Etikonomi
Volume 24(1), 2025: 53 - 68
P-ISSN: 1412-8969; E-ISSN: 2461-0771
https://doi.org/10.15408/etk.v24i1.38452

Interconnectedness and Systemic Risk: Insights from Indonesian Financial Conglomerates

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JEL Classification:
C58
G21

Received: 16 April 2024

Revised: 09 September 2024

Accepted: 27 October 2024

Available online: March 2025

Published regularly: March 2025

Abstract

Research Originality: This research addresses the gap in existing studies by examining the time-varying volatility spillover index among conglomerates in listed financial companies in Indonesia, an unexplored area.

Research Objectives: The study investigates the potential interconnectedness among financial institutions, one source of systemic risk, by analyzing volatility spillovers within conglomerates.

Research Methods: Using a generalized VAR approach, we examined total volatility spillover, directional volatility spillover, and total volatility spillover indices for 14 companies from four conglomerates, utilizing daily data from 2010 to March 2023.

Empirical Results: The results reveal significant interconnectedness within these conglomerates, indicating potential for systemic risk that could threaten the financial system's stability. Another noteworthy finding is that the volatility transmission within banking conglomerates predominantly originates from subsidiary companies to parent companies.

Implications: Regulators need to supervise spillovers at both the parent and subsidiary levels by developing regulations that address both levels to ensure effective risk management.

Keywords:

conglomerates; volatility spillover; interconnectedness; systemic risk

How to Cite:

Kusumahadi, T. A., Saadah, S., Permana, F. C. (2025). Interconnectedness and Systemic Risk: Insights from Indonesian Financial Conglomerates. *Etikonomi, 24*(1), 53 – 68. https://doi.org/10.15408/etk.v24i1.38452.

INTRODUCTION

As of December 28, 2022, four of the ten companies with the largest market capitalization in the Indonesian stock market are established as banking conglomerates. These banks manage networks of subsidiary companies operating across various sectors within the financial industry, including banking, insurance, the capital market, and other non-bank financial institutions. Interconnectedness among entities in a conglomeration may lead to an economic shock, causing immediate transmission from one entity to other entities and compromising the stability of a financial system. Consequently, micro-prudential authorities encounter substantial challenges in maintaining a stable financial system and addressing potential spillovers from these conglomerates. Adequate supervision is required to control financial conglomerates' stability and mitigate potential systemic impacts on the financial sector and the broader economy.

As highlighted by the World Bank (2019), the prevalence of financial conglomerates contributes a significant source of systemic risk within Indonesia's financial sector. The asset share of financial conglomerates within the financial services sector has shown a consistent upward trajectory, rising from 57.8% after the enactment of Financial Services Authority Regulation No. 45/POJK.03/2020 concerning Financial Conglomerates (effective October 16, 2020) to 61.0% by June 2022. The increasing concentration of financial conglomerate assets underscores the critical need for enhanced regulatory oversight. The World Bank (2019) emphasizes the potential for significant systemic repercussions should one of these conglomerates face financial distress. The global relevance of this issue is further demonstrated by the issuance of the Principles for the Supervision of Financial Conglomerates, which reflects the heightened international focus on the risks posed by these entities. The heightened focus stems from concerns that inadequate regulation and oversight of financial conglomerates have been identified as contributing factors in precipitating financial crises. In other words, it is suggested that regulators exercise their comprehension to consider the potential impacts and risks caused by conglomerates' activities on the overall financial system.

Systemic risk involves the probability of correlated defaults among financial institutions, potentially steering the widespread loss of confidence in the financial system. Bank Indonesia (2014) defines systemic risk as potential instability resulting from interconnected disruptions within the financial system, influenced by size, business complexity, and excessive procyclicality. Moreover, the high degree of interconnectedness among financial institutions increases the potential for risk transmission, or contagion, throughout the financial system. As banks form the financial system's foundation, their interconnectedness through downstream conglomerate activities highlights the necessity for comprehensive oversight. In Indonesia, three of the largest government-owned banks control around 40% of total banking assets, while financial conglomerates hold approximately 80% of these assets, equivalent to 72% of the country's GDP. This high concentration increases the risk of systemic disruption, as evidenced by the 2008 financial crisis following the collapse of Lehman Brothers.

Over time, financial conglomerates have been the subject of extensive research addressing various aspects. Curi and Murgia (2018) emphasized the importance of internal

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DOI: https://doi.org/10.15408/etk.v24i1.38452

capital markets within financial conglomerates, signifying the importance of allocating resources among subsidiaries. On the other hand, Boguth et al. (2022) highlighted the significance of understanding conglomerates' value and internal capital allocation strategies, reflecting broader interests in financial economics. Hidayat (2016) found that financial conglomerates outperform focus banks regarding financial performance, while Supangkat et al. (2020) demonstrated that financial conglomerates and competition positively impact banking efficiency and stability.

However, these studies frequently neglect the crucial issue of interconnectedness among entities within a single conglomerate—a key source of systemic risk that potentially undermines the financial system's stability. Previous studies suggested various views on this discussion. Excessive diversification within financial conglomerates may trigger systemic collapse schemes. Complexities associated with these conglomerates frequently result in increased systemic risk, as illustrated by the global financial crisis 2007, proving the interrelated structure of conglomerates affected market instability (Kuznetsova et al., 2018). Despite implementing regulatory frameworks to mitigate these risks, such measures have proven insufficient in comprehensively addressing the full extent of the risks posed by financial conglomerates (Franzoni & Giannetti, 2017).

Furthermore, previous research has predominantly concentrated on macroeconomic impacts, leaving the dynamic nature of volatility spillovers within conglomerate organizations largely unexplored. Diebold and Yilmaz (2012; 2014) applied Generalized Vector Autoregressive methodologies to quantify the transmission of volatility spillovers among equity, bond, foreign exchange, and commodity markets. Their findings indicated that significant spillovers accelerated the transmission of cross-market volatility during the global financial crisis. However, previous studies mainly observed spillovers between different markets—such as equity, bond, foreign exchange, and commodity markets, limiting the discussion of the internal dynamics and interconnectedness among entities within a single conglomerate, particularly in emerging markets such as Indonesia.

Adawiyah and Pramuka (2017) analyzed the performance of financial conglomerates in Indonesia by implementing industrial organization theory and focusing on the efficiency of internal capital markets. However, their study did not consider the volatility dynamics that play a critical role in systemic risk—an oversight particularly pertinent in Indonesia, where the high degree of interconnectedness among financial institutions can lead to pronounced spillover effects during economic instability. Similarly, Widiyono (2023) did not delve into the financial implications of interconnectedness and volatility spillovers in observing the legal frameworks governing conglomerates. In contrast, legal structures are crucial in managing risks within conglomerates. They often fall short in empirically measuring volatility spillovers.

Additionally, the resilience of conglomerates in the face of economic downturns has been extensively explored. Anconetani et al. (2024) discussed how internal capital markets possibly mitigate financial constraints, highlighting conglomerates' ability to buffer against financial shocks. This perspective overlooks the potential risks associated with interconnectedness, exacerbating vulnerabilities during crises. Examining the volatility spillover index offers a novel perspective on conglomerates' dual nature as resilient and

potentially risky entities. Gyan (2017) and Christianti (2020) closely assessed financial conglomerates' performance and risk profiles, despite overlooking the time-varying volatility spillovers that can arise from their interconnected structures.

Researchers commonly apply standard VAR models or multivariate GARCH frameworks to analyze volatility spillovers. A case in point is Gamba-Santamaria et al. (2017), who implemented the DCC-GARCH model to construct volatility spillover indices in Latin America, effectively capturing the time-varying nature of asset covariances. However, these methodologies may not adequately address the intricate interdependencies inherent in financial conglomerates, especially within emerging markets such as Indonesia. Observing developed markets with limited discussion of emerging economies receives more attention. Chirilă & Chirilă (2022) investigated volatility spillovers solely within the stock markets of Germany, France, and Central and Eastern Europe, highlighting their implications for portfolio management and policy-making. The study did not extend to Indonesia's distinctive financial landscape, where conglomerates play a crucial economic role.

The impact of conglomerate structure regarding volatility spillovers has not yet been largely discussed. Aslam et al. (2021) analyzed intraday volatility spillovers among European financial markets during the COVID-19 pandemic, focusing on the importance of interconnectedness in managing financial crises. However, the European markets' examination does not reflect the distinct characteristics of Indonesian conglomerates, which may exhibit different spillover dynamics due to varying regulatory environments and market structures. Investigating these dynamics within Indonesian conglomerates offers a new perspective on the interconnectedness of financial institutions and their implications for systemic risk.

Unlike prior research, this study focuses on the time-varying volatility spillover index among conglomerates within Indonesian listed financial institutions. Applying a Generalized VAR approach, this paper offers a more comprehensive analysis by integrating cross-sectional dependencies and capturing the dynamic interactions of volatility spillovers across multiple entities concurrently. This research aims to elucidate the impact of these spillovers on Indonesia's financial stability and to enhance the understanding of financial interconnectedness and systemic risk. The anticipated findings are expected to provide valuable insights for policymakers and financial practitioners in effectively managing risks associated with interconnected financial systems.

METHODS

This study implements the generalized vector autoregressive method to explore interconnectedness among financial institutions. This method enables a detailed examination of volatility transmission among entities within financial conglomerates. As established by Diebold and Yilmaz (2012; 2014), this paper implements forecast error variance decomposition derived from the generalized VAR model to measure both total and directional volatility spillovers.

The total volatility spillover indices reflect the overall extent of transmitted volatility across the financial network, indicating systemic risk. In contrast, directional volatility

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spillovers reveal the specific pathways through which volatility flows between entities. The generalized VAR method is employed to improve the precision of these measurements, ensuring the robustness of the variable ordering and minimizing the decomposition of forecast error variance. The following equation formulates the computation of the total volatility spillover index:

$$S^g(H) = \frac{\sum_{i,j=1}^{N} \tilde{\theta}_{ij}^g(H)}{\sum_{i,j=1}^{N} \tilde{\theta}_{ij}^g(H)} \cdot 100 = \frac{\sum_{i,j=1}^{N} \tilde{\theta}_{ij}^g(H)}{N} \cdot 100 \quad (1)$$

$\tilde{\theta}_{ij}^g(H)$ is H-step-ahead forecast error variance decompositions, referring to the framework of Koop, Pesaran, dan Potter (1996) and Pesaran dan Shin (1998), subsequently abbreviated as KPPS, where H = 1, 2, …

This index measures the contribution of each entity's volatility spillover to the overall forecast error variance within a financial system. By employing the rolling sample technique, researchers can analyze how total volatility spillover evolves, identifying periods when it reaches extreme values. High total volatility spillover values indicate significant systemic risk due to the increased interconnectedness among financial conglomerates. Such peaks in spillover indices often correspond with periods of market stress or instability, highlighting the potential for widespread risk propagation across the financial system. Thus, monitoring total volatility spillover indices provides valuable insights for anticipating and managing systemic risks related to the stability of financial networks.

The total volatility spillover index quantifies the extent to which volatility transmits from one financial entity to another; however, it does not capture the directional aspects of these spillovers. This study applies the generalized VAR method to analyze directional volatility spillovers comprehensively. Detailed examination of the volatility transmission from one specific entity to another, revealing the direction of spillovers, is expected to be drawn accordingly. Following is the formulation of directional volatility spillovers received by the entity from all other entities:

$$S^g{}_{i.}(H) = \frac{\sum_{j=1}^{N} \tilde{\theta}_{ij}^g(H)}{\sum_{i,j=1}^{N} \tilde{\theta}_{ij}^g(H)} \cdot 100 = \frac{\sum_{j=1}^{N} \tilde{\theta}_{ij}^g(H)}{N} \cdot 100 \quad (2)$$

Meanwhile, the directional volatility spillovers transmitted by entity to all other entities is formulated as follows:

$$S^g{}_{.i}(H) = \frac{\sum_{j=1}^{N} \tilde{\theta}_{ji}^g(H)}{\sum_{i,j=1}^{N} \tilde{\theta}_{ji}^g(H)} \cdot 100 = \frac{\sum_{j=1}^{N} \tilde{\theta}_{ji}^g(H)}{N} \cdot 100 \quad (3)$$

Based on the directional volatility spillovers above, the net spillover from entity to all other entities can be calculated by the following equation:

$$S^g{}_i(H) = S^g{}_{.i}(H) - S^g{}_{i.}(H) \quad (4)$$

Net spillover differs the volatility transmitted to other entities and the volatility received from other entities. This metric suggests the relative role of each entity within a financial system. By analyzing net spillover, one can identify which entities act as net transmitters—those that pass more volatility to others than they receive—and which act

as net receivers—those that absorb more volatility from others than they transmit. This distinction is crucial for assessing the influence and risk profile of different entities within a financial conglomerate. Net spillover helps to pinpoint key players that could contribute to or mitigate systemic risk, thereby guiding targeted regulatory and risk management strategies.

Before calculating these spillovers, it is required to convert the data into daily volatility data for each entity using the following equation (Brooks, 2019). This transformation is based on the highest and lowest stock prices for each entity, allowing for a more precise analysis of volatility dynamics.

$$\sigma^2_{it} = \ln\left(\frac{high_{it}}{low_{it}}\right) x\ 100\% \qquad (5)$$

Where:

σ^2_{it} = variance of stock in period

$high_{it}$ = high price of stock in period

low_{it} = low price of stock in period

Table 1. Sample Period

Conglomerates Group	Company	Code	Industry	Sample Period
1	Parent company	PC1	Bank	May 9, 2018 – March 31, 2023
	Subsidiary company	SC11	Bank	
2	Parent company	PC2	Bank	May 9, 2018 – March 31, 2023
	Subsidiary company	SC21	Bank	
	Subsidiary company	SC11	Bank	
3	Parent company	PC3	Multi-sector holding	January 15, 2010 – March 31, 2023
	Subsidiary company	SC31	Financial holding	
4	Subsidiary company	SC41	Investment banking	January 13, 2014 – March 31, 2023
	Subsidiary company	SC42	Life insurance	
	Subsidiary company	SC43	Bank	
	Subsidiary company	SC44	Consumer financing	
	Parent company	PC4	Bank	
	Subsidiary company	SC45	Consumer financing	
	Subsidiary company	SC46	General insurance	
	Subsidiary company	SC47	General insurance	

Where:
PC = Parent Company within each conglomerates group
SC = Subsidiary Company within each conglomerates group

The research examines 14 companies that are part of four distinct conglomerates within the financial sector. The dataset includes four parent companies that are central to their respective conglomerates, overseeing and managing the operations of their subsidiary companies. These subsidiaries operate across various sectors within the financial industry, including banking, insurance, and asset management. Notably, among the ten subsidiaries, one is part of two different conglomerates and is managed by two parent companies,

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introducing a unique layer of complexity to understanding the interconnectedness and spillover effects within the observed conglomerates.

The selection of these 14 companies is based on their public listing status on the Indonesian Stock Exchange (known as Tbk.). The inclusion of public financial data is critical as it ensures transparency and facilitates a comprehensive analysis of financial metrics. Other listed financial companies were excluded either because they do not belong to a conglomerate or because they are part of one but lack accessible data. This targeted selection enhances the accuracy and reliability of the examination of volatility spillovers and interconnectedness within financial conglomerates.

Table 1 presents the research sample period, as obtained from the Bloomberg Terminal. The identities of the companies are anonymized using coded references to maintain confidentiality. The study adheres to stringent privacy and confidentiality standards by utilizing the set anonymized codes, in line with ethical research practices. This approach ensures the protection of the companies' identities and minimizes the risk of revealing specific financial information that could potentially affect their market perception.

RESULT AND DISCUSSION

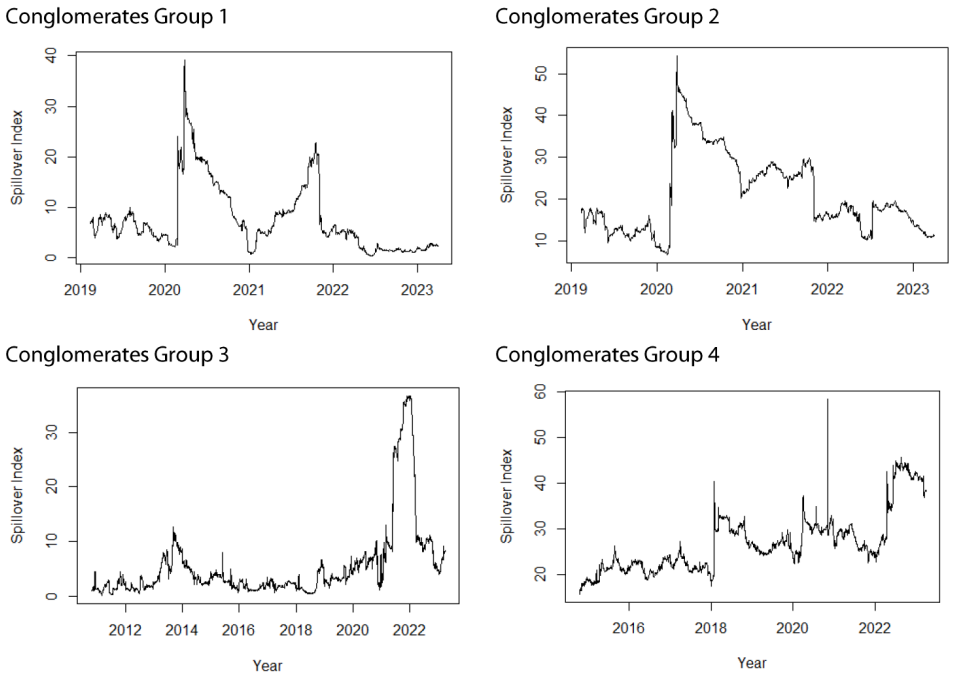
Analyzing volatility spillover within Indonesian financial conglomerates reveals significant interconnectedness among their entities. By implementing the Generalized Vector Autoregressive (VAR) method, created by Koop et al. (1996) and later used by Diebold and Yilmaz (2012; 2014), the changing connections can be closely apprehended. The findings of this study indicate that the volatility spillovers among conglomerate entities are not static but vary over time, with a marked increase during periods of market stress. These spillovers' intensity increased during the COVID-19 pandemic, indicating that negative market shock amplifies volatility transmissions within conglomerates. This research reveals the dynamic nature of these spillovers, highlighting the transmission of shocks from parent companies to subsidiaries and in the opposite direction.

Figure 1 depicts the dynamic volatility spillover indices for the four conglomerate groups under analysis. The findings reveal a broadly consistent pattern across all groups, with a marked increase in volatility during the COVID-19 pandemic. For instance, in Conglomerate Group 1, the spillover index surged in early 2020, peaking on March 27, 2020, at 39.174, before gradually declining by late 2021. This market disruption, attributed to the COVID-19 pandemic, aligns with previous studies that identified heightened volatility (Bora & Basistha, 2021; Chaudhary et al., 2020; Kusumahadi & Permana, 2021; Okorie & Lin, 2021; Yousef, 2020). Likewise, Conglomerate Group 2 exhibited a significant spike in volatility spillovers, reaching a peak of 54.30 on March 27, 2020, indicative of increased market uncertainty and the subsequent transmission of volatility among entities within the group.

In Conglomerates Group 3, Figure 1 illustrates how volatility spillover varied from 2010 to 2023, with the index beginning to increase in May 2021 and peaking on December 27, 2021. For Conglomerates Group 4, the results show that the volatility

spillover index was relatively lower from 2016 to 2017 compared to 2018 to 2023, peaking on November 3, 2020, at 58.49 and gradually declining towards the end of 2022. The dynamic volatility spillover index indicates fluctuations in spillover intensity, with notable peaks during periods of market stress.

Figure 1. Dynamic Volatility Spillover Index of Conglomerates Group 1-4



The findings of this study align with previous research that underscores the heightened spillover effects during market downturns. Diebold and Yilmaz (2012; 2014) found that cross-market volatility spillovers became more pronounced during the global financial crisis, a pattern reflected in the increased spillovers observed in this study during the COVID-19 pandemic. Recent research indicates that spillover effects in financial markets become increasingly pronounced during periods of crisis, such as the COVID-19 pandemic and the 2008 financial crisis. For example, studies have documented a substantial rise in spillovers among regional stock markets during the COVID-19 crisis, highlighting the intensifying market interdependence under stress (Belaid et al., 2023). Furthermore, spillovers across various asset classes surged during this period, reflecting a broader trend of heightened interconnectedness during global crises (Ben Amar et al., 2021). The pandemic significantly amplified these spillover effects, adding complexity to the investment and regulatory environment.

Fang et al. (2021) found that spillovers between Chinese markets and G7 economies were markedly higher during the 2008 global financial crisis and the 2009 European debt crisis, demonstrating how market stress amplifies interconnectedness. Furthermore, Tan et al. (2022) studied the global financial market risk during the COVID-19 pandemic, revealing that increased spillover levels confirm the trend of heightened market interconnectedness

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DOI: https://doi.org/10.15408/etk.v24i1.38452

and complicated risk management strategies. Analysis of financial stress in the MENA region shows that stress transmission was significantly higher during the global financial crisis (Elsayed & Yarovaya, 2019). Research on this topic consistently demonstrates how periods of market stress significantly amplify spillover effects, with crises like the COVID-19 pandemic and the 2008 financial crisis exacerbating the interconnectedness of the financial market. This result highlights the necessity for robust risk management strategies to tackle increased spillover risks during turbulent circumstances.

Table 2. Volatility Spillover of Conglomerates Group 1

	PC1	SC11	Directional FROM others
PC1	90.25	9.75	9.75
SC11	8.53	91.47	8.53
Directional TO others	8.53	9.75	
Directional including own	98.78	101.22	
Total Spillover Index			9.14

In addition, this research finds the occurrence of volatility spillover within each conglomerate group. Table 2 presents Conglomerates Group 1's volatility spillover[1]. The findings indicate that the transmission of volatility from subsidiaries to parent companies accounts for 9.75% of the forecast error variance. Meanwhile, the reverse transmission from PC1 to SC11 is 8.53%. The total spillover index suggests that, on average, 9.14% of the forecast error variance volatility within this group is due to spillover. The relatively low directional and total spillover indices suggest the group has limited but notable interdependencies. Table 3 further details the net spillover index, indicating that SC11 acts as a transmitter, describing that part of the volatility in PC1 originated from SC11.

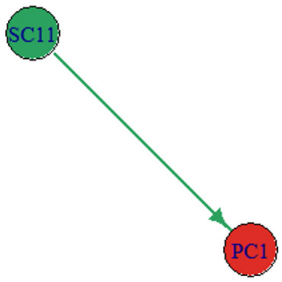
Table 3. Net Spillover Conglomerates Group 1

	To	From	Net Spillover
PC1	8.53	9.75	-1.22
SC11	9.75	8.53	1.22

Table 4 provides a detailed analysis of volatility spillovers within Conglomerates Group 2. The results indicate that SC11 exhibits a higher level of volatility spillover to other entities compared to both PC2 and SC21. Specifically, SC11 accounts for 38.39% of the forecast error variance, underscoring its substantial impact. Moreover, Table 4 reveals that SC11 receives more volatility spillover from other entities (33.02%) than PC2 and SC21. This finding suggests that SC11 plays a dual role as both a major transmitter and receiver of volatility within the group.

[1] The results obtained are based on vector autoregression with a lag of 4 and generalized variance decompositions with 10-day-ahead volatility forecast errors.

Figure 2. Transmitter of Conglomerates Group 1



Furthermore, Table 4 reveals the directional volatility spillovers among specific entities. The volatility spillover from SC21 to SC11 is slightly higher than the reverse spillover from SC11 to SC21, amounting to 25.12 compared to 24.75. Similarly, the volatility spillover from SC21 to PC2 is more substantial than that from PC2 to SC21, at 5.49 versus 4.19. Notably, the volatility spillover from SC11 to PC2 (13.64) surpasses the spillover in the opposite direction, PC2 to SC11 (7.9). The total spillover index of 27.03% demonstrates that volatility is more significant in Conglomerates Group 2 than in Conglomerates Group 1. Table 5 provides additional information about the net spillover in Group 2. It suggests that SC11 and SC21 are net volatility transmitters, with net spillover values of 5.36 and 1.68, respectively. This finding infers that these subsidiaries are significant drivers of volatility within the group.

Table 4. Volatility Spillover of Conglomerates Group 2

	SC11	PC2	SC21	Directional FROM others
SC11	66.98	7.90	25.12	33.02
PC2	13.64	80.87	5.49	19.13
SC21	24.75	4.19	71.06	28.94
Directional TO others	38.39	12.09	30.61	
Directional including own	105.36	92.96	101.68	
Total Spillover Index				27.03

Table 5. Net Spillover of Conglomerates Group 2

	To	From	Net Spillover
SC11	38.39	33.02	5.36
PC2	12.09	19.13	-7.04
SC21	30.61	28.94	1.68

Figure 3 visually represents the direction and magnitude of spillover transmissions. The green circles post as transmitters SC11 and SC21, with SC11's larger circle indicating its stronger transmission capacity. PC2, on the other hand, exhibits negative net spillover, shown as a red circle, indicating that other entities influence it more than it influences them. The volatility spillover direction is predominantly from SC11 to PC2, SC21 to PC2, and SC21 to SC11.

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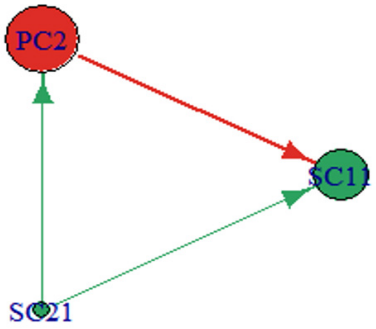
Figure 3. Transmitter in Conglomerates Group 2



According to Table 6, the volatility transmitted from the parent company (PC3) to the subsidiary (SC31) is 2.13%, while the spillover in the opposite direction is 3.10%. The total spillover index in Table 6 shows that in the sample of Conglomerates Group 3, spillover is responsible for 2.62 percent of the forecast error variance's volatility in both groups. In other words, within Conglomerates Group 3, there are a few directional and total spillovers. Table 7 highlights that SC31 is a significant volatility transmitter, with a positive net spillover of 0.96. The results suggest that SC31 plays a crucial role in driving the group's volatility, especially during market stress periods.

Table 6. Volatility Spillover of Conglomerates Group 3

	PC3	SC31	Directional FROM others
PC3	96.90	3.10	3.10
SC31	2.13	97.87	2.13
Directional TO others	2.13	3.10	
Directional including own	99.04	100.96	
Total Spillover Index			2.62

Table 7. Net Spillover of Conglomerates Group 3

	To	From	Net Spillover
PC3	2.13	3.10	-0.96
SC31	3.10	2.13	0.96

Figure 4. Transmitter of Conglomerates Group 3

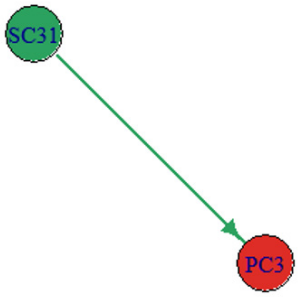


Table 8 gives a detailed overview of volatility spillover within Conglomerates Group 4[2]. The data indicate that SC42 is the most significant contributor to volatility among the entities, accounting for 38.27% of the forecast error variance. This data suggests that SC42 considerably influences volatility within the group. Moreover, Table 8 shows that SC41 is the most affected by spillovers from other entities, with 30.88% of the forecast error variance attributable to external influences. These findings underscore SC41's vulnerability to external volatility within the group. On average, the total spillover index reveals that 14.31% of the forecast error variance among the eight entities in Group 4 is attributable to spillovers.

Further analysis of Table 8 highlights the entities with the most significant impact on others. For example, SC41 exerts the most significant influence on SC44, contributing 1.62% to its forecast error variance. SC43 and SC46 also significantly affect SC44, contributing 1.92% and 0.45%, respectively. The spillover from SC42 to PC4 is particularly notable, at 19.84%, while PC4 transmits the highest volatility to SC42, contributing 17.71%. These findings suggest that volatility sources within Group 4 vary markedly across entities, indicating that the distribution of volatility's impact is uneven. This result illustrates a complex network of influence where certain entities play a more significant role in transmitting volatility across the group.

Table 8. Volatility Spillover of Conglomerates Group 4

	SC41	SC42	SC43	SC44	PC4	SC45	SC46	SC47	Directional FROM others
SC41	95.81	0.68	0.07	1.54	1.02	0.13	0.38	0.37	4.19
SC42	0.94	69.43	1.34	2.17	17.71	0.07	0.05	8.29	30.57
SC43	0.08	1.93	91.90	1.40	1.60	1.27	0.11	1.70	8.10
SC44	1.62	4.04	1.92	87.19	2.09	0.33	0.45	2.38	12.81
PC4	1.09	19.84	1.62	1.03	69.12	0.06	0.04	7.19	30.88
SC45	0.11	0.51	0.89	0.54	0.09	97.14	0.31	0.40	2.86
SC46	0.33	0.23	0.11	0.06	0.09	0.33	98.83	0.03	1.17
SC47	1.14	11.04	1.49	2.40	7.54	0.05	0.24	76.10	23.90
Directional TO others	5.32	38.27	7.43	9.14	30.14	2.23	1.59	20.36	
Directional including own	101.13	107.71	99.33	96.33	99.26	99.37	100.42	96.45	
Total Spillover Index									14.31

To identify the primary transmitters of volatility within Group 4, Table 9 outlines the net spillover dynamics. SC42 emerges as the leading transmitter, exhibiting the highest net spillover value. SC41 and SC46 also function as transmitters due to their positive net spillover values. These findings indicate that SC42, SC41, and SC46 are the primary drivers of volatility spillovers within Conglomerates Group 4.

[2] The results obtained are based on vector autoregression with a lag of 4 and generalized variance decompositions with 10-day-ahead volatility forecast errors.

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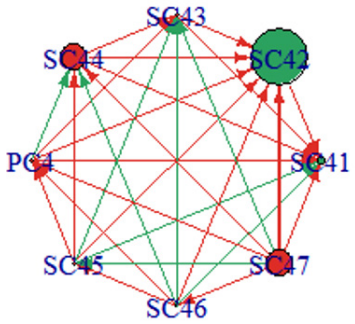
DOI: https://doi.org/10.15408/etk.v24i1.38452

Table 9. Net Spillover of Conglomerates Group 4

	To	From	Net Spillover
SC41	5.32	4.19	1.13
SC42	38.27	30.57	7.71
SC43	7.43	8.10	-0.67
SC44	9.14	12.81	-3.67
PC4	30.14	30.88	-0.74
SC45	2.23	2.86	-0.63
SC46	1.59	1.17	0.42
SC47	20.36	23.90	-3.55

Figure 5 visually represents the direction of the net volatility spillover. It pictures the volatility transmission of SC42 to SC43, SC44, PC4, SC45, SC46, SC47, and SC41. Additionally, SC43 acts as a transmitter, influencing SC45, SC46, SC44, and SC47. These findings describe the stock price volatility of subsidiary entities significantly driving spillovers within Conglomerates Group 4.

Figure 5. Transmitter of Conglomerates Group 4



The findings of this study reveal that in all four financial conglomerates examined, volatility spillovers predominantly flow from subsidiaries to parent companies. The observed bidirectional spillovers suggest that subsidiaries can also be sources of systemic risk, challenging the conventional understanding that risk and volatility typically cascade from the parent company to its subsidiaries. This result is particularly noteworthy, highlighting a less explored aspect of volatility dynamics. While research on volatility spillovers from subsidiaries to parent companies remains limited, the implications of these findings are substantial.

Zhang (2024) discusses the critical role of parent companies in managing their subsidiaries. It emphasizes the operational and financial decisions made at the subsidiary level, profoundly impacting the parent company's risk exposure and overall corporate governance. Financial conglomerates deeply intertwine the operations of their subsidiaries with those of the parent company, thereby amplifying the effects of volatility. This interconnectedness means that shocks at the subsidiary level—whether due to market conditions, regulatory changes, or internal management decisions—can transmit upwards, affecting the parent company's financial stability and risk profile. The findings of this study align with the

notion that subsidiaries, although under the parent company's control, are not mere passive entities but active participants in the conglomerate's overall risk dynamics.

The observed volatility spillovers from subsidiaries to parent companies underscore the importance of a comprehensive risk management approach that accounts for the bidirectional flow of risk within conglomerates. Effective risk management is particularly significant within Indonesian financial conglomerates. Regulatory frameworks and supervisory practices must be adapted to address the complexities of managing interconnected entities. Furthermore, the findings suggest that parent companies must oversee and strategically engage with their subsidiaries to mitigate potential risks. The upward transmission of volatility highlights the necessity for parent companies to maintain robust internal controls and governance mechanisms to monitor and manage subsidiary activities effectively. This approach is crucial for sustaining financial stability across the entire conglomerate and ensuring that risks originating at the subsidiary level do not compromise the parent company's financial health.

CONCLUSION

The empirical analysis presented in this study provides significant insights into the interconnectedness and volatility spillover within financial conglomerates in Indonesia. Employing the Generalized Vector Autoregressive (VAR) approach, the study examines time-varying volatility spillover indices across four conglomerate groups, utilizing daily volatility data from 2010 to March 2023. The results reveal substantial interconnectedness among financial institutions, as indicated by the time-varying volatility spillover index. Additionally, the intensity of volatility spillovers among entities within these conglomerates fluctuates over time, with notable increases during periods of market stress, such as the COVID-19 pandemic. The marked rise in volatility spillovers during the COVID-19 pandemic highlights the dynamic nature of these spillovers, consistent with previous research that has documented heightened market co-movements during financial crises. Furthermore, this study uncovers that volatility is transmitted from subsidiaries to parent companies.

The findings of this study align with the World Bank's recommendations regarding the urgent need for regulators to focus on the systemic risks posed by financial conglomerates. Volatility spillover within these conglomerates potentially signifies the heightened systemic risk, threatening the stability of the broader financial system. To address this, regulators, in particular OJK, should strengthen oversight by implementing the new POJK regulation, refining the existing POJK 2020. The implications of this regulation are significant given the study's findings, documenting the need for robust oversight to manage volatility spillovers. Given the directional nature of volatility spillovers identified in this study, regulators should supervise closely at both the parent and subsidiary levels to effectively manage volatility spillovers. The supervision may involve implementing specific regulatory frameworks that target the unique risks at each level, ensuring that both parent companies and their subsidiaries are adequately monitored for signs of systemic risk. Additionally, regulators should consider stress-testing conglomerates under various market conditions to anticipate potential spillovers and develop countermeasures. These steps will be crucial in maintaining financial stability and mitigating the risks associated with conglomerate structures in Indonesia's financial sector.

https://journal.uinjkt.ac.id/index.php/etikonomi
DOI: https://doi.org/10.15408/etk.v24i1.38452

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DOI: https://doi.org/10.15408/etk.v24i1.38452