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The Effect of Liquidity Risk and Insurance Risk on the Profitability of General Insurance Companies in Indonesia

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Abstract

Background: Indonesian general insurers face liquidity and underwriting risks, while the role of Minimum Risk-Based Capital (MMBR) in profitability remains underexplored. This study investigates the effects of liquidity risk and insurance risk on profitability within an MMBR framework using a composite index of ROA, ROE, and NPM.
Objective: This study aims to evaluate how liquidity risk and insurance risk individually and jointly influence the profitability of general insurance companies in Indonesia.
Methods: Secondary financial statement data from OJK-registered general insurers covering the period 2017–2024 were analyzed using a quantitative approach. Panel data regression was estimated using three competing models: the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). The optimal model was selected through sequential application of the Chow test, Hausman test, and Lagrange Multiplier test.
Results: The empirical findings indicate that liquidity risk does not have a statistically significant effect on profitability, whereas insurance risk shows a significant positive relationship with profitability. When analyzed simultaneously, liquidity risk and insurance risk collectively explain a meaningful proportion of variation in profitability. Descriptive evidence further shows that the sampled insurers generally maintained adequate risk-based capital buffers under the MMBR regime throughout the observation period.
Conclusion: The findings underscore the importance of MMBR-based risk governance in enhancing insurance sector performance. While insurance risk contributes positively to profitability through effective underwriting and reserve management, liquidity risk mainly serves as a solvency buffer. Strengthening compliance with MMBR standards can improve financial resilience and support long-term industry sustainability.

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INTRODUCTION

A pronounced structural asymmetry characterizes the Indonesian general insurance sector: premium-derived cash receipts and claim-related disbursements remain chronically misaligned. Because the revenue base is concentrated in short-duration premium contracts yet is subject to episodic surges in claims activity, sustained pressure on corporate liquidity positions is virtually inevitable.

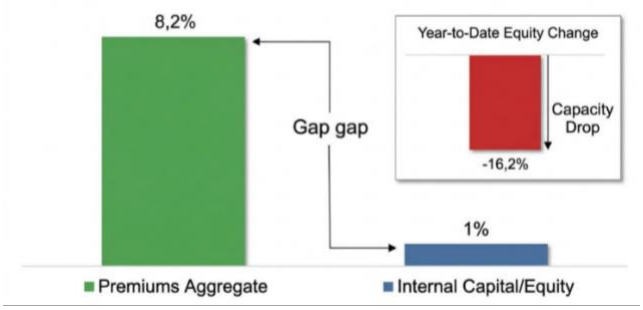

Figure 1. Annual Equity-Premium
Source: Researcher Data, 2025

Aggregate premium volume expanded by roughly 8.2% in 2024, yet equity capital grew at a mere 1% on an annualized basis and contracted by 16.2% on a year-to-date measure, signaling an erosion of the industry's internal capacity to backstop near-term liabilities. This widening gap between premium momentum and capital replenishment further constrains the scope for improving both liquidity buffers and the overall capital position.

Elevated operating costs intensify the liquidity strain. Across the sector, expense ratios have settled in the 30–35% range, materially exceeding the approximately 10% benchmark associated with efficient operations. When combined with loss ratios hovering near 45% and commission ratios around 15%, the resulting combined ratio approaches 90%, effectively eliminating the underwriting profit margin (Cummins & Weiss, 2000). Under these conditions, most of the earned revenue is absorbed by operating expenses and indemnity payments, leaving negligible room for the accumulation of liquidity reserves.

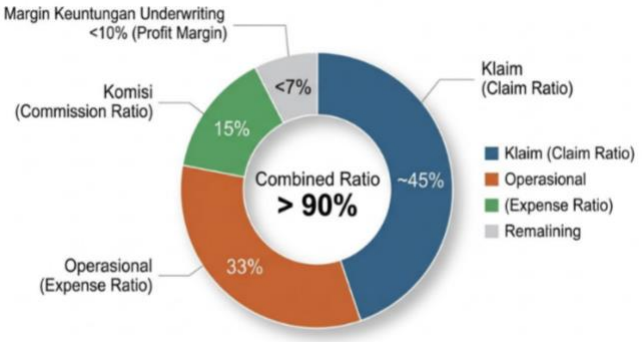

Figure 2. Combined Ratio Components
Source: Researcher Data, 2025

The collapse of PT Asuransi Jiwasraya serves as a cautionary case study in the consequences of inadequate liquidity risk governance within the insurance sector. The firm's descent into negative equity and its inability to honor policyholder claims severely undermined public trust in the broader insurance market, while amplifying perceptions of systemic financial-sector fragility (Saleha et al., 2023). The erosion of confidence triggered by the Jiwasraya and Bumiputera episodes also reshaped consumer purchasing behavior toward insurance products, heightening the imperative for stronger policyholder safeguards and improved governance standards across the industry.

Responding to these developments, the regulatory authority strengthened provisions governing liquidity floors, capital adequacy thresholds, and financial disclosure requirements, including the mandated adoption of PSAK 117, which necessitates substantial recalibration of business strategy and risk management architecture. While conventional metrics such as loss ratios and expense ratios remain widely used to evaluate underwriting outcomes and cost efficiency, reliance on these indicators alone does not adequately capture the full spectrum of risks confronting insurers.

To address this measurement gap, the Financial Services Authority introduced the Risk-Based Minimum Capital (MMBR) framework, codified in POJK No.71/POJK.05/2016 and operationalized through SEOJK No.1/SEOJK.05/2021. By incorporating liquidity risk and

insurance risk within a unified, regulation-anchored measurement system, the MMBR provides a more comprehensive lens for evaluating an insurer's capacity to meet claim obligations and sustain long-term financial performance.

From a theoretical standpoint, the nexus between risk exposure and insurer profitability can be examined through three complementary lenses: Financial Intermediation Theory, Liquidity Preference Theory, and Underwriting Theory. Under the intermediation view, insurers function as institutions that pool premiums and allocate them into investment vehicles; liquidity risk arises when short-term claim obligations exceed available liquid assets. Underwriting Theory, in turn, posits that the quality of risk selection and the adequacy of technical provisions are pivotal determinants of sustainable profitability. Profitability in this study is measured using ROA, ROE, and NPM, while both risk dimensions are operationalized through the MMBR capital-charge methodology prescribed by OJK.

The integration of Financial Intermediation Theory, Liquidity Preference Theory, and Underwriting Theory within the MMBR framework provides a multi-theoretical foundation that is both conceptually coherent and empirically operational. Financial Intermediation Theory Gurley (1960) conceptualizes insurance companies as financial intermediaries that transform illiquid premium inflows into investment returns and claim reserves; liquidity risk emerges when maturity mismatches between premium inflows and claim outflows create funding gaps, potentially impairing both solvency and profitability. Liquidity Preference Theory (Keynes, (1936) and Diamond (1983) further suggests that firms holding excessive liquid reserves forgo higher-return investment opportunities, implying a non-linear relationship between liquidity and profitability that depends on whether liquidity functions as a solvency buffer or an opportunity cost.

Underwriting Theory Rejda (2005) emphasizes that the quality of risk selection, accuracy of reserve estimation, and efficiency of claims settlement are key determinants of underwriting profitability. Collectively, these theories suggest that MMBR-measured insurance risk adequacy should positively relate to profitability through improved underwriting quality, while MMBR-based liquidity risk may exhibit a weaker or insignificant relationship, as liquidity primarily reflects regulatory compliance rather than direct profit generation. The present study operationalizes these theoretical expectations through the MMBR framework, generating testable hypotheses grounded in both regulatory practice and financial theory.

Empirical evidence on the risk–profitability relationship remains context-dependent and inconclusive. Arazi (2025) report that conventionally measured liquidity does not consistently exhibit a statistically significant relationship with insurance company profitability in Indonesia, find a positive liquidity–profitability relationship. Qubbaja (2025) and Zahra (2023) further demonstrate that risk conditions and macroeconomic fluctuations influence insurer performance. These divergent findings indicate the need for a more comprehensive risk-measurement framework. Importantly, no prior study in the Indonesian context has simultaneously examined liquidity risk and insurance risk through the MMBR lens, a regulation-mandated capital adequacy indicator that more accurately reflects supervisory intent and the solvency condition of general insurers. This gap represents a substantial theoretical and empirical limitation addressed in the present study by constructing MMBR-aligned risk proxies consistent with OJK regulatory provisions (POJK No.71/POJK.05/2016), thereby producing a more contextually valid and policy-relevant contribution than conventional ratio-based approaches (Alhassan & Biekpe, 2016; Kamel & Naoual, 2024).

Against this backdrop, a clear research gap persists in risk measurement methodology. Most prior studies continue to rely on conventional financial ratios (such as current ratios, loss ratios, and leverage indicators) as proxies for risk, even though such measures do not fully capture the complexity of risk exposure in insurance firms. The MMBR framework offers a more comprehensive alternative by integrating liquidity risk, insurance risk, and capital adequacy within a standardized measurement structure.

Accordingly, this study positions MMBR-derived liquidity risk and insurance risk as the primary explanatory variables for profitability variation among Indonesian general insurers. The novelty of this study lies in three dimensions: (1) operationalizing both risk constructs using OJK-mandated MMBR capital components rather than conventional financial ratios, thereby ensuring regulatory alignment and measurement validity. (2) simultaneously estimating the individual and

joint effects of both MMBR-based risk dimensions on a composite profitability measure within a balanced panel of 48 general insurers over the 2017–2024 period. (3) employing a Fixed Effects Model with robust standard errors to control for unobserved firm-level heterogeneity, addressing methodological limitations in prior Indonesian insurance studies. This design enables a more precise, contextually grounded, and policy-relevant contribution to the literature on risk management and insurance financial performance.

The objectives of this research are formulated to provide a clear analytical framework for empirically examining the relationships among liquidity risk, insurance risk, and the profitability of Indonesian general insurers. Risk measurement follows the MMBR framework as prescribed by the Financial Services Authority. The specific objectives are: 1) Analyze the influence of liquidity risk on the profitability of general insurance companies in Indonesia. 2) Analyzing the influence of insurance risk on the profitability of general insurance companies in Indonesia. 3) Analyze the effect of liquidity risk and insurance risk simultaneously on the profitability of general insurance companies in Indonesia.

METHOD

Research Design

A quantitative, explanatory-causal research design was employed in this investigation, enabling objective hypothesis testing of the relationships between liquidity risk, insurance risk, and general insurer profitability in Indonesia. A quantitative orientation was adopted because it permitted rigorous statistical assessment based on numerical, historically recorded data (Creswell & Creswell, 2018; Saunders et al., 2023).

The unit of analysis comprised general insurance firms domiciled and actively operating in Indonesia, which held membership in the Indonesian General Insurance Association (AAUI) and fell under the supervisory jurisdiction of the Financial Services Authority (OJK). Data inputs consisted of secondary information drawn from audited annual financial statements and risk-calculation reports, sourced from company websites, AAUI publications, and OJK disclosures.

The study period spanned 2017 through 2024, a window selected to encompass the pre-pandemic, pandemic, and post-pandemic phases of the insurance business cycle. This temporal scope enabled a more comprehensive depiction of how liquidity risk, insurance risk, and profitability trajectories evolved under varying macroeconomic conditions within the Indonesian general insurance sector.

Research Variables

Three categories of variables structured the empirical model: independent variables comprising liquidity risk and insurance risk; control variables capturing firm size (proxied by equity) and macroeconomic conditions (proxied by inflation); and the dependent variable, general insurer profitability. The inclusion of control variables was intended to mitigate omitted-variable bias arising from determinants outside the focal risk dimensions, thereby improving the precision of the estimated liquidity-risk and insurance-risk coefficients (Gujarati & Porter, 2012; Wooldridge, 2020).

Departing from the conventional ratio-based approach prevalent in earlier studies, this investigation quantified liquidity risk and insurance risk through the MMBR capital-charge methodology mandated by OJK. The adoption of this regulation-aligned measurement strategy ensured that variable construction was contextually appropriate and consistent with the prudential supervision framework governing Indonesian insurers.

Specifically, the MMBR-based risk indicators were defined as follows. Liquidity Risk (X1_LIQ) was measured using the natural logarithm of the Liquidity Risk Capital Charge (Beban Modal Risiko Likuiditas) derived from the MMBR calculation report, which captured the amount of capital required to buffer against short-term liquidity shortfalls relative to current liabilities. Insurance Risk (X2_INS) was measured using the natural logarithm of the Insurance Risk Capital Charge (Beban Modal Risiko Asuransi), which reflected the capital requirement against underwriting risk, including reserve insufficiency and claim volatility, as stipulated in POJK No.71/POJK.05/2016 and SEOJK No.1/SEOJK.05/2021. Profitability (Y_PROF) was operationalized as a composite index computed through Z-score normalization of three indicators—Return on Assets (ROA = Net Income / Total Assets), Return on Equity (ROE = Net

Income / Total Equity), and Net Profit Margin (NPM = Net Income / Total Revenue)—with the composite score representing the standardized mean of the three Z-scores. Control variables included Total Equity (C1_EKU, natural log) as a proxy for firm size and the annual inflation rate (C2_INF) as a macroeconomic indicator.

Equation Model

The empirical specification took the form of a panel data regression model in which profitability served as the dependent variable, while liquidity risk and insurance risk constituted the primary independent variables. To enhance estimation precision and reduce bias attributable to confounding factors, the model incorporated control variables for firm size (equity) and macroeconomic conditions (inflation). The regression equation was specified as follows:

$$Y\_PROF = \beta_0 + \beta_1 X1\_LIQ + \beta_2 X2\_INS + \beta_3 C1\_EKU + \beta_4 C2\_INF + \varepsilon$$

Description:
Y_PROF = Profitability
X1_LIQ = Liquidity Risk
X2_INS = Insurance Risk
C1_EKU = Total Equity
C2_INF = Inflation Rate
β_0 = Constant (interse)
β_1, β_2, $\beta 3$, $\beta 4$ = The regression coefficient of each variable
ε = *Term* or residual error

This specification facilitated both partial hypothesis testing, via t-tests on individual risk coefficients, and a joint significance assessment of all model variables through the F-test. Hypothesis evaluation was therefore embedded within a panel regression framework that maintained consistency between the empirical specification and the estimated outputs.

Population and Sample

The target population encompassed all general insurance entities operating in Indonesia that were members of AAUI and supervised by OJK. Sample construction followed a purposive selection protocol to ensure that each analytical unit met the empirical requirements of the study. The screening criteria were: 1) General insurance companies that were actively operating in Indonesia during the observation period. 2) Companies that published complete and consistent annual financial statements for the period 2017–2024. 3) Companies that had adequate data to measure liquidity risk, insurance risk, and profitability according to the operational definitions of the research. Application of these purposive criteria yielded a final sample of 48 general insurance companies that satisfied all stated conditions. Given the eight-year observation window (2017–2024), the dataset comprised 384 firm-year observations configured as a balanced panel.

Data Types and Sources

The analytical dataset consisted of quantitative, objectively measurable numerical records amenable to statistical processing. A quantitative data structure was deemed appropriate because the research objective centered on empirically testing causal relationships between liquidity risk, insurance risk, and general insurer profitability (Creswell & Creswell, 2018).

All data were obtained from secondary sources: audited annual financial reports of general insurers covering the 2017–2024 fiscal period, including statements of financial position, income statements, and accompanying notes. These records were retrieved from corporate websites, AAUI publications, and OJK-issued industry reports and statistical compendia. Reliance on officially published secondary data was chosen to safeguard the reliability, consistency, and validity of the analytical inputs (Saunders et al., 2023; Creswell, 2018).

Data Collection Techniques

Data acquisition was conducted through a systematic documentation review of publicly available, externally audited financial statements issued by the sampled general insurance firms. The assembled dataset encompassed balance sheets, income statements, and explanatory notes for the 2017–2024 reporting cycle, from which the required liquidity risk, insurance risk, and profitability indicators were computed in accordance with the study's operational definitions.

Source materials were obtained from corporate portals, AAUI, and OJK repositories, and were subsequently cross-verified and filtered to ensure analytical consistency within the panel regression framework (Creswell & Creswell, 2018; Saunders et al., 2023).

Data Analysis Techniques

Panel data regression served as the primary analytical technique for examining the influence of liquidity risk and insurance risk on general insurer profitability in Indonesia. By combining time-series and cross-sectional dimensions, the panel structure increased the number of observations, enhanced degrees of freedom, and reduced bias arising from unobserved heterogeneity across firms (Baltagi, 2008). Panel estimation was particularly well-suited to this study given that the sample comprised multiple insurers observed over a defined temporal window, thereby enabling simultaneous exploitation of inter-firm and inter-period variation.

Research Hypothesis

The following research hypotheses are proposed in this study based on problem definitions, theoretical studies, and previous research.

H1: Liquidity risk has a significant effect on the profitability of general insurance companies in Indonesia.

H2: Insurance risk has a significant effect on the profitability of general insurance companies in Indonesia.

H3: Liquidity risk and insurance risk simultaneously have a significant effect on the profitability of general insurance companies in Indonesia

RESULTS AND DISCUSSION

Results

Overview of Research Objects

The unit of analysis in this study is general insurance companies that are officially registered with and supervised by the Financial Services Authority (OJK). As non-bank financial institutions, these companies collect premium income, settle claims, manage investment portfolios, and establish technical reserves to ensure the continuity of policyholder obligations. The industry is characterized by substantial exposure to claims uncertainty, investment return volatility, and macroeconomic fluctuations, making the balance between liquidity management and profitability a critical aspect of corporate financial stewardship.

Indonesian general insurers also operate within a risk-based supervisory framework centered on Risk-Based Capital (RBC), which requires firms to maintain solvency margins and capital adequacy ratios in accordance with regulatory thresholds. In parallel, the gradual implementation of PSAK 117, which adopts IFRS 17 into the national accounting system, enhances the accuracy of insurance contract liability measurement and improves financial reporting transparency (International Accounting Standards Board, 2020). This study covers the period 2017–2024, involving 48 firms and 384 balanced panel observations, thereby providing a robust empirical setting to examine how liquidity risk and insurance risk affect the profitability of general insurance companies in Indonesia.

Descriptive Analysis

Descriptive analysis is conducted to characterize the distributional properties of the research data by reporting the mean, median, maximum, minimum, standard deviation, and distributional shape of each variable. These summary statistics provide an initial overview of data dispersion and variability, which supports the interpretation of subsequent regression results (Ghozali, 2021).

Table 1

Descriptive Statistics

	Y_PROF	X1_LIQ	X2_INS	C1_EKU	C2_INF
Red	4.911802	7.283635	10.74559	2.437461	1.872375
Median	4.8595	7.4425	10.8625	2.574	2.396
Maximum	8.913	12.534	13.748	3.709	3.679

Minimum	2.176	1.386	5.442	-3.298	-1.304
Std. Dev.	1.020533	2.107464	1.530411	0.580049	1.450423
Skewness	0.072544	-0.25447	-0.54377	-4.97746	-1.11799
Kurtosis	3.314037	3.237143	3.635611	41.54951	3.299046
Jarque-Bera	1.914711	5.043975	25.38814	25362.63	81.42484
Probability	0.383907	0.0803	3.07E-06	0	2.08E-18
Sum	1886.132	2796.916	4126.307	935.985	718.992
Sum Sq. Dev.	398.8901	1701.057	897.0463	128.8629	805.7275
Observations	384	384	384	384	384

As reported in Table 1, profitability (Y_PROF) averaged 4.911802 with a standard deviation of 1.020533, indicating moderately dispersed profitability outcomes across the sample period. The liquidity risk indicator (X1_LIQ) recorded a mean of 7.283635 and a standard deviation of 2.107464, while insurance risk (X2_INS) averaged 10.74559 with a standard deviation of 1.530411. Both control variables (equity (C1_EKU) and inflation (C2_INF)) exhibited sufficient variation to justify their inclusion in the econometric specification.

Collectively, the descriptive statistics confirm that each variable displays adequate distributional breadth for regression-based analysis. Although certain variables deviate from strict normality based on the Jarque–Bera criterion, such departures do not present a material impediment to panel regression inference when the number of observations is large (Gujarati & Porter, 2012; Wooldridge, 2020).

From an industry perspective, the relatively moderate variation in profitability (Std. Dev. = 1.020533) suggests that general insurers in Indonesia exhibit diverse performance trajectories, likely reflecting differences in firm-specific underwriting strategies, investment returns, and claims management efficiency. The broader dispersion in liquidity risk (Std. Dev. = 2.107464) is particularly notable, as it implies that some companies maintain significantly higher liquidity buffers, potentially at the cost of foregone investment returns, while others operate closer to minimum regulatory thresholds. The average insurance risk charge (X2_INS mean = 10.74559), positioned toward the upper range of observations, indicates that most firms actively accumulate capital reserves for underwriting exposures, consistent with OJK's MMBR supervisory framework. The negative minimum equity value (-3.298) signals that a subset of firms experienced equity erosion during the observation window, reinforcing the systemic liquidity fragility documented in the Jiwasraya case. These descriptive patterns collectively suggest that both risk dimensions carry heterogeneous industrial implications that warrant deeper investigation through regression analysis.

Panel Data Regression Method Test Results

Model selection tests are conducted to identify the most appropriate panel data estimation framework for capturing the effects of liquidity risk, insurance risk, equity, and inflation on general insurer profitability in Indonesia. Panel regression's capacity to combine time-series and cross-sectional variation yields efficiency gains and facilitates the characterization of inter-firm heterogeneity across the sample period (Baltagi, 2008).

Table 2

Common Effect Model (CEM) Estimation Results

Variable	Coefficients	Std. Error	t-Statistic	Prob.	Remarks
C	3.536805	0.489429	7.226384	0.0000	***
X1_LIQ	-0.068339	0.028509	-2.397073	0.0170	**
X2_INS	0.142466	0.040118	3.551149	0.0004	***
C1_EKU	0.129765	0.091644	1.415969	0.1576	Insignificant
C2_INF	0.013657	0.035583	0.383811	0.7013	Insignificant

Model statistics:

R-squared = 0.035187

Adjusted R-squared = 0.025005

F-statistic = 3.455599

Prob(F-statistic) = 0.008642

Durbin-Watson stat = 1.037558
Description: *** p < 0.01; ** p < 0.05; * p < 0.10.
Source: Data processing, 2026

The CEM is predicated on the assumption that no systematic differences exist across individual firms or time periods, so that estimation proceeds via pooled Ordinary Least Squares (OLS). Under this specification, liquidity risk (X1_LIQ) enters with a negative and statistically significant coefficient of −0.068339 (p = 0.0170), while insurance risk (X2_INS) registers a positive and significant coefficient of 0.142466 (p = 0.0004). Neither control variable attains significance: equity (C1_EKU, p = 0.1576) and inflation (C2_INF, p = 0.7013). The model's R-squared of 0.035187 implies that only 3.52 percent of profitability variation is captured under pooled estimation (Gujarati & Porter, 2012).

Table 3
Fixed Effect Model (FEM) Estimation Results

Variable	Coefficients	Std. Error	t-Statistic	Prob.	Remarks
C	1.533708	1.083562	1.415432	0.1579	Insignificant
X1_LIQ	0.035287	0.036049	0.978846	0.3284	Insignificant
X2_INS	0.292163	0.098198	2.975239	0.0031	***
C1_EKU	-0.020885	0.102852	-0.203062	0.8392	Insignificant
C2_INF	0.017369	0.029663	0.585523	0.5586	Insignificant

Model statistic:
R-squared = 0.424472Adjusted R-squared = 0.336062F-statistic = 4.801200Prob(F-statistic) = 0.000000Durbin-Watson stat = 1.707254
Description: *** p < 0.01; ** p < 0.05; * p < 0.10.
Source: Data processing, 2026

FEM relaxes the CEM homogeneity assumption by introducing firm-specific intercepts that absorb time-invariant unobserved heterogeneity. Under this specification, insurance risk (X2_INS) retains a positive and highly significant coefficient of 0.292163 (p = 0.0031). By contrast, liquidity risk (X1_LIQ, p = 0.3284), equity (C1_EKU, p = 0.8392), and inflation (C2_INF, p = 0.5586) all fail to reach conventional significance thresholds. The R-squared climbs to 0.424472, indicating that FEM explains 42.45 percent of the profitability variation, and the F-statistic of 4.801200 (p = 0.000000) confirms joint significance of the model as a whole (Wooldridge, 2020).

Table 4
Random Effect Model (REM) Estimation Results

Variable	Coefficients	Std. Error	t-Statistic	Prob.	Remarks
C	3.306490	0.647878	5.103568	0.0000	***
X1_LIQ	-0.012548	0.031492	-0.398455	0.6905	Insignificant
X2_INS	0.142763	0.056438	2.529575	0.0118	**
C1_EKU	0.057442	0.093733	0.612825	0.5404	Insignificant
C2_INF	0.012080	0.029453	0.410144	0.6819	Insignificant

Model stats (weighted):
R-squared = 0.017319Adjusted R-squared = 0.006948F-statistic = 1.669925Prob(F-statistic) = 0.156244Durbin-Watson stat = 1.480268
Description: *** p < 0.01; ** p < 0.05; * p < 0.10.
Source: Data processing, 2026

REM treats firm-specific effects as randomly drawn components of the composite error term. Insurance risk (X2_INS) again proves positive and significant (coefficient = 0.142763, p = 0.0118), while liquidity risk (X1_LIQ, p = 0.6905), equity (C1_EKU, p = 0.5404), and inflation (C2_INF, p = 0.6819) remain statistically insignificant. The R-squared under REM is 0.017319, reflecting comparatively weak explanatory power, and the F-statistic of 1.669925 (p = 0.156244) indicates that the model lacks joint significance (Baltagi, 2008).

Panel Data Regression Model Selection Test Results
Chow Test

Table 5
Chow Test Results

Test	Statistics	df	Prob.	Verdict
Chow Test – Cross-section F	2.937184	(47,332)	0.0000	FEM is more accurate than CEM
Chow Test – Cross-section Chi-square	133.516471	47	0.0000	FEM is more accurate than CEM

Source: Data processing, 2026

The Chow test adjudicates between the CEM and FEM. With a Cross-section F statistic of 2.937184 and a Cross-section Chi-square of 133.516471—both yielding probabilities of 0.0000—the null hypothesis of homogeneous intercepts is decisively rejected at the 5% level, implying that significant inter-firm heterogeneity exists (Gujarati & Porter, 2012; Baltagi, 2008). FEM is therefore deemed superior to CEM in accommodating unobserved individual-level differences, and subsequent comparison via the Hausman test is warranted to adjudicate between FEM and REM (Wooldridge, 2020; (Ghozali, 2021).

Hausman Test

Table 6
Hausman Test Results

Test	Statistics	df	Prob.	Verdict
Hausman Test – Cross-section random	9.547007	4	0.0488	FEM is more accurate than REM

Source: Data processing, 2026

The Hausman test arbitrates between FEM and REM. A Chi-square statistic of 9.547007 with 4 degrees of freedom and a probability of 0.0488 leads to rejection of the null hypothesis at the 5% significance level, signaling correlation between the firm-specific effects and the model's regressors (Wooldridge, 2020; Baltagi, 2008). Consequently, FEM is judged more consistent and appropriate than REM for the present dataset (Gujarati & Porter, 2012; Ghozali, 2021). Because both the Chow and Hausman diagnostics converge on FEM as the preferred estimator, the Lagrange Multiplier test is not required and is omitted from the analysis.

Classic Assumption Test
Normality Test

Table 7
Classical Assumption Test Results

Test Type	Indicator	Value	Prob.	Conclusion
Normality	Jarque-Bera	25.61595	0.000003	Residual is not normally distributed
Multicollinearity	Centered VIF X1_LIQ	1.361549	-	No multicollinearity
	Centered VIF X2_INS	1.421815	-	No multicollinearity
	Centered VIF C1_EKU	1.065808	-	No multicollinearity
	Centered VIF C2_INF	1.004666	-	No multicollinearity
Autocorrelation	Wooldridge Test (D_RESID_LAG)	-0.304235	0.0000	There is a first-order autocorrelation (AR1)

Source: Data processing, 2026

Normality testing evaluates whether the regression residuals conform to a Gaussian distribution, a classical assumption whose satisfaction supports the validity of inferential statistics and the precision of parameter estimates. The Jarque–Bera test, a standard tool in econometric diagnostics Gujarati (2012), yielded a statistic of 25.61595 with a probability of 0.000003. As this probability falls below the 5% threshold, the null hypothesis of normality is rejected, indicating that the panel regression residuals are not normally distributed (Wooldridge, 2020).

Importantly, despite the non-normal residual distribution (Jarque-Bera p = 0.000003), this does not invalidate the regression analysis. By the Central Limit Theorem (CLT), with a sufficiently large sample size (in this study, n = 384 panel observations) the sampling distribution of the ordinary least squares (OLS) estimator converges to normality asymptotically, regardless of the underlying error distribution. Therefore, standard t-statistics and F-statistics retain their approximate validity for hypothesis testing purposes (Wooldridge, 2020; Gujarati & Porter, 2021; Baltagi, 2008). Similarly, the detected first-order autocorrelation (AR1), while indicating serial dependence in residuals, is addressed through the application of White Cross-section (Period Cluster) robust standard errors in the final FEM specification, which simultaneously corrects for both heteroscedasticity and autocorrelation without requiring AR(1) correction of the data itself. This approach follows best practice for panel data inference with persistent serial correlation (Wooldridge, 2020; Baltagi, 2008).

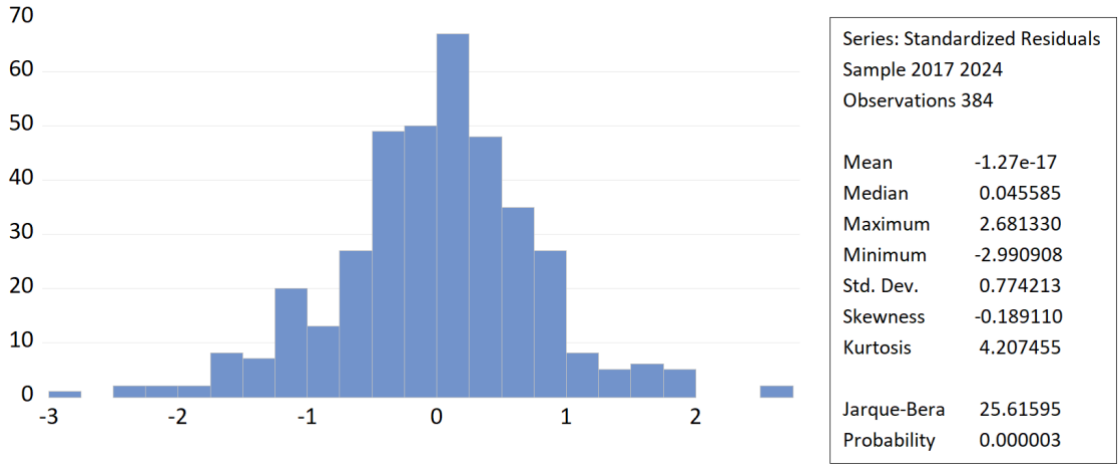

Figure 3. Normality Test Results
Source: Data Processing, 2026

Residual skewness of −0.189110 points to a mildly left-skewed distribution, whereas kurtosis of 4.207455 denotes a leptokurtic profile with heavier tails than the normal benchmark. The near-zero residual mean (−1.27E-17) confirms that the model satisfies the unbiasedness condition despite departing from full normality (Baltagi, 2008). These diagnostics indicate that residual non-normality is not a substantive concern in a panel setting with 384 observations; the Central Limit Theorem ensures that the sampling distributions of the OLS estimators approach normality in large samples, preserving the validity and reliability of the statistical tests employed (Ghozali, 2021).

Multicollinearity Test

Multicollinearity assessment determines whether the independent variables are excessively correlated. Centered VIF values for X1_LIQ, X2_INS, C1_EKU, and C2_INF are 1.361549, 1.421815, 1.065808, and 1.004666, respectively—all well below the conventional threshold of 10. The model is therefore free from multicollinearity, allowing the regressors to enter simultaneously without destabilizing coefficient estimates (Gujarati & Porter, 2012; Wooldridge, 2020; Baltagi, 2008).

Heteroscedasticity Test Using Covariance Method: White Cross-section (Period Cluster)

Heteroscedasticity testing investigates whether residual variances remain constant across observations in the panel specification. Corrective adjustment is applied via the White Cross-section (Period Cluster) method, which recalibrates standard errors to account for both heteroscedasticity and serial dependence simultaneously (Wooldridge, 2020).

Under the FEM specification augmented with robust standard errors, insurance risk (X2_INS) continues to exert a positive and significant influence on profitability (coefficient = 0.292163, p = 0.0115). Liquidity risk (X1_LIQ, p = 0.1106), equity (C1_EKU, p = 0.8627), and inflation (C2_INF, p = 0.3304) remain statistically insignificant (Gujarati & Porter, 2021).

Table 8
FEM Final Model Estimation Results with Robust Standard Errors

Variable	Coefficients	Std. Error	t-Statistic	Prob.	Remarks
C	1.533708	0.870756	1.761353	0.1216	Insignificant
X1_LIQ	0.035287	0.019324	1.826089	0.1106	Insignificant
X2_INS	0.292163	0.086044	3.395515	0.0115	**
C1_EKU	-0.020885	0.116423	-0.179391	0.8627	Insignificant
C2_INF	0.017369	0.016607	1.045879	0.3304	Insignificant

Model statistic:
R-squared = 0.424472Adjusted R-squared = 0.336062F-statistic = 4.801200Prob(F-statistic) = 0.000000Durbin-Watson stat = 1.707254
Description: *** p < 0.01; ** p < 0.05; * p < 0.10.
Source: Data processing, 2026

An R-squared of 0.424472 denotes that the model accounts for 42.45 percent of the profitability variation, with the remaining portion attributable to factors outside the specification. The F-statistic of 4.801200 (p = 0.000000) establishes that the model achieves joint significance. Deploying the White Cross-section (Period Cluster) correction within FEM yields heteroscedasticity- and autocorrelation-robust standard errors, thereby enhancing the credibility of both parameter estimates and hypothesis tests (Baltagi, 2008; Wooldridge, 2020; Ghozali, 2021).

Autocorrelation Test

Serial dependence in the panel residuals is evaluated through the Wooldridge Test for Autocorrelation in Panel Data. The lagged differenced-residual coefficient (D_RESID_LAG) equals −0.304235 with a probability of 0.0000, indicating rejection of the no-autocorrelation null and confirming the presence of first-order serial correlation (AR(1)) (Wooldridge, 2020; Baltagi, 2008). Application of robust standard errors via the White Cross-section (Period Cluster) technique is considered the appropriate remedy, as it simultaneously addresses both heteroscedasticity and autocorrelation, ensuring that parameter estimates remain consistent and inference remains dependable (Gujarati & Porter, 2012; Ghozali, 2021).

Hypothesis Test

Partial Test (t-test)

Table 9
Partial Test Results (t-test)

Variable	Coefficients	t-Statistic	Prob.	Verdict	Remarks
X1_LIQ	0,035287	1,826089	0,1106	H1 rejected	Insignificant
X2_INS	0,292163	3,395515	0,0115	H2 accepted	Positive and significant
C1_EKU	-0,020885	-0,179391	0,8627	-	Insignificant
C2_INF	0,017369	1,045879	0,3304	-	Insignificant

Significance: 5 percent.
Source: Data processing, 2026

Partial hypothesis testing via t-tests evaluates the individual contribution of each regressor to general insurer profitability. Under the FEM with robust standard errors, liquidity

risk (X1_LIQ) yields a coefficient of 0.035287 and a probability of 0.1106—failing to achieve significance. Insurance risk (X2_INS), by contrast, carries a coefficient of 0.292163 with a probability of 0.0115, confirming a positive and statistically significant relationship with profitability (Gujarati & Porter, 2012; Wooldridge, 2020; Baltagi, 2008).

Neither control variable attains significance: equity (C1_EKU, p = 0.8627) and inflation (C2_INF, p = 0.3304). These outcomes collectively indicate that, over the study horizon, insurance risk constituted the dominant risk-side determinant of general insurer profitability, while liquidity risk, firm size, and the inflation environment did not exercise a statistically discernible direct effect within the model (Ghozali, 2021; Novara et al., 2025).

Simultaneous Test (F Test)

Table 10
Simultaneous Test Results (F Test)

Indicator	Value	Interpretation
F-statistic	4,801200	Simultaneously significant models
Prob(F-statistic)	0,000000	H3 accepted
R-squared	0,424472	The variables in the model explain the 42.45% variation in profitability
Adjusted R-squared	0,336062	The clear power of the model after adjustment is 33.61%

Source: Data processing, 2026

The F-test for joint significance evaluates whether all model variables collectively influence profitability. The FEM yields an F-statistic of 4.801200 with a probability of 0.000000. As this probability is below the 5% threshold, the model is deemed jointly significant (Gujarati & Porter, 2012; Baltagi, 2008).

With an R-squared of 0.424472, the model captures 42.45 percent of the profitability variation; the remainder is attributable to unmodeled determinants. The Adjusted R-squared of 0.336062 indicates that explanatory power holds at a moderate level after penalizing for the number of regressors. FEM is therefore judged fit for purpose in hypothesis testing and in supporting the advanced analysis undertaken in this study (Wooldridge, 2020; Ghozali, 2021).

Coefficient of Determination Test (R2)

The coefficient of determination (R^2) gauges the proportion of profitability variation that the independent variables collectively explain. FEM estimation produces an R^2 of 0.424472, signifying that liquidity risk, insurance risk, equity, and inflation together account for 42.45 percent of the cross-firm variation in profitability; the remaining 57.55 percent is attributable to determinants lying outside the model (Gujarati & Porter, 2012; Baltagi, 2008).

After adjustment for the number of regressors and observations, the Adjusted R^2 stands at 0.336062, confirming moderate explanatory capacity. FEM thus demonstrates an acceptable goodness-of-fit and is retained as the basis for hypothesis adjudication and subsequent interpretive analysis (Wooldridge, 2020; Ghozali, 2021).

The Adjusted R-squared value of 0.336062 (33.61%) indicates moderate explanatory power. While this level of fit is statistically acceptable for cross-sectional panel studies in the insurance industry—where firm-specific behavior is highly idiosyncratic Alhassan (2016)—it also signals the presence of unobserved heterogeneity or omitted variables that the MMBR-based specification does not fully capture. Potential omitted determinants include investment return quality, reinsurance arrangements, operational efficiency ratios, and corporate governance structures. Future research should incorporate these dimensions to improve model fit and reduce unexplained profitability variation.

Discussion

Liquidity Risk Level Based on MMBR

Measured through the MMBR lens, the liquidity risk profile of Indonesian general insurers captures the sector's ability to honor near-term obligations while preserving financial stability

over the study horizon. Descriptive statistics reveal a relatively stable mean liquidity risk score accompanied by moderate dispersion, suggesting that the liquidity posture of the sampled firms was, overall, adequately maintained. This pattern implies that risk-based capital provisions were generally sufficient to underpin both operational cash requirements and policyholder-related liabilities.

Within the prudential supervision framework, the MMBR constitutes a pivotal gauge of insurer financial soundness, particularly regarding liquidity risk stewardship. Sufficient capital buffers signal that a firm possesses the absorptive capacity to withstand potential losses emanating from day-to-day operations and short-term liabilities. The data indicate that, throughout the observation period, general insurers broadly succeeded in equilibrating liquid assets against outstanding obligations, thereby sustaining comparatively stable and well-governed liquidity positions. These observations resonate with Financial Intermediation Theory and Liquidity Preference Theory, both of which foreground the criticality of liquidity governance for operational continuity, obligation fulfilment, and long-run institutional viability (Gurley & Shaw, 1960; Mishkin, 2007; Cummins & Weiss, 2000). In aggregate, the evidence affirms that risk-based capital sufficiency plays a material role in underpinning the financial stability of Indonesian general insurers.

Insurance Risk Level Based on MMBR

As assessed through the MMBR methodology, the insurance risk exposure of Indonesian general insurers captures their capacity to absorb claim liabilities and to maintain capital adequacy relative to underwriting risks. Descriptive results indicate an average insurance risk score (X2_INS) of 10.74559 with a standard deviation of 1.530411, reflecting a moderate degree of inter-firm variation. This pattern suggests that, in the main, sampled firms sustained comparatively stable solvency positions and adequate capital buffers over the study period.

FEM regression estimation confirms that insurance risk exerts a positive and statistically significant influence on general insurer profitability in Indonesia. The X2_INS coefficient of 0.292163 ($p = 0.0115$) indicates that stronger underwriting-risk-based capital adequacy is associated with superior profitability performance. This result implies that disciplined insurance risk governance contributes meaningfully to the financial stability and operational longevity of insurance firms (Baltagi, 2008).

In the supervisory context, MMBR functions as a core metric for gauging insurer financial health, with particular relevance to insurance risk oversight. Adequate capital provisioning reflects the firm's readiness to absorb prospective claim liabilities and to navigate risk uncertainty, while simultaneously demonstrating adherence to the prudential principle in financial management. These findings are congruent with Underwriting Theory and Insurance Risk Theory, which contend that the robustness of risk buffers, the rigor of underwriting selection, and the sufficiency of technical reserves are essential pillars of insurer financial stability and profit sustainability (Rejda & McNamara, 2005; Cummins & Weiss, 2000; Financial Services Authority, 2020).

The Effect of Liquidity Risk on Profitability

Regression output (Tables 8 and 9) reveals that the liquidity risk coefficient (X1_LIQ) is 0.035287 with a probability of 0.1106—exceeding the 5% significance threshold. Consequently, liquidity risk fails to demonstrate a statistically significant impact on general insurer profitability during the study period, and the corresponding hypothesis is rejected.

This outcome suggests that liquidity, when managed within the MMBR architecture, operates predominantly as a solvency-protection and obligation-fulfilment mechanism rather than as a direct engine of profit generation. Theoretically, this interpretation aligns with Financial Intermediation Theory and Liquidity Preference Theory, which conceptualize liquidity as an instrument of operational stability and risk control rather than a primary source of earnings growth (Mishkin, 2007; Gurley & Shaw, 1960). Empirically, the finding echoes Arazi (2025), who report that conventionally measured liquidity does not consistently predict insurer profitability. Within the present model, the non-significance may also partly reflect the inclusion of equity and inflation controls, which absorb some of the variance otherwise attributable to liquidity risk.

The Effect of Insurance Risk on Profitability

Tables 8 and 9 further show that the insurance risk coefficient (X2_INS) is 0.292163 with a probability of 0.0115—below the 5% significance cut-off. Insurance risk therefore exerts a positive and statistically significant effect on general insurer profitability in Indonesia, and the corresponding hypothesis is supported.

Given that insurance risk is operationalized through the MMBR capital-charge approach, the positive coefficient should be read as evidence that stronger underwriting-risk capital adequacy and more disciplined risk management translate into improved profitability outcomes. This interpretation is consistent with OJK's supervisory philosophy, which positions MMBR as the primary barometer of insurer financial health—particularly in the context of underwriting exposure and claims-settlement capacity. Theoretically, the result accords with Underwriting Theory and Insurance Risk Theory, which hold that effective risk selection, adequate technical provisioning, and efficient claims control fortify both financial stability and profit margins. The evidence further suggests that firms maintaining stronger risk buffers tend to exhibit greater operational resilience and enhanced policyholder confidence.

These findings align with and extend the international literature. Alhassan (2016) demonstrate that underwriting efficiency and capital adequacy are critical determinants of non-life insurer profitability in South Africa, consistent with the positive MMBR-insurance risk coefficient observed here. Kamel (2024), analyzing Algerian insurers, similarly report a positive risk-profitability nexus, attributing it to the discipline imposed by risk-based capital frameworks on underwriting practices. Horvey (2024) confirm, using a dynamic panel threshold approach in South African life insurers, that risk adequacy enhances profitability beyond a threshold capital level. Critically, the positive coefficient in this study does not imply that higher risk exposure is desirable per se; rather, it reflects that firms maintaining higher MMBR-required insurance risk capital buffers demonstrate stronger technical reserve adequacy and more disciplined claims management, which ultimately translate into superior underwriting margins and sustainable profitability (Rejda & McNamara, 2005; Cummins & Weiss, 2000). This interpretation is consistent with risk-return theory, where adequate capitalization against underwriting risk enables firms to write larger premium volumes with controlled loss ratios, rather than restricting growth out of solvency concerns.

The Effect of Liquidity Risk and Insurance Risk Simultaneously on Profitability

The F-statistic of 4.801200 (p = 0.000000) reported in Table 10 establishes that the regression model achieves joint significance, confirming that liquidity risk and insurance risk—together with the control variables—collectively influence the profitability of Indonesian general insurers. The hypothesis of simultaneous significance is therefore upheld.

This outcome indicates that insurer profitability is not governed by a single risk dimension in isolation but rather by the interplay of multiple internal risk-management practices and the firm's overall financial condition. Theoretically, the finding is consonant with Financial Intermediation Theory, Liquidity Preference Theory, and Insurance Risk Theory, all of which stress that integrated risk stewardship is essential for preserving financial stability, honoring policyholder claims, and sustaining corporate performance over time. Within the insurance industry, joint management of liquidity and insurance risks through the MMBR framework is of strategic importance because it enables firms to safeguard solvency, meet claim obligations, and uphold profitability on a continuing basis. This interpretation is reinforced by Addini (2024), who find that more comprehensive risk-management architectures are associated with superior corporate performance.

Research Implications

Theoretical Implications

This investigation advances the risk-management literature in the insurance domain by demonstrating the empirical utility of the MMBR framework as a risk-quantification instrument. The positive and significant insurance-risk coefficient reinforces Underwriting Theory and Insurance Risk Theory, both of which foreground risk-selection quality, technical-reserve adequacy, and claims governance as pillars of insurer financial performance.

Conversely, the non-significance of the liquidity risk coefficient enriches the discourse

surrounding Financial Intermediation Theory and Liquidity Preference Theory. The evidence implies that liquidity functions more as a safeguard of operational continuity and solvency than as a proximate driver of profitability. In sum, the study confirms that a regulation-grounded risk-measurement approach yields a more comprehensive perspective on the risk–performance nexus in the insurance sector.

Practical Implications

For insurance-company management, the results underscore the value of fortifying MMBR-anchored risk governance, especially with respect to insurance risk, whose significant profitability impact has been empirically validated. Enhancing underwriting discipline, ensuring technical-reserve sufficiency, and tightening claims-settlement controls represent actionable levers for stabilizing financial performance and sustaining competitive viability.

For the regulatory community, the findings affirm that MMBR-based risk indicators retain analytical relevance in evaluating insurer financial health and in fostering systemic stability. For investors and other capital-market participants, the study reinforces the importance of incorporating regulation-aligned liquidity and insurance risk metrics into performance assessment and decision-making frameworks.

CONCLUSION

Drawing on both descriptive and inferential panel regression analyses, this study concludes that liquidity risk does not have a statistically significant effect on the profitability of Indonesian general insurers, indicating that liquidity primarily functions as a mechanism for maintaining financial stability and solvency rather than directly improving profit performance. In contrast, insurance risk has a significant positive effect on profitability, suggesting that effective underwriting risk management, adequate technical reserves, and operational efficiency are key drivers of financial performance and long-term business sustainability. Furthermore, the simultaneous analysis demonstrates that liquidity risk and insurance risk jointly exert a significant influence on profitability. This finding highlights the strategic importance of integrated risk governance within the Minimum Risk-Based Capital (MMBR) framework in enhancing financial performance, maintaining industry stability, and supporting the sustainable development of the Indonesian general insurance sector.

Several limitations of this study should be acknowledged. First, the Adjusted R-squared of 0.3360 indicates that approximately 66.4% of profitability variation remains unexplained, suggesting the presence of unobserved firm-specific heterogeneity or omitted variables—such as investment yield, reinsurance quality, management efficiency, and corporate governance—that future studies should incorporate. Second, while the FEM with robust standard errors addresses autocorrelation and heteroscedasticity, the persistence of AR(1) in the residuals suggests that a dynamic panel model (e.g., Arellano-Bond GMM) could more precisely capture the inertia in profitability over time. Third, the study is limited to general insurance companies; life insurers and reinsurers operate under distinct risk structures and may yield different MMBR-profitability dynamics. Fourth, the measurement of profitability as a composite Z-score index, while analytically comprehensive, introduces sensitivity to the weighting scheme and may complicate direct comparisons with studies using single-ratio indicators. Future research should address these limitations by extending the MMBR framework to life insurance and reinsurance, incorporating dynamic panel estimation, and integrating qualitative governance dimensions to enrich the empirical understanding of regulation-based risk management and financial sustainability in the Indonesian insurance industry.

From a regulatory and policy perspective, these MMBR-based findings carry important implications. For the Financial Services Authority (OJK), the results confirm that the MMBR framework is a meaningful supervisory instrument: insurance risk capital adequacy demonstrably influences company profitability, validating the regulatory design intent of POJK No.71/POJK.05/2016. Regulators should continue strengthening MMBR reporting requirements and consider setting differentiated MMBR thresholds for risk classes with heterogeneous underwriting profiles. For industry practitioners and boards, the positive insurance risk-profitability relationship signals that investments in underwriting discipline, actuarial reserve accuracy, and claims management directly pay dividends in financial performance—justifying

resource allocation toward technical risk governance rather than cost-cutting in risk management functions. For investors and analysts, the insignificance of liquidity risk in the MMBR context suggests that liquidity adequacy reflects baseline regulatory compliance, and profitability screening should weight insurance risk buffer strength as a more discriminating performance predictor among general insurers in Indonesia.

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AUTHOR CONTRIBUTION STATEMENT

Gifari Ahmad Fadhila bears sole responsibility for every phase of the research undertaking, encompassing problem identification, conceptual-framework development, data acquisition, statistical processing and analysis, interpretation of empirical results, and the drafting and refinement of the final manuscript.

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