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Market Risk Measures Impact on Systemic Risk in Indonesia Banking Industry

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Abstract: This study investigates the relationship between market risk measures and systemic risk in Indonesia's banking sector. It aims to inform policymakers and regulators in promoting financial stability. By examining how market risk measures, specifically total risk encompassing systematic and idiosyncratic components, influence systemic risk in Indonesia's banking system, this study addresses a notable research gap, particularly in emerging markets like Indonesia. This research contributes to the understanding of systemic risk dynamics in an emerging market context, offering insights into how market risk measures contribute to systemic risk. Employing a quantitative approach, this study utilizes secondary data from the Indonesia Stock Exchange and Datastream Refinitiv Eikon. Non-probability sampling selects banks listed on the Indonesia Stock Exchange, with daily stock price data used to construct market risk measures. Systemic risk is measured using both CoVaR and MES, and regression analysis is employed to explore the relationship between market risk and systemic risk. The study reveals a significant positive association between total risk and systemic risk, highlighting the crucial role of idiosyncratic risk in this relationship. These findings underscore the importance of considering both systematic and idiosyncratic market risk when assessing systemic risk in Indonesia's banking sector. The study emphasizes the need for robust risk management practices and regulatory measures to ensure financial stability in emerging markets.

Keyword: Systemic Risk, Market Risk, Idiosyncratic Risk, Banking Industry, Indonesia

INTRODUCTION

There is inherent uncertainty in the global economy. The economic shocks brought on by this uncertainty may destabilize the economy of other nations. Numerous things, such as crises and the economic strategies that various nations pursue, might result in these shocks. The 2007-2009 Global Financial Crisis (GFC) in the United States is one example, which created widespread stress and had an influence on the global economy. Due to the 2007-2009 GFC, systemic risk has become a major area of study and policy, with the financial industry serving as its analytical hub (Giglio et al., 2016). Research on economic and finance after the

GFC are filled by plenty of quantitative measurements related to systemic risks (Wijoyo et al., 2022). Recent empirical research has shown that a variety of factors might contribute to an increase in systemic risk, such as firm-specific variables (Laeven et al., 2016; Mazumder & Piccotti, 2023; Sahibzada et al., 2022) and macroeconomic variables (Giglio et al., 2016; He et al., 2023). During periods of worldwide economic turmoil, like as the 2007 financial crisis, market risks impacted the overall functioning of the market and could not be circumvented or lessened by owning a specific portfolio (Sensoy, 2016). Every business has some level of market risk, which is natural on finance brought on by its fluctuations that cause an imbalance between the assets and liabilities of the organization. As a result, appropriate risk management techniques must be implemented to balance their risk and returns and minimize any negative impacts on its performance in finance (Kahihu et al., 2021). The annualized standard deviation or the annualized measure of the amount of variation of a random variable expected about its mean of stock returns is a measure of market risk, and its constituent components (systematic and idiosyncratic risk), provide valuable insights concerning portfolio and management decisions building (Tzouvanas, 2024).

The relationship between market risk and systemic risk has been the subject of extensive research in recent years, particularly following the global financial crisis of 2008. Several studies have explored this connection in various contexts, highlighting the potential impact of market risk on the stability of the financial system. In their study, Benoit et al., (2017) examined the correlation between market risk, measured as systematic risk (beta), and systemic risk. They found a strong positive correlation between the two variables. This suggests that banks with higher market risk are also more likely to contribute to systemic risk. Tzouvanas (2024) further investigated the impact of market risk measures on systemic risk in the US banking industry. His research employed a comprehensive set of market risk measures. The findings revealed that market risk is a significant predictor of systemic risk. Despite the growing body of evidence supporting the link between market risk and systemic risk, Löffler & Raupach (2018) noted that this relationship has received relatively only a little attention in the broader research landscape. While research has established a connection between market risk and systemic risk in other contexts, the specific dynamics of this relationship within the Indonesian banking sector remain unexplored. Existing studies on systemic risk in Indonesia primarily focus on measurement techniques (Wijoyo et al., 2022) and its connections to firm-specific factors like capital adequacy (Raz, 2018), diversification (Fresno & Hanggraeni, 2020), and macroeconomic variables (Purwono & Dimayanti, 2020). However, the influence of market risk on systemic risk within the Indonesian banking industry has not been thoroughly investigated. This gap in knowledge motivates the following research question: Do market risk measures influence systemic risk in the Indonesia banking industry?

Regarding to these findings, the objective of this study is to contribute to the literature on understanding the systemic risk by exploring further into the context of market risk. Many ideas and studies present similar arguments about market risk metrics and systemic risk. However, empirical proof of market risk decomposed into systemic risk elements, particularly in developing countries, remains sparse. This paper provides these gaps by offering empirical proof from Indonesia's banking industry. Additionally, this paper contributes to the literature on the market risk impact to systemic risk (Tzouvanas, 2024) by providing the evidence from a developing country, which is Indonesia.

METHOD

The study is using quantitative method and utilizes a non-probability sampling technique, where sample selection occurs at the researcher's discretion based on predetermined criteria. The employed data is external secondary data, accessed through the Datastream Refinitiv Eikon platform. The data specifically focuses on publicly traded banks listed on the Indonesia Stock Exchange (IDX) for the period from 2007 to 2022. It encompasses both daily stock price data for 46 banks to construct the annual bank total risk measure for each bank. Table 1 provides a detailed breakdown of the sample selection process, highlighting the number of banks included each year and the total number of observations. Additional data encompassing the bank financial data and relevant macroeconomic variables will also be obtained from the same source.

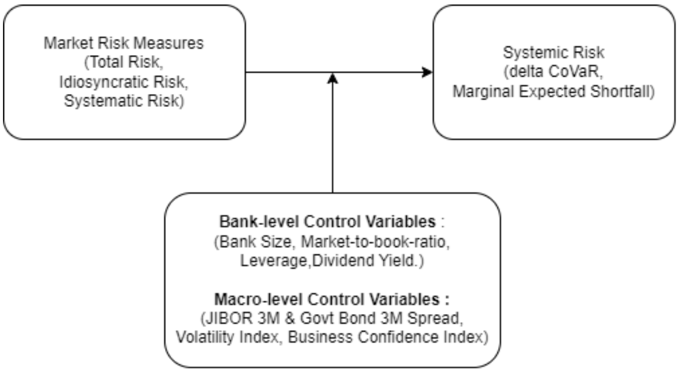
Table 1. Sample and Observation

Year	Total banks added	Banks total	Total of Observation	Sample %
2007	21	21	21	3.874539
2008	3	24	24	4.428044
2009	0	24	24	4.428044
2010	1	25	25	4.612546
2011	2	27	27	4.98155
2012	0	27	27	4.98155
2013	1	28	28	5.166052
2014	6	34	34	6.273063
2015	3	37	37	6.826568
2016	2	39	39	7.195572
2017	1	40	40	7.380074
2018	0	40	40	7.380074
2019	2	42	42	7.749077
2020	1	43	43	7.933579
2021	2	45	45	8.302583
2022	1	46	46	8.487085
Total	46	-	542	100

Source: Author's Own Work

Research Framework

The purpose of this research aims to investigate the influence of market risk on the systemic risk of the banking sector in Indonesia. The research is qualitative and the research model refers to the research conducted by Tzouvanas (2024) which uses the Conditional Value-at-Risk (CoVaR) approach (Adrian & Brunnermeier, 2016) and the alternative Marginal Expected Shortfall (MES) approach (Acharya et al., 2017) to measure systemic risk. The calculation of daily stock returns is used for the market risk size measure. Total risk, which incorporates systematic risk and idiosyncratic risk, is calculated as the annualized standard deviation of daily stock returns. Meanwhile, the three-factor capital asset pricing model (Fama & French, 1993) approach is used to construct idiosyncratic risk and systematic risk. The research framework underlying this research can be seen in Figure 1.



Source: Author's Own Work
Figure 1. Research Framework

Systemic Risk Measures

The main measure of systemic risk in this study uses ΔCoVaR, which is the contribution of a bank's VaR to the VaR of the banking industry. To calculate CoVaR, the quantile regression method developed by Adrian & Brunnermeier (2016) is used.

$$X_{j,s}^{q} = a^{q} + \beta^{q} X_{i,s} + \varepsilon_{i,s}^{q} \tag{1}$$

The predictive value $X_{j,s}^{q}$ represent the banking sector VaR based on $X_{i,s}$ at day s. Thus, $CoVaR_{i,s}^{q} = \hat{X}_{j,s}^{q}$, and $CoVaR_{i,s}^{q}$ are VaR of j based on the VaR of i for each given s and q. To effectively evaluate systemic risk, the measurement of $\Delta CoVaR$ is performed, the changes in $CoVaR$ of bank i at q = 95% against the median condition (q = 50%). By using formula (1) at q = 50% which is then stored as $(CoVaR_{i,s}^{0.5})$, and then repeated for q = 95% which is stored as $(CoVaR_{i,s}^{0.95})$. Then, the $\Delta CoVaR$ can be measured as shown in Equation (2).

$$\Delta CoVaR_{i,s} = CoVaR_{i,s}^{0.95} - CoVaR_{i,s}^{0.5} \tag{2}$$

Finally, the annualised $\Delta CoVaR_{t}$ represent the mean of all $\Delta CoVaR_{s}$ during year t.

For the alternative, Marginal Expected Shortfall (MES) (Acharya et al., 2017) another systemic risk metric, is taken into account. MES is measured by calculating the loss of bank i during the whole sector j is in a stressed state. The formula for MES itself is:

$$MES_{i,s} = -E_{t}\left(X_{i,s} | X_{j,s} \leq VaR_{j}^{0.95}\right) \tag{3}$$

Where $(X_{i,s})$ is the expected short-term equity loss of bank i based on the banking sector $(X_{j,s})$ suffers loss that exceeds its VaR at q (95%). Annual (MES_{t}) represent the mean of all (MES_{s}) during year t.

Market Risk Measures

Market risk measured using the calculation of daily stock returns $(R_{i,s})$. Total risk (TR) computed by using the annualized standard deviation of each bank's daily stock returns.

$$TR_{i,t} = \sigma\left(R_{i,s}\right) \times \sqrt{246} \tag{4}$$

The total risk indicated previously incorporates both systematic and idiosyncratic risk. To construct it, the three-factor model (Fama & French, 1993) is used:

$$R_{i,s} - R_{f,s} = \alpha_{i} + \beta_{i,1}\left(R_{m,s} - R_{f,s}\right) + \beta_{i,2} SMB_{s} + \beta_{i,3} HML_{s} + \varepsilon_{i,s} , \tag{5}$$

The left side of equation (5) relates to stock return excess, and the right side represents a stock's performance in comparison to the market portfolio (α_{i}). While $\left(R_{m,s} - R_{f,s}\right)$ is the market portfolio excess return factor, (SMB_{s}) quantifies the return of small stocks compared to the large stocks factor, (HML_s) is a factor that indicates the return of value stocks against the growth stocks and $\varepsilon_{i,s}$ is the residuals.

For systematic risk (BETA) the coefficient $\beta_{i,1}$ will be used. Meanwhile, the idiosyncratic risk will be calculated using the annual standard deviation of the residual $(\varepsilon_{i,s})$ with the following formula (Tzouvanas, 2024) :

$$IDIO_{i,t} = \sigma(\varepsilon_{i,s}) \times \sqrt{246} \quad (6)$$

Regression Model

In this study, the data panel regression method is used to find the relationship between market risk size and systematic risk, as well as to determine the causations and identification. Here are the regression equations used in this study.

$$Y_{i,t+1} = a + \beta_1 MRISK_{i,t} + \gamma Y_{i,t} + \delta' \Phi_{i,t} + \Lambda + \varepsilon_{i,t} \quad (7)$$

Y is the systemic risk variables (MES or $\Delta CoVaR$), the delayed value of Y $(Y_{i,t})$ which is employed as a variables controlling for initial situations. $MRISK$ is the market risk variable (total, systematic, and idiosyncratic risk). Φ serves as the control variables for numerous macro-level and bank-specific variables. The bank-level control variables, include bank size (logarithmic of the total amount of assets, SIZE), market-to-total asset ratio (mbratio), dividend yield (DVY), and Leverage (LEV). For the macro-level variables, this study use the term spread variable (the difference between the yields of 3-months Jakarta Interbank Offered Rate (JIBOR) and 3-months government bonds yield, SPREAD) and the volatility index (VIX) which used the annual volatility level of Indonesia stock market data, Additionally, the data for Indonesia Business Confidence Index (BCI) is also used as the macro-level variables. The factor Λ demonstrate several specifications which control year and bank fixed effects.

RESULTS AND DISCUSSION

Descriptive Statistic Analysis

The number of observations in this study is 542 bank-years. As can be seen from the descriptive statistics of the data in Table 2, the systemic risk measured using (dCoVaR) shows that the average individual bank contributes 0.005854 (0.5854%) to systemic risk, with the largest individual bank contribution value being 0.045059 (4.5059%) and the smallest contribution being -0.00154 (-0.0154%). Then, when the market is in distress, the average individual bank contributes 0.018334 (1.8334%) to systemic risk, as measured using Marginal Expected Shortfall (MES), with the largest and smallest values being 0.103356 (10.3356%) and -0.039904 (-3.9904%), respectively. Meanwhile, the average market risk measure total risk (TR) is 0.03502. The average value for idiosyncratic risk (idio) is 0.4358 and systematic risk (BETA) is 0.0311187.

Table 2. Descriptive analysis of delta CoVaR, Marginal Expected Shortfall, Total Risk, Idiosyncratic Risk, BETA and Control Variables.

Variable	Mean	Median	Max	Min	Skew	Kurt
dCoVaR	0,005854	0,003654	0,045089	-0,00154	1,920965	7,963052
MES	0,018334	0,014862	0,103356	-0,039904	0,934364	4,815069
TR	0,03502	0,0282	0,35995	0	5,740685	51,88541
idio	0,4358	0,29973	11,10955	-0,00004	10,49118	162,1763
BETA	0,0311187	0,000038	2,5693675	-0,00154	6,34423	57,57622
lag.dCoVaR	0,006125	0,003671	0,045089	-0,00154	-	-
lag.MES	0,017926	0,014608	0,103356	-0,039904	-	-
SIZE	13,55	13,46	15,3	11,82	0,148453	2,19138
M/B	0,55985	0,19533	17,60033	0,02467	6,939306	69,13077
LEV	0,381281	0,261073	2,492116	0	1,529979	5,454661

DVY	0,015158	0,007153	0,2	0	3,012561	17,55559
VIX	19.79	19,5	34,04	12,01	0,903102	3,630289
SPREAD	4,46873	4,65458	12,31	0,04143	0,792245	3,22003
BCI	99,87	99,1	102,3	98,9	0,875841	2,535428

Source: Author's Own Work

Classical Assumption Test Analysis

In this study, the Kolmogorov-Smirnov (KS), Anderson-Darling (AD), and Shapiro-Wilk tests will be used to perform normality tests. The results of the normality tests using the Kolmogorov-Smirnov (KS), Shapiro-Wilk (SW), and Anderson-Darling (AD) tests on the measures of the dependent variables (dCoVaR and MES) presented in Table 3 show that all p-values are less than 0.05 (significance level). This indicates that we have sufficient evidence to reject the null hypothesis, which states that the data is normally distributed.

Table 3. Normality Test Result

Variable	Kolmogorov-Smirnov (KS)	Shapiro-Wilk (SW)	Anderson-Darling (AD)
dCoVaR	D = 0,14754 p-value = 1,129e-10	W = 0,81598 p-value < 2,2e-16	A = 27,311 p-value < 2,2e-16
MES	D = 0.089572 p-value = 0.0003341	W = 0.94612 p-value = 3.882e-13	A = 8.3156 p-value < 2.2e-16

Source: Author's Own Work

Next, the Breusch-Pagan and Ljung-Box tests were conducted to assess homoscedasticity and autocorrelation. These tests were performed four times: for the regression models of dCoVaR against TR, dCoVaR against idio and BETA, MES against TR, and MES against idio and BETA. The results of these tests are presented in Table 4. The Breusch-Pagan test yielded p-values less than 0.05 for all models, indicating that homoscedasticity can be rejected and heteroscedasticity is present. Consequently, robust standard errors will be employed after the main model, and p-values will be compared to assess the impact of heteroscedasticity. The Ljung-Box test for autocorrelation, with a lag of 1, showed p-values greater than 0.05 for all models, implying that autocorrelation can be rejected and there is no autocorrelation in the models.

Table 4. Autocorrelation and Homoscedasticity Test Result

Test	dCoVaR - TR (Model 1)	dCoVaR – idio + BETA (Model 2)	MES - TR (Model 3)	MES – idio + BETA (Model 4)
Breusch-Pagan Test	BP = 34,708 df = 9 p-value = 6,707e-05	BP = 70,236 df = 10 p-value = 3,992e-11	BP = 41,418 df = 10 p-value = 9,514e-06	BP = 42,529 df = 9 p-value = 2,63e-06
Ljung-Box Test	X-squared = 0,058798 df = 1 p-value = 0,8084	X-squared = 1,7514 df = 1 p-value = 0,1857	X-squared = 1,0525 df = 1 p-value = 0,3049	X-squared = 1,0525 df = 1 p-value = 0,3049

Source: Author's Own Work

To assess multicollinearity in the model data, the variance inflation factor (VIF) is employed in this study. The VIF values for each model are presented in Table 5. Based on the VIF values result, we can assess the presence of multicollinearity. The VIF values range from 1 to 5, with an average close to 1. A VIF of 1 indicates no multicollinearity.

Table 5. Variance Inflation Factor (VIF) Value Result

Variable	VIF dCoVaR – TR (Model 1)	dCoVaR - idio+BETA (Model 2)	MES – TR (Model 3)	MES - idio+BETA (Model 4)
TR	1.055715	-	1.054819	-
idio	-	1.046675	-	1.053388
BETA	-	1.006969	-	1.008728
lagdcov	1.302771	1.311759	-	-
lagMES	-	-	1.183466	1.20226
SIZE	1.414185	1.431177	1.419973	1.439786
mbratio	1.010337	1.016201	1.010622	1.015625
LEV	1.076594	1.082332	1.068579	1.073881
DVY	1.044962	1.051158	1.086352	1.097873
VIX	1.531553	1.529466	1.353559	1.346333
SPREAD	1.375669	1.374811	1.360744	1.360907
BCI	1.484118	1.48605	1.46811	1.469213

Source: Author's Own Work

To assess multicollinearity in the model data, the variance inflation factor (VIF) is employed in this study. The VIF values for each model are presented in Table 5. Based on the VIF values result, we can assess the presence of multicollinearity. The VIF values range from 1 to 5, with an average close to 1. A VIF of 1 indicates no multicollinearity.

Regression Estimation Result

The Chow and Hausman tests were conducted to identify the most suitable panel data regression model for this analysis. These tests indicated that a fixed effects model is the most appropriate choice. The results of the regression estimation are presented in Table 6.

Table 5. Variance Inflation Factor (VIF) Value Result

	dCoVaR (Model 1)		dCoVaR (Model 2)		MES (Model 3)		MES (Model 4)	
	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value
TR	0.0795 (0.0795)	0.00 *** (0.0123) *	- -	- -	0.2738 (0.2738)	0.00 *** (0.0096) **	- -	- -
idio	- -	- -	0.0045 (0.0045)	0.00 *** (0.00)***	- -	- -	0.0071 (0.00706)	0.0012 ** (0.0658) .
BETA	- -	- -	0.0003 (0.003)	0.8494 (0.0375) *	- -	- -	0.00 (0.00)	0.9926 (0.9371)
lagdcov	0.2480 (0.248)	0.00 *** (0.0096) **	0.2860 (0.286)	0.00 *** (0.0019) **	- -	- -	- -	- -
lagmes	- -	- -	- -	- -	0.0029 (0.0029)	0.9513 (0.9596)	0.0214 (0.0214)	0.6657 (0.7135)
SIZE	0.0002 (0.0002)	0.8371 (0.8849)	-0.0006 (-0.0006)	0.4445 (0.6418)	0.0038 (0.0038)	0.21 (0.4612)	0.0022 (0.0022)	0.4894 (0.7081)
mbratio	0.0007 (0.0007)	0.0010 ** (0.00) ***	0.0006 (0.0006)	0.0034 ** (0.00) ***	-0.0005 (-0.0005)	0.5325 (0.1471)	-0.0005 (-0.0005)	0.5667 (0.2477)
LEV	0.0006 (0.0006)	0.3877 (0.5485)	0.0010 (0.0010)	0.1333 (0.3034)	0.0034 (0.0034)	0.1649 (0.2273)	0.0041 (0.0041)	0.1096 (0.1695)
DVY	0.0267 (0.0267)	0.0601 . (0.0271) *	0.0227 (0.0227)	0.1105 (0.1621)	-0.0756 (-0.0756)	0.1482 (0.1435)	-0.0722 (-0.0722)	0.1889 (0.2247)
VIX	0.0002 (0.0002)	0.0005 *** (0.0008) ***	0.0002 (0.0002)	0.0003 *** (0.0022) **	0.0004 (0.0004)	0.0141* (0.0138)*	0.0005 (0.0005)	0.0022 ** (0.0051) **
SPREAD	0.0001 (0.0001)	0.0507 . (0.0106) *	0.0001 (0.0001)	0.0445 * (0.0019) **	-0.0002 (-0.0002)	0.3376 (0.2815)	-0.0002 (-0.0002)	0.5002 (0.3987)
BCI	-0.0006 (-0.0006)	0.0041 ** (0.00) ***	-0.0007 (-0.0007)	0.0006 *** (0.00) ***	-0.0031 (-0.0031)	0.00 *** (0.00) ***	-0.0034 (-0.0034)	0.00 *** (0.00) ***
Bank FE	√		√		√		√	
Year FE	√		√		√		√	
Obs	542		542		542		542	
R^2	0.31156		0.31411		0.18772		0.11448	

Note(s) : The asterisks after p-value : '*' , '**' and '***' indicates the 10%, 5%, 1% levels of significance respectively. Systemic Risk Measures Variables : dCoVaR and MES are the delta CoVaR and Marginal Expected Shortfall respectively. Market Risk Measures

Variables : TR, idio and BETA are the Total Risk, Idiosyncratic Risk and Systematic Risk respectively.The number in parentheses are the Coefficient and p-values result with Robust standard errors.

The findings from Model 1 reveal that total risk (TR) has a significant positive impact on a bank's co-movement of returns under distress, measured as delta CoVaR (dCoVaR). This significance is evident at the 1% level. A one-unit increase in total risk leads to a 0.0795 unit increase in its systemic risk measured as delta CoVaR.

Additionally, some of the control variables in the model, including mbratio, VIX, and BCI, also exert significant positive influences on dCoVaR. These effects are statistically significant at the 5%, 1%, and 5% levels, respectively. The analysis also considered the potential impact of heteroscedasticity (unequal error variances) by clustering standard errors by bank. This correction resulted in some changes to the significance levels of the variables. The significance of TR changed from 1% to 10%, while mbratio and BCI changed to significant at the 1% level. The significance levels of DVY and SPREAD became significant at the 10% level. It's important to note that while the significance levels were affected, the regression coefficients themselves (which quantify the impact of each variable on dCoVaR) remained unchanged.

Model 2 investigates the impact of market risk, measured by its constituent components (idiosyncratic risk and beta), on systemic risk (dCoVaR). The findings reveal that idiosyncratic risk (idio) has a significant effect on systemic risk (dCoVaR) at a 1% significance level. A one-unit increase in idiosyncratic risk leads to an increase of 0.0045 in dCoVaR. Beta, however, is not statistically significant for dCoVaR. Several control variables used in the model have statistically significant effects: mbratio (5% significance level), VIX (1% significance level), SPREAD (10% significance level), and BCI (1% significance level). Correcting for heteroscedasticity alters the significance levels of some variables. While the significance level of idio remains unchanged, beta becomes significant at the 10% level. The significance levels of mbratio and SPREAD increase to 1% and 5%, respectively, while VIX decreases to 5%. The significance level of BCI and the coefficients for all variables remain unchanged.

Model 3 examines the impact of total risk (TR) on the probability of large losses for a set of institutions based on their interconnectedness, which is measured by the systemic risk metric MES. This model shows that TR has a significant impact on systemic risk (MES) at the 1% level of significance. A one-unit increase in TR leads to an increase of 0.2738 in MES. The control variables show different results compared to Models 1 and 2. Only VIX and BCI are statistically significant for MES, with significance levels of 10% and 1% respectively. Clustering the standard errors only affects the significance level of TR, which changes from 1% to 5%. The significance levels of other variables and all coefficients remain unchanged.

Model 4 analyzes the impact of the constituent components of market risk (idiosyncratic risk and systematic risk) on systemic risk (MES). The findings show that idio has a significant impact on MES at the 5% significance level. A one-unit increase in idio leads to a 0.0071 increase in MES. Beta is not statistically significant. VIX and BCI are statistically significant for systemic risk (MES) at the 5% and 1% levels, respectively. Robust standard errors render idiosyncratic risk non-significant (p-value = 0.0658). The significance levels of the control variables and the coefficients remain unchanged.

Discussion

The focal point of this study is the investigation into the influence of market risk measures on systemic risk within the Indonesian banking industry. Through meticulous analysis and rigorous examination of various risk metrics, the aim is to provide a nuanced understanding of the intricate relationship between market risk and systemic risk dynamics in this specific context.

Our findings offer compelling insights into the relationship between market risk measures and systemic risk within the Indonesian banking sector. Notably, total risk, represented by the annualized standard deviation of bank daily returns, emerges as a significant predictor of systemic risk. This aligns with established literature for the US banking industry and underscores the importance of considering overall market volatility in assessing systemic risk (Tzouvanas, 2024).

Furthermore, our analysis delves into the impact of idiosyncratic risk, which denotes institution-specific or industry-specific risks. While initially showcasing significance in influencing systemic risk, particularly evident when employing MES for systemic risk measurement, its significance diminishes under robust standard error conditions. This nuanced pattern suggests that idiosyncratic risk's contribution to systemic risk may be contingent upon methodological approaches and sample size considerations. This result from Indonesia's banking industry are also in line with previous findings for US banking industry (Tzouvanas, 2024) and the Chinese stock market (Darby et al., 2019).

Conversely, our study reveals that systematic risk, characterized by broader market or economic fluctuations, does not exhibit a statistically significant influence on systemic risk within the Indonesia banking industry, which also in line with the findings from previous study (Abendschein & Grundke, 2022; Tzouvanas, 2024).

CONCLUSION

This study contributes to the understanding of systemic risk in the Indonesian banking sector by examining its relationship with various market risk measures. Employing data from the Indonesia Stock Exchange, we found compelling evidence that total risk, encompassing both systematic and idiosyncratic components, significantly impacts systemic risk. Our findings suggest that elevated market risk increases the probability of disruptions within the entire financial system due to market fluctuations. Notably, the analysis reveals that idiosyncratic risk, specific to individual banks, plays a more significant role in driving systemic risk than systematic risk. This finding emphasizes the importance of considering firm-specific factors when assessing overall financial stability.

While the study highlights the influence of market risk on systemic risk, some limitations and opportunities for further research are acknowledged. Sample size limitations might explain the instances where robust standard errors rendered some variable relationship non-significant. Additionally, our study's focus on the Indonesian banking sector restricts the generalizability of the findings to other markets or industries. Future research could address these limitations by: (1) Expanding the sample size: This could strengthen the statistical significance of the relationship between market risks measures and systemic risk. (2) Encompassing a broader scope: Including data from other sectors within Indonesia or incorporating data from other countries could provide a more comprehensive picture of systemic risk dynamics across different financial landscapes. (3) analyze different market risk or systemic risk measures and approach which can help in understanding the underlying causes of systemic risk fluctuations can help us better understand this topic.

Deeper exploration into the underlying mechanisms through which market risk influences systemic risk is warranted. This could involve investigating factors such as regulatory framework, market structure or even investor behavior. By examining these channels, researchers can gain a more nuanced understanding of how risk contagion occurs within the banking sector.

Finally, Understanding the connection between market risk and systemic risk has significant implications for policymakers and market participants. Our findings underscore the importance of robust risk management practices, regulatory measures where policymakers should consider incorporating systemic risk considerations into bank capital adequacy requirements, and ongoing monitoring or can be defined as a continuous assessment of systemic risk factors to ensure the stability and resilience of the Indonesian banking sector, and financial systems more broadly.

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