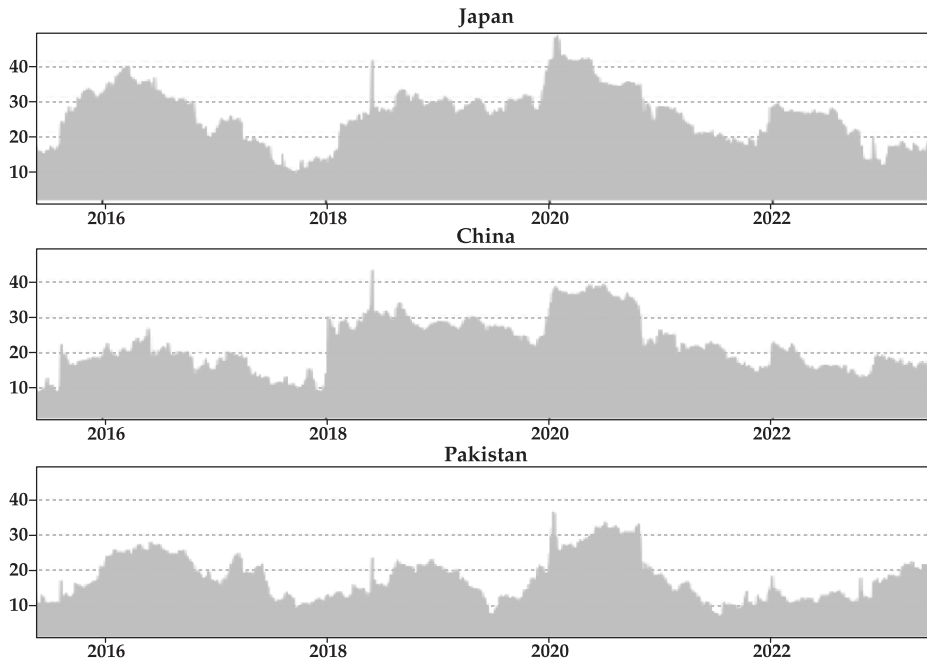
Figure 2: Connectedness to Others: Spillovers From Markets and Macro Variables



Source: Authors' estimates.

Figure 3 illustrates the *spillovers* on the three markets from other markets and the macroeconomic variables. The analysis of the time-varying influence among stock markets reveals that the integration and impact from other markets and information sources also rise as economic development increases. Less developed nations tend to be more isolated and relatively less susceptible to spillovers. Nevertheless, a common trend observed across all markets in the regions is the heightened level of contagion during the COVID-19 pandemic, irrespective of their market size development.

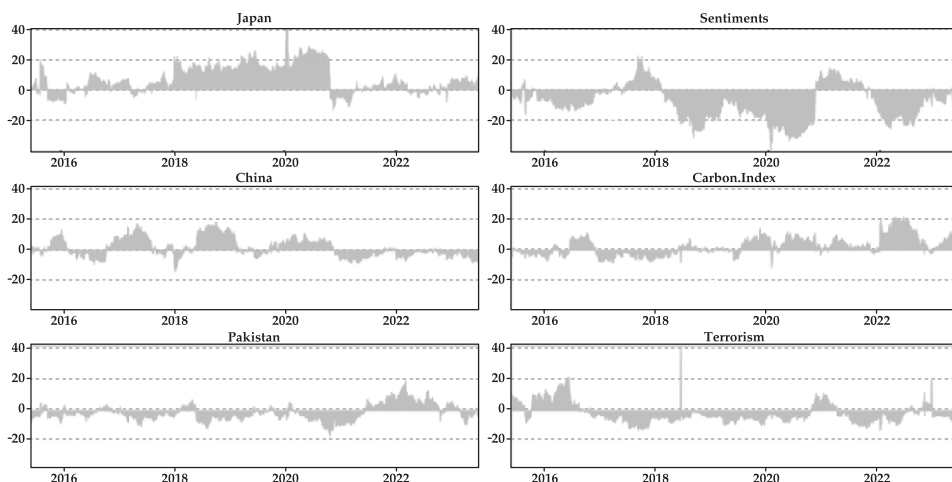
Figure 3: Connectedness with Others: Spillovers on Each Market



Source: Authors' estimates.

Next, the net directional spillover from each macroeconomic variable is shown in Figure 4. The large net spillovers from the Japanese stock market and due economic news sentiments demonstrate significantly higher connectedness throughout the sample period. In contrast, the spillovers due to the global carbon index are rising across regional stock markets, highlighting the growing relevance of this issue in that context. Moreover, the connectedness of Chinese stock markets has declined in the post-pandemic era, while the market connectedness of Pakistani stock exchanges is increasing. Lastly, there has been a weak net spillover from terrorism-related informational inflow since the pandemic, which can be attributed to an overall improvement in terrorism-related activities. However, the impact of terrorist activities remains significant, as historically, they have resulted in the highest and strongest net spillovers exceeding 40%. These findings further highlight the relevance and importance of these variables for economic stability and regional progress.

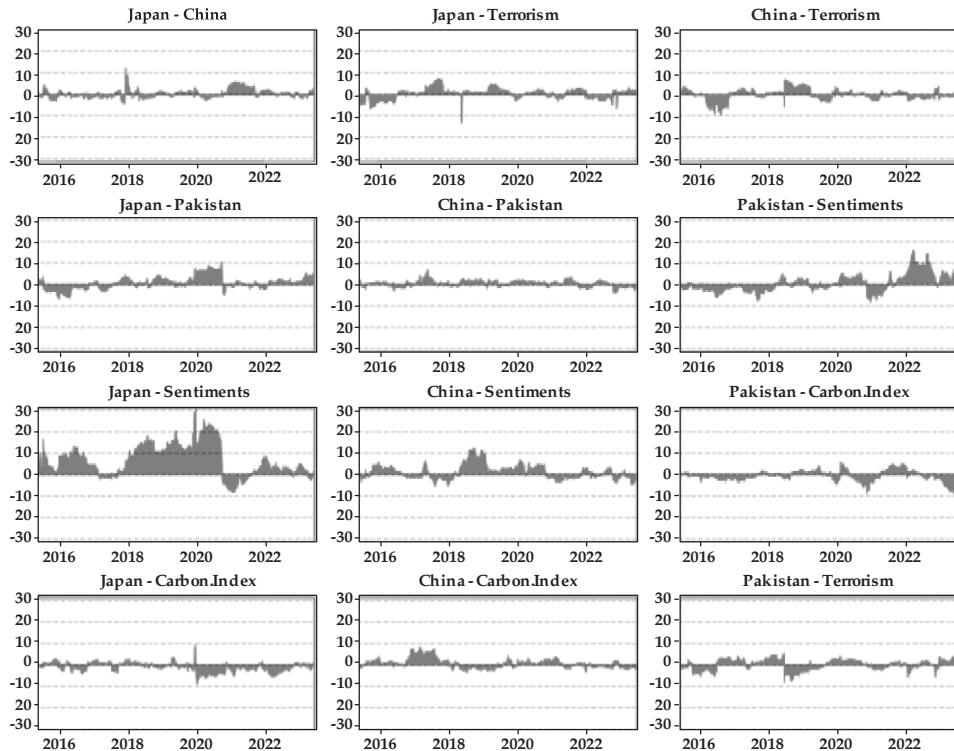
Figure 4: Net Directional Connectedness From Each Market and Macro Variable



Source: Authors' estimates.

To further enhance understanding of the findings, the results of pairwise connectedness are also illustrated in Figure 5. These results indicate a significant spillover of economic news sentiments across Asia-Pacific stock markets, where the degree of development is found to be directly related to the level of spillover from economic news. The second most influential factor is global carbon emissions, whose influence remains consistent over time for China or is increasing, as seen in Japan and Pakistan. The impact of terrorism-related news is also notable, though it shows a decreasing trend, which can be attributed to recent improvements in law and order across the region. Despite this trend, it remains a relevant factor for stock markets. In addition, the Japanese stock market has been found to significantly influence other stock markets in the region, exerting a greater impact on the less developed ones.

Figure 5: Net Pairwise Connectedness



Source: Authors' estimates.

The study's findings align with existing literature on spillover and connectedness, indicating that most stock markets are moderately connected (Abdullah et al., 2023; Ali et al., 2023). It also confirms the established pattern of higher connectivity and spillovers during extreme financial events (Ali et al., 2023; Yousaf et al., 2023). Additionally, the demographic variation based on economic development corresponds with the behavioral analysis of the stock market by Rasheed et al. (2023) and Tan et al. (2024). While significant influence from traditional economic news sentiments is reported, which aligns with conventional finance theory, it is not the sole significant factor driving stock market movements across the region. Markets are also substantially influenced by foreign non-economic factors such as security and climate change. Therefore, the findings are consistent with the behavioral perspective of finance in the Asia-Pacific region, and stakeholders must consider the impact of these macro-regional and global factors to foster and sustain economic growth area.

6. Conclusion

The world is increasingly shifting toward a multipolar economic reality, and the post-pandemic era has brought the Asia-Pacific region to the forefront of global growth and development. This region holds vast untapped potential; therefore, the current study focuses on uncovering some of its dynamics. The rationale for the study is rooted in behavioral theory and contributes to the understanding of the contextual exuberance among the region's economies. The study model considers the complex interplay of behavioral factors related to climate, security, and global economic conditions. It also examines the influence and interplay among stock markets based on their level of development using a comprehensive dynamic and static connectedness model.

The study's findings highlight a moderate degree of connectedness among developmental and behavioral factors; furthermore, this connectedness among markets becomes significantly stronger during times of crisis, such as the COVID-19 pandemic. The results indicate that the primary factors driving spillovers among stock markets are economic news sentiments and the level of economic development. More economically developed nations tend to experience higher contagion and spillover effects, and vice versa. Additionally, the study reveals a notable impact of terrorism-related news on regional markets, although this impact has been decreasing since the pandemic, which can be attributed to improved security conditions post-lockdown and the U.S. withdrawal from Afghanistan. Lastly, climate-related factors are increasingly affecting stock markets, making them a crucial consideration for future studies.

The research advances knowledge in behavioral finance, regional finance, and market connectivity. Overall, the study's findings are relevant to a wide range of audiences. It highlights the importance of considering regional and developmental disparities to achieve improved portfolio performance for stakeholders in the Asia-Pacific region. Additionally, the results provide crucial insights into indexed mutual funds and demonstrate how index funds can be further diversified from economic sentiments, security, and sustainability factors by incorporating other index funds into their portfolios. Lastly, policymakers and stock market authorities will find it highly relevant to explore this novel option for creating stable and less volatile markets to ensure their effective functioning and protection. The study offers a broad overview of the stock market on one hand while explaining the movement and sensitivity at the regional and developmental levels on the other. This equips stakeholders

with better tools to foster an environment conducive to a more effective and efficient market. Future researchers can enhance the generalizability of the findings by investigating the time-varying dynamics of this relationship. Furthermore, future studies can broaden the findings by examining other representative markets in the region and incorporating additional relevant macroeconomic factors.

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