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The influence of governance of risk management on systemic risk in Indonesian banking for the 2019-2023 Period

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Abstract

Indonesian banking plays a vital role in supporting national economic growth. However, the industry is also vulnerable to systemic risks that can undermine national financial stability. This study aims to analyze the influence of governance of risk management on systemic risk in Indonesian banking for the 2019–2023 period, using the Value at Risk (VaR) and Expected Shortfall (ES) measurement approaches. Utilizing a quantitative approach with the panel data regression method, this study examined 32 foreign exchange banks that were selected purposively. The results show that the existence of a Risk Management Committee (RMC) significantly reduces systemic risks, as measured by both the VaR and ES approaches. The use of the variance-covariance estimator (vce) cluster method successfully corrected the weaknesses of the model due to heteroscedasticity and autocorrelation. These findings confirm the importance of a strong risk governance structure in minimizing the impact of the financial crisis. The implications of these results encourage the strengthening of the role of the RMC and the adaptation of bank risk governance to respond to the evolving risk dynamics in the national financial sector.

Keywords: Expected shortfall, Governance of risk management, Risk management committee, Systemic risk, Value at risk.

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1. Introduction

Indonesian banking plays an important role in supporting the national economy. Banking is the backbone and contributes to helping increase economic growth and investment, among others, through financing economic and business activities carried out by institutions, state-owned enterprises, corporations, small and medium enterprises, and retail. In addition, banks help the government finance strategic projects in the form of infrastructure and/or development in various other economic sectors. Banking plays an important role in supporting the development of all sectors of the Indonesian economy, namely trade, industry, and services [1].

However, in the banking industry, there are systemic risks that are serious threats because they have the potential to shake the stability of the global financial system [2]. The global financial crisis of 2008 is one of the proofs of how the failure of one or more financial entities triggered widespread systemic collapse. This risk not only impacts the financial sector but also the economy as a whole worldwide. It is therefore important to understand the factors that affect and manage systemic risk effectively [3].

Regarding systemic risk, there are several opinions, including De Bandt et al. [4], which states that systemic risk is a risk that causes the failure of one or several financial institutions as a result of a systemic event. These failures can spread and spread (contagion) to other financial institutions [5]. Argue that if a bank fails, there will be a significant negative impact on the financial system and the economy.

Another opinion was put forward by Anginer et al. [6]. This stated the systemic impact of a bank as a correlation of bank risk-taking behavior as measured by R-squared from the regression equation between the change in the magnitude of a bank's default risk and the change in the magnitude of the default risk of all banks in a banking system [7].

In conducting various studies related to systemic risks, obstacles were found, namely, the bank's internal data was not always available because it was confidential and not open to the public. In this regard, to overcome this, several researchers have tried to build a systemic risk model, including System Value at Risk (SVaR), proposed by Kauhanen [8], and Value at Risk (VaR) as proposed by Tzouvanas [9]. Research on the development of the VaR model as a systemic risk was also carried out by Mensi et al. [10].

Various systemic risk studies in Indonesia have been conducted, including by Nugroho and Halik [11] who stated that profitable banks may have greater risks because they have easy access to borrowing, so that they accumulate greater risk [12]. Stated that the high level of competition among banks encourages banks to diversify their risks, causing the banking system to be more robust. As for Setiyo et al. [13], who stated that Islamic banking in Indonesia is known to be jointly affected and threatened by the stability of the financial system. Based on the identification of the above problems, the objectives of this study are:

1. Analyze the implementation of banking governance of risk management in Indonesia.
2. Analyze the relationship between the governance of risk management and systemic banking risk in Indonesia as measured through the VaR method.
3. Analyze the relationship between governance of risk management and systemic risk banking in Indonesia as measured through the ES method.

2. Method

The population in this study comprises all foreign exchange banks, specifically 105 foreign exchange banks in Indonesia, during the 2019–2023 period. The selection of the research sample utilized random sampling, which involved selecting foreign exchange banks that have significant foreign exchange transactions and a large market share in foreign exchange transactions within the national financial system. With this approach, the research aims to illustrate the relevant systemic risks in the Indonesian banking industry. The number of samples was 32 foreign exchange banks meeting these criteria.

This study uses secondary data obtained from public financial statements, annual reports, stock market data of banks listed on the Indonesia Stock Exchange (IDX), and literature studies in the form of supporting data obtained from journals, articles, and reference books.

In this study, the researcher collected financial data in the form of annual financial data containing data on the bank's net foreign exchange position, bank size, profitability from various sources, and then took Covid-19 data, namely the presence or absence of Covid-19. Furthermore, two (2) analyses were carried out, namely descriptive analysis and panel data regression analysis, which will ultimately answer the research objectives.

3. Results and Discussion

3.1. Panel Data Regression Analysis

In this study, panel regression analysis was used to examine the influence of risk management on *systemic risk,* which was measured through two main indicators, namely *VaR* and *ES.* These two indicators were analyzed to provide a more comprehensive picture of the relationship [14].

This approach allows the identification of how risk management, such as the presence of *RMCs*, can affect the level of systemic risk faced. The results of this analysis are expected to provide in-depth insights into the effectiveness of risk management in reducing potential large losses. Because there are two risk management governance indicators to be analyzed, the panel regression equations estimated in this study are two, which are as follows:

Regression Equation I :

$$VaRit = \propto + \beta 1KMRit + \beta 2ROAit + \beta 3Sizeit + \beta 4Covidit + \beta 5kbmiit + \varepsilon it$$

Regression Equation II:

$$ESit = \propto + \beta 1KMRit + \beta 2ROAit + \beta 3Sizeit + \beta 4Covidit + \beta 5kbmiit + \varepsilon it$$

3.2. Classical Assumption Test of Regression Equations I

The classical assumption test in panel regression includes three main things: multicollinearity, heteroscedasticity, and autocorrelation. The multicollinearity test aims to ensure that there is no very strong relationship between independent variables in the model, which can be tested with *the Variance Inflation Factor* (*VIF*); if *the VIF* is greater than 10, then there is significant multicollinearity.

The heteroscedasticity test identifies whether the residual variance is not constant, which is tested with the

Breusch-Pagan or White's test. If the p-value is less than 0.05, then heteroscedasticity is present. Meanwhile, the autocorrelation test examines whether the residual from the previous observation relates to the next observation, which can be tested with the Breusch-Godfrey test. A p-value of >0.05 in the test indicates no autocorrelation in the regression model.

Table 1.
Multicollinearity Test Results.

Independent Variables	*VIVID*	Conclusion
Size	2.20	
KBMI	2.12	*VIF* <10, no multicollinearity
RMC	1.09	
ROA	1.06	
Covid	1.01	

Table 1 shows the results of the multicollinearity test conducted to identify the presence of a very strong relationship between independent variables in the panel regression model. Based on the Variance Inflation Factor (VIF) value, all independent variables, namely Size (2.20), KBMI (2.12), RMC (1.09), ROA (1.06), and Covid (1.01), have VIF values smaller than 10. This indicates that there are no significant multicollinearity problems between independent variables in the model, which means that the regression coefficient estimation can be interpreted well without concern for instability due to multicollinearity.

Table 2 .
Heteroscedasticity Test.

Regression equations	*P Value Wald Test*	Criterion	Conclusion
1	0.0000	<0.05	There is heteroscedasticity

The next classical assumption test is the heteroscedasticity test. Table 6 shows the results of the heteroscedasticity test using the Wald test for Regression Equation 1. The p-value of 0.0000 is smaller than 0.05, which indicates that there is heteroscedasticity in the regression model. This means that the residual variance is not constant across observations, which can affect the validity of the estimated results. Therefore, improvement measures such as the use of robust estimation models for heteroscedasticity need to be considered to ensure that the results of the analysis remain valid.

Table 3.
Autocorrelation Test.

Regression equations	***P Value Wooldridge test***	Criterion	Conclusion
1	0.0377	<0.05	There is an autocorrelation

The next classic assumption is autocorrelation. Table 7 shows the results of the autocorrelation test using *the Wooldridge Test* for Regression Equation 1. A *P-value* of 0.0377, which is smaller than 0.05, indicates that there is an autocorrelation in the regression model. That is, the residual of the previous observation is related to the residual of the next observation, which can affect the validity of the estimate in the model. Therefore, to address the problem of autocorrelation, it is necessary to make improvements in the model, such as the use of more appropriate models or adjustments to the residual autocorrelation structure [15].

4. Regression Model Estimation Results I

The selection of the random effects model as the best model shows that the differences between entities in the sample have a significant influence that is considered random. However, further analysis revealed the existence of heteroscedasticity and autocorrelation issues in the data. This problem has the potential to cause the estimation results to be inefficient and the statistical tests to be invalid. To overcome this, a reestimation was carried out using a robust approach through the variance-covariance estimator (vce) cluster method.

The VCE cluster method corrects the error standard, resulting in more reliable statistical inferences. With this approach, the model can still be used even if classical assumptions are violated. The use of VCE clusters is effective in handling heteroscedasticity and autocorrelation simultaneously, resulting in bias analysis due to violations of heteroscedasticity and autocorrelation assumptions. Table 8 shows the difference in regression analysis results without the use of vce clusters and after the use of vce clusters.

Table 4.
Comparison of regression analysis results without the use of *VCE cluster* and after the use of *VCE cluster*

	(1) **zVaR**	**(2)** **zVaR**
zRMC	-0.115 (-1.35)	-0.115*** (-35.28)
zROA	-0.0443 (-0.56)	-0.0443*** (-7.42)
zSize	-0.193 (-1.20)	-0.193*** (-9.46)
covid	0.179 (1.78)	0.179*** (8.58)
kbmi	0.548 (1.01)	0.548*** (18.54)
_Cons	-0.740 (-1.15)	-0.740*** (18.66)
N	138	138

Table 4 shows a comparison of regression analysis results between models that do not use VCE clusters and models that use VCE clusters. In models that did not use VCE clusters, the results of the analysis showed that no single independent variable had a significant effect on the bank's systemic risk (VaR). However, after the use of VCE clusters, all independent variables showed a significant influence on the bank's systemic risk (VaR) [16].

These differences in results illustrate the importance of using VCE clusters in regression analysis. The use of VCE clusters can overcome problems that arise due to violations of classic assumptions in regression, such as heteroscedasticity (the difference in error variance between observations) and autocorrelation (error dependence between observations). Both of these problems can lead to biased and inefficient estimations, so regression results without a cluster can provide inaccurate conclusions.

Through the use of the VCE cluster, regression analysis becomes more robust and provides more precise results in describing the relationship between independent variables and systemic risk in banks. It also suggests that models that use VCE clusters are more reliable for studies involving data with complex structures or the presence of dependencies between observations.

Thus, the use of VCE clusters is highly recommended when data show the possibility of heteroscedasticity and autocorrelation, as it can produce more valid estimates and support more appropriate policies or decisions in risk management.

4.1. Panel Regression Model Selection on Regression Equation II

Table 5.
Results of the Regression Equation II Model Selection Test.

Regression equations	***P Value Chow Test***	**Criterion**	**Conclusion**
Chow Test	0.0000	<0.05	Selected FE
' Uji ***Hausman***	0.1564	>0.05	Selected RE
LM Test	0.0000	<0.05	Selected RE

The results of the model selection test for Regression Equation III showed that based on the Chow test, the p-value obtained was 0.0000, which was smaller than 0.05, so the model chosen was a Fixed Effects (FEM) model. However, in the Hausman test, the p-value obtained was 0.1564>0.05, which indicates that the Random Effects (REM) model is more appropriately used.

The LM test also gave a p-value of 0.0000 < 0.05, which supported the selection of the Random Effects (REM) model. Thus, although the Chow test favors the Fixed Effects Model, both the Hausman test and the LM test support the use of Random Effects as the most appropriate model for analysis in Regression Equations II.

4.2. Classical Assumption Test of Regression Equations II

Table 6.
Multicollinearity Test Results.

Independent Variables	***VIVID***	**Conclusion**
Size	2.20	
Kbmi	2.12	*VIVID* < 10 no multicollinearity
RMC	1.09	
ROA	1.06	
Covid	1.01	

The results of the multicollinearity test in Table 6 show that all independent variables tested have a VIF (Variance

Inflation Factor) value of <10, namely Size (2.20), KBMI (2.12), RMC (1.09), ROA (1.06), and Covid (1.01).

This low VIF value suggests that there is no problem of multicollinearity between independent variables in the regression model. Therefore, it can be concluded that there is no strong linear relationship between independent variables that can undermine the results of regression analysis, so this model is acceptable for further analysis.

Table 7.
Heteroscedasticity Test Results.

Regression equations	***P Value Wald Test***	Criterion	Conclusion
II	0.0000	<0.05	There is heteroscedasticity

The results of the heteroscedasticity test in Table 7 show that the p-value of the Wald Test for Regression Equation III is 0.0000, which is smaller than 0.05. This indicates that there is heteroscedasticity in the model, i.e., error variance (residual) that is not constant across all observations.

In the presence of heteroscedasticity, the results of the regression model estimation can be inefficient, although the coefficients remain consistent. Therefore, adjustments need to be made, for example, by using robust estimation to address this problem and improve model accuracy.

Table 8.
Autocorrelation Test Results.

Regression equations	***P Value Wooldridge test***	**Criterion**	**Conclusion**
II	0.0580	>0.05	None Autocorrelation

The results of the autocorrelation test in Table 8 show that the *p-value of the Wooldridge test* for Regression Equation III is 0.0580, which is greater than 0.05. This indicates that there is no autocorrelation in the model, i.e., errors (*residuals*) between observations are not related to each other. Thus, the assumption of error independence in the regression model is achieved, and the estimation results can be considered valid in the absence of autocorrelation problems. Therefore, this model is acceptable for further analysis without the need to make adjustments related to autocorrelation.

5. Regression Model II Estimation Results

The selection of the random effects model as the best model shows that the differences between entities in the sample have a significant influence that is considered random. However, further analysis revealed the existence of heteroscedasticity problems in the data. This problem has the potential to cause the estimation results to be inefficient and the statistical tests to be invalid.

To overcome this, a re-estimation was carried out using a robust approach through the variance-covariance estimator (VCE) cluster method. This method corrects the standard error, resulting in more reliable statistical inferences. With this approach, the model can still be used even if classical assumptions are violated. The use of VCE clusters is effective in addressing heteroscedasticity. Therefore, the results of the analysis become more reliable to support conclusions.

This approach ensures that the interpretation of model parameters remains valid. This step is also commonly used in data panel-based research. The implementation of this method increases the credibility of the estimation results and the validity of the analysis. Table 9 shows the difference in regression analysis results without the use of vce clusters and after the use of vce clusters.

Table 9.
Comparison of Regression Model Estimation Results before and after the use of VCE clusters

	(1) ***zES***	**(2)** ***zES***
zRMC	-0.168 (-1.72)	-0.168*** (-42.19)
zROA	-0.0289 (-0.33)	-0.0289*** (-5.74)
zSize	-0.135 (-0.81)	-0.135*** (-6.70)
covid	0.130 (1.02)	0.130*** (46.78)
kbmi	0.531 (1.04)	0.531*** (15.87)
_Cons	-0.688 (-1.14)	-0.688*** (-19.60)
N	138	138

Note: t-statistics in parentheses
*p < 0.05, **p < 0.01, ***p < 0.001.

Table 9 shows a comparison of regression analysis results between models that do not use VCE clusters and models that use VCE clusters.

In a model that did not use a VCE cluster, the results of the analysis showed that no independent variable had a significant effect on the systemic risk of the bank (ES). However, after the use of the VCE cluster, all independent variables showed a significant influence on the bank's systemic risk (ES).

These differences in results illustrate the importance of using VCE clusters in regression analysis. The use of VCE clusters has been shown to be able to overcome problems that arise due to violations of classical assumptions in regression, such as heteroscedasticity (the difference in error variance between observations) and autocorrelation (error dependence between observations). Both of these problems can lead to biased and inefficient estimations, so regression results without a cluster can provide inaccurate conclusions.

6. Hypothesis Testing Results

Table 10.
Hypothesis Testing Results.

Yes	Hypothesis	Analysis Results	Conclusion
1	Good bank risk governance (the existence of a Risk Management Committee) can reduce the risk of *systemic risk* bank measured through *VaR values*	-0.115***	Accepted
2	Good bank risk governance (the existence of a Risk Management Committee) can reduce the risk of *systemic risk* bank as measured through *ES value*	-0.168***	Accepted

Table 10 shows the results of hypothesis testing, which aims to test the relationship between bank risk governance, as measured by the existence of a Risk Management Committee, and the control of systemic bank risk. The results of the analysis showed that the first hypothesis, which states that good bank risk governance can reduce systemic bank risk as measured by the VaR value, was accepted with a significant negative result of -0.115***. This suggests that the better the risk governance, the lower the VaR value, which reflects lower systemic risk.

Furthermore, the second hypothesis tests the influence of risk governance on systemic risk as measured through the ES value. The results of the analysis showed a significant negative coefficient of -0.168***, which indicates that good risk governance can lower the value of ES, or in other words, reduce the potential for possible extreme losses. This illustrates the importance of careful risk management in maintaining financial system stability.

Overall, the results of this study provide strong evidence that good risk governance, especially through the existence of a Risk Management Committee, has a significant role in suppressing systemic risks. This provides important implications for risk management practices in the banking industry to maintain stability and mitigate the potential adverse impacts of extreme events.

6.1. The Influence of Governance Risk Management on Systemic Risk with the ES Approach

The results of this study show that Governance Risk Management, which is shown by the existence of a bank risk management committee, has been proven to be able to significantly suppress the bank's Systemic Risk with the ES approach. A well-organized risk management committee plays an important role in identifying and managing risks that have the potential to undermine the stability of the financial system, as well as ensuring that banks have effective mitigation strategies in place to address crisis situations. With the ES approach, which measures extreme losses beyond the expected risk value, the committee can better prepare banks for very bad market scenarios.

The ES approach assists banks in measuring potential losses that are greater than just the usual risk value, focusing on the extreme tail of the loss distribution. This provides a clearer picture of the potential for large losses that can occur, allowing risk management committees to develop more appropriate policies to mitigate the impact of these risks. As a result, with a risk management committee focused on systemic risk management using the ES approach, banks can reduce the likelihood of major losses that could shake the financial system as a whole.

The existence of a risk management committee also strengthens transparency and communication regarding risks in banks. This committee ensures that all risk management strategies are carefully evaluated and approved, which ultimately increases public confidence in banks' ability to deal with market uncertainty. Thus, the existence of a special committee for risk management can be an effective tool in reducing systemic risks and increasing bank stability.

Overall, this study confirms that the existence of Governance of Risk Management, supported by a strong risk management committee, as well as the implementation of the ES approach, can assist banks in mitigating potential systemic risks. This not only strengthens the bank's resilience to market shocks but also makes an important contribution to maintaining the stability of the broader financial system. The existence of an effective risk management committee has proven to be crucial in suppressing systemic risks, especially when adopting an ES approach.

This committee is responsible for carefully identifying, measuring, and managing risks, which in turn can minimize the negative impact on the financial system. With strong oversight from risk committees, banks can reduce excessive risk-taking behavior and keep risk exposure within safe limits. Research shows that a well-structured risk management committee plays an important role in lowering its vulnerability to financial crises and strengthening banks' resilience to market disruptions [17].

In addition, the presence of the Chief Risk Officer (CRO) within the executive board serves as a key driver in the bank's risk management, which contributes directly to the reduction of systemic risk.

Research shows that banks that have good governance structures and strong risk management are better able to reduce their exposure to extreme market fluctuations. With proper oversight, the CRO and risk committees can ensure that risk management policies not only meet regulatory standards but also focus on sustainable long-term value creation, with more controlled systemic risks [18, 19].

However, to optimize the impact of risk management committees on systemic risk reduction, banks must continue to adapt their strategies according to changing market conditions and technological developments. In the face of more complex and globally connected risks, a more holistic and adaptive approach is urgently needed. Therefore, while strong risk governance provides clear benefits, it is important for banks to tailor their governance structures to the unique characteristics and challenges of their markets, to address systemic risks more effectively and sustainably [17, 20].

7. Conclusion

The conclusions obtained from the results of this study are as follows: Bank risk management in Indonesia, especially related to the existence of the Risk Management Committee (RMC), shows significant developments in terms of risk governance. Most banks in Indonesia have established RMCs as part of a formal structure to identify, assess, and manage the risks faced, reflecting the growing awareness of the importance of risk management to maintain the stability and sustainability of bank operations. The existence of this RMC is proof that many banks already understand the importance of a good supervisory structure in managing risks that can affect their performance. However, although the majority of banks already have this committee, there are still a number of banks that do not have one, which indicates that there is room for improvement in the implementation of comprehensive risk management in the Indonesian banking sector, especially in strengthening internal supervision and more effective risk mitigation capabilities. Governance of Risk Management, as shown by the existence of RMC, has been proven to significantly reduce the bank's systemic risk with the VaR approach. The existence of RMC plays a role in identifying, evaluating, and managing risks faced by banks, thereby minimizing negative impacts on financial system stability. The VaR approach, which is used to measure potential losses in extreme market conditions, further demonstrates that with good risk management and proper supervision, banks can reduce their contribution to systemic risk. These findings underscore the importance of the role of effective governance in reducing potential crises and maintaining banking stability.

The bank's risk management committee has been proven to be able to significantly suppress the bank's systemic risk with an ES approach. A well-organized risk management committee plays an important role in identifying and managing risks that have the potential to undermine the stability of the financial system, as well as ensuring that banks have effective mitigation strategies in place to address crisis situations. With the ES approach, which measures extreme losses beyond the expected risk value, the committee can better prepare banks for very adverse market scenarios.

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