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Dynamic Connectedness among Australian Stock Market Sectors: A Time-Varying Parameter VAR Approach

Avustralya Borsa Sektörleri Arasında Dinamik Bağlantılılık: Zamanla Değişen Parametre VAR Yaklaşımı

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Abstract

This study investigates the dynamic connectedness among six key sectors in the Australian Stock Exchange (ASX) using a Time-Varying Parameter Vector Autoregressive (TVP-VAR) model. By examining the interactions among Consumer Staples, Energy, Financials, Industrials, Information Technology, and Metals & Mining indices, the analysis highlights how sectoral connectedness evolves, particularly during periods of economic crisis. The results reveal that specific sectors act as net transmitters or receivers of shocks. Energy, Metals, & Mining are more sensitive to global commodity prices, while Consumer Staples maintain stability. This approach offers a comprehensive view of sectoral risk transmission and its implications for market stability and risk management. The findings provide critical insights for investors and policymakers aiming to mitigate systemic risks and enhance portfolio diversification in response to market fluctuations.

Keywords: Dynamic connectedness, TVP-VAR, Australian stock sectors, Sectoral risk transmission, Economic shocks

Jel Codes: C32; G10; G14

Öz

Bu çalışma, Avustralya Menkul Kıymetler Borsası'ndaki (Australian Stock Exchange- ASX) altı temel sektör arasındaki dinamik bağlantılılığı Zamanla Değişen Parametreli Vektör Otoregresif (TVP-VAR) modeli kullanarak araştırmaktadır. Analiz, Temel Tüketim Malları, Enerji, Finans, Sanayi, Bilgi Teknolojileri ve Metaller ve Madencilik endeksleri arasındaki etkileşimleri inceleyerek, özellikle ekonomik kriz dönemlerinde sektörel bağlılığın nasıl geliştiğini vurgulamaktadır. Sonuçlar, belirli sektörlerin şokların net aktarıcıları veya alıcıları olarak hareket ettiğini ortaya koymaktadır. Enerji, Metaller ve Madencilik küresel emtia fiyatlarına daha duyarlı iken, Temel Tüketim Malları istikrarını korumaktadır. Bu yaklaşım, sektörel risk aktarımına ve bunun piyasa istikrarı ve risk yönetimi üzerindeki etkilerine dair kapsamlı bir bakış açısı sunmaktadır. Bulgular, sistemik riskleri azaltmayı ve piyasa dalgalanmalarına yanıt olarak portföy çeşitliliğini artırmayı amaçlayan yatırımcılar ve politika yapıcılar için kritik bilgiler sağlamaktadır.

Anahtar Kelimeler: Dinamik bağlantılılık, TVP-VAR, Avustralya hisse senedi sektörleri, Sektörel risk aktarımı, Ekonomik şoklar

Jel Kodları: C32; G10; G14

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1. INTRODUCTION

Growing uncertainties in the global economy have increased interest in how financial markets respond to external shocks (Caldara et al., 2016; Carrière-Swallow and Céspedes, 2013; Glebocki and Saha, 2024). While sector indices on the Australian Stock Exchange (ASX) reflect the country's economic diversity, the interaction of each index during downturns and recoveries is crucial for understanding market risks. This study examines the dynamics of connectedness between the Consumer Staples (AXSJ), Energy (AXEJ), Financials (AXFJ), Industrials (AXNJ), Information Technology (AXIJ), and Metals & Mining (AXMM) indices on the ASX. These sectors interact with each other and react to global economic events differently. For example, the energy and mining sectors are sensitive to global commodity prices, while their performance indirectly affects the financial industry (Bissoondoyal-Bheenick et al., 2018; Thai and Birt, 2019). Although the AXSJ sector has a more stable structure, it can be affected by fluctuations in other sectors during major economic crises.

The AXSJ sector on the ASX tends to show more stable performance as demand for staple consumer goods continues regardless of economic conditions (Guerrieri et al., 2022; Yu et al., 2022). As this sector tends to fluctuate less than other sectors during times of crisis, it is considered a haven for investors (Junttila et al., 2018). The AXEJ sector reflects Australia's wealth in energy resources such as natural gas, coal, and oil (Jayawardena et al., 2016). However, exogenous shocks can directly affect this sector due to its sensitivity to global commodity prices (Tiwari et al., 2020; Wang et al., 2022). Therefore, the energy sector shows the Australian economy is vulnerable to global market fluctuations.

The financial sector covers a country's banking and insurance activities and is directly related to economic growth (Lee et al., 2022; Ouyang and Li, 2018; Pradhan et al., 2017). While the AXFJ sector contributes to the overall performance of the Australian economy, it can have a fragile structure during periods of financial shocks and crises. The AXNJ sector includes various subsectors, such as manufacturing, construction, and transport, and links the country's infrastructure investment and economic growth. While this sector performs strongly during periods of economic growth (Lee et al., 2016; Pradhan et al., 2017), it can be affected by demand declines during crisis periods. The AXIJ sector has an significant place in Australia's digital transformation process and has the potential for rapid growth; however, it is also highly volatile and can be sensitive to exogenous economic shocks.

Finally, the AXMM sector is crucial to the country's economy due to Australia's rich natural resources (Hayat and Tahir, 2021). This sector has a structure that directly affects the economy depending on the global price movements of commodities such as iron ore, gold, and coal (Danish et al., 2019). Changes in demand, especially in Asian economies such as China and India, cause significant fluctuations in this sector and increase the Australian economy's external dependence.

This study examines the interconnectedness dynamics of six major sector indices (Consumer Staples, Energy, Financials, Industrials, Information Technology, Metals and Mining) on the Australian Stock Exchange (ASX). The research's motivation is to understand each sector's response to global economic events and exogenous shocks and to analyze how these sectors interact during crisis periods. In this way, the impact of sectoral connectedness and interactions on the Australian economy can be assessed regarding risk management and strategy development.

1.1. Research Questions:

1. How do sectoral indices in Australia exhibit the dynamics of connectedness in crisis and normal periods?

2. Which sectors are more affected by other indutries and by spillovers to other sectors?

3. How do the levels of connectedness vary across sectors in response to fluctuations in global markets or economic shocks?

4. What are the implications of these connectedness dynamics for the risk management and strategy development of market participants and policymakers?

After defining the general information, research questions, and motivation related to the topic of the study, the literature review section was introduced. The second section presents the theoretical framework. The third section introduces the data used in the study. The methodology is presented in the fourth section. The fifth section discusses empirical findings. Sections five and six include a discussion based on the findings, recommendations, and implications. The conclusion section summarizes the study and provides suggestions for future research, thereby concluding the study.

1.2. Related Literature

In recent years, the dynamics of connectedness in financial markets have gained importance due to increased risk spillovers, especially during crisis periods. Studies across countries and markets show that crises intensify market interactions by increasing the degree of interconnectedness. Although these studies focus on spillovers in equity, commodity, and foreign exchange markets, they have only examined cross-sectoral interactions within the same stock market to a limited extent. Analyzing how cross-sector dynamics change during crisis periods, particularly in resource-dependent economies such as Australia, is an essential gap in the existing literature.

The dynamics of connectedness across financial markets have attracted much attention due to the increased risk of spillovers, especially during crises. (Ha and Nham, 2022) and (Mishra et al., 2023) have shown how connectedness increases with time-varying models such as TVP-VAR. In particular, the increase in connectedness during crisis periods is remarkable (Cao and Xie, 2024) analyze the impact of extreme shocks on carbon and energy markets but do not provide details on sectoral responses to different shocks within the stock market. In Australia, Chatziantoniou et al. (2021) and Huynh et al. (2021) analyze market effects but do not delve deeply into sectoral spillover dynamics.

Studies such as Bissoondoyal-Bheenick et al. (2018) and Thai and Birt (2019) have analyzed the dynamics of Australian sectors about global commodity prices. In particular, the sensitivity of the energy and mining sectors to exogenous shocks has been highlighted. The tendency of these sectors to propagate or internalize shocks has been analyzed; however, their interactions with other sectors during crisis periods have received limited attention. This shortcoming suggests that intersectoral dynamics in resource-dependent economies such as Australia should be analyzed in more detail.

Studies on volatility spillovers between equity and commodity markets in the US and G7 countries (Jain and Sehgal, 2019; Mensi et al., 2013) have revealed market interdependencies. These studies highlight the impact of major events such as the global financial crisis. Vo and Tran (2020) examine the volatility transitions between the US and ASEAN markets and reveal the spillover effect of US stock market shocks on ASEAN markets.

In addition, Xie and Cao (2024) examine the risk spillovers between cryptocurrency and Chinese markets and show the increasing influence of the cryptocurrency market.

Research focusing on Asia and Australia also offers new perspectives on financial connectedness. Abidin et al. (2014) analyze price and volatility spillovers between stock markets in the Asia-Pacific region. Spillovers between China and Australia are particularly noteworthy. Wang et al. (2022) analyze volatility spillovers between energy and clean energy markets but do not focus on sectoral effects within exchanges. Similarly, Lee et al. (2022) and Ouyang and Li (2018) examined the impact of economic uncertainty and financial shocks on the market but did not focus on sectoral spillover dynamics.

Studies in emerging economies such as Turkey, India, and China observe the spillover structure of financial shocks across different markets. For example, Nandy and Chattopadhyay (2019) analyze volatility transitions between India's equity and foreign exchange markets. Lee et al. (2022) examine the relationship between the insurance and banking sectors and growth, focusing on their interactions during crises.

This extensive literature suggests that the analysis of intra-market connectedness during crisis periods is limited. Particularly in trade-dependent economies such as the Australian Stock Exchange, there is a need for an in-depth analysis of sectoral dynamics. Our study aims to contribute to the literature by investigating crisis-specific interactions between Australia's major sector indices.

2. THEORETICAL BACKGROUND

The theoretical framework of this study is based on the analysis of the connectedness dynamics of financial markets and the behavior of sectoral interactions in the face of economic shocks. Based on Merton's (1973) portfolio theory and Markowitz's (1952) modern portfolio theory, the emergence of systemic risks and sectoral interactions in financial markets is analyzed. In this framework, the intensification of sectoral interdependencies during financial shocks or economic fluctuations increases risk spillovers and can threaten market stability.

The connectedness theory argues that financial markets act not only individually but also interdependently. This theory emphasizes the acceleration of risk spillovers across sectors, especially in times of crisis. In line with Minsky's (1992) financial instability hypothesis, it is vital to understand how systemic risks increase through these interactions. According to Minsky, market risks spread through sectoral interactions and interdependencies, which can lead to economic instability. In this context, sectoral interactions in the Australian Stock Exchange during crisis and normal periods provide a convenient space to assess the emergence of systemic risk.

In addition, time-varying connectedness models developed by Diebold and Yilmaz (2012) and Baruník and Křehlík (2018) are used to reflect the dynamic nature of financial markets. These models aim to analyze how sectoral responses to exogenous shocks vary over time, considering the changing nature of market conditions.

The Efficient Market Hypothesis (EMH) also plays an important role in this theoretical framework. Developed by Fama (1970), EPH asserts that financial markets immediately reflect all available information in prices. In the context of market efficiency, we examine how sector indices on the Australian Stock Exchange respond to this information during periods of crisis or uncertainty. When markets are efficient, prices are updated instantaneously in response to exogenous shocks, and inter-sector linkages are reflected in price changes that reflect all information available in the market. However, some sectors are more stable, suggesting that despite market efficiency, they may be less volatile than other sectors in times of crisis.

Using this theoretical framework, the study examines the dynamics of connectedness among Australian sector indices from the perspectives of systemic risk, market efficiency, and sectoral crisis resilience. It offers strategic implications for market participants and policymakers in sectoral risk management.

3. DATA

This study analyzes the dynamics of sectoral connectedness in the Australian Stock Exchange using daily data for the period 01.04.2010 - 09.30.2024. The choice of the study period is important as it includes the recovery period after the global financial crisis, the effects of the COVID-19 pandemic, and economic shocks such as the energy crisis. The global and regional crises experienced during this period allow for a more comprehensive analysis of sectoral connectedness and shock spillovers in the Australian market. As of 09.30.2024, this extended period allows us to analyze the market's responses to crisis periods as well as its recovery and stabilization processes.

Table 1: Summary Statistic

	AXMM	AXIJ	AXNJ	AXFJ	AXEJ	AXSJ
Mean	0.007	0.036	0.016	0.014	-0.015	0.012
Variance	2.274	2.353	1.027	1.273	2.518	0.886
Skewness	-0.173***	-0.377***	-0.950***	-0.668***	-1.083***	-0.090**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.023)
Ex.Kurtosis	2.522***	4.638***	14.200***	11.734***	14.781***	5.083***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
JB	1032.246***	3517.018***	32694.164***	22217.309***	35550.680***	4120.073***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ERS	-12.291	-19.466	-6.667	-9.278	-10.974	-21.835
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Q(20)	15.768*	18.902**	28.164***	47.898***	22.323***	29.350***
	(0.093)	(0.027)	(0.000)	(0.000)	(0.006)	(0.000)
$Q^2(20)$	985.260***	1401.054***	1418.448***	5974.157***	1048.703***	1122.130***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: Skewness: D'Agostino (1970) test; Kurtosis: Anscombe and Glynn (1983) test; JB: Jarque and Bera (1980) normality test; ERS: Elliott et al. (1996) unit-root test; $Q(20)$ and $Q^2(20)$: Fisher and Gallagher (2012) weighted Portmanteau test statistics. Values in parentheses represent p-values. In addition, * indicates significance as 0.10, ** indicates significance as 0.05 and *** indicates significance as 0.01.

Table 1 shows that the returns of the indices have significant skewness and high kurtosis. While this indicates that returns are not normally distributed, significant Jarque-Bera test results for all indices confirm that returns deviate from a normal distribution. In addition, high Q(20) and $Q^2(20)$ values indicate that returns exhibit significant serial correlation and volatility clustering. These results suggest that sector indices may be subject to time-varying changes.

4. METHOD: BALCILAR ET AL. (2021) EXTENDED JOINT CONNECTEDNESS

In this study, we use an extended connectedness approach based on the time-varying parameter vector autoregression with time-varying parameters (TVP-VAR) model to examine the dynamics of connectedness among sector indices on the Australian Stock Exchange (ASX). This method is based on the time-varying connectedness approach developed by Antonakakis and Gabauer (2020), which combines the Diebold and Yilmaz (2012) framework with the TVP-

VAR model (Balcilar et al., 2021). The TVP-VAR model provides the ability to analyze how sector interactions change over time. In addition, this model is sensitive to parameter changes and minimizes outlier effects. To describe the TVP-VAR model, the y_t series is expressed as follows:

$$y_t = B_t y_{t-1} + \varepsilon_t \qquad \varepsilon_t \sim N(0, \Sigma_t) \tag{1}$$

Where y_t is a K-dimensional vector of variables and B_t is a K x K time-varying parameter matrix. In this model, all parameters (i.e., B_t and Σ_t matrix) are allowed to change over time, making the relationship between sectors dynamic. This TVP-VAR model is transformed into a TVP-VMA (time-varying moving average) model using Wold's representation theorem so that the H-step forward forecast error variance is expressed as:

$$\xi_t(H) = \sum_{h=0}^{H-1} A_{h,t} \varepsilon_{t+H-h} \tag{2}$$

Where the matrices $A_{h,t}$ represent time-varying multipliers. This expression allows us to examine the time-varying interactions between indices in more detail. The extended measure of connectedness proposed by Diebold and Yilmaz (2012) shows the effect of a shock of variable j on variable i and is defined as follows:

$$gSOT_{ij,t} = \frac{\sum_{h=0}^{H-1} \left(e_i' A_{h,t} \Sigma_t e_j\right)^2}{\sum_{k=1}^{K} \sum_{h=0}^{H-1} \left(e_k' A_{h,t} \Sigma_t A_{h,t}' e_k\right)} \tag{3}$$

This formulation measures the influence of variables on each other over time and allows these effects to be decoupled using Generalized Forecast Error Variance Decomposition (GFEVD). The Total Connectedness Index (TCI) indicates the overall level of connectedness of the system and is calculated by averaging the directional connectedness across all variables:

$$TCI = \frac{1}{K} \sum_{i=1}^{K} S_{gen,from_{i\leftarrow}}, t \tag{4}$$

The advantages of this model include the absence of the need to specify arbitrary window sizes, reduced sensitivity to outliers, and the adaptability of parameters to changes. Our study analyzes the dynamic linkages among Australia's sectoral indices using this extended connectedness method and relates our findings to crisis periods.

5. EMPIRICAL FINDINGS

This section analyzes the dynamic connectedness structure among sectoral indices on the Australian Stock Exchange. This analysis allows us to better understand the spillover effects of sectoral shocks and inter-index interactions. The extended connectedness method based on the TVP-VAR model used in the study shows how sectoral interactions change during crises and regular periods and reveals which sectors are more affected by shocks. In line with the results, this section assesses the capacity of sectors to transmit or be affected by shocks.

According to the results in Table 2, from directional influence (received influence), the AXMM index is affected by 54.43% of the external influences, and 14.97% of these influences come from AXEJ and 11.6% from AXIJ. AXIJ, on the other hand, is affected by 61.97% of external influences, with the highest impact of 16.54% coming from AXNJ. The AXNJ index is influenced by other sectors by 71.22% and is mostly influenced by AXIJ by 16.17%. AXFJ receives 63.81% of external influences, and 18.51% comes from AXNJ. AXEJ is affected by external influences 58.69% of the time, with the largest influence coming from AXMM at 14.6%. Finally, AXSJ is externally influenced 62.99% of the time, with the largest influences coming from AXIJ at 15.37% and AXNJ at 16.79%. These "from" directional effects net out the effects each index receives from the others, showing the market's overall sensitivity to external shocks.

Table 2: Averaged Joint Connectedness Table

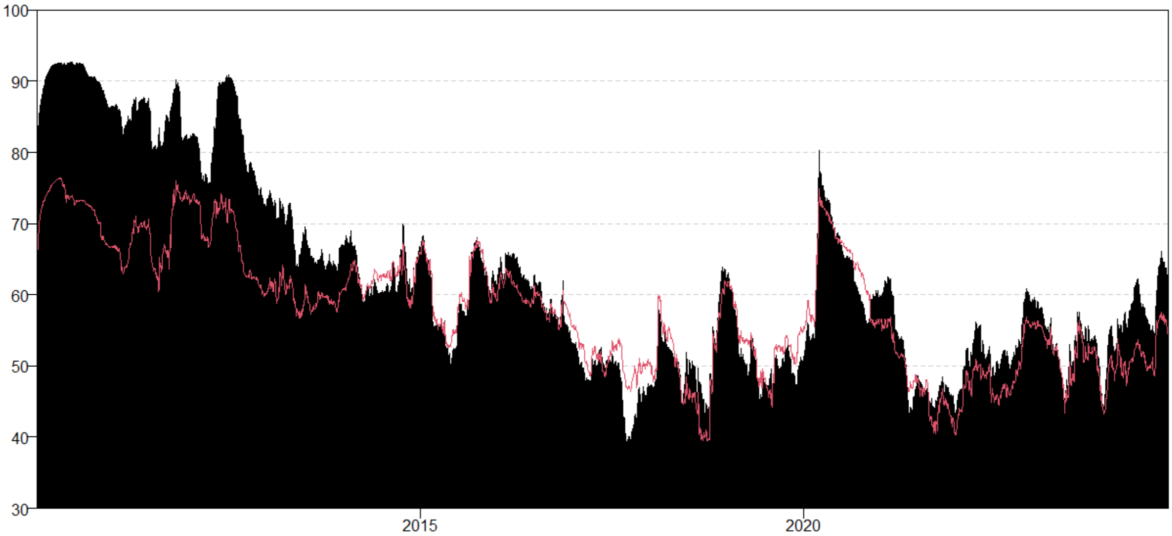
	AXM	AXIJ	AXNJ	AXFJ	AXEJ	AXSJ	FROM
AXMM	45.57	11.60	10.88	8.26	14.97	8.72	54.43
AXIJ	10.38	38.03	16.54	11.9	9.36	13.79	61.97
AXNJ	11.56	16.17	28.78	16.26	9.42	17.81	71.22
AXFJ	9.32	11.84	18.51	36.19	10.18	13.96	63.81
AXEJ	14.6	9.87	10.93	13.15	41.31	10.13	58.69
AXSJ	8.92	15.37	16.79	14.60	7.30	37.01	62.99
TO	54.78	64.86	73.66	64.18	51.23	64.4	TCI
NET	0.35	2.88	2.44	0.37	-7.46	1.41	62.18

Notes: Results are based on a TVP-VAR model with lag length of order one (BIC) and a 20-step-ahead generalized forecast error variance decomposition.

To Directional Impact (Spillover): The AXMM index has a spillover effect of 54.78% on other sectors, with a particularly strong impact on AXEJ with 14.97% and AXIJ with 11.6%. The AXIJ index, on the other hand, has an impact of 64.86%, with the most significant effect on AXNJ (16.54%) and AXSJ (13.79%). AXNJ, with an impact of 73.66%, strongly influences AXSJ with 17.81% and AXFJ with 16.26%. The AXFJ index, with an impact of 64.18%, has a powerful influence on AXNJ (18.51%) and AXSJ (13.96%). AXEJ has an impact of 51.23% and has the highest impact on AXMM (14.6%). The AXSJ index, on the other hand, has an impact of 64.4% on AXNJ (16.79%) and AXIJ (15.37%). These "to" directional effects reveal each index's directive role on other market sectors.

Table 1 provides a comprehensive analysis of the dynamic interactions between the sectoral indices in the Australian stock market in terms of both "from" (received) and "to" (emitted) effects. The results show the sensitivity of the indices to exogenous market shocks as well as their moderating role in other sectors. For example, the AXNJ and AXIJ indices, with their high "To" values, play a proactive spillover role in the market, while the AXMM and AXSJ indices stand out for their ability to internalize external effects. This network of interactions clarifies the role of each index in the diffusion of market risks and suggests a structure in which sectoral shocks are quickly transmitted to other sectors. In this context, the results suggest that both the absorbed and propagated effects of each index's should be considered when developing sectoral risk management and market stabilization strategies.

Figure 1: Dynamic Total Connectedness



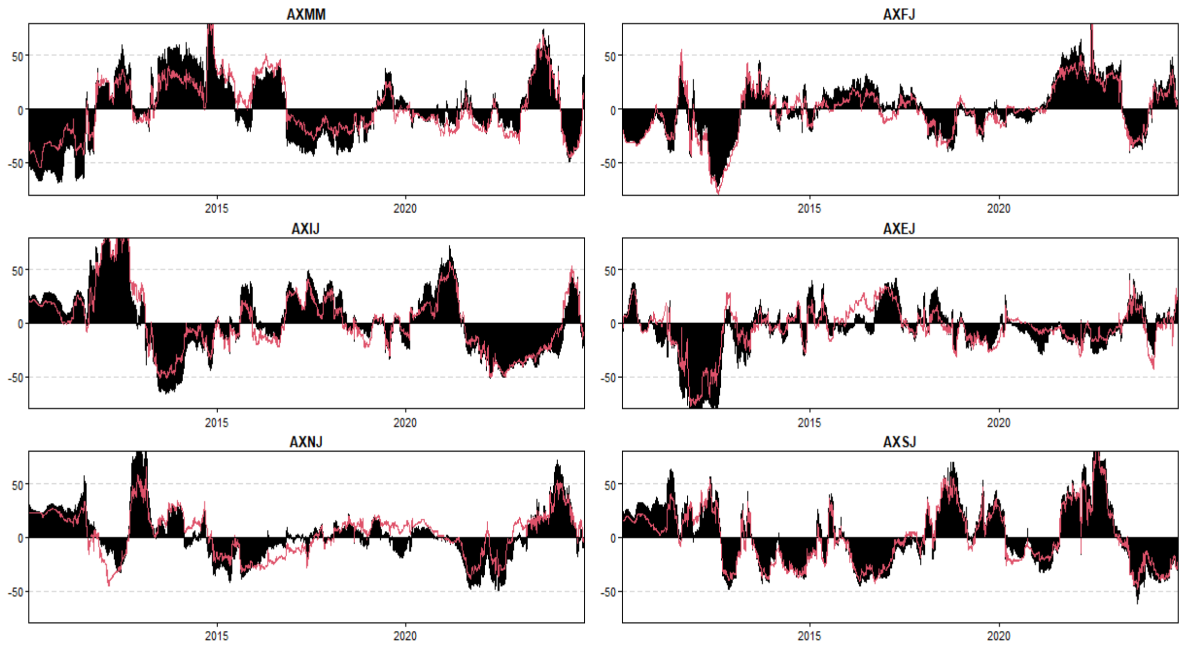
Notes: Results are based on a TVP-VAR model with lag length of order one (BIC) and a 20-step-ahead generalized forecast error variance decomposition. The Black shaded area represents the joint connectedness results, whereas the red line illustrates the original connectedness the results.

Figure 1 dynamically assesses the connectedness between the various Australian sector indices using the TVP-VAR model. The black shaded area in the figure represents the "joint connectedness" values, while the red line shows the "original connectedness" results.

Figure 1 shows the evolution of the aggregate level of connectedness between Australian sector indices over the period 2010-2024. The black shaded area represents "common connectedness" values, and the red line represents "original connectedness" values. The graph shows that levels of connectedness, which were relatively low in the early 2010s, increased rapidly in 2020 due to the impact of the COVID-19 pandemic. The pandemic led to high uncertainty in markets, increased simultaneous movements across all sectors, and increased interdependence across sectors. The increase in connectedness over this period reflects an increase in systemic risk across the market.

In the post-pandemic years of 2021 and 2022, it is noteworthy that the red line becomes compatible with the black area and the level of connectedness normalizes. In this period, the market becomes less sensitive to shocks, and the indices move with their individual dynamics. In 2023-2024, the connectedness levels follow a balanced course but do not reach as high levels as the sudden increase during the pandemic period, indicating that the risk level of the market and the tendency of the indices to move synchronously are decreasing.

Figure 2: Dynamic Net Total Directional Connectedness

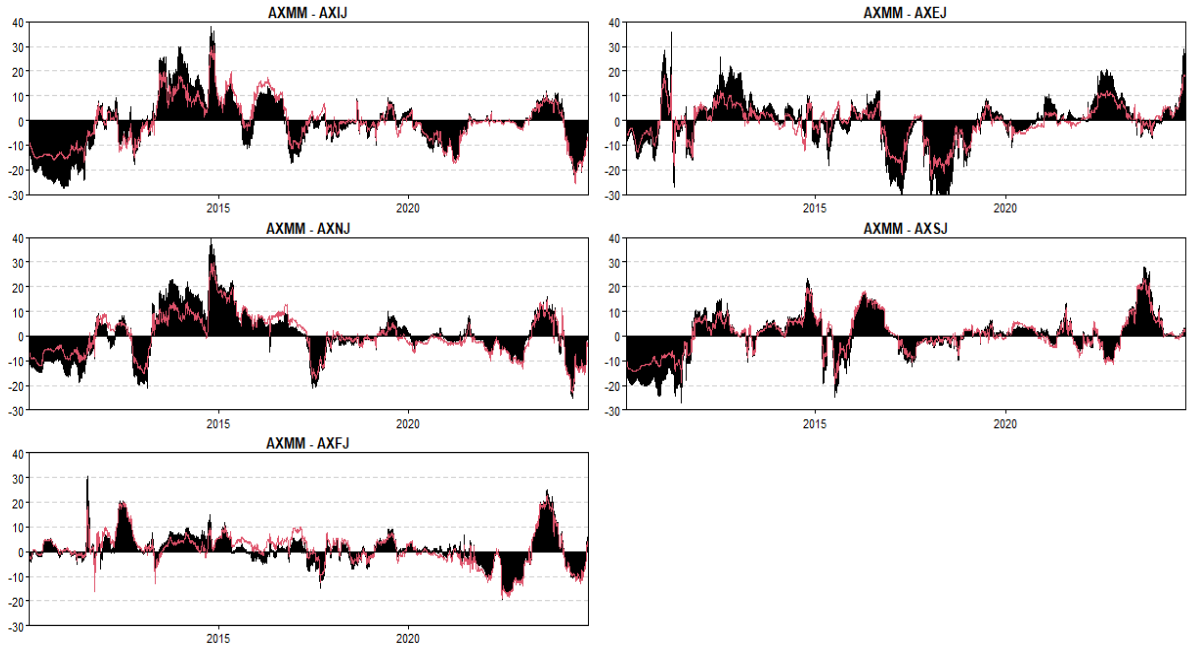


Notes: The results are based on a TVP-VAR model with lag length of order one (BIC) and a 20-step-ahead generalized forecast error variance decomposition. The Black shaded area represents the joint connectedness results whereas the red line illustrates the original connectedness results.

Figure 2 shows the directional connectedness structure between Australian sector indices over the period 2010-2024. The black shaded area represents "common directional connectedness" levels, and the red line represents "original directional connectedness" levels. While directional connectedness levels were relatively low in the early 2010s, an increase in directional connectedness was observed in 2016-2017 due to volatility in global markets. However, the most notable increase occurred in 2020 because of the shocks caused by the COVID-19 pandemic. The high level of directional connectedness throughout the pandemic period indicates that the impact of sectors on each other increased, leading to an increase in systemic risk across markets.

After the pandemic, a gradual decline in directional connectedness levels is observed in 2021 and 2022, with the red line aligning with the black area, indicating a period of relative stabilization of market conditions. In 2023-2024, directional connectedness levels are lower and more stable compared to the pandemic period. This suggests that in the post-crisis period, sectors have started to act with their own dynamics, and their influence on each other has diminished. Especially for market participants and policymakers, monitoring the increasing levels of connectedness during the crisis period can be considered an important risk management tool.

Figure 3: Dynamic Net Pairwise Directional Connectedness



Notes: Results are based on a TVP-VAR model with lag length of order one (BIC) and a 20-step-ahead generalized forecast error variance decomposition. Black shaded area represents the joint connectedness results whereas the red line illustrates the original connectedness results.

Figure 3 illustrates the dynamic net pairwise connectedness structure between Australia's various sector indices over the period 2010-2024. In the early 2010s, the level of pairwise connectedness was low, indicating that the indices generally moved independently, and sector interactions were limited. However, in 2016-2017, a significant increase in connectedness was observed, in parallel with fluctuations in global markets. In particular, the energy, mining, and financial sectors became more sensitive to commodity price fluctuations, leading to an increase in cross-sectoral interactions.

In 2020, the level of bidirectional connectedness reached its highest level due to the COVID-19 pandemic. The pandemic increased sectoral interdependence and led to an increase in systemic risk across the market. In the post-pandemic period of 2021-2022, connectedness levels gradually decreased, and market conditions normalized. Finally, the more balanced and lower levels of connectedness in the 2023-2024 period suggest that sectors began to act with their own dynamics again following exogenous shocks. These results suggest that Australian sector indices are highly interconnected during crisis periods but tend to move individually thereafter.

5.1. Evaluation of the Findings

According to the results, the degree of connectedness between sector indices varies over time and increases especially during exogenous shocks. While there was limited interaction among indices in the early 2010s, fluctuations in global markets had an impact in the 2016-2017 period, and there was a significant increase in interaction among sectors such as energy, mining, and finance. The volatility in this period shows the sensitivity of the indices to global commodity prices and their impact on each other. When the AXMM, AXIJ, AXIJ, AXNJ, AXFJ, AXFJ, AXEJ, and AXSJ indices mentioned in the study are evaluated in terms of both the effects they receive and the effects they emit, certain indices play a more central role. in the market, while others tend to internalize more external effects. Indices such as AXNJ and AXIJ, with their high spillover effects, play a proactive interaction role in the market.

The COVID-19 pandemic period was characterized by high pairwise connectedness scores for all indices, indicating a period of increased cross-sector interdependence and systemic risk. This finding suggests that sectors acted interdependently in the uncertain environment created by the pandemic, and the market reacted synchronously. However, during the normalization period after the pandemic (2021-2022), the level of bidirectional connectedness decreases and indices are observed to act more independently with their own dynamics. In 2023-2024, it is noteworthy that this independence trend continues and the interactions between indices are not as intense as during the pandemic. These results suggest that Australian sector indices move more synchronously during crisis periods, but their individual dynamics come to the fore during normalization processes. Therefore, these findings provide important information for policymakers on sectoral risk management strategies and market stabilization.

6. DISCUSSION

In this study, we analyze the dynamics of connectedness among different sector indices in Australia from 2010 to 2024. The results provide important insights into how sector indices respond to exogenous shocks and interact over time. The dynamic pairwise net connectedness levels obtained from the research show that sectoral interactions vary in line with economic and global events. For example, the increase in connectedness between indices in 2016-2017, in line with fluctuations in global markets, shows that the energy and mining sectors are sensitive to global commodity prices and that these price changes also affect other sectors, such as the financial sector. This reflects the sensitivity of the Australian economy to fluctuations in global markets and has increased the ability of some indices to propagate or internalize exogenous shocks.

The COVID-19 pandemic stands out as an important event that maximizes the connectedness of the indices. The increased uncertainty in the markets during the pandemic caused sectors to act in a more synchronized manner, and high levels of pairwise correlation were observed during this period. This finding can be seen as an indicator of systemic risk, which increases market-wide during crisis periods. In the post-pandemic period, on the other hand, the decline in the level of connectedness indicates that the indices moved more independently with their own dynamics and that market conditions began to normalize. The lower levels of connectedness in 2023-2024 suggest that Australian sector indices had a more resilient structure to external shocks in the post-crisis period, and sectoral dependencies decreased.

Considering these findings, it is important to develop sectoral risk management strategies in Australia. For example, during periods of high connectedness, market participants and policymakers can take various measures to limit risk spillovers across sectors. High levels of connectedness, especially in times of crisis, indicate that sectoral shocks can spread quickly across the market, and this is an area that policymakers should pay attention to mitigate the effects of this situation. In conclusion, this paper provides a strategic framework for market participants and policymakers to manage systemic risk in times of crisis. It contributes to the understanding of the responses of different sectors to exogenous shocks.

7. RECOMMENDATIONS AND IMPLICATIONS

The results of this study suggest that the dynamics of connectedness among Australian sectoral indices are critical for both the propagation of economic shocks and the management of sectoral risks. Policymakers need to monitor intersectoral connectedness more closely, especially during periods of high volatility, as increased levels of index connectedness may trigger systemic risk in the market. While the entire market moves in the same direction during periods of crisis creates systemic vulnerability, regulatory measures that encourage indices to move independently during such periods can increase the resilience of the market. In this context, the widespread use of stress testing practices or sectoral risk analysis can help sectors to better withstand crises.

In addition, more tailored risk management tools should be developed on a sectoral basis, considering the different responses of each sector to external shocks. For example, protecting sectors that are vulnerable to foreign exchange market fluctuations can strengthen market stability. These findings suggest that financial regulators and market participants should develop sector-specific strategies to mitigate sectoral interactions during crisis periods and to support sectors to act with their unique dynamics during recovery periods. This study of the Australian market can serve as a model for financial market regulation in other countries with similar structures and contribute to the creation of a more resilient market structure to external shocks.

8. CONCLUSION

This paper analyzes the dynamic linkages between the six major sector indices on the Australian Stock Exchange (Consumer Staples, Energy, Financials, Industrials, Information Technology, and Metals and Mining) using a TVP-VAR model. The results show that inter-sector interactions change over time in response to exogenous shocks such as economic crises. In particular, the Energy, Metal and Mining sectors are observed to respond more quickly to exogenous shocks due to their sensitivity to global commodity prices. On the other hand, the Consumer Staples sector has a more stable structure and has fluctuated less than other sectors during crisis periods. This makes it a haven for investors. The study also shows that the financial and industrial sectors play an important role in the propagation of systemic risk through the effects they receive and propagate from other sectors.

These findings have important strategic implications for market participants and policymakers. Analyzing sectoral linkages to mitigate systemic risk in the market and to develop portfolio diversification strategies can contribute to market stability. The success of the TVP-VAR model in measuring time-varying connectedness dynamics shows how sectoral interactions intensify and relax in specific periods. This approach provides guidance for investors and policymakers to take proactive steps in times of crisis.

For future studies, it is recommended that these analyses be conducted across a wider range of sectors and across countries. In addition, the use of frequency-based connectedness analysis would allow for separate analysis of short-, medium- and long-term effects. This would allow for a more detailed understanding of sectoral interactions and the development of more crisis-resilient investment strategies.

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