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Analysis of Factors Affecting the Financial Health of General Insurance Companies and Life Insurance Companies in Indonesia for the Period of 2013 – 2021

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Abstract

Financial health is an important factor for insurance companies. This study aims to analyze the factors that affect the level of financial health of general insurance companies and life insurance companies in Indonesia. This study uses logistic regression analysis and survival analysis. The results of the analysis show that the return on assets has a negative influence on the non-fulfillment of the financial health of life insurance companies or the general public. Meanwhile, the claim ratio has a positive influence on the financial health of the insurance company. In life insurance companies, the placement of insurance in bond instruments or debt securities has a negative effect on the non-fulfillment of the financial health condition of the insurance company. The results obtained between logistics regression and survival analysis for life insurance companies are not much different. However, the results of the survival analysis produced for general insurance companies are biased. This study contributes to understanding insolvency risks in emerging-market insurance systems using dual-model analysis, offering practical implications for regulators and practitioners in developing economies with limited policyholder protection mechanisms.

Keywords: financial health; life insurance; general insurance.

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INTRODUCTION

Insurance is an agreement between the policyholder and the insurance company. The agreement is the basis for the insurance company to receive a certain amount of premiums (Gunawan, 2022). The premium is used as a reward to provide compensation to the insured or policyholder due to the occurrence of an uncertain situation (Telaumbanua[1] et al., 2021). In addition, premiums are also used in exchange for providing payments based on the life and death of the insured or policyholder in accordance with the promised benefits (Law Number 40 of 2014).

Insurance has an important role for the economic sector and economic growth. Insurance companies invest some of the funds to invest in the financial markets (Ivan26 et al., 2015). The financial activities of insurance companies cannot be separated from banks or other institutions so that problems in insurance companies will have an impact on the bank or other institutions. In addition, by insuring the risks owned by households or companies, the financial stability of households or companies can be overcome (Mgeryan & Anikina, 2018).

Insurance company failures have become a concern for parties such as insurance regulators, investors, management, financial analysts, banks, auditors, policyholders, and consumers (Talesh, 2016). These concerns arise because of the interest in protecting the general public against the consequences of the bankruptcy of insurance companies, as well as minimizing liability for management and auditors. Thus, regulations regarding insurance are needed to ensure that insurance companies remain financially viable so that they can fulfill their contractual promises to the insured (Rustam & Yaurita, 2018).

As stipulated in the provisions governing financial health in Indonesia, insurance companies must apply the principle of prudence in asset management and pay attention to minimum investment limits while still developing the company's capital capabilities. The purpose of prudential regulation is to ensure that the chances of an insurance company's failure are below an "acceptable" value (Plantin & Rochet, 2016). The main tool that can be used for regulators to achieve this goal is to set a solvency margin, which is the minimum amount of equity of a company that can be used as a buffer (Pelkiewicz et al., 2020).

Solvency is a capital requirement that is sufficiently available for the insurance company to carry out legal obligations to the insured in accordance with the benefits written on the insurance policy (Istrate & Badea, 2017). When insurance companies are unhealthy, regulators must take reasonable measures, such as revocation of licenses, temporary suspensions, as well as further efforts that restrict the insurer's freedom to conduct business. Large insurance companies are sometimes more interested in investing in risky assets that have corporate relationships with different financial institutions. The placement of the investment makes insurance companies riskier (Siddik et al., 2022).

Several studies have been conducted to find out the causes of insurance company failure (*Insolvency*). In the life insurance sector, the top three risks that cause are management, investment risk, and market risk. Most of the events occurred during or after the 2007-2008 financial crisis, where 48% of the cases representing companies failed, including companies that had partially settled their obligations (Thakor, 2015). Macroeconomic variables do not have a very significant role outside of financial indicators, except for interest rates, where interest rate increases have a negative impact on life insurance stability during the period 1985-2016 (Overton & Bandt, 2020).

The root causes of impairment and bankruptcy in insurance companies in the United States and Canada are explored to obtain potential indicators that can be used to indicate that companies are at risk of impairment or bankruptcy. Some of the risk factors studied were categorized based on financial and demographic factors (Lazányi et al., 2017). The financial factors used are premium growth, profitability, liquidity, investment, leverage and risk-based capital. Meanwhile, the demographic factors used include company size, number of operations, geographical concentration and product concentration (Risk and Regulatory Consulting LLP, 2017). Life insurance company bankruptcies in Europe are almost non-existent. However, the deregulation of the European market has the opportunity to change the situation (Larsson & Lönnborg, 2015). Unlike other insurance industries in developed countries, Indonesian insurance has unique characteristics with relatively low penetration and there is no full guarantee for policyholders (Sembiring, 2020). This makes identifying factors that can affect the likelihood of insurance failure all the more important to study (Tumbelaka et al., 2021).

Unlike other insurance industries in developed countries, Indonesian insurance has unique characteristics with relatively low penetration and there is no full guarantee for policyholders (Hassan, 2023). This makes identifying factors that can affect the likelihood of insurance failure all the more important to study, particularly given the systemic implications for financial stability in emerging markets (Tumbelaka et al., 2021).

Insurance companies in Indonesia consist of general insurance companies and life insurance companies. In conducting an insurance business, insurance companies have an obligation to meet the financial health of the insurance company as regulated by the Financial Services Authority Regulation Number 5 of 2023. The insurance company is required to meet the minimum level of solvency to ensure that the insurer has the financial capacity to cover all the risks it has to bear or pay all its obligations. If the insurer does not meet the specified solvency level, the insurer has an obligation to submit a restructuring plan. The restructuring

plan carried out by the insurance company must be in line with the action plan or improvement of the insurance company's capital as stipulated in the provisions regarding the determination of the status and follow-up supervision of non-bank financial services institutions. If the insurance company is considered unable to immediately maintain its financial health or deteriorate, the regulator has the authority to immediately revoke the insurance company's business license (exit policy) as stipulated in the Financial Services Authority Regulation Number 9/POJK.05/2016. This is being done to minimize losses that will be experienced by consumers.

Insurance companies have an obligation to always meet the minimum solvency level of 100% (one hundred percent) of the Minimum Risk-Based Capital (MMBR) and are obliged to set a target internal solvency level of at least 120% (one hundred and twenty percent) of the MMBR. Insolvency is defined as a condition where an insurance company does not meet the solvency level required by the regulator. Solvency indicates whether a company can meet its long-term and short-term obligations. It is the ability of a company to carry out its obligations in any situation. The solvency of an insurance company affects its ability to obtain premiums, investments, and financing capital (Jawad & Ayyash, 2019). A company can meet existing or potential obligations by liquidating assets efficiently. Conversely, if the total assets of the insurance company are less than its current liabilities, the insurer faces the risk of insolvency and cannot fulfill its obligations (Rauch & Wende, 2015).

For this reason, our study used data on general insurance companies and life insurance companies in Indonesia from 2013 to 2021 to observe the factors that affect the financial health of general insurance companies and life insurance companies in Indonesia that are experiencing insolvency conditions or conditions where the insurance company does not meet the financial health provisions of the company required by the regulator so that it can lead to the failure of the insurance company.

While previous studies on insurer insolvency have largely focused on developed markets, this research extends the analysis to Indonesia's dual insurance structure, offering new empirical insights into solvency behavior under a developing financial regulatory regime. The use of both logistic regression and Cox proportional hazard models provides a comprehensive analytical framework that captures both the probability and timing of insolvency events, contributing methodologically to the literature on insurance failure prediction in emerging markets.

RESEARCH METHOD

This study used annual data on life insurance companies and general insurance companies from 2013 to 2021. The number of insurance companies studied was 153, comprising 59 life insurance companies and 94 general insurance companies. The data used formed panel data, consisting of multiple objects observed at a time (cross sections), and also time series data for each object across several time periods. The panel data used were unbalanced, with a different number of time series observations for each cross-section. The methods employed were logistic regression analysis and semi-parametric survival analysis.

Insolvency was defined as a condition in which an insurance company did not meet the solvency level required by the regulator, which was at least 120%. When the risk-based capital (RBC) of an insurance company was less than 120%, it was defined as not meeting financial health or insolvency. The financial information collected was assessed annually and coded as 1 if insolvency conditions were met, while companies with RBC above 120% were denoted with 0. Each company was assessed annually to determine whether it fell into the

insolvency (1) or solvent (0) category. The independent variables or covariates to be tested in this study were as follows:

Table 1: Independent Variable

Variable	Description	Expectations
ROA	*Return on Asset*	-
ROE	*Return on Equity*	-
Debt Investment	The proportion of the number of bond and debt securities placements compared to the total investment of insurance companies	-
Claim Ratio	Proportion of gross claims compared to the insurance company's gross *premiums r*	+
Reinsurance	The proportion of reinsurance premiums compared to the amount of the insurance company's gross premiums	-
Expense Ratio	The proportion of total operating expenses compared to the amount of income of the insurance company	+

In this study, the logistic regression model can be modeled as follows:

$$Y_{it} = \beta_0 + \sum_{k=1}^{k} \beta_k X_{kit} + \varepsilon_{it} \quad (1)$$

Where the observation and time period so that it $i = 1, 2, \ldots, Nt = 1,2, \ldots, TY_{it}$ is a dummy variable of the insurance company I and the time period *of the t* with a value of 1 for an insolvent insurance company and zero otherwise which is calculated every year. is an interception constant, is a regression coefficient with the variable measured K$\beta_0\beta_k$, is an independent variable of K-KX_{kit} for the insurance company *I* in the time period *T*, and is an error of the regression for the ε_{it}*insurance company I* and the time period *T*.

The estimation of the logistic regression model in this study can be stated as follows:

$$ln\left(\frac{p_{i,t}}{1-p_{i,t}}\right) = \beta_0 + \beta_1 ROA_{1it} + \beta_2 ROE_{2it} + \beta_3 Debtin_{3it} + \beta_4 Loss_{4it} + \beta_5 Reins_{5it} + \beta_6 BOPO_{6it} + \varepsilon_{it} \quad (2)$$

The chances of an insurance company that does not meet the level of financial health are expressed by $p_{i,t}$, while the chances of an insurance company that meet the level of financial health are expressed by $.1 - p_{i,t}$ Data processing will be done separately for general insurance companies and life insurance companies to obtain the main factors that affect the level of financial health of the insurance company.

Survival analysis with the Cox Proportional Hazard Model was used to determine the influence of covariates on the time of failure, in this case the failure of the insurance company to meet the minimum solvency level. The independent variables used in the Cox Proportional Hazard model are assumed to be time-independent variables.

$$h_i(t) = exp(\beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)\, h_0(t) \quad (3)$$

where $h_0(\mathrm{t})$, is a basic hazard function,
$\beta 1, \beta 2, \ldots,$ βk is the regression coefficient,
x1, x2, ..., xk is a covariate

The interpretation of βi is as follows:

1. If βi is positive, then the *hazard rate* increases at the covariate *k* or there is a positive correlation between the covariate *k* and the *hazard rate*
2. If βi is negative, then the hazard rate decreases at the covariate k or there is a negative correlation between the covariate k and the hazard rate

The Cox model is stated as the Cox Proportional Hazard model model because of the assumption that the hazard function is always proportional. For example, by comparing the hazard functions of two insurance companies x and y,

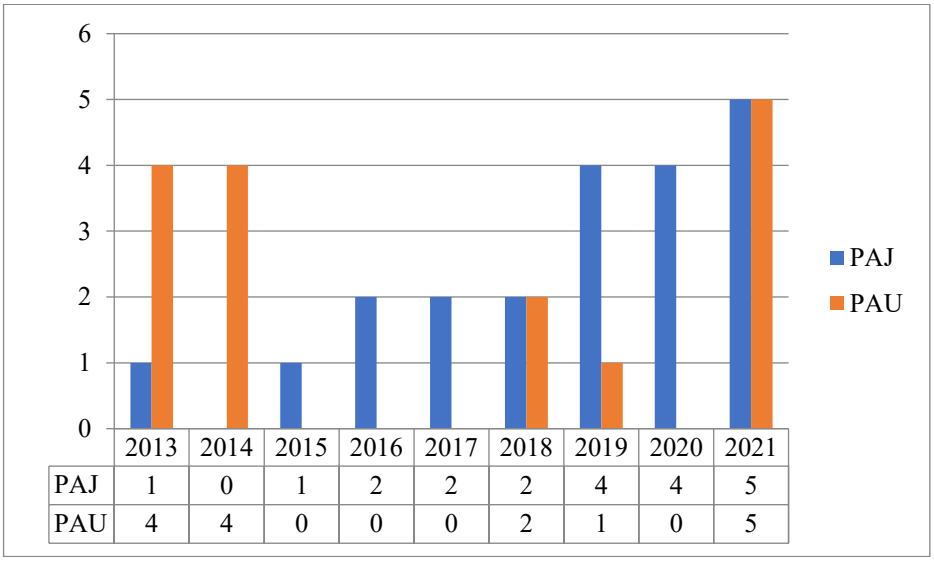
$$\frac{h(t|Z_x)}{h(t|Z_y)} = \frac{h_0(t)\exp\left(\sum_{i=1}^{k}\beta_i z_{xi}\right)}{h_0(t)\exp\left(\sum_{i=1}^{k}\beta_i z_{yi}\right)} = \exp\left(\sum_{i=1}^{k}\beta_i\left(z_{xi} - z_{yi}\right)\right) \quad (4)$$

constant value all the time.

RESULTS AND DISCUSSION

This study uses financial statement data of insurance companies from 2013 to 2021. The insurance companies that are under observation are 137 insurance companies, namely 56 life insurance companies and 81 general insurance companies. Life insurance companies and general insurance companies observed every year are different. This is because there are insurance companies that obtain business licenses within the interval of observation or have their business licenses revoked by regulators. So that the total number of data studied was 1118 observations.

Based on data from 2013-2021, the number of insurance companies that are experiencing financial health or insolvency has increased using *Ms. Exel*, as illustrated in Figure 1. Insurance companies experiencing insolvency increased with the most frequency in 2021 for both general insurance companies and life insurance, which amounted to 8.6% of all observed insurance companies. Almost in every observation period, there are life insurance companies that experience insolvency conditions. This shows that life insurance companies are quite vulnerable to insolvency conditions.



	2013	2014	2015	2016	2017	2018	2019	2020	2021
PAJ	1	0	1	2	2	2	4	4	5
PAU	4	4	0	0	0	2	1	0	5

Figure 1. Frequency of Insolvent Insurance Companies

As described in the previous chapter, the results of this research will be divided into two sectors, namely life insurance companies and general insurance companies. This is because the characteristics of the company are different, where general insurance companies in Indonesia bear more risks with a shorter coverage period than life insurance companies that bear more risks with a longer period. The results of descriptive analysis, logistic regression analysis for life insurance companies and general insurance companies are as follows.

Descriptive Statistical Analysis

Based on table 1, overall data on life insurance companies in Indonesia that are included in the observations are 452, where the frequency of life insurance companies that experience insolvency is 21 observations and life insurance companies that are not insolvent are 431 observations.

Table 1 Descriptive Statistical Results of Life Insurance Companies

Variable	Solvent	Dissolve	Difference		
	Mean	Mean	*Diff.*	*T-test*	
ROA	-0,0184	-0,1132	0,0948	3,1184	**
ROE	-0,0011	-5,9751	5,9741	4,2546	**
Debt Investment	0,2477	0,1255	0,1222	2,8176	**
Claim Ratio	0,9009	275,3180	-274,4170	-4,8025	**
Reinsurance proportion	0,0746	0,1731	-0,0985	-1,7871	*
Expense Ratio	275,5306	21,0391	254,4915	0,2069	
Observation	431	21			
* p < 0.1, ** p < 0.05					

The average ROA for life insurance companies that experience insolvency is minus 0.1132, while the average ROA for life insurance companies that are in a solvent condition has a higher value, which is minus 0.0184 with a difference of 0.0948. Furthermore, the difference in the average ROA between life insurance companies that experience insolvency and life insurance companies that are in a solvent condition is tested with a zero hypothesis, namely the average ROA between life insurance companies that experience solvent and insolvent conditions is the same. The t-test result obtained was 3.1184 with a p-value of 0.0019 or less than the significance value of 0.05. Thus, the zero hypothesis can be rejected, namely the average ROA shows a difference between life insurance companies that experience solvent and insolvent conditions. This also applies to the ROE variable, the proportion of investment in bonds or debt securities to the total investment (Debt Investment), claim ratio and the proportion of reinsurance.

Meanwhile, the average expense ratio of life insurance companies as shown by the amount of operating expenses compared to net premium income in life insurance companies experiencing insolvency conditions is 21.0391. Meanwhile, the average cost ratio for life insurance companies that are in a solvent condition has a higher value, which is 275.5306. The average difference in the cost ratio in life insurance companies experiencing insolvency and solvent conditions was minus 254.4915. The t-test results obtained were minus 0.2069 with a p-value of 0.8362 or greater than the significance value of 0.05. Thus, the zero hypothesis cannot be rejected, namely that the average cost ratio in life insurance companies that experience insolvency and the average cost ratio in solvent conditions is the same. Furthermore, for general insurance companies, the number of data included in the observations was 666, consisting of the frequency of general insurance companies that experienced insolvency as

many as 16 observations, and general insurance companies that did not experience insolvency as many as 650 observations.

Based on table 2, the average ROA for general insurance companies that experience insolvency is minus 0.1346, while the average ROA for life insurance companies that are in a solvent condition has a higher value, which is 0.0300 with a difference of 0.1646. Furthermore, the difference in the average ROA between general insurance companies that experience insolvency and companies that are in a solvent condition is tested with a zero hypothesis, namely the average ROA between general insurance companies that experience solvent and insolvent conditions is the same. The t-test results obtained were 10.0876 with a p-value of 0.000 or less than the significance value of 0.05. Thus, the zero hypothesis can be rejected, namely the average ROA shows a difference between general insurance companies that experience solvent and insolvent conditions. This also applies to the results obtained on the variables ROE, claim ratio, proportion of reinsurance and expense ratio.

Table 2 Descriptive Statistical Differences Test of General Insurance Companies

	Solvent	**Dissolve**	**Difference**		
	Mean	**Mean**	***Diff.***	***T-test***	
ROA	0,0300	- 0,1346	0,1646	10,0876	**
ROE	- 0,0011	- 5,9751	5,9741	- 3,4320	**
Debt Investment	0,2292	0,2129	0,0164	0,3311	
Claim Ratio	0,4485	1,5877	- 1,1391	- 7,9079	**
Reinsurance ratio	0,3666	0,5901	- 0,2235	- 3,8346	**
Expense Ratio	0,5879	1,2402	- 0,6523	- 3,2457	**
Observation	650	16			
*** p < 0.1, ** p < 0.05**					

Meanwhile, the average proportion of investment placement in bonds or debt securities to total investment (debt investment) for general insurance companies that experience insolvency conditions is 0.2129, while the average debt investment for general insurance companies that are in solvent conditions has a higher value, which is 0.2292. The average difference in debt investment in general insurance companies that experience insolvency conditions with solvent conditions is 0.0164. The t-test result obtained was 0.3311 with a p-value of 0.7407 or greater than the significance value of 0.05. Thus, the zero hypothesis cannot be rejected, namely that the average investment placement in bonds or debt securities shows that there is a similarity between general insurance companies that experience solvent and insolvent conditions.

Logistic Regression Analysis

Before analyzing the results of the logistics regression, testing the assumption of model feasibility (goodness of fit) was carried out to find out whether the logistic regression function can accurately estimate the actual value statistically. The feasibility test of the model used, namely the Hosmer and Lemeshow test, the overall model fit test, and the multicollinearlity test.

Hosmer and Lemeshow's are used to test the feasibility of a regression model, which is to test the null hypothesis that there is no difference between the model and the empirical data used so that it can be said to be fit. If the statistical value of HL Goodness-of-fit is greater than 0.05, then the null hypothesis cannot be rejected. This shows that the model is able to

predict the value of its observations or that the model is acceptable because it matches the observation data (Ghozali and Ratmono, 2017).

The overall model fit test is used to find out whether simultaneously independent variables have a significant influence on the dependent variables. These test values can be seen in LR statistic and McFadden R-Squared or Pseudo R-Squared.

The multicollinearity test is used to test whether there is a strong relationship or correlation between independent variables. If multicollinearity is found in the model, then the value of the regression coefficient of independent variables cannot be determined or cannot be estimated precisely. Correlation between two independent variables that exceed 0.8 can be a sign of multicollinearity. Multicollinearity can be detected using Tolerance and Variance Inflation Factor (VIF). The commonly used value to indicate the presence of multicollinearity is Tolerance less than 0.10 or equal to VIF greater than 10 (Ghozali and Ratmono, 2017).

The following are the results of the logistical regression analysis for life insurance companies and general insurance companies after testing the assumptions as mentioned above are met.

Logistic Regression Analysis in Life Insurance Companies

By using STATA, furthermore, the results of logistical regression are obtained as in table 3. Based on the results of the logistic regression, the parameter estimation of the logite regression model can be expressed with the following equation:

$$ln\left(\frac{p}{1-p}\right) = -2{,}3542 - 4{,}1037\ \text{ROA} - 0{,}0243\ \text{ROE} - 4{,}7049\text{DebtIns} + 0{,}3161\ \text{Claim} - 0{,}3315\ \text{Reins} - 0{,}4825\ \text{Expense} \quad (5)$$

or

$$\frac{p}{1-p} = \exp(-2{,}3542 - 4{,}1037\ \text{ROA} - 0{,}0243\ \text{ROE} - 4{,}7049\text{DebtIns} + 0{,}3161\ \text{Claim} - 0{,}3315\ \text{Reins} - 0{,}4825\ \text{Expense}) \quad (6)$$

Table 3 Life Insurance Company Logistics Regression Results

Variable	Coefficient	Odds Ratio	Std. err.	z-Statistic.	
ROA	-4,1037	0,0165	0,02	-3,440	**
ROE	-0,0243	0,9760	0,03	-0,860	
Debt Investment	-4,7049	0,0091	0,02	-2,380	**
Claim Ratio	0,3161	1,3718	0,18	2,350	**
Reinsurance	-0,3315	0,7178	1,58	-0,150	
Expense Ratio	-0,4825	0,6173	0,14	-2,110	
Constant (C)	-2,3542	0,0950	0,04	-5,620	**

* significant at the α level of 10%.
** significant at the α level of 5%.

Furthermore, based on equations 5 or 6 and the results of logistical regression in life insurance companies in table 3, it can be interpreted that for each increase in the ROA variable will decrease the log of odds of the insolvency condition of the life insurance company by 4.1037. If other independent variables are considered constant, then the odds of the life insurance company experiencing insolvency will decrease by 0.0165 for every increase in the ROA variable. The probability value of the ROA variable is 0.001 or less than α 0.05. Thus,

any significant increase in the ROA variable decreases the chances of life insurance companies experiencing insolvency conditions. In other words, the ROA variable is significant in showing a negative relationship with the insolvency condition of the life insurance company. Other significant variables are Debt Investment, claim ratio and constant

On the other hand, for the ROE variable, any increase in the ROE variable will decrease the log of odds of insolvency conditions in life insurance companies by 0.0243. If other independent variables are considered constant, then the odds of the life insurance company experiencing insolvency will decrease by 0.9760 for each increase in value in the ROE variable. The probability value of the ROE variable is 0.390 or more than α 0.05. Thus, any increase in the ROE variable does not significantly decrease the chances of life insurance companies experiencing insolvency. This also applies to the variable proportion of reinsurance.

As for the expense ratio variable, every increase per 1 unit of value in the expense ratio variable will reduce the log of odds of insolvency conditions in life insurance companies by 0.4825. If other independent variables are considered constant, then the odds that the life insurance company will experience insolvency conditions will decrease by 0.6173 for every increase per 1 unit of value in the cost ratio variable. Although the variable value of the cost ratio has a probability of 0.035 or less than α 0.50, the expected effect is contrary to the hypothesis, so any decrease in the cost variable is not significant increasing the chances of the life insurance company experiencing insolvency.

Logistic Regression Analysis in General Insurance Companies

By using STATA, the logistical regression results as shown in table 3 were obtained. The parameter estimation of the logit regression model can be expressed by the following equation:

$$ln\left(\frac{p}{1-p}\right) = -4{,}1961 - 19{,}5088\ \text{ROA} + 0{,}8727\ \text{ROE} - 0{,}6538\text{DebtIns} + 0{,}5491\ \text{Claim} + 0{,}4043\ \text{Reins} - 0{,}1943\text{Expense} \quad (7)$$

or

$$\frac{p}{1-p} = \exp(-4{,}1961 - 19{,}5088\ \text{ROA} + 0{,}8727\ \text{ROE} - 0{,}6538\text{DebtIns} + 0{,}5491\ \text{Claim} + 0{,}4043\ \text{Reins} - 0{,}1943\text{Expense}) \quad (8)$$

Table 4 General Insurance Company Logistics Regression Results

Variable	*Coefficient*	*Odds Ratio*	*Std. err.*	*z-Statistic.*	
ROA	-19,5088	3.37e-09	0,000	-4,51	**
ROE	0,8727	2,3934	1,589	1,31	
Debt Investment	-0,6538	0,5201	0,816	-0,42	
Claim Ratio	0,5491	1,7316	0,567	1,68	*
Reinsurance	0,4043	1,4983	1,698	0,36	
Expense Ratio	-0,1943	0,8234	0,187	-0,86	
Constant (C)	-4,1961	0,0151	0,009	-6,68	**

* significant at the α level of 10%.
** significant at the α level of 5%.

Furthermore, based on equations 7 or 8 and the results of logistical regression in general insurance companies in table 4, it can be interpreted that for each increase in the value

of the ROA variable will decrease the log of odds of the insolvency condition of general insurance companies by 19.5088. If other independent variables are considered constant, then the odds of general insurance companies experiencing insolvency conditions will decrease by 3.37e-09 or close to 0 for every increase in value in the ROA variable. The probability value of the ROA variable is 0.00 or less than α of 0.05. Thus, any significant increase in the ROA variable decreases the chances of general insurance companies experiencing insolvency conditions. In other words, the ROA variable is significant in showing a negative relationship with the insolvency condition of the general insurance company. Another significant independent variable is shown in the claim ratio variable with a significance of 0.10.

Conversely, any increase in the ROE variable will increase the log of odds of insolvency conditions in general insurance companies by 0.8727. If other independent variables are considered constant, then the odds of general insurance companies experiencing insolvency will increase by 2.3934 for each increase in value in the ROE variable. The probability value of the ROE variable is 0.189 or more than α is 0.05. Thus, any increase in the ROE variable does not significantly decrease the chances of general insurance companies experiencing insolvency conditions. Other insignificant independent variables were obtained in the variables of debt investment, the proportion of reinsurance, and the expense ratio.

Survival Analysis

Using the Cox Proportional Hazard model, the selection of factors or variables that are considered to affect the timing of insolvency conditions is selected. The covariate variables used in this analysis use the same variables as the independent variables of the logistic regression analyzers, namely ROA, ROE, proportion of investment placements in the form of bonds or debt securities from total investment (DebtIns), claim ratio which is the total claims compared to the total premiums, the proportion of reinsurance placements from the total premiums and the expense ratio which describes the operating expenses compared to the premium income Neto.

Assumption testing was carried out using a global test of the Cox regression model for all variables. Checking the proportional hazard assumption with a global test using a zero hypothesis that the data meets the proportional hazard assumption.

Survival Analysis in Life Insurance Companies

In this analysis, the data used in the observation was 425 observations consisting of 56 life insurance companies during the period from 2013 to 2021. The 9 life insurance companies have a solvency ratio of less than 120% or insolvent. Meanwhile, the remaining 47 life insurance companies are in a condition of surviving during the observation period or are censored data, namely life insurance companies that can maintain a solvency level above 120% until the end of the observation period or until December 31, 2021. By using STATA, the Cox regression results are obtained as shown in table 5 where the hazard ratio value shows the influence of variables on the hazard function.

Table 5 Cox Regression Results in General Insurance Companies

Covariates	Coefficient	Do it. Ratio	z	P>|z|	
ROA	-5,2127	0,0054	-2,98	0,003	**
ROE	-0,0138	0,9863	-1,30	0,192	
DebtIns	-5,6668	0,0035	-1,78	0,075	*
Claim	0,1208	1,1283	1,73	0,083	*
Reins	2,5318	12,5763	1,02	0,308	

Expense	-0,1758	0,8388	-1,47	0,142

Based on table 5, the Cox Proportional Hazard model can be structured as follows:

$$\log h(t) = \alpha(t) - 5{,}2127\ \text{ROA} - 0{,}0138\ \text{ROE} - 5{,}6668\ DebtIns + 0{,}1208\ Claim + 2{,}5318 Reins - 0{,}1758\ Expense \quad (9)$$

or

$$h(t) = \exp\begin{pmatrix} -5{,}2127\ \text{ROA} - 0{,}0138\ \text{ROE} - 5{,}6668\ DebtIns \\ +0{,}1208\ Claim + 2{,}5318 Reins - 0{,}1758\ Expense \end{pmatrix} h_0(t) \quad (10)$$

Based on the model in equations 9 or 10, it can be interpreted that the ROA covariate has a coefficient of minus 5.2127 significant at 0.05 to the survival time α of the life insurance company experiencing insolvency with a *hazard* value of 0.0054. These results show that any increase in ROA by 1% will reduce the insolvency condition of life insurance companies by 0.54%.

In addition to ROA, the proportion of placements in bonds or debt securities to the total investment has a significant negative effect on the time when life insurance companies experience insolvency conditions. The higher the ROA of a life insurance company, it will make the life insurance company experience a longer insolvency situation. Likewise, an increase in the proportion of placements in bonds and debt securities to the total investment will make the time for insolvency conditions in life insurance companies longer. In contrast, the proportion of claim payments to premiums earned by life insurance companies has a positive relationship. This shows that the higher the ratio of insurance companies' claims to total premiums, the faster life insurance companies experience insolvency.

Survival Analysis in General Insurance Companies

This analysis uses data from 628 observations consisting of 81 general insurance companies during the period from 2013 to 2021. The 12 general insurance companies have a solvency ratio of less than 120% or insolvency. Meanwhile, the remaining 69 general insurance companies are in a condition of surviving during the observation period or are censored data, namely general insurance companies that can maintain a solvency level above 120% until the end of the observation period or until December 31, 2021.

Table 6 Cox Regression Results in General Insurance Companies

_t	Coefficient	Do it. Ratio	z	P>|z|
ROA	-3,7794	0,0228	-0,92	0,356
ROE	0,5291	1,6974	1,72	0,085
DebtIns	-3,6757	0,0253	-1,59	0,112
Claim	0,2825	1,3265	0,64	0,525
Reins	-0,2892	0,7489	-0,21	0,836
Expense	-0,1971	0,8211	-0,21	0,831

Based on the results of the Cox regression in table 6, the Cox Proportional Hazard model can be compiled as follows:

$$\log h(t) = \alpha(t) - 3{,}7794\text{ROA} + 0{,}5291\text{ROE} - 3{,}6757 DebtIns + 0{,}2825 Claim - 0{,}2892\ \text{Reins} - 0{,}1971\ \text{Expense} \quad (11)$$

or

$$h(t) = \exp\begin{pmatrix} -3{,}7794\text{ROA} + 0{,}5291\text{ROE} - 3{,}6757DebtIns \\ +0{,}2825Claim - 0{,}2892\ \text{Reins} - 0{,}1971\ \text{Expense} \end{pmatrix} h_0(t) \quad (12)$$

Based on the model in equations 11 or 12, it can be interpreted that the ROA covariate has a coefficient of minus 3.7794 which is not significant at 0.05 with a $\alpha hazard$ value of 0.0228. These results show that any increase in ROA of 1% does not significantly decrease the insolvency condition of general insurance companies. The results in table 6 show that ROE has a significance value of less than 0.10. However, this shows that ROE does not significantly have a negative influence on insolvency conditions as the hypothesis established at the beginning of the study, namely that the ROE variable has a negative influence on the time of insolvency in insurance companies. Some general insurance companies that experience insolvency have a negative equity value and suffer losses during the observation period so that it will result in a positive ROE value. This causes the ROE variable to be biased.

With the limitations of research time and data availability, the researchers made some limitations in this study. This study only uses data on general insurance companies and life insurance companies in Indonesia for the period from 2013 to 2021. Observations are limited to general insurance companies and life insurance companies whose financial information is available in the period 2013 to 2021. Insurance companies whose financial information is not available in a certain period, such insurance companies are not included in the observation in that period.

As stipulated in the provisions of the financial health of insurance companies, indicators of financial health of insurance companies that can cause the insurance company to be subject to the revocation of its business license or cause the failure of an insurance company, include the solvency level, the ratio of investment adequacy and equity. In this study, the researcher only used the solvency level as a determinant of insurance company failure.

Based on the analysis of the results of the logistics regression for life insurance companies mentioned above, it can be concluded that the ROA variable and the debt investment variable have a negative relationship with the chance of insolvency in life insurance companies. Meanwhile, the claim ratio variable has a positive relationship with the chance of life insurance companies experiencing insolvency conditions. So, the higher the ROA value of a life insurance company and the greater the proportion of investment placement in bonds or debt securities, the chances of the life insurance company experiencing insolvency conditions will decrease. On the other hand, the higher the claim ratio of the life insurance company, the more likely it is that the life insurance company will experience insolvency.

The results of this study are in line with previous research that linked ROA and the proportion of investment placements in bonds or debt securities to have a negative relationship with the failure of life insurance companies. In life insurance companies, the profitability growth represented by ROA significantly affects the failure of life insurance companies using samples in 5 developed countries such as the United States, France, the United Kingdom, Japan, and the Netherlands. The ROAs generated by life insurance companies play a lower role as compared to the ROAs generated by general insurance companies (Overton & Bandt, 2020).

In addition, this study has also confirmed previous research which stated that the proportion of investment placements in debt securities or fixed asset income has a negative relationship with the chance of failure. The higher the proportion of investment in debt instruments in the total investment, the lower the likelihood of failure in life insurance companies (Overton & Bandt, 2020).

In addition, the variable proportion of reinsurance placement from insignificant insurance premiums had a negative relationship and insignificant business efficiency had a

positive relationship with the chance of failure of the life insurance company. This confirms the results of previous research, where operating efficiency and the proportion of reinsurance do not play a role in predicting the failure of life insurance companies (Overton & Bandt, 2020).

In contrast to the previous study, this study included the claim ratio as one of the variables that describes the proportion of claims compared to life insurance company premiums where this variable significantly has a positive effect on the non-fulfillment of the financial health of the insurance company (insolvency). In addition, the researcher only included indicators based on financial information, not including macroeconomic aspects or insurance company governance.

Based on the analysis of the results of the logistics regression for general insurance companies mentioned above, it can be concluded that the significant ROA variable has a negative relationship with the chance of insolvency in general insurance companies. Meanwhile, the claim ratio variable has a positive relationship with the chance of general insurance companies experiencing insolvency conditions. So, the higher the ROA value of a general insurance company, it will lower the chances of the general insurance company experiencing insolvency. On the other hand, the higher the claim ratio of general insurance companies, it will increase the chances of general insurance companies experiencing insolvency conditions.

The results of this study are in line with previous research that linked ROA to having a negative relationship with the failure of general insurance companies. The ROA generated by the general insurance company plays a lower role compared to the ROA generated by the life insurance company. In general insurance companies, the odds ratio of the ROA variable is close to 0 while the odds ratio value of the variable ROA in life insurance companies is higher at 0.017 (Overton & Bandt, 2020).

In terms of assets, the results of logistic regression analysis for general insurance companies show that the proportion of investment placements in bonds or debt securities does not have a significant negative effect on the chances of insolvency conditions. This confirms previous research which explains that the characteristics of general insurance companies have a fairly short production cycle with a shorter duration of liability than life insurance companies. Thus, the choice of long-term investment portfolios tends to play no role in predicting the insolvency condition of general insurers (Overton & Bandt, 2020).

The results of this study also confirm previous research that the claim ratio has a positive relationship with the chance of insolvency in general insurance companies even though it is of a weaker significance.

On the other hand, this study is different from previous research where the variables ROE, proportion of reinsurance and expense ratio do not significantly affect the occurrence of insolvency conditions in general insurance companies in Indonesia. In addition, this study does not use macroeconomics such as inflation or gross domestic product or premium growth and the influence of probability variables on time.

Results obtained from the model Cox proportional hazard In line with the results obtained by Logistic Regression for Life Insurance Companies. The ROA variable and the proportion of placements in bonds and debt securities to the total investment have a negative influence on the insolvency condition of life insurance companies. This is in line with a study that discusses the comparison of the failures of life insurance companies and general insurance companies with a sample of 5 countries (Overton & Bandt, 2020). Meanwhile, the proportion of claim payments to the total premium has a significant effect on the insolvency condition of life insurance companies. But on the other hand, the results obtained from the Cox proportional

hazard In general insurance companies, it shows that the covariate variable used does not have a significant influence on the insolvency condition.

CONCLUSION

This study concludes that the determinants of financial distress differ notably between life and general insurance companies in Indonesia. For life insurers, Return on Assets (ROA), investment in debt instruments, and the Claim Ratio significantly influence insolvency, with higher ROA and debt investments serving as protective factors, while a higher Claim Ratio increases insolvency risk. For general insurers, only ROA and the Claim Ratio significantly affect insolvency probability, but the survival analysis yielded biased results, suggesting limitations in the Cox Proportional Hazard model for this sector. Future research should incorporate macroeconomic variables and corporate governance metrics to develop more comprehensive predictive models, explore advanced analytical techniques like machine learning, extend the study period, and consider cross-country comparisons in emerging markets to better understand the broader influences on insurance solvency.

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