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Bank Systemic Risk in Indonesia

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ABSTRACT: Banks are the primary participants and play a crucial role in the financial systems of most economies, including Indonesia. Banks face systemic risk because of their dynamic structure and the complex economic environment in which they operate. This study aims to measure the systemic risk in the Indonesian banking industry. This study employs quarterly data from 2010 to 2022 for 39 banks listed on the Indonesian stock exchange. In order to obtain the systemic risk index, this study uses the approach of conditional value at risk (CoVar) as well as marginal expected shortfall (MES).

KEYWORDS: Systemic Risk, CoVar, MES, Banking, Indonesia

JEL Clasification : E52, E58, E61.

1. INTRODUCTION

Banks are financial institutions that prioritize profits and are considered to rely on interest income as the main source of income to fund their operations. However, not all credit issued by banks is free from risk. Most of them are risky and can endanger the health of the bank (Anwar et al., 2023). Banks' business activities continue to be associated with various forms of risk. Generally, risk is inherent in all banking activities. Bankruptcies might happen if banks fail to manage risks properly. This certainly has an impact on the stability of the country's economy (Naili and Lahrichi, 2022).

The primary risk encountered by banks is credit risk. The risk associated with non-repaid loans pertains to the potential for the bank to incur losses as a result of the borrower's failure to fulfill their prior commitments to the bank. Every change in economic activity during a crisis affects the quality of banking finance (Anwar et al., 2024). Periods of crisis and financial instability have demonstrated that banks often take bold risks to achieve higher investment returns, a behavior that has led to persistent issues for the financial system and the economy overall (Calomiris et al., 2024). In essence, banks operate by collecting funds and using them to finance credit through the addition of interest. Riskier investments often carry low interest rates in order to leverage higher returns. To maintain debt at a time of low interest rates, banks have to invest in high risk assets (Charnvitayapong 2020; Suhendra and Anwar, 2021).

Systemic risk is defined as the risk that arises if a financial institution, especially banking, experiences distress, which then creates a contagion effect or domino effect that triggers other financial institutions to also experience distress, which can further result in a bank run and undermine the stability of the financial system (Ellis et al., 2012). Acharya (2009) proposed another definition of systemic risk, characterizing it as the spread of simultaneous bank failures caused by the failure of one bank, ultimately leading to the failure of other banks. According to Renn et al. (2022), this failure condition can arise from either a systemic event itself or its impact. Therefore, systemic risk plays a significant role in determining the stability of a country's financial system, particularly when it stems from financial imperfections such as asymmetric information, agency problems, moral hazard, and the potential for contagion risk or domino effects from these problems (Anwar et al., 2022; Nguyen et al., 2024).

Systemic risk has caused several economic crises, including the Asian Financial Crisis in 1997–1998, and the Subprime Mortgage Crisis in 2008, which serve as proof of this theory. This ultimately led to a contagion effect, causing numerous large companies in Asia to face bankruptcy and most East Asian countries to also experience a crisis. Particularly affected were Indonesia, South Korea, and the Philippines. Then the Subprime Mortgage Crisis in 2008, which began with a wave of defaults on property loans in the United States, triggered the collapse of a number of banks and various financial institutions (Guo, 2023). One of the fourth largest investment banks in the US at that time, namely Lehman Brothers, also went bankrupt as a result of the crisis. Of course, bankruptcy also has a domino effect on other financial institutions. Even the Prime Mortgage Crisis in 2008 had a global

impact, triggering a recession in countries around the world, especially Europe. Thiemann et al. (2021) reinforces the notion that a financial institution crisis poses a threat to the entire financial system and generates systemic risk, resulting in a substantial impact. The Prime Mortgage Crisis started with the failure of a US financial institution, subsequently spreading throughout the financial system to trigger a global systemic crisis and a downturn in the global economy (Tori et al., 2023; Suhendra et al., 2022).

In general, systemic risk itself can disrupt financial stability and endanger a country's economy; therefore, the existence of systemic risk is a major concern for central banks in any country. Systemic risk impacts the central bank's primary duty of upholding financial system stability and facilitating the smooth operation of a nation's economy (Liu et al., 2024; Zakaria et al., 2024).

2. LITERATURE REVIEW

Banking is exposed to a wide range of risks, and these risks can have an impact on banking and even other financial institutions (Marinde et al., 2022). We refer to these potential risks as systemic risks that each country faces. Systemic risk refers to the potential for one or more financial institutions to fail due to a systemic event, such as a shock that occurs in one financial institution and then spreads to several other large institutions (Duan et al., 2021).

In addition, various experts have defined systemic risk differently. Tobias and Brunnermeier (2016) define systemic risk as the risk posed by a financial institution, particularly in the banking industry, experiencing distress. This distress can then trigger other financial institutions in the industry, potentially leading to a bank run that could further undermine the stability of the financial system. Acharya (2009) defines systemic risk as an event of simultaneous bank failure, where the failure of one bank triggers the failure of other banks. Basically, we can compare systemic risk to an epidemic in a country's financial system, as the risk from a banking shock can quickly spread, impact other financial institutions, and potentially lead to the collapse of the financial system.

This definition highlights the significance of systemic risk factors in a country, as they play a crucial role in regulating the stability of the financial system. Silva et al. (2017) bolster this assertion in their research, emphasizing that systemic risk plays a significant role in determining the stability of a nation's financial system. This is particularly true for financial imperfections such as asymmetric information, agency issues, moral hazard, and the potential for contagion risk or a domino effect. In this case, systemic risk focuses on the danger of the entire financial system collapsing, which could cause a major downturn in the economy. The impact of a systemic financial crisis surpasses that of other sectoral crises due to its significant influence on financial institutions, particularly banking, which holds significant sway over the economy. According to Ozil (2020) confirms that the significant influence of banks in a nation contributes to systemic risk, particularly for large banks that could significantly contribute to the financial system's collapse.

As the financial system develops and advances in technology, it certainly supports the acceleration of financial system integration and financial linkage between banks (Pu et al., 2021). The higher the linkage or concentration in the banking industry, the higher the level of systemic risk (Brunnermeier et al., 2020). If there are interrelated relationships between elements of the financial system, known as interconnectedness, systemic risk can arise and spread quickly, potentially leading to financial system instability. Therefore, the systemic risk instrument plays a crucial role in an economy, given that systemic risk is a negative externality that every financial institution carries. This risk can burden other financial institutions, thereby compromising the country's economic stability (Acharya, 2009).

Several methods exist for measuring systemic risk using various indicators, each with its own advantages and disadvantages. Two commonly used methods for measuring systemic risk values are the Conditional Value at Risk (CoVar) and Marginal Expected Shortfall (MES) techniques. Researchers that focus on systemic risk widely use these two methods; Acharya (2009) coined the MES method, while Tobias and Brunnermeier (2016) coined the CoVar method. The CoVar method measures systemic risk using relatively simple calculations and real-time interpretation.

3. RESEARCH METHOD

Tobias and Brunnermeier (2016) first coined the Conditional Value at Risk (CoVar) method, followed by Acharya et al. (2017) with the Marginal Expected Shortfall (MES) method, Brownlees & Engle (2011) with the SRISK method, and several other calculation methods. Tobias and Brunnermeier (2016) developed the Conditional Value at Risk (CoVar) calculation method, which serves as the basis for this research. This method will generate a percentage contribution to the risk of loss within a specified confidence interval. By focusing on the contribution of banking as a financial sector to a country's systemic risk, the conditional value at risk (CoVar) method calculates systemic risk values. This method describes the financial system's performance in the realization of the distribution of bank returns, so systemic risk calculations using this method can capture the risk of contagion or contagion effects that will affect the financial system's stability (Zedda and Cannas, 2020).

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In this research, a calculation method based on the Conditional Value at Risk (CoVar) method by Tobias and Brunnermeier (2016), which uses multivariate GARCH to estimate the CoVar value. This method utilizes the daily closing stock price components for each bank, subsequently calculating the return value for use in multivariate GARCH estimation to determine systemic risk figures.

The calculation method utilizes the institution's return value (i) and the confidence level *(q),* defining the value at risk, $VaR^i_{q,t}$, as the q-quantile of the return distribution using the following general equation:

$$\Pr(R^i_t \leq VaR^i_{q,t}) = q \qquad (2.24)$$

We use *q = 0,05,* $VaR^i_{0,05,t}$ to determine the return value at the fifth quantile. The modelling form of Tobias and Brunnermeier (2016) defines $CoVaR^{i|j}_{q,t}$ as the VaR of an institution (i) of the financial system (j) during financial distress, namely when the return value is at VaR conditions. The quantile values of the conditional distribution implicitly determine the meaning, resulting in the following equation:

$$\Pr(R^i_t \leq CoVaR^i_{q,t} | R^i_t = VaR^i_{q,t}) = q \qquad (2.25)$$

The GARCH model estimates the CoVar model from Tobias and Brunnermeier (2016), and the time-series relationship between an institution's CoVar and its VaR value supports time variation because of the time-varying correlation. The method developed by Girardi and Ergün (2013) offers several advantages. Firstly, it enhances the quality of CoVar estimates by effectively modeling the volatility of the return variables. Additionally, it can adapt to changing volatility over time, thereby enhancing the model's capacity to estimate future CoVar values.

Acharya (2009) proposed the Marginal Expected Shortfall (MES) method approach. According to Acharya (2009), calculations using the MES method are the correct method for predicting bank pressure (bank distress). MES measures how big the impact of financial institutions, in this case, banks, is on shocks in aggregate. According to Acharya et al. (2017), MES has several benefits. First, MES requires simple data, but it has stronger predictive capabilities than risk measures. Both MES vary at the bank level so as to overcome the disadvantages of country-level volatility measures. Third, MES requires market-based information to forecast. Thus, when using accounting-based measures, it eliminates concerns about manipulation or inconsistencies across regulatory jurisdictions or over time due to changes in accounting policies.

The first step in this MES approach is to look for stock returns in stock index data. The second step is to estimate using generalised autoregressive conditional heterocedasticity (GARCH). The conditional variance GARCH is then used to get the MES results. The model for the MES is presented below.

$$MES_{i,t} = E_t(r_{i,t+1} | r_{m,t+1} < q_{a,t}(r_{t+1}) = C \qquad (2.26)$$

Where: $r_{i,t}$ is the logarithm of daily stock returns, $r_{m,t}$ is the daily stock index return on the market, and C is the tail risk. Tail risk is a financial term that refers to the risk of an event that has a low probability of occurring, but if it does, it can have a very large or extreme impact. Here, the term 'tail' refers to the tail of an event's probability distribution curve. Typically, events that occur in these tails have a significant impact, either positive or negative, on an investment portfolio or the market as a whole.

Network theory considers all possible risk transmission networks in various financial systems, or forms a model of relationships between financial institutions and their responses in normal or distress situations. The theory also introduces the notion of "too interconnected, too fail," indicating that a financial system facing systemic risk issues is likely a result of overly connected financial institutions, potentially leading to negative consequences for other institutions within the system. Wu et al. (2021) provide support for this concept, demonstrating its relevance to global systemic risk. Their research indicates that high interconnection among institutions increases systemic risk, potentially leading to bankruptcy. Apart from that, it also supports the concept of "too big to fail," which refers to large financial institutions being considered important, so that if failure occurs, it can have major consequences for the economy and society.

4. RESULTS AND DISCUSSION

Systemic risk is a type of risk that occurs in an economy. This risk arises when banking financial institutions experience distress, which then creates a contagion effect or domino effect that triggers other financial institutions to also experience distress, which can further result in bank runs and undermine the stability of the financial system. Measuring systemic risk figures is important not only for studying various global economic crises caused by systemic risk but also for assessing the benefits of systemic risk analysis in terms of estimating the level of risk associated with certain economic behaviour and estimating potential risks to reduce these risks. The likelihood of a crisis and the preservation of the stability of the financial system are paramount.

Mitra and Shaw (2023) support the urgency of systemic risk, stating that it's a risk associated with the potential for the financial system or a specific part of it to collapse, potentially causing negative impacts across the entire economy. The

development of systemic risk figures frequently fluctuates due to the vulnerability of systemic risk to various conditions, behaviors, and factors within the financial system and the broader economy. The graph below shows the development of the average systemic risk figure for the 39 banks selected in this study, which shows a fluctuating trendline.

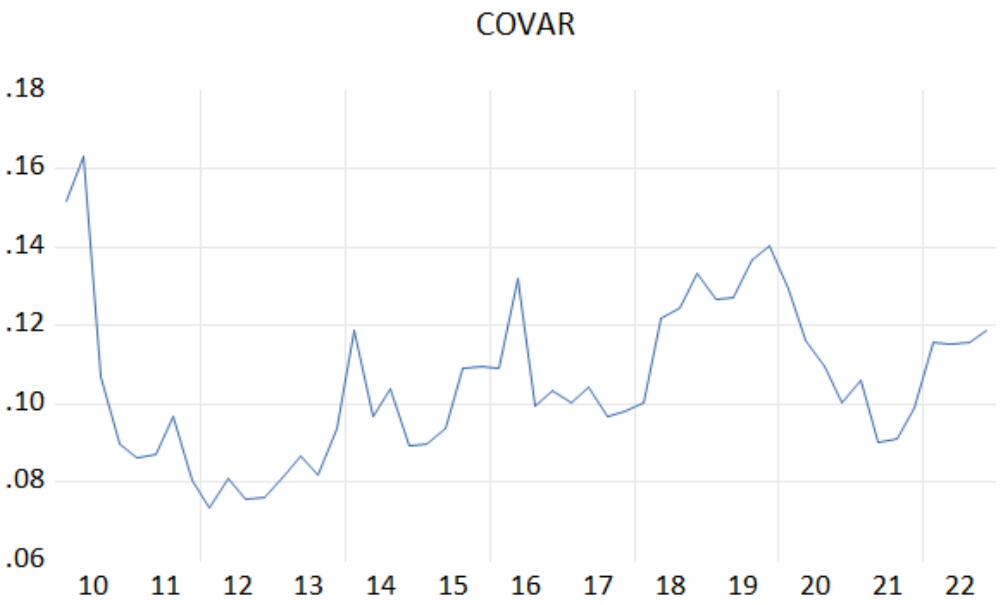

Figure 1. Systemic Risk (COVAR)

Figure 1 above shows the evolution of average systemic risk using the CoVar approach in the Indonesian banking sector from the first quarter of 2010 to the fourth quarter of 2022, which fluctuates every year. This is because changes in systemic risk are very susceptible to changes in conditions or behaviours that occur, so systemic risk figures experience many fluctuations throughout the period. The graph reveals a significant surge that peaked in 2010 at 0.17%, marking the pinnacle of systemic risk. Additionally, the second quarter of 2019 has the second highest systemic risk point, at 0.14%. It is very likely that this is due to the COVID-19 pandemic that hit the world at the beginning of 2019. This has had a big impact on the economy, which, of course, can affect systemic risk.

The residual effects of the global financial crisis in 2008–2009 led to a spike in systemic risk in the first quarter of 2010. Although most countries have not experienced a severe banking crisis, global uncertainty still influences risk perceptions in the banking sector. So during this period, central banks and governments around the world were still in the process of stabilising the shaken economy, which contributed to high systemic risk. In 2011, systemic risk showed a significant decline. This decline may reflect the gradual recovery of the global economy after the crisis, as well as stabilisation policies implemented by the government and monetary authorities of each country to strengthen the banking sector and domestic economy.

The period 2012 to 2016 was characterised by relatively stable systemic risk fluctuations, although there were slight spikes. This may be due to the gradual global economic recovery as well as the impact of the taper crisis. The taper crisis itself refers to the US Federal Reserve's announcement in 2013 of a gradual reduction or taper of its massive asset purchase programme known as Quantitative Easing (QE), which caused a lot of uncertainty in financial markets around the world and a decline in local currency exchange rates. In 2013, systemic risk increased in line with the market's response to tapering. Capital outflows and pressure on currency exchange rates cause financial instability and increase systemic risk.

Systemic risk increased again in 2019 to reach 0.14%. The economic impact of the United States-China trade war and COVID-19, which emerged at the end of 2019, may have caused this increase. Global uncertainty, disruptions to supply chains, and economic activity had a direct impact on the banking sector. Apart from that, social restrictions, lockdown policies, and significant changes in global and domestic economic activities can also influence systemic risk.

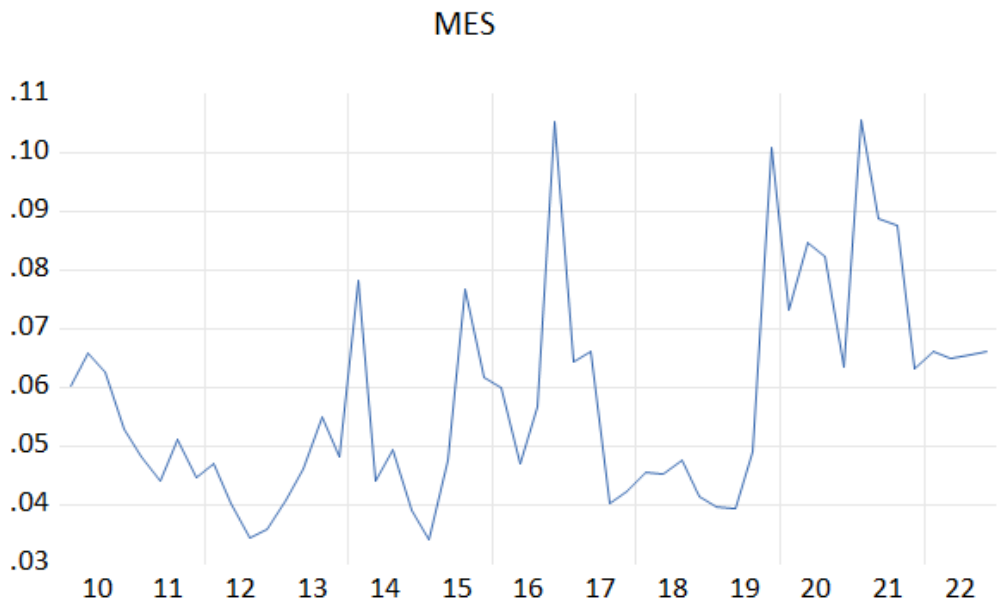

Figure 2. Systemic Risk (MES)

After calculating the CoVaR, which measures the individual contribution of 39 banks to systemic events, if the bank experiences default, we carry out an MES calculation. This calculation measures the cumulative contribution of banks to systemic events when the market is in distress due to an economic recession or crisis conditions. This process represents the cumulative evolution of systemic risk.

Figure 2 reveals the systemic risk based on the MES approach. It demonstrates that systemic risk development experienced sharp fluctuations from 2010Q1 to 2022Q4. The second quarter of 2016 was the highest point, reaching a contribution of 0.10%. The second quarter of 2014 had the lowest contribution, which was approximately 0.03. In 2010, systemic risk was at a relatively moderate level. Over time, systemic risk showed a downward trend until it reached a temporary low of around 0.04 in 2012. This year represents a recovery phase after the global financial crisis, such as stabilizing the exchange rate and controlling inflation, which helps to create a more stable economic environment. Fluctuations from 2013 to 2016 saw a sharp spike, with systemic risk reaching a peak in the second quarter of 2016, namely 0.10%. These fluctuations may be the result of the taper crisis and global economic volatility.

At its peak in 2016, the systemic risk showed a declining trend and was relatively stable from 2017 to 2018, although there was little fluctuation. This may be due to increased global economic stability, with a gradual recovery in developed and developing countries helping to reduce systemic risk. Then, in 2019, systemic risk again increased sharply, followed by an even sharper spike in 2020 and fluctuations that will continue until 2022 due to the United States-China trade war and COVID-19. Trade tensions between the United States and China create significant global uncertainty and affect market sentiment and international capital flows. Moreover, exchange rate and investment fluctuations, which add pressure to the banking sector and increase systemic risk, primarily affect developing countries. In addition, restrictive policies that were quite strict to control the spread of the virus resulted in disruptions to economic activity, which affected the banking sector as a whole. Even though there are signs of recovery in 2021 and 2022, systemic risk still shows fluctuations due to the impact of the United States-China war and COVID-19.

5. CONCLUSION

This research endeavours to determine the level of systemic risk that exists within the Indonesian banking sector. The analysis utilizes quarterly data from 39 banks listed on the Indonesian stock exchange, spanning from 2010 to 2022. To calculate the systemic risk index, this research uses the method of conditional value at risk (CoVar) in addition to the marginal anticipated shortfall (MES). The result indicates that the systemic risk in the Indonesian banking industry fluctuates, shown by both the CoVar and MES approaches.

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