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Cross-border sovereign risk transmission in BRICIT Nations: Unveiling asymmetries and the role of country risk premiums

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ABSTRACT

This research highlights the asymmetric interdependence structure among the sovereign risks of Brazil, Russia, India, China, Indonesia, and Türkiye (BRICIT) nations, challenging the traditional view that bilateral trade is the main channel for cross-border spillover effects. Despite their dependence on Russian crude oil imports for energy, the BRICIT nations show no significant sovereign risk interdependence with Russia. The study finds that Indonesia's credit default swap (CDS) has the highest level of interdependence with other nations. Further exploration of alternative transmission channels necessitates an examination of the country risk premium, revealing Türkiye as the most vulnerable nation due to its negative association with the CDS of other countries, particularly India. By contrast, India is identified as a preferred investment destination, thanks to its lower uncertainty and strong GDP growth over the past decade. Additionally, the research underscores China's economic influence, demonstrated by its positive association with all other BRICIT nations. This suggests that despite the high sovereign risk associated with China, investors do not view other emerging markets as viable, lower-risk alternatives. The perceived risk related to China appears to extend beyond its borders, impacting the sovereign risk profiles of other emerging economies.

1. Introduction

Emerging economies are becoming increasingly crucial to the dynamics of the global market, with Brazil, Russia, India, China, Indonesia, and Türkiye (BRICIT) nations playing a central role in this transformation. These countries are recognized as the engines of global economic growth, significantly contributing to the world GDP and attracting substantial foreign direct investment (FDI). The BRICIT nations' economic and geopolitical landscape is marked by rapid development, significant demographic dividends, and growing influence in international trade and political affairs. However, this rapid ascent comes with its challenges. Fast-paced growth has introduced a range of risks, including political instability, economic volatility, and social unrest, which are further intensified by the interconnectedness of these economies in the global market. Literature has indicated that this creates economic opportunities and serves as a pathway for the transmission of economic and geopolitical shocks across borders (Kenourgios et al., 2016; Glasserman & Young, 2016; Cheng & Zhao, 2019; Pan et al., 2024). This dual nature presents a complex scenario where the potential for growth and development is closely intertwined with the risk of instability and contagion (Amelkin et al., 2024).

The regional instability and uncertain business environments within the BRICIT nations significantly elevate the investment risk in these emerging economies. The rapid economic growth and global market integration of BRICIT have been marred by political instability, regulatory uncertainties, and socioeconomic disparities (Günay, 2016). These factors collectively contribute to a high-risk investment environment. As Kose et al. (2006) highlighted, emerging economies, despite their promising growth prospects, often experience volatile economic policies and weak political institutions, leading to sudden changes in investment climates and financial markets. Moreover, the economic and geopolitical interconnections among these countries amplify these risks at both national and global scales. For instance, an economic downturn in one BRICIT nation can ripple through, affecting trade partners and causing fluctuations in global commodity prices and financial markets (Albrecht & Hinderer, 2008). The literature has emphasized the complexity of these interconnections, suggesting they can act as channels for the transmission of economic and geopolitical shocks

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(García-Canal & Guillén, 2008, May 8). Given that BRICIT nations represent a substantial portion of the global economy, the potential for contagion and cross-border shock transmission underscores the need for a nuanced understanding of the interplay among regional instability, uncertain business environments, and global economic dynamics (O'Neill, 2001; Hooijmaaijers, 2019; Chaturvedi & Saha, 2019).

Academic discourse has often avoided deeply exploring market spillovers stemming from interconnections, primarily attributing these relationships to trade (Gorea & Radev, 2014; Gu, 2019) and financial channels (De Bruyekere et al., 2013; Kallestrup, Lando, & Murgoci, 2016, September; Dungey & Renault, 2017, August 7). These interconnections are vital for understanding how spillovers can spread across markets. However, rigorous statistical evidence of such interconnections is crucial before making any inferences based on a spillover approach. Recently, the interconnectedness among sovereign entities has become increasingly common, prompting a shift toward analyzing spillover effects and their consequences, albeit with less emphasis on establishing statistical interdependence.

The significant financial crises, such as the Global Financial Crisis of 2008 and the Eurozone sovereign debt crisis of 2010, have drawn attention to the sovereign entities of emerging markets. These regions have become appealing investment destinations, promising high growth potential amidst high inflation and stagnation in developed economies. This shift is partly driven by regional instability and uncertain business environments, which increase the risks associated with these economies. The interconnectedness of these markets implies that these risks can impact sovereign entities, highlighting the need for early assessment tools that can guide institutional investors in adopting a measured approach to risk management.

Furthermore, the interdependence among sovereign entities is not isolated but relies on a mediating channel through which the perceived riskiness of one sovereign can be transmitted to others. This channel acts as a conduit for propagating shocks based on these interconnections. Therefore, it is crucial to address the initial stages of shock transmission before moving on to more complex stages of risk propagation. In this context, this research employs the country risk premium (CRP) as a tool to analyze and understand risk transmission between sovereign entities. This approach highlights the importance of identifying and examining the mediating channels that facilitate the spread of risk, offering a structured framework for assessing the dynamics of sovereign interdependence and its implications for global financial stability.

Despite the growing body of literature on emerging economies, a notable gap remains in the comprehensive assessment and management of risks within the interconnected landscape of these economies, especially among the BRICIT nations. Existing research has primarily focused on the economic growth prospects and market potential of these countries, often neglecting the complex risks arising from regional instability and uncertain business environments (Rodrik, 2018). Furthermore, while some studies have investigated the contagion effects of financial crises in emerging markets, there is a lack of studies specifically addressing how regional instability and uncertainties in the business environments of the BRICIT nations contribute to risk transmission across borders, affecting both the private and sovereign sectors (Feng et al., 2023; Forbes & Rigobon, 2002).

A comprehensive understanding of these dynamics is essential. As noted by Aizenman, Pinto, and Radziwill (2007), the globalization of financial markets has solidified the interconnectedness of economies, making it crucial to grasp how vulnerabilities in one nation can trigger risks across the global financial system. This is especially pertinent for the BRICIT nations, whose economic activities are intricately linked both with each other and the global economy. Literature suggests that political instability, economic policy uncertainty, and weak governance structures can amplify the risk of cross-border transmission, impacting international trade, investment flows, and financial markets (Bekaert et al., 2011; Günay, 2016). Nevertheless, there is a significant lack of studies systematically analyzing how these risks are transmitted and their implications for risk management strategies in both the private and sovereign sectors. This gap highlights the need for research focused on the specifics of risk transmission in interconnected emerging economies, particularly within the BRICIT nations. Such studies would enhance academic understanding and provide valuable insights for policymakers, investors, and multinational corporations in developing more effective risk management and mitigation strategies.

This research aims to thoroughly investigate the interconnectedness of the BRICIT nations and evaluate its impact on the risk profile of emerging economies, with a particular focus on how these risks are transmitted to sovereign entities. This exploration is crucial due to the increasing integration of these economies into the global financial system and their substantial contribution to global economic growth. The literature has highlighted the need to understand the intricate web of economic and geopolitical interconnections among emerging markets and their potential to amplify risks across borders (Michie, 2010). Additionally, research endeavors have been aimed at developing an early assessment mechanism to serve as a barometer for institutional investors. This tool is designed to support a more informed and strategic approach to mitigating risks associated with investment in these regions, thereby enhancing the resilience of investment portfolios amid global economic uncertainties (Brunnermeier et al., 2008). Bekaert et al. (2014) emphasized the importance of such early assessment mechanisms in offering a proactive strategy for managing risks in interconnected emerging economies.

The need for such a mechanism is emphasized by Kaminsky et al. (2003). The authors highlighted the difficulties in predicting financial crises in emerging markets due to the complex interplay of various risk factors, including external shocks and domestic vulnerabilities. By focusing on the BRICIT nations, this research addresses a notable gap in the literature, which lacks a comprehensive framework for assessing and managing risks in interconnected emerging economies (Aizenman, Lee, & Rhee, 2007; Kose et al., 2006). The proposed early assessment mechanism aims to utilize insights from analyzing the interconnectedness of the BRICIT nations, providing a strategic tool for institutional investors to navigate the complexities of investing in emerging markets with greater precision and foresight. For investors and financial analysts, understanding these risk mechanisms is crucial for identifying both opportunities and vulnerabilities within their portfolios, leading to more informed decision-making processes.

This study systematically investigates the interconnected sovereign risks among the BRICIT nations by first establishing their dependence structure. Drawing inspiration from Trutschnig's (2011)copula-based measure, we quantify this dependence structure through an asymmetric measure, guided by the Markovian Kernel underlying the two random variables (x, y). This approach acknowledges potential asymmetries in the magnitude of interdependence, particularly in the context of bilateral trade. Moreover, it explores the transmission channels through which one credit default swap (CDS) influences another. Accordingly, CRP is utilized, with the mediating variable being spread between two risk premiums. A higher spread indicates increased vulnerability to risk from another nation. Assuming that the dependence structure could be asymmetric due to uneven effects of transmission channels, the study employs a copula-based measure to capture this dependence, as proposed by Junker et al. (2021). This measure, estimated on the logarithmic return of the BRICIT CDS, provides a detailed understanding of risk transmission among these nations. Furthermore, our methodological approach integrates Zhao and Luo's (2017) idea of estimating the mediation effect by combining two frameworks: causal mediation analysis across the mediation variable and a vector autoregressive model across temporal observations. This dual-framework integration allows to comprehensively analyze the mediation effects and temporal dynamics of sovereign risk transmission among the BRICIT nations, contributing to a deeper understanding of their interconnected financial vulnerabilities.

The methodological framework of this research is centered on the

analysis of the CRP as a key tool for examining and channeling risk transmission among the BRICIT nations. The CRP, an essential metric for assessing the additional return investors expect for taking on the risk of investing in a foreign country compared to a risk-free asset, serves as a quantifiable measure of the perceived risks associated with investing in these emerging economies. This approach draws from the work of Damodaran (2012, 2023). The author elucidated the calculation and application of the CRP in valuing investments across different countries, emphasizing its role in capturing the economic, political, and financial risks of each nation. By utilizing the CRP, this study provides a nuanced understanding of how risks are perceived and priced in the capital markets of the BRICIT nations, enabling a comparative analysis across these economies. Integrating the CRP into our methodological framework allows us to uncover the underlying factors contributing to risk premiums in these countries and how these factors interact to influence risk transmission across borders. This approach is supported by Bekaert and Harvey (2003), who demonstrated the utility of CRP in signaling the integration of emerging markets into the global financial system and the associated risks. Furthermore, applying the CRP in this research is expected to illuminate the interconnected risks among the BRICIT nations, providing insights into the potential channels of risk propagation. Understanding these channels is crucial for developing strategies to mitigate these risks, as highlighted by Erb et al. (1996), who emphasized the importance of accurately measuring CRPs in managing international investment portfolios.

In conclusion, the structure of this research paper is meticulously designed to comprehensively explore the interconnected risks in the BRICIT nations and their implications for global economic stability. Following introduction, the study proceeds with a detailed literature review, contextualizing our study within the existing body of knowledge and highlighting the gaps our research seeks to fill. The methodology section elaborates on the quantification of the dependence structure, inspired by copula-based measures, to explore the transmission channels through which one CDS influences the other. This section specifically details the use of the CRP as a tool for assessing risk transmission among the BRICIT nations. Subsequently, the analysis of findings section presents the results derived from our empirical investigation, offering insights into the interconnected risks and their potential propagation across borders. Finally, in the conclusion section, we synthesize our findings, discuss their implications for policymakers, investors, and financial analysts, and suggest avenues for future research.

2. Literature review

Sovereign risk transmission, the process through which economic and financial risks originating in one country affect others, has become a critical topic in global financial markets. This transmission is influenced by various factors, including economic fundamentals, financial linkages, and contagion effects. The role of CDS in this process has garnered considerable attention. Zhang et al. (2022) examined the impact of China's rise as a major trading power. They revealed that China's sovereign risk significantly affects the CDS spreads of other countries. Their dynamic analytical approach indicates that changes in China's sovereign risk create substantial contagion effects on its suppliers of goods and services. Conversely, China is vulnerable to contagion from its primary importers, demonstrating how sovereign risk spreads through the global supply chain. The study highlights that China's economic growth negatively impacts weaker European economies by diverting their clients, while China faces intense competition from neighboring export-oriented countries. Additionally, the authors emphasized the role of FDI and portfolio investments in the interdependencies between China's CDS and those of other countries. Aizenman et al. (2013) identified CDS spreads as a key indicator of market perceptions of sovereign risk, effectively capturing cross-country spillover effects. The authors argued that during financial crises, changes in CDS spreads in one country can significantly influence spreads in others, underscoring the interconnected nature of global financial markets. This transmission often occurs through various economic and financial channels, including cross-border investments, fiscal deficits, debt levels, trade linkages, financial markets, banking exposures, and economic policies. Understanding these mechanisms is crucial for policymakers and investors to mitigate risks and maintain financial stability.

Furthermore, in the study of sovereign risk transmission, the debate often revolves around whether sovereign credit spreads are influenced by global or country-specific risk factors. Previous research has mainly explored the interdependencies among CDS and corporate bonds (Forte & Peña, 2009). Volatility in one country's CDS can swiftly spread to other markets through portfolio rebalancing by international investors, as extensively documented by Longstaff et al. (2011). Empirical studies by Eichengreen and Mody (1998), Rose and Spiegel (2012), and Hantzsche (2022) have indicated that higher debt-to-GDP ratios and fiscal imbalances increase the likelihood of sovereign default and contagion. Kaminsky et al. (2003) illustrated that interconnected banking systems can amplify sovereign risk spillovers, as seen during the European debt crisis. Additionally, trade linkages and commodity price fluctuations can intensify sovereign risk, particularly for commodity-exporting nations (Candelon et al., 2011). Schiller (2017) expanded this analysis by linking U.S. suppliers to foreign customers, emphasizing the significance of negative shocks from overseas as a channel for contagion effects. Contagion effects, driven by investor perceptions and market sentiment, can lead to rapid and widespread sovereign risk transmission. Eichengreen et al. (1996) highlighted the role of investor herding and information cascades in fueling contagion across sovereign bond markets, regardless of economic fundamentals. Understanding the sovereign risk through metrics such as credit ratings, bond spreads, and CRPs is essential for global finance (Panizza et al., 2009; Izadi & Hassan, 2018).

In recent years, financial integration has intensified the interconnectedness of sovereign risks (Bekaert et al., 2014). The Portugal, Italy, Ireland, Greece, and Spain (PIIGS) crisis in Europe, for instance, underscored the strong relationships among sovereign CDS spreads of several countries beyond PIIGS (Ait-Sahalia et al., 2014). Wu et al. (2016) revealed that sovereign credit risk initially spreads rapidly within regions before expanding globally through prolonged risk spillovers. The phenomenon of credit contagion now extends beyond corporate bond and equity markets. Trade linkages are a primary channel for sovereign risk transmission (Cheewatrakoolpong & Manprasert, 2014). When a country experiences a sovereign risk event, such as a default or a significant credit rating downgrade, the resulting economic instability can reduce its import demand. As highlighted by Rose and Spiegel (2012), this decline negatively impacts the exports and economic performance of its trading partners. As international trade linkages continue to strengthen, economies are expected to become more interconnected (Boffa, 2018; Huang et al., 2023).

Exploring sovereign risk transmission among the BRICIT nations is crucial given their growing significance in the global economy. Collectively, these nations represent a substantial share of global GDP, trade, and financial flows. For instance, as of 2023,[1] China is the world's second-largest economy with a GDP exceeding $15 trillion, while India ranks fifth with a GDP surpassing $3 trillion. Brazil, the largest economy in South America, has a GDP of over $2 trillion, and Russia, a major oil producer, holds significant influence with a GDP exceeding $1.5 trillion. Indonesia, with its expanding population and middle class, has a GDP of approximately $1.3 trillion, and Türkiye, strategically located between Europe and Asia, maintains a GDP of approximately $1.1 trillion. As emerging markets, BRICIT nations are particularly susceptible to external shocks and contagion effects due to their interconnectedness with international markets and reliance on foreign capital inflows

[1] Source: https://www.forbesindia.com/article/explainers/top-10-largest-economies-in-the-world/86159/1.

(O'Neill, 2001). Their rapid integration into the global financial system has heightened their exposure to sovereign risk, which can be influenced by external shocks and policy errors (Michie, 2010; Kirikkaleli & Gokmenoglu, 2020). Sovereign risk—the threat to a nation failing to meet its external financial obligations—is a critical issue for BRICIT economies, characterized by volatile markets and developing financial systems. This situation underscores the urgent need to research how sovereign risk is transmitted within and across BRICIT economies and accordingly develop effective risk management strategies. Understanding the propagation of sovereign risk within and between BRICIT nations is essential for policymakers, investors, and international organizations to anticipate and mitigate potential spillover effects. Given the diverse economic structures, geopolitical dynamics, and policy frameworks of BRICIT nations, studying sovereign risk transmission in this context provides valuable insights into the drivers and channels of contagion across both developed and developing economies. Sovereign risk transmission, driven by financial, trade, CRP, and geopolitical linkages, is particularly pronounced in emerging markets, making them vulnerable to external disturbances (Eaton et al., 1986; Forbes & Warnock, 2012). This vulnerability, evident during financial crises, highlights the complex relation between global financial integration and sovereign risk (Reinhart & Rogoff, 2009), emphasizing the need for a nuanced approach to managing sovereign risk in an interconnected world.

Emerging economies like BRICIT are especially vulnerable to sovereign risk due to factors such as volatile growth, reliance on foreign capital, political instability, and opaque financial systems (Günay, 2016; Kirikkaleli & Gokmenoglu, 2020; Pan et al., 2024; Reinhart et al., 2003). Historical crises, such as those in Latin America during the 1980s and in Asia in 1997, highlight these vulnerabilities by demonstrating how swiftly the shifts in investor sentiment and external financing can impact these markets (Kaminsky et al., 2003). While global financial integration provides access to capital, it also exposes these economies to global financial disturbances. For instance, the 2008 financial crisis revealed how open economies were prone to capital flight and currency devaluation (Hassan et al., 2017; Obstfeld et al., 2009).

The BRICIT nations illustrate the growing economic and financial ties, both of which connect these countries and subject them to shared sovereign risks and CRPs. The 2008 crisis showed how quickly the risk can spread across borders, affecting sovereign debt and economic stability (Forbes & Rigobon, 2002). Research has documented the interconnectedness within the BRICIT group, revealing how shocks in one country can have widespread effects. This underscores the need to understand these linkages to manage sovereign risk effectively in the interconnected global economies (Kose et al., 2006; Aizenman et al., 2011).

Trade linkages and financial market interconnections are crucial in transmitting sovereign risk across global economies, where disruptions can quickly impact global trade dynamics and economic stability (Forbes & Warnock, 2012; Frankel & Rose, 1998). Policy decisions within a country can also significantly affect the cross-border risk, demonstrating how domestic changes can reverberate through interconnected economies (Eichengreen et al., 1996). Furthermore, global events such as fluctuations in commodity prices and geopolitical tensions further influence sovereign risk, highlighting the global economy's susceptibility to external shocks (Froyen et al., 1997).

Understanding this intricate network of risk transmission is vital for developing effective risk management strategies. Sovereign entities and international financial institutions use various measures—such as economic diversification, reserve accumulation, and regulatory cooperation—to mitigate these risks and enhance global financial stability (Aizenman et al., 2004; Obstfeld et al., 2010). As economic interconnectedness increases, the demand for advanced analytical tools and international coordination to manage systemic risks effectively grows. This points to a future where global partnerships and innovations are essential for maintaining a resilient financial system (Cooper & Eichengreen, 1999).

Despite extensive research on sovereign risk transmission, significant gaps remain, particularly in understanding the mechanisms of risk among interconnected economies like the BRICIT nations. Existing literature often lacks a detailed exploration of specific risk transmission channels, underscoring the need for targeted empirical studies. Furthermore, there is a pressing need for new theoretical models that reflect the complexities of sovereign risk in our globally integrated economy (Obstfeld & Rogoff, 1996). Current frameworks often fail to address the intricate financial, trade, and policy connections that shape the global financial landscape, especially in emerging markets. This gap highlights the necessity of refining theoretical and empirical tools to improve sovereign risk prediction and management, assisting policymakers and investors in navigating the challenges of globalization (Kaminsky et al., 2003).

This study seeks to address these gaps by examining sovereign risk transmission mechanisms within the BRICIT nations and developing theoretical models for enhanced understanding and prediction in interconnected economies. By using CRP as a key analytical tool, as detailed by Damodaran (2012, 2023), this research aims to advance the empirical analysis of risk transmission. The CRP provides measurable insights into the risks associated with investing in emerging markets, capturing each nation's unique economic, political, and financial risk aspects. This approach facilitates a deeper understanding of risk perceptions and valuations across the BRICIT countries' capital markets, enabling a thorough comparative analysis.

Our use of the CRP, building on the foundational work of Bekaert and Harvey (2003), represents a significant advancement in empirical research on sovereign risk transmission. It highlights how the integration of emerging markets into the global financial system affects risk perceptions and premiums. Additionally, this research sheds light on the interconnected risks among the BRICIT nations, identifies potential channels for risk propagation, and provides valuable insights for developing effective risk mitigation strategies. By offering a structured analysis of risk transmission mechanisms, this study addresses a critical gap in the literature and strengthens both theoretical and empirical approaches to managing the sovereign risk in interconnected economies, as emphasized by Erb et al. (1996). Thus, our study not only deepens the understanding of sovereign risk dynamics among BRICIT nations but also provides a methodological framework for future research in this crucial area of international finance.

3. Research design

This study explores the dependence structure among the sovereign risks of the BRICIT nations, as reflected by CDS values. The CDS data, obtained from Bloomberg, cover the period from January 2014 to March 2022. The choice of 2014 as the starting year is ascribed to the availability of CDS data for India only from that year. Additionally, the research examines the role of CRP as a mediating factor affecting the relations between CDS values of the BRICIT nations. Like the CDS data, CRP data were also sourced from Bloomberg. Given that the CRP is not directly observable, Bloomberg estimates it by measuring the difference between the yield on a nation's sovereign bonds and the yield on 10-year US Treasury bonds. This method provides a quantitative measure of the extra risk involved in investing in BRICIT sovereign bonds compared with risk-free US Treasury bonds.

3.1. Dependence structure

The empirical analysis of factors affecting CDS values for the BRICIT nations relies on understanding the interdependence among these CDS values. Therefore, the first step in this research is to establish the statistical interdependence among the CDS values, which is essential for the subsequent analysis. Traditional dependence measures, such as Pearson's correlation, Spearman's rank correlation, and Kendall's tau, generally assume symmetric dependence. These methods presuppose

that the dependence between two variables is equal in both directions and are based on monotonic principles, which means they do not account for asymmetries in the relationships. In contrast, asymmetric dependence recognizes the possibility of unequal bilateral relationships between variables. This study uses a copula-based measure inspired by Trutschnig's 2011 approach, denoted as ζ_1, which is underpinned by the Markovian Kernel, guiding the relation between the two random variables (x, y). This method provides a more nuanced framework for analyzing the dependence structure, addressing the limitations of symmetric measures.

Mathematically, if M_A, M_B denote the Markov Kernels of the bivariate copulas A, B

Then,

d_1 (distance of C to product Copula π denoting interdependence) is evaluated as

$$d_1(A,B) = \int_{[0,1]}\int_{[0,1]} |M_A\ (x,[0,y]) - M_B\ (x,[0,y])|\ d\lambda(x)\ d\lambda(y)$$

and $\zeta_1(C) \in [0,1]$ is defined as $\zeta_1(C) = 3\ d_1(C,\pi)$; where "3" is normalizing constant.

Hence, $\zeta_1(C) = 3\int_{[0,1]}\int_{[0,1]} |M_A\ (x,[0,y]) - y|\ d\lambda(x)\ d\lambda(y)$.

After confirming the presence of dependence among CDS values, the next step is to identify the channels through which one CDS affects another. The methodology proposed by Junker et al. (2021) for quantifying dependence has outperformed the other methods, such as distance correlation (Szekely et al., 2007), the maximal information coefficient (Reshef et al., 2011), robust copula dependence (Ding et al., 2017), the randomized dependence coefficient (Lopez-Paz et al., 2013), and xicor (Chatterjee, 2020). A key advantage of the copula-based measure of dependence is its scale invariance, which enables the comparison of dependencies across different scales. Additionally, the measure's range, from 0 to 1, reflects varying degrees of interdependence, from none to complete. Importantly, this approach considers the direction of dependence, allowing for the recognition of potential asymmetries in the relation between two variables. Understanding both the directionality and degree of interconnection is crucial for a thorough analysis of risk transmission mechanisms in financial markets.

3.2. Granger Causality using mediator

Our approach is based on Zhao and Luo's (2017) method for estimating the mediation effect by integrating two frameworks: causal mediation analysis across the mediation variable and vector autoregressive model for temporal observation. Specifically, for data constituting ($\Delta lnCDS_{it}$, M_t, $\Delta lnCDS_{jt}$), the model incorporating the mediating variable can be mathematically represented as follows:

$$M_t = \Delta lnCDS_{it}\ A + E_{1t} \tag{1}$$

$$\Delta lnCDS_{jt} = \Delta lnCDS_{it}\ C + M_t\ B + E_{2t}\ ;\ \text{where i} \neq \text{j} \tag{2}$$

where $\Delta lnCDS$ represents the logarithmic return on CDS and serves as the variable in the vector autoregressive model; M_t denotes the mediating variable, which, in this study, is the CRP, estimated as the difference between the yield on government bond and a 10-year US treasury bond.

The residuals for equations (1) and (2) are mathematically interrelated with their lags as follows:

$$E_{1t} = \sum_{j=1}^{p} \omega_{11j}\ E_{1,t-j} + \sum_{j=1}^{p} \omega_{21j}\ E_{2,t-j} + \varepsilon_{1t}$$

$$E_{2t} = \sum_{j=1}^{p} \omega_{12j}\ E_{1,t-j} + \sum_{j=1}^{p} \omega_{22j}\ E_{2,t-j} + \varepsilon_{2t}$$

The coefficients of the equations are estimated by maximizing the likelihood function.

4. Data analysis

Table 1 summarizes the statistics for the logarithmic changes in CDS values and CRP across the BRICIT nations, detailing the mean, median, standard deviation, kurtosis, and skewness for both CDS and CRP. This analysis provides insight into the relative stability and risk profiles of these emerging markets. The data reveal varied patterns among the BRICIT countries: India's CDS and CRP exhibit the highest and lowest variabilities, respectively. Russia and Indonesia have the highest kurtosis for both CDS and CRP, indicating a greater likelihood of extreme values. India's CDS is notably positively skewed, suggesting occasional large positive shifts. Russia's CRP also displays a high positive skew, reflecting occasional significant increases in the country risk premium. Most BRICIT countries show CDS means close to zero, indicating that, over time, changes in CDS values tend to average out. Conversely, the positive CRP means for all nations indicate a consistent premium required for holding country-specific risk. Table 1 shows that, except for Türkiye and Russia, the average returns on the change in CDS values are negative for these nations, suggesting that, on average, Türkiye and Russia experience higher sovereign risk than the other BRICIT nations. Notably, the CDS price reflects the perceived sovereign risk of a nation; a higher CDS price signals a greater perceived risk. The consistently positive average CRP aligns with expectations, as it represents the yield spread between sovereign bonds and US Treasury bonds. Given the minimal risk of default by the US government, yields on sovereign bonds from BRICIT nations are typically higher, highlighting the greater perceived risk associated with these countries' bonds. Moreover, there is a noticeable trend where BRICIT nations influence each other's sovereign risk. This interconnectedness, driven by investor perceptions of these countries as viable investment destinations, underscores the importance of considering regional dynamics and cross-country interactions when evaluating sovereign risk within the BRICIT group.

Fig. 1 offers a visual representation of the variations in the CRP among the BRICIT nations. Each panel in the figure contrasts the CRP of a specific BRICIT nation against that of the others. For example, the first panel illustrates how the CRP of Brazil evolves over time compared with the mean, highlighting periods when it is above or below this baseline. When the CRP consistently exceeds the mean line, the perceived risk for that nation is considered high. The trend for China shows that its CRP generally remains below the baseline, suggesting that investors view China as less risky relative to the other BRICIT nations. In contrast, Türkiye's CRP frequently stays above the baseline, reflecting a higher risk perception among investors. This graphical analysis provides a clear, intuitive view of how risk perceptions fluctuate over time across the BRICIT nations, with the CRP's position relative to the mean line

Table 1
Descriptive statistics of credit default swap and country risk premium of BRICIT nations.

BRICIT Nations	Mean	Median	Standard Deviation	Kurtosis	Skewness
CDS					
BR_CDS	−0.0019	−0.0102	0.1506	4.9423	1.3550
RU_CDS	0.0027	−0.0026	0.0849	7.7993	1.5104
IN_CDS	−0.0096	−0.0216	0.1622	3.5430	4.5328
CH_CDS	−0.0069	−0.0181	0.1405	−0.1917	0.3745
ID_CDS	−0.0124	−0.0117	0.1522	7.4885	1.6048
TU_CDS	0.0053	−0.0026	0.1466	2.2632	0.6888
Country Risk Premium					
BR_CRP	0.0438	0.0447	0.0271	0.3818	−0.1163
RU_CRP	0.1058	0.1009	0.0602	9.6258	1.9586
IN_CRP	0.0477	0.0465	0.0123	2.1753	1.1686
CH_CRP	0.0970	0.0980	0.0135	0.9137	0.7224
ID_CRP	0.0406	0.0354	0.0204	1.1262	1.1547
TU_CRP	0.0846	0.0630	0.0530	−0.3138	0.9084

Codes for countries: US – United States of America, BR- Brazil, RU-Russia, IN-India, CH-China, ID-Indonesia, TU-Türkiye.

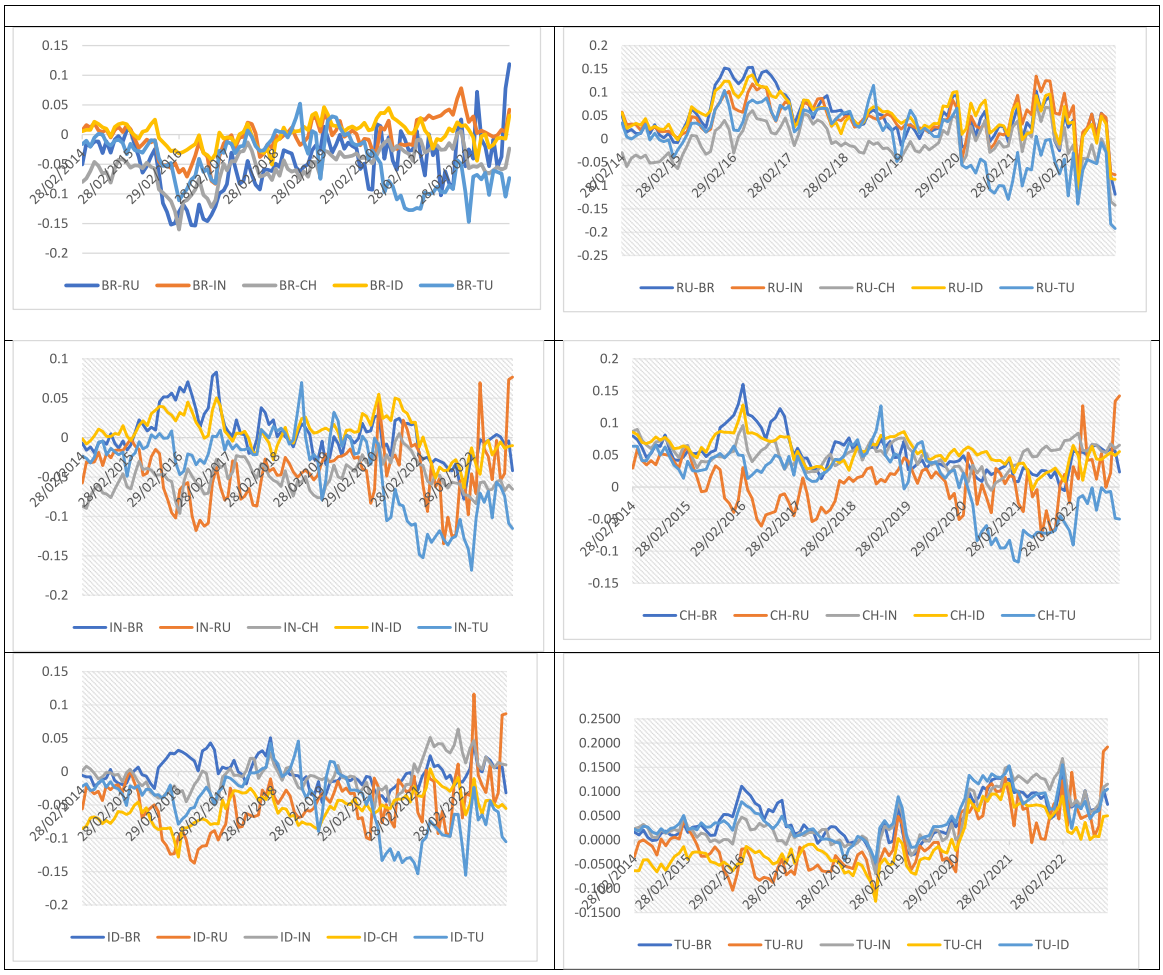


Fig. 1. Price/Return Plot for CDS of BRICIT Nations
Codes for countries: US – United States of America, BR- Brazil, RU-Russia, IN-India, CH-China, ID-Indonesia, TU-Türkiye.

serving as a gauge of each nation's relative riskiness.

5. Result discussion

5.1. Asymmetric dependence between BRICIT CDS

Table 2 displays the p values related to the dependence structure among the CDS values of the BRICIT nations. The off-diagonal elements in the table indicate the statistical significance of the dependence between pairs of variables, denoted as p(X,Y). Here, the cell position (X,Y) indicates how significantly variable X affects variable Y. A p value of <0.05 suggests a significant influence of X on Y. Of note, p(X,Y) can differ from p(Y,X), reflecting the asymmetry in the dependence structure. This asymmetry is further illustrated by the varying p-values for the pairs (X,Y) and (Y,X). The dependence analysis, based on the approach of Junker et al. (2021), is conducted on the logarithmic returns of the BRICIT CDS. This method ensures stationarity in data transformation, thereby reducing the impact of extreme values on the dependence assessment.

Table 2
P value of Dependence q(X,Y) based on "qad" Estimator.

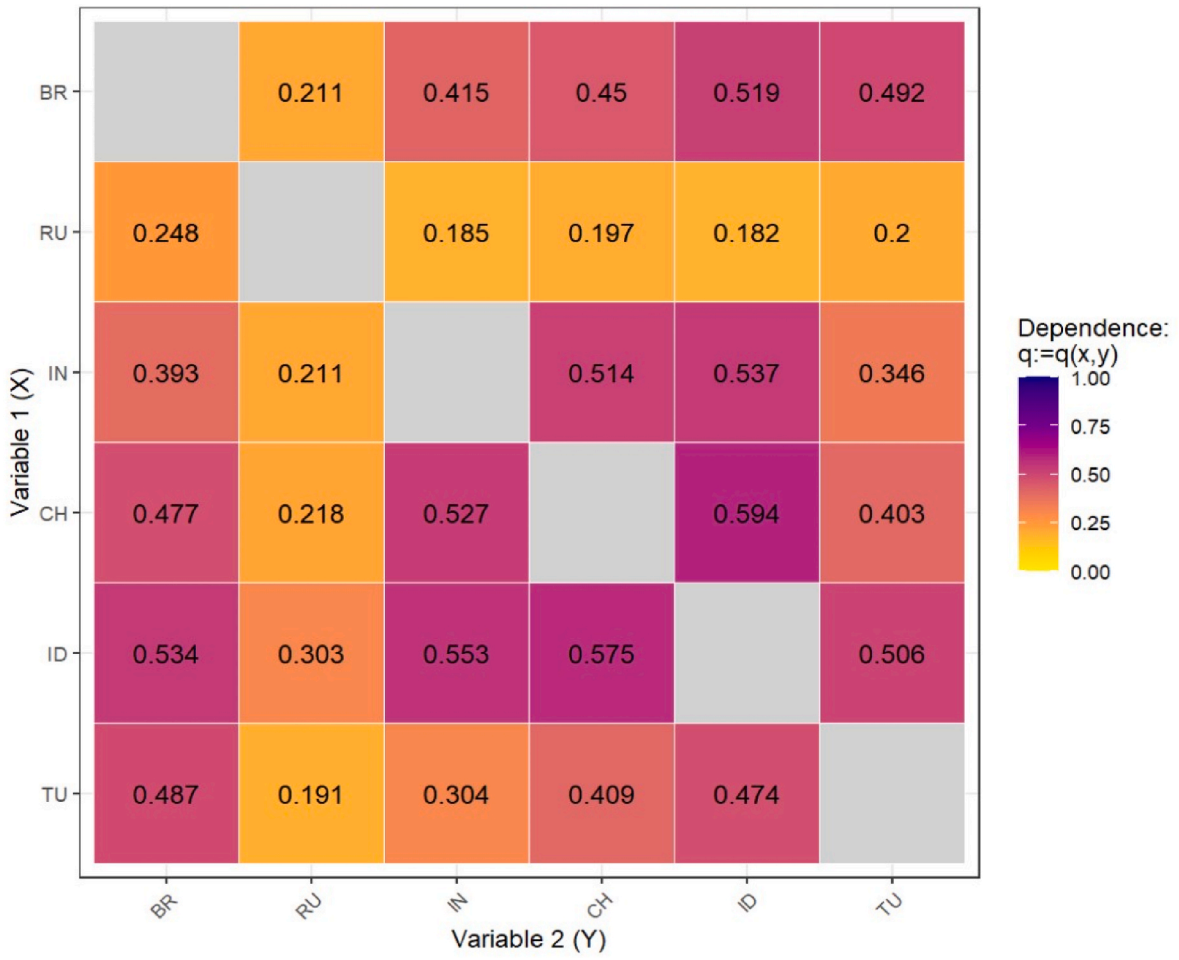
	BR	RU	IN	CH	ID	TU
BR		0.795	0	0	0	0
RU	0.45		0.946	0.889	0.957	0.882
IN	0	0.81		0	0	0.013
CH	0	0.739	0		0	0.001
ID	0	0.095	0	0		0
TU	0	0.914	0.083	0.003	0	

Codes for countries: BR- Brazil, RU-Russia, IN-India, CH-China, ID-Indonesia, TU-Türkiye.

Table 2 reveals that Brazil demonstrates significant directed dependence on all other BRICIT nations—India, China, Indonesia, and Türkiye—except Russia. This indicates that changes in Brazil significantly impact these nations. Conversely, Russia does not show significant direct dependence on any other BRICIT country, implying that changes in Russia have minimal impact on the other nations. India displays a significant direct dependence on Brazil, China, Indonesia, and Türkiye, indicating that changes in India affect these countries. However, India does not significantly influence Russia. Similarly, China significantly impacts Brazil, India, Indonesia, and Türkiye but does not significantly affect Russia. Indonesia shows significant influence over all other BRICIT nations, with only a borderline significant influence on Russia. Türkiye exhibits a significant direct dependence on Brazil, China, and Indonesia, with borderline significance toward India and no significant influence on Russia.

Table 3 features a heatmap that visualizes the average directed dependence q(X,Y) from nation X (rows) to nation Y (columns) among the BRICIT nations. The heatmap employs colors ranging from yellow (indicating low dependence) to purple (indicating high dependence) to represent these values. Brazil shows moderate-to-high dependence on Russia (0.211), India (0.415), China (0.45), Indonesia (0.519), and Türkiye (0.492). In contrast, Russia has consistently lower dependence on other nations, with the highest direct dependence being on Brazil

Table 3
Scale Invariant Directed Dependence.



(0.248). India exhibits significant dependence on Brazil (0.393) and high dependence on China (0.514) and Indonesia (0.537). China demonstrates strong dependence on Brazil (0.477), India (0.527), Indonesia (0.594), and Türkiye (0.403). Indonesia shows substantial dependence on Brazil (0.534), India (0.553), China (0.575), and Türkiye (0.506). Türkiye reveals notable dependence on Brazil (0.487), China (0.409), and Indonesia (0.474). Overall, the heatmap highlights China, Indonesia, and Brazil as key influencers with significant directed dependence values toward multiple nations. In contrast, Russia exhibits the lowest directed dependence, reflecting a more isolated influence within the group. This indicates that the Russian CDS neither significantly impacts nor is significantly impacted by the CDS values of the other BRICIT nations, suggesting distinctive characteristics in the dependence structure of Russian sovereign risk compared with its peers.

The transmission of financial contagion can occur through various channels, including financial linkages (De Bruyekere et al., 2013; Kallestrup et al., 2016, September; Dungey & Renault, 2017, August 7) and trade connections (Gorea & Radev, 2014; Gu, 2019). Analysis of export data from Russia to Brazil, China, India, Indonesia, and Türkiye, as shown in Appendix I, Figure A, indicates an upward trend. Despite the increase in trade activity, the logarithmic returns of Russian CDS do not exhibit significant interdependence on those of its trading partners, as detailed in Table 2. Similarly, significant import levels from these countries into Russia do not translate into notable CDS interdependence. This observation suggests that the absence of significant interdependence diminishes the likelihood of spillover effects.

This observation is particularly relevant in the energy sector, where the majority of the BRICIT nations depend on Russian crude oil imports. The petrodollar nexus, coupled with the Ruble crisis, has heightened investor concerns about the Russian market, impacting Russia's sovereign risk as reflected in its CDS prices (Grigoryeva, 2021). This situation suggests that major emerging markets are relatively insulated from the exchange rate risks associated with Russia. These risks have not propagated through trade channels to affect the sovereign risk of trading partners. This insight highlights the complexity of contagion mechanisms and demonstrates the resilience of emerging markets to specific types of financial risks.

The analysis indicates that Indonesia exhibits the highest level of directed dependence among the BRICIT nations, suggesting that the sovereign risk of the other countries is significantly influenced by Indonesia. This conclusion is supported by the trade data in Appendix I, Tables A and B, which detail the median quarterly trade within the study period. Table A's off-diagonal elements for each row represent the median exports to the other nations. Table B's off-diagonal row elements indicate the median imports from the other countries. The color coding in these tables highlights the top five highest values for median exports and imports, illustrating an asymmetry in the interdependence relative to bilateral trade trends.

Despite not leading in bilateral trade volumes, Indonesia emerges as both the most influential and the most influenced nation regarding the dependence structure, as evidenced by Table 3. This discrepancy indicates the presence of other crucial factors influencing dependence

channels. Specifically, the average directed dependence from Indonesia to the other nations, denoted as $q_{avg}(ID, Y^*)$, is lower than the directed dependence from the other nations to Indonesia, $q_{avg}(Y^*, ID)$. This suggests that Indonesian CDS is more affected by the other nations compared with the impact it exerts on these nations. Among these influences, the Chinese CDS has the most significant impact on Indonesia, exceeding the influence of Brazil and India. Conversely, China is identified as the second most interdependent CDS, predominantly acting as an influencer, rather than being influenced. Thus, within the BRICIT group, China plays a major role in affecting the sovereign risk of the other nations, while the Indonesian CDS is notably more susceptible to external influences.

The analysis of interdependence among the BRICIT nations highlights not only the inherent asymmetry in their sovereign risk profiles but also identifies the principal influencers and the most vulnerable nations within the group. The fluctuations in CDS returns are shaped by a mix of country-specific macroeconomic factors (Galariotis et al., 2016; Ho, 2016; Doshi et al., 2017) and broader global determinants. Although these global factors tend to be consistent across nations, the specific mechanisms through which one nation's CDS impacts another can vary considerably. To further investigate these dynamics, the next section examines two primary channels of influence: bilateral trade and CRP. This comparison aims to provide a deeper understanding of the factors driving sovereign risk transmission within the BRICIT group.

5.2. Channels that transgress risk in sovereign risk of one nation to another

Table 4 demonstrates the mediating effect of the CRP spread on the transmission of sovereign risk between different CDS measures. The coefficients A, C, and B, as outlined in equations (1) and (2) from Section 4.2, are used to quantify this effect. Each submatrix in the table illustrates the impact of the logarithmic change in one country's CDS on the CDS values of the other BRICIT nations, with the CRP spread serving as the intermediary variable. For example, the first submatrix shows how changes in Brazil's CDS influence the other nations, mediated through the CRP spread. The CRP spread is calculated as the difference between the CRPs of the involved countries, which reflects the variation between the endogenous variable and the response. In a scenario where Brazil's CDS is the endogenous variable, the CRP spread is computed as the difference between Brazil's CRP and that of the other nations. If India is the response variable, the spread is the difference between Brazil's and India's CRP. This method is used to quantify the premium that investors receive for holding a sovereign bond from one country compared to a U. S. Treasury bond, capturing the yield spread. A more positive spread indicates higher perceived risk associated with the nation relative to others.

Table 4
Country risk premium spread as channel of transmission.

BR				
	IN	CH	ID	TU
A	−0.0057	−0.0091	0.0102	0.0178
C	0.6406	0.409	0.724	0.6253
B	0.654	−0.9871	−0.2472	1.053
Total	0.6369	0.418	0.7215	0.644
Indirect	−0.0037	0.009	−0.0025	0.0187
IN				
	BR	***CH***	***ID***	***TU***
A	−0.0035	−0.0051	0.0031	−0.0121
C	0.5664	0.3201	0.7638	0.4071
B	0.6822	−1.1719	2.3916	2.8725
Total	0.5641	0.3261	0.7711	0.3722
Indirect	−0.0024	0.006	0.0073	−0.0349
CH				
	BR	***IN***	***ID***	***TU***
A	0.0175	0.0114	0.0191	0.0011
C	0.5007	0.4555	0.6226	0.3718
B	0.1683	0.2536	1.3277	2.6834
Total	0.5036	0.4584	0.648	0.3747
Indirect	0.0029	0.0029	0.0254	0.003
ID				
	BR	***IN***	***CH***	***TU***
A	−0.0057	−0.0198	−0.0179	−0.0252
C	0.7055	0.8248	0.5085	0.6079
B	−0.9337	1.8134	−1.0368	2.724
Total	0.7108	0.7888	0.5271	0.5391
Indirect	0.0053	−0.036	0.0186	−0.0687
TU				
	BR	***IN***	***CH***	***ID***
A	−0.0369	−0.0525	−0.0512	−0.0392
C	0.701	0.5797	0.3687	0.6748
B	0.2878	2.2294	0.9465	2.6138
Total	0.6904	0.4626	0.3202	0.5723
Indirect	−0.0106	−0.1171	−0.0485	−0.1025

Codes for countries: BR- Brazil, RU-Russia, IN-India, CH-China, ID-Indonesia, TU-Türkiye.

Table 4 presents a comprehensive analysis of the mediating role of the CRP spread in sovereign risk transmission among the BRICIT nations, utilizing coefficient measures A, C, and B. For Brazil, the analysis reveals significant indirect effects on Türkiye (0.0187) and China (0.0090), with substantial total effects on Indonesia (0.7215) and Türkiye (0.6440). India's CDS shows notable indirect effects on Indonesia (0.0073) and China (0.0060) and high total effects on Indonesia (0.7711) and Brazil (0.5641), indicating a strong sovereign risk transmission via the CRP spread. Türkiye's CDS exhibits moderate-to-high total effects on Brazil (0.6904), Indonesia (0.5723), and India (0.4626). However, the indirect effects are negative and substantial in some cases, such as with India (−0.1171). China's CDS demonstrates significant indirect effects on Indonesia (0.0254) and moderate effects on Brazil (0.0029) and India (0.0029), with high total effects, particularly with Indonesia (0.6480). Indonesia's CDS reveals significant total effects on all nations, especially on India (0.7888) and Brazil (0.7108), with notable indirect effects, particularly on Türkiye (−0.0687). Table 4 highlights that Brazil, India, and China are key influencers with strong interconnectedness. Türkiye and Indonesia exhibit substantial but more complex mediation patterns. Russia is not included in this analysis, indicating its less important role in this context.

Our analysis reveals that the direct effect (C) between CDS values across nations is positive in all cases. This finding implies that an increase in the logarithmic change of the CDS price for one country is linked to an increase in the CDS price of another, indicating a positive correlation in risk between the two nations, despite variations in the magnitude of their CDS values. However, the indirect effects present a more complex picture, with many instances showing a negative relationship. This insight, derived from mediation analysis, indicates that certain CDS pairs exhibit negative interconnections. A negative indirect effect may arise from either a negative association of the mediator with the independent variable (A) or a negative impact of the mediator on the response variable (B). Such scenarios have distinct economic implications. Specifically, a negative relation between the mediator and the endogenous variable suggests that the sovereign risk, as indicated by the CDS, is inversely related to the risk premium spread. This underscores the complexity of the relations between sovereign risk measures and highlights the nuanced role of the CRP spread as a mediating factor in these dynamics.

Türkiye exhibits a negative indirect effect in its relationships with all other BRICIT nations due to the negative association between the CRP spread and the Turkish CDS. This relation implies that an increase in the perceived riskiness of Türkiye's CDS leads to a widening spread of Türkiye's sovereign bonds relative to those of the other nations. This reflects market perceptions where Türkiye's likelihood of default influences its bond yields in comparison with other countries in the study. As Türkiye is perceived as riskier than Brazil, India, China, and Indonesia, the premiums on the CDS of these nations decrease relative to that of Türkiye. Essentially, high market perceptions of Türkiye's default risk make other nations appear less risky in comparison, resulting in a

decrease in their sovereign risk.

The magnitude of this indirect effect is especially pronounced in India, where a high perceived riskiness of Turkish sovereign assets correlates with India being viewed as the least risky market, thereby exerting the most significant negative influence on sovereign CDS values. Indonesia also exhibits a notable indirect effect in this context. This aligns with India's position as one of the fastest-growing economies in recent years, offering substantial growth potential. In contrast, China has faced significant economic slowdown and contraction, while Brazil has encountered political instability that has negatively impacted its investment climate. Other pairs demonstrating a negative indirect relationship mediated by the Country Risk Premium include {BR - > IN, BR- > ID, IN- > BR, IN- > TU, ID- > IN, ID- > TU}. The indirect effects in these cases vary not only in magnitude but also in direction, highlighting asymmetric dependencies among the CDS values of these nations. This asymmetry reveals the complex interplay of sovereign risk perceptions among the BRICIT countries, shaped by both individual country risks and broader market sentiments.

A significant finding from the analysis is that the Chinese CDS exhibits a positive indirect effect on Brazil, India, and Indonesia, though not on Türkiye. Notably, the Chinese CDS maintains a positive association with the mediator in all cases. This pattern indicates that regardless of investors' perceptions of sovereign risk in China, the perceived risk in the other nations remains high. This could be attributed to China's substantial economic and geopolitical influence among emerging economies. Research has highlighted that the macroeconomic and geopolitical landscape significantly affects a nation's sovereign risk (Bratis et al., 2023; Naifar & Aljarba, 2023). Countries with geopolitical and economic dominance are often relatively insulated from shifts in investor sentiment. As a result, even amid unfavorable investment conditions, nations within the sphere of influence of a dominant country experience the impact of its economic and geopolitical strategies. Thus, the observed asymmetry in China's case, where both direct and indirect effects of its CDS on other nations are positive, underscores the complex dynamics of sovereign risk transmission influenced by China's central role in the global economy.

6. Conclusion

Extensive research has examined spillover effects within financial markets, with a particular focus on the rapidly growing sector of emerging economies. A crucial step in understanding these spillover dynamics is identifying the interdependence among the relevant variables. This study suggests that, in addition to the attractive returns of emerging markets, the sovereign risks associated with these economies are also interconnected. Therefore, the primary aim of this research is to map out the dependence structure among the sovereign risks of the BRICIT nations. Recognizing the potential for asymmetric effects in these transmission channels, the study utilizes a copula-based measure, as proposed by Junker et al. (2021), to capture the nuances of dependence.

A key finding of this research is that despite Russia's significant bilateral relationships with the BRICIT nations, there is a lack of substantial interdependence with these nations regarding sovereign risk. This finding contradicts the results reported in existing literature, which has highlighted bilateral trade as a key mediator in the relation between country CDS values (Gorea & Radev, 2014; Gu, 2019). Notably, even though the BRICIT nations heavily rely on Russian crude oil imports to meet their energy needs, they seem relatively insulated from Russia's sovereign risk. This suggests a complex interplay between economic dependencies and risk transmission mechanisms that may not be directly linked to the intensity of bilateral trade relations. Given the observed asymmetries in the level of interdependence compared to bilateral trade, this study explores the transmission channels through which one CDS influences another. In this context, CRP is used as a key variable, with the spread between the risk premiums of two countries serving as the mediating factor. A larger spread indicates a greater vulnerability of one nation to the sovereign risk of another. To investigate this dynamic, a Granger mediation analysis methodology is employed to evaluate the mediation effect within time-varying data.

The findings indicate that, on average, Türkiye is the most vulnerable among the BRICIT nations, showing a negative indirect effect with every other CDS, mediated through the risk premium spread. Additionally, recent trends suggest that investor sentiment is increasingly favoring the Indian market, which is perceived as offering lower uncertainty and greater growth potential. In contrast, China stands out for its regional influence, with its sovereign risk affecting other CDS measures similarly, implying that there are limited alternative markets from an investor's perspective when facing Chinese market risk. This research provides a foundation for further exploration of market interconnections, focusing on both regional and global channels that impact CDS prices. Future studies should examine the geopolitical and economic variables of influential nations with regional dominance, as these factors can overshadow alternative investment opportunities during times of heightened risk.

CRediT authorship contribution statement

Pawan Kumar: Writing – review & editing, Visualization, Supervision, Validation, Formal analysis. **Vipul Kumar Singh:** Conceptualization, Methodology, Validation, Resources, Writing – review & editing, Project administration.

Appendix I

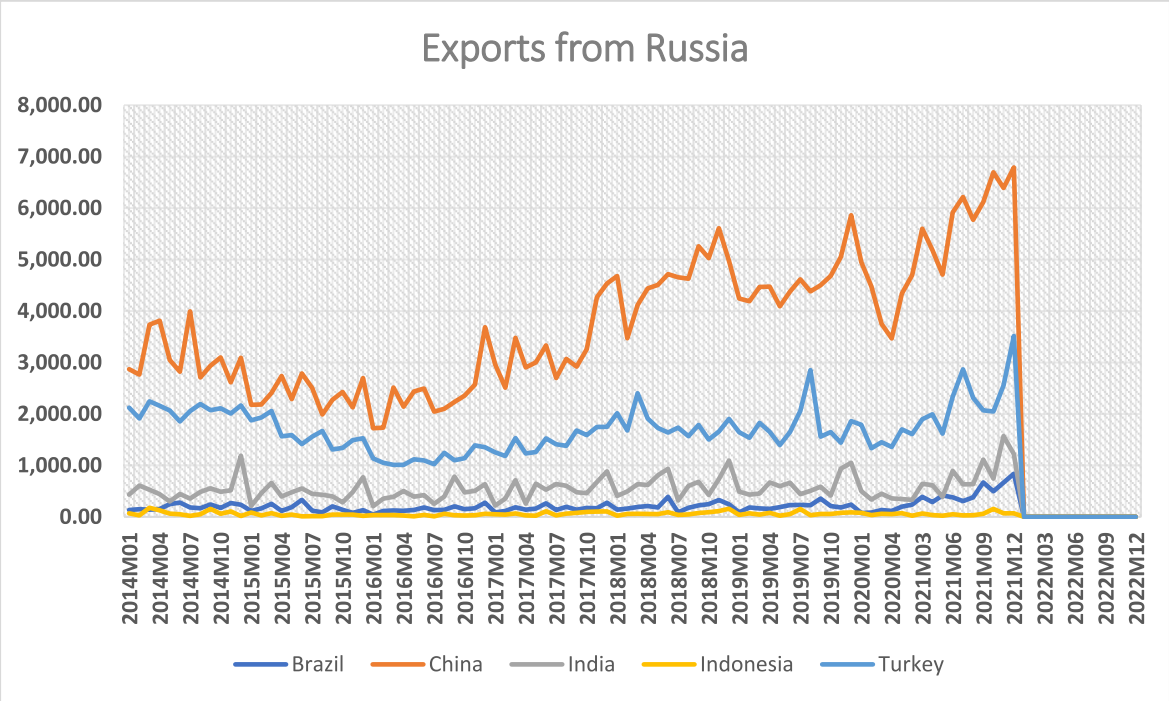


Fig. A. Total Exports from Russia in USD millions

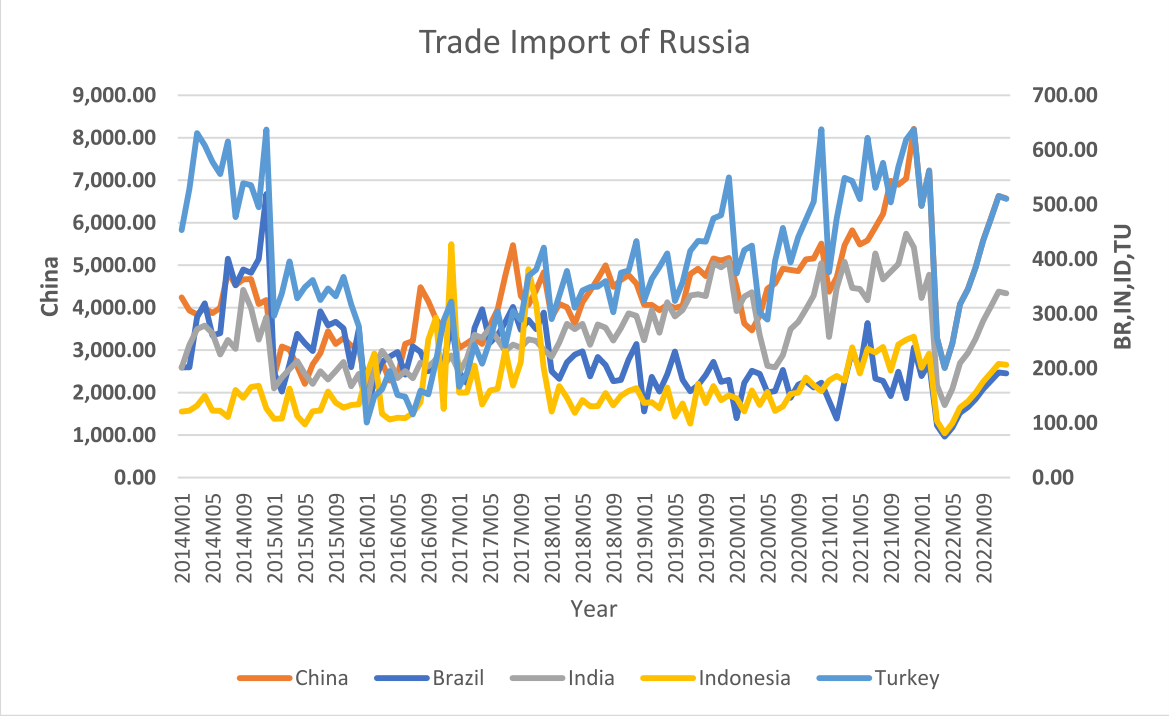


Fig. B. Total Exports to Russia in USD millions

Table A
Export Matrix (X,Y) based on Median Value.

	BR	RU	IN	CH	ID	TU
BR		4766.179	346.994	153.4065	167.1418	150.508
RU	183.0344		3581.297	496.5191	51.35115	1648.39
IN	306.6611	1157.497		355.2303	188.1095	436.9
CH	2805.516	5857.448	3514.658		4055.11	1628.743

(*continued on next page*)

Table A (*continued*)

	BR	RU	IN	CH	ID	TU
ID	98.33565	2033.42	1038.938	85.85367		99.89896
TU	42.56785	242.7387	77.27316	21.83515	327.1691	

Table B
Import Matrix (X,Y) based on Median Value.

	BR	RU	IN	CH	ID	TU
BR		2892.132	392.9982	121.3109	264.8533	51.56079
RU	197.0867		4166.391	256.6906	151.9048	375.6351
IN	358.65	5777.619		1262.425	500.3	125.985
CH	5610.48	1434.812	2698.199		4207.36	309.8134
ID	180.2637	3098.473	341.762	103.4708		27.8335
TU	216.1877	2075.137	531.4446	127.0443	1866.58	

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