Ownership and Solvency of (Re)Insurance Companies: An Indonesian Climate-Based Insurance Study

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Abstract: Despite the urgency of COVID-19, insurance companies are facing a slower-moving global crisis, namely climate change. This paper aims to investigate how corporate ownership affects the solvency of (re)insurance companies. It also analyses how climate-based insurance products, and the COVID-19 pandemic period differentiate these effects. The quantitative approach uses company accounting data throughout 2016-2022 and solvency is measured by risk-based capital (RBC). The findings show that for climate change-based (re)insurance companies, the larger the foreign-owned company, the higher the RBC level. Meanwhile, there is no difference in the effect of government and non-government owned insurance companies on their RBC. Another finding found that foreign ownership has a significant effect on the RBC of general insurance companies during the COVID-19 pandemic, while there is no relationship between the two during normal conditions. This research is expected to encourage the development and sustainability of climate change-based insurance, as well as input for financial regulators.

Keywords: climate risk, (re)insurance, risk-based capital, solvency.

INTRODUCTION

Day (2023) considered climate change as the biggest risk faced by (re)insurance companies. This study focuses on climate change risk or climate risk, which refers to the assessment of risk as a consequence or effect of climate change. This requires attention and action from stakeholders as it can contribute to broader projects related to climate change (Diantini et al., 2023). According to federal regulators in the United States (US), the potential damage from climate change could be as severe as the effects of mortgages that triggered the 2008 crisis (Bachir et al., 2019). Furthermore, based on the World Economic Forum's 2024 Global Risks Report, extreme weather poses the greatest risk of causing large-scale severity to food systems and infrastructure over the next two years. Meanwhile, the global economy is largely unprepared for these consequences. Therefore, climate risk is getting more and more attention from government, industry, and academics (researchers).

Furthermore, PwC (2024), as in the results of its 2023 survey, stated that climate change risk became the top three threats in Indonesia after inflation and cyber risk. In line with government programs, for example, the Directorate General of Climate Change has committed to reducing carbon emissions since 2010 and has managed to reduce them significantly in 2017–2018 by close to 26%, which is expected to be further reduced to

29% by 2030. Moreover, the Financial Services Authority (OJK) issued POJK 51/POJK.03/2017, which regulates the possibility of climate change that could worsen the financial services portfolio and create systemic risks to financial stability (Pradnyani et al., 2023). In accordance with the Law No. 24 of 2007, the Government must be responsible for implementing disaster management by reducing this risk since it is potentially to reduce the country's per capita Gross Domestic Product (GDP) (Kahn et al., 2019). It is evident that climate change in Indonesia has affected economic activities; for example, heavy rainfall in January 2013 inundated Jakarta, causing $550 million in losses and damages. Furthermore, extreme floods and droughts impacted agricultural land, causing $671.2 million in losses to producers in 2003-2008 (USAID, 2017). To cover disaster losses, the Ministry of Finance, through the Fiscal Policy Agency, published the Disaster Risk Financing and Insurance Strategy (PARB Strategy), which contains recommendations for a mix of policies and instruments for disaster risk financing in the short and medium terms. This strategy includes policies and financing instruments for the non-disaster period, emergency response, and rehabilitation and reconstruction.

However, some researchers argue that the concept of PARB in Indonesia has yet to be fully effective. This is shown by the absence of a correlation between the disaster budget and the level of disaster risk in Aceh (Fahlevi et al., 2019). Another example is the lack of participation from the private sector in reducing disaster risk from 23 areas in Semarang, which are prone to natural disasters (Mughron et al., 2016). In addition, the need for integration between government agencies in managing disaster risk slows the progress of the emergency response and lowers the level of risk management governance (Djalante et al., 2017). Thus, the general approach used by the government cannot meet the needs of every business and individual. Therefore, insurance coverage is expected to help low-income households and farmers with and stimulate investment in disaster prevention measures (Nobanee et al., 2022).

Insurance is naturally considered an "economic stabilizer" that plays an important role in uncertain conditions, such as natural disasters or COVID-19 (Qiu, 2020). The climate-related risks can affect almost all industries and are the single biggest economic risk facing the world today. The results of a survey conducted by the Deloitte team show that insurance companies in the US have faced an increase in insurance claim payments for losses from natural disasters over the past nearly 50 years due to increased climate risks, especially physical risks (Bachir et al., 2019). This paper aims to analyze how company characteristics affect the solvency and financial resilience of insurance and reinsurance companies. The expected implication of this investigation is to provide information to decision-makers both regulators and insurance practitioners, especially in Indonesia so that they can better assess, adapt to, and reduce or mitigate physical climate change risks. This research is also expected to help identify market opportunities for climate change insurance in Indonesia for the sustainability of insurance companies.

This manuscript contributes in several ways. Firstly, to the best of the researcher's knowledge, this paper is a preliminary study investigating the effect of company characteristics on the solvency and resilience of (re)insurance companies in Indonesia. In addition, this study includes climate change-based insurance products as a moderating variable. This factor is important because the financial resilience of (re)insurance companies explains the ability to change and adapt to disturbances (climate change).

Second, this study focuses on insurance companies in Indonesia which is vulnerable to natural disasters and is included in the list of 35 countries in the world with a high risk of loss of life due to the impact of various types of disasters, increased climate risk based on the Global Climate Risk Index, and one of the countries with most vulnerable to rising sea levels (USAID, 2017). This is demonstrated by several natural disasters, such as the earthquake and tsunami in Aceh and northern Sumatra in 2004, the subsequent major earthquakes in Lombok,

and the earthquake and tsunami in Palu and Donggala in 2018. These physical climate risks are predicted to increase three to four times by 2050, which could reduce economic growth (Woetzel et al., 2020).

There is also limited research on this topic in Indonesia. Most previous studies were conducted in developed countries, such as the USA and Europe (see Batten, 2018; Andersson et al., 2020). Meanwhile, studies conducted in non-developed countries still need to be more extensive and there is a significant imbalance in scientific knowledge production between developing and developed countries. Topics that remain controversial in developing countries are partly due to government strategies, demand factors, and geographical conditions (Nobanee et al., 2022).

Furthermore, studies conducted in Indonesia are still limited to studies that examine the demand side (the insured) or farmers regarding how they manage risks in the face of climate risk (see studies by Estiningtyas, 2015; Kusuma et al., 2018). Thus, this study has an interesting novelty to examine: the effect of company characteristics on the solvency and resilience of companies (re)insurance in Indonesia by including climate change-based insurance products as a moderating variable.

METHODS

The analysis period was from 2016 to 2022, divided into the normal period (2016–2019) and the COVID-19 Pandemic period (2020–2022). The pandemic period spanned three years, encompassing the first year of Indonesia's encounter with COVID-19 (2020) and culminating in the year of COVID-19's resolution (2022). The first positive COVID-19 case in Indonesia was detected on March 2, 2020, and the pandemic was declared to have concluded when President Jokowi announced that the number of COVID-19 patients had approached zero on June 1, 2023.

As of December 31, 2022, data retrieved from OJK show 94 insurance companies with operating permits in Indonesia. These companies included insurance, reinsurance, and joint venture companies (excluding Actuary Consultants and Insurance Agents). When analyzing the study's findings, the author concentrated on data related to general insurance companies and reinsurance.

General insurance, often called general or non-life insurance, steps in to help out when things go wrong. It gives benefits when there is damage, loss, or something stolen. The whole idea is to cushion or minimize the blow in case of any risks. This could be fire, accidents, or even delayed flights.

Therefore, general insurance is like a standard insurance deal, similar to life insurance, but with some special qualities. For example, it covers more than just the unfortunate end of things; it can pay out money directly to clients rather than only covering losses. In addition, it is not just about protecting lives, but it is also about safeguarding stuff like cars, buildings, and other non-living things. In addition to insurance companies, reinsurance companies are included as research samples. Unlike insurance companies that act as insurers and make agreements with policyholders about managing potential risks, reinsurance works differently.

In these agreements, policyholders agree to pay regular premiums over a set period, and the insurer is responsible for covering potential risks. On the other hand, reinsurance is an arrangement between a reinsurer and an insurer (the insurance company), where the reinsurer agrees to shoulder a portion or the entirety of insurance risks. Claims made by policyholders are then divided between the insurer and the reinsurer. In addition, this arrangement allows reinsurance companies to step in and increase the claim limit if the insurance company faces limitations in paying out a certain number of claims. This ensures optimal protection for policyholders, even if the insurer's ability to cover claims is constrained.

To measure the financial health of a (re)insurance company, Risk-Based Capital (RBC) is used. RBC is an indicator of an insurance company's ability to finance its obligations. The greater the solvency ratio (RBC) of an insurance company, the healthier the company's financial condition. According to OJK Regulation No. 71/POJK.05/2016, minimum RBC provisions is 120 percent. This means that the amount of free assets or assets remaining after the insurance company has fulfilled its obligations is at least 120 percent of the risk value. In this study, data to measure RBC comes from quarterly data from (re)insurance companies starting to implement climate-based insurance until the last quarter (2000).

The ownership variable is measured using two proxies: government ownership and foreign ownership. STATE represents government ownership as measured by the percentage of shares owned by government institutional investors (Zeitun & Tian, 2007). FOREIGN represents foreign ownership as measured by the total percentage of shares owned by foreigners (Li & Liao, 2017).

This study includes control variables as used by Li & Liao (2017); Ruza et al. (2019); and Cheong et al (2021), namely company size (total assets), debt level (DER), and risk level (FIRMRISK). Furthermore, this research adds the category of companies listed on the stock exchange. Details regarding the measurements for all variables are shown in Table 1.

To provide an overview of the quantitative approach to assessing the solvency of (re)insurance companies by taking into account the consideration of the time horizon and uncertainties related to the pandemic (crisis), the following is a calculation model to test the proposed hypothesis:

$$RBC_{i,t} = \alpha 0 + \alpha 1 STATE_{i,t} + \alpha 2 FOREIGN_{i,t} + \alpha 3 SIZE_{i,t} + \alpha 4 DER_{i,t} + \alpha 5 FIRMRISK_{i,t} + \varepsilon_{i,t} \qquad (1)$$

Table 1 Operational variable

| Variables	Measure	References
Dependent		
Risk-Based Capital ratio (RBC)	$\dfrac{Total\ Adjusted\ Capital\ (TAC)}{Risk\ Based\ Capital}$ TAC = sum of un-invested surplus	National Association of Insurance Commissioners (NAIC) (1990)
Independent		
State ownership (STATE)	Percentage of shares held by government institutional investor	Zeitun & Tian (2007)
Foreign ownership (FOREIGN)	Percentage of shares held by foreign institutional investor	Li & Liao (2017)
Control		
Firm's assets size (Size)	Natural logarithm of Total Assets	Ruza et al. (2019)
Leverage (DER)	Ratio of Debt-to-Equity Ratio	Cheong et al. (2021)
Firm's Risk (FIRMRISK)	Ratio of Investment to Total Assets	Cheong et al. (2021)
Listed firms (LISTED)	Dummy, 1=listed firms, 0=other	Ruza et al. (2019)

Source: OJK and Companies website.

RESULTS AND DISCUSSION

Figures 1 & 2 describe the number of observations in this study and the average value of the solvency level of insurance companies as measured by risk-based capital (RBC) during 2016–2022. The number of annual observations during the first five years (2016–2020) consisted of 17 samples which increased to 44 (158%) in the following two years or during 2021–2022.
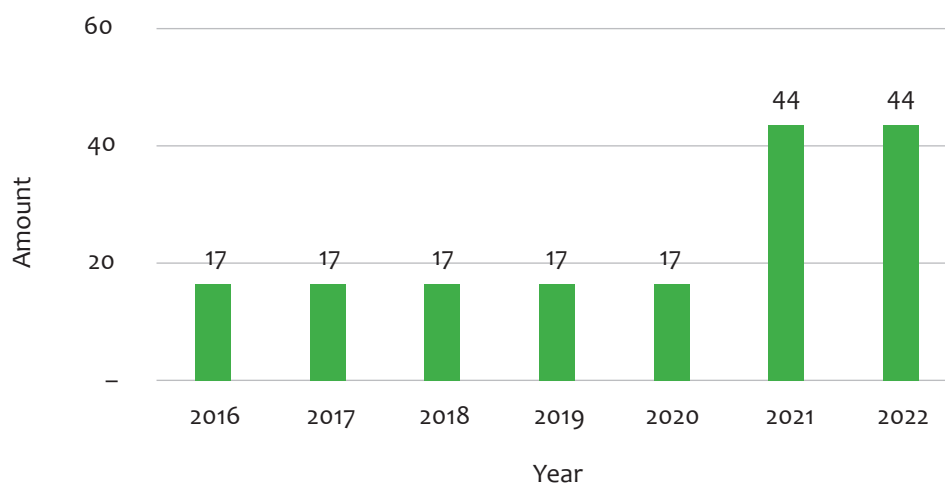
Source: Author's findings

Figure 1 Number of climate change-based insurance observations during 2016–2022
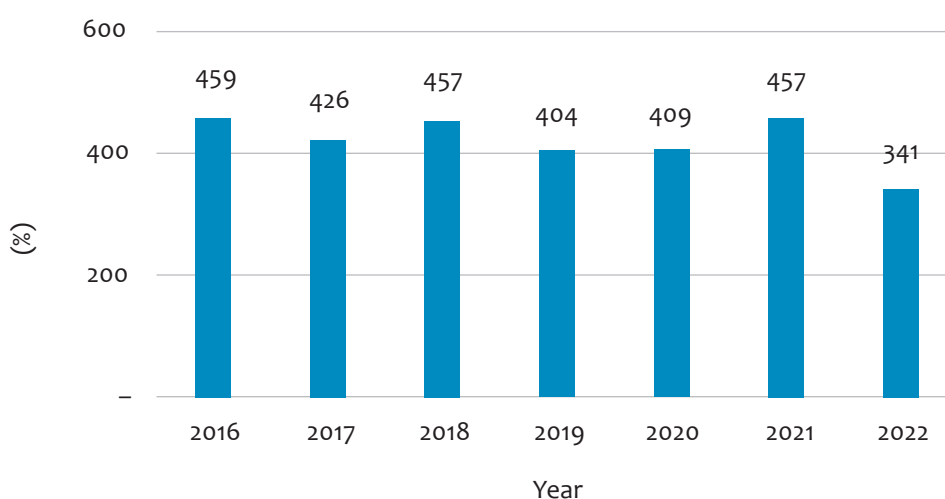
Source: Author's findings

Figure 2 Average Risk-Based Capital (RBC) of insurance companies in Indonesia

This sustainable expansion means that the financial services industry, through green insurance, is increasingly providing support in dealing with climate change. Meanwhile, Figure 2 explains that the average RBC value fluctuated throughout the observation period. The highest average value occurred in 2016 at 459%, while the lowest was in 2022 at 341%. A lower RBC indicates a decline in the soundness of financial companies (Re) insurers in meeting long-term obligations. In accordance with historical data from the Financial Services Authority (OJK), the average general insurance RBC value decreased after the COVID-2019 pandemic.

Table 2 presents descriptive statistics on the solvency determinants of (re)insurance companies in Indonesia. In general, the average level of solvency of the sample companies is 323.94%, which is in accordance with the minimum requirements, i.e., above 120%. If the difference is based on climate-based products, companies with climate risk-based insurance products (CRBI) have a higher average value (350.51%) than RBC from companies that are non-CRBI (304.14%). However, the lowest RBC value occurred in CRBI companies (–289%), which could cause the variation value of the CRBI sample to be higher (201.48%) than the non-CRBI sample of 167.52%. A negative CRBI number indicates that the company is unable to fulfill its obligations, including the payment of claims made by its customers. In addition, this is related to wealth management, which is still low.

The average level of government ownership (STATE) in general is relatively very low at 4.13%, and only two insurance companies are 100% owned by the government. Foreign ownership variable (FOREIGN), on average, belongs to a significant level of share ownership (above 20%), however, the diversity of the data is relatively high (34.391%). The average percentage of foreign ownership is 22.2%. It is estimated that the growth of foreign insurance in Indonesia will increase due to the enactment of Government Regulation No.3 of 2020 on Foreign Ownership of Insurance Companies. This regulation became effective on 20 January 2020, allowing foreign ownership to be increased for insurance companies to more than 80%.

Table 2 Descriptive Statistics – all samples

	Mean	Median	Max	Min	Stdev.	Skewness
Dependent Variables						
Total RBC (%)	323.94	289.00	1005.30	–289.00	184.00	1.111
CRBI (%)	350.51	309.00	1053.00	–289.00	201.48	0.787
Non-CRBI (%)	304.14	262.50	956.00	1.009	167.52	1.397
STATE (%)	4.146	0	100.00	0	18.891	4.639
FOREIGN (%)	22.220	0	99.900	0	34.391	1.109
Control Variables						
lnSIZE	13.851	13.909	17.379	5.106	1.750	–2.019
DER (%)	186.25	168.40	671.70	8.700	115.92	1.272
FIRMRISK (%)	47.815	47.900	96.300	1.700	17.624	0.159
Total observations	405					

Notes: This table shows descriptive statistics for all variables used in this research. RBC is Risk-Based Capital ratio. CRBI is Climate Risk-Based Insurance. STATE is State ownership. FOREIGN is foreign ownership. Size is the Firm's assets size. DER is Debt to Equity Ratio. FIRMRISK is Investment to Total Asset Ratio.

Table 3 shows the correlation matrix. The higher the correlation between variables, the more easily the relationship between variables can be explained. The low correlation between independent variables indicates the possibility of avoiding multicollinearity problems for the estimated model.

Table 3 Correlation Matrix – all samples

	Independent Variables			Control Variables		
	RBC	**STATE**	**FOREIGN**	**LNSIZE**	**DER**	**FIRMRISK**
Dependent Variables						
RBC	1.000					
Independent Variables						
STATE	−0.166***	1.000				
FOREIGN	−0.001	−0.142***	1.000			
Control Variables						
LNSIZE	−0.141***	0.271***	0.240***	1.000		
DER	−0.544***	0.144***	0.230****	0.230***	1.000	
FIRMRISK	0.277***	−0.105**	−0.145***	−0.176***	−0.395***	1.000

Notes: Standard errors *, **, *** indicate significance at 10%, 5%, and 1%, respectively.

The STATE and FOREIGN variables are negatively correlated with the dependent variable (RBC). This provides preliminary evidence indicating that the greater the government and foreign ownership, the lower the solvency. Likewise, there is a negative correlation between RBC and company size and liabilities. Meanwhile, RBC has a positive correlation with the FIRMRISK sample. Furthermore, the correlation coefficient between the control and independent variables does not indicate a multicollinearity problem as indicated by a coefficient value not greater than 0.9.

Table 4 presents the estimation of two models to identify the factors that determine the solvency of the sample companies using the fixed effect panel regression model or the fixed effect model (FEM). FEM can cover the weaknesses of the Common effect model (CEM) related to the incompatibility of the model with the actual situation or the inability to show differences between units of observation. FEM will produce an unbiased estimate of β (Clark & Linzer, 2012). Moreover, the results of the Hausman test show that FEM is better than the Random effect model (REM).

The parameters in this research model are able to explain the RBC variation of > 80% for both the entire sample (column 1) and sub-samples (column 2 and column 3). Column 1 of Panel A and Panel B is the regression result of all samples throughout the study period (2016–2022). Panel A, Column 2, uses data or a sample of risk-based (re)insurance companies. In contrast, Column 3 describes the regression results from a sample of (re)insurance companies that are not based on climate change risk. Panel B divides data based on the normal period (Column 2) and the COVID-19 Pandemic period (Column 3).

Government ownership (STATE) in this research did not significantly influence the solvency (RBC) of insurance companies for all samples and sub-samples (see Panels A and B). This is thought to be influenced by the low variation in data on the level of government ownership, which is only 3 out of 58 samples (5.17%). In this case, all

samples of state-owned insurance companies have climate change-based insurance. Panel A, Column 3, cannot report the STATE variable in the results of the regression exam. This finding indirectly confirms that government ownership contributes greatly to developing climate-based insurance products. However, the government has not been successful in influencing financial health performance using this product. If the normal period and the COVID-19 period (Panel B) are differentiated, government ownership has no different effect on the solvency of companies (re)insurance in Indonesia. State owned companies are accused of being inefficient business entities that are mostly influenced by the orientation of the establishment of SOEs as non-profit companies so that they do not work optimally to improve their performance. In line with Quynh et al. (2022), there is a "social view" that state-owned enterprises 'may have been established by benevolent social planners to pursue industrial policies. In addition, the appointment of SOE shareholders plays a small role in accelerating capital structure adjustments when the company's capital structure falls (Wang et al., 2023).

Table 4 Regression estimation results

Panel A – Effect of Climate Change Risk

Variables	Proposed effect	1	2	3
		All samples	CRBI samples	Non-CRBI samples
C		−0.640	5.351**	−1.918
STATE	−	2.263	-1.199	
FOREIGN	+	1.396**	3.479*	−0.222
lnSIZE		0.213*	-0.231**	0.340
DER		−0.505***	−0.459***	−0.435***
FIRMRISK		2.618***	3.050***	2.011***
Adjusted R-Square		0.809	0.991	0.885
Prob(F-Statistic)		0.000	0,000	0.000
N.Obs		405	173	232
Dummy years		yes	yes	yes

Panel B – Effect of COVID-19

Variables	Proposed effect	1	2	3
		All period (2016-2022)	Normal period (2016-2019)	COVID-19 period (2020-2022)
C		−0.640	−5.351***	4.114
STATE	-	2.263	5.539	16.580
FOREIGN	+	1.396**	0.095	4.302*
lnSIZE		0.213*	0.634***	−0.286***
DER		−0.505***	−0.668***	−0.133**
FIRMRISK		2.618***	1.470***	4.014***
Adjusted R-Square		0.809	0.935	0.966
Prob(F-Statistic)		0.000	0,000	0.000
N.Obs		405	232	173

Notes: Standard errors *, **, *** indicate significance at 10%, 5%, and 1%, respectively.

The amount of foreign ownership (FOREIGN) has a positive and significant effect of 5 percent on the RBC level of general (re)insurance companies (Panel A and Panel B Column 1). A positive and significant effect (with a 10% level) also occurs in the sample of climate change-based general (re)insurance companies (Panel A Column 2) and general (re)insurance companies in the COVID-19 period (Panel B Column 2). This result is in line with the hypothesis that foreign ownership can provide better control. The experience of foreign investors in climate change-based insurance has been able to encourage management to mitigate risks and identify better opportunities. In line with the findings of Borin & Mancini (2016); Bykova & Jardon (2018); Ren et al. (2022), which generally show that foreign investment plays a role in improving business performance. In addition, foreign financial institutions gain strong support and experience from the parent company. It relies heavily on substantial financial support when developing its structure and operations in the domestic market from its parent company, especially if the foreign company is a representative of a strong international financial group (Riabichenko et al., 2019; Karyani & Agusman, 2024).

Company size (SIZE) as a control variable in this research shows a positive and significant effect on the RBC of general (re)insurance companies and under normal conditions (one percent significance level). In general, insurance companies are in good condition if they have high assets or liquidity, which indicates the ability to pay good claims (Caporale et al., 2017). de Haan & Kakes (2010) also state that large total assets will be more flexible for insurance companies for operational activities and bear risks under normal conditions.

However, in abnormal conditions (COVID-19) and when climate change is uncertain, higher assets have a negative and significant effect on RBC at the significance level. The inability to manage assets during uncertain climate change and crisis times (economic downturn during COVID-19) will worsen for large asset companies. Large assets also indicate greater potential losses (claims) in the future (Caporale et al., 2017). Thus, stronger and more reliable risk mitigation is needed to minimize the side effects of this size. Contrary to the findings of Chache et al. (2020) that insurance companies that need sufficient risk-based capital should consider their size especially in times of crisis. This is aimed at ensuring financial stability and protecting themselves from uncertain conditions.

As a control variable, the debt level ratio (DER) is consistently significant in relation to RBC for the entire sample and sub-sample. This result is in line with the argument stating that large debt will increase financial stress, reducing the firm's ability to withstand crisis conditions. The level of corporate risk (FIRM RISK), which in this case is measured through the ratio of investment to total assets, shows a positive and significant effect on solvency for all samples, both whole samples and sub-samples. Projects that invest highly will increase income or investment returns and increase profits. Increased profits can be used by (re)insurance companies to pay their long-term liabilities.

CONCLUSION

Extreme climate change is an important risk factor to be mitigated by industry. This paper analyzes the effect of climate-based insurance products and ownership on the solvency of (re)insurance companies. The results show that government ownership has no effect on solvency, while foreign ownership has a positive effect on the solvency of (re)insurance companies, especially insurance based on climate change risk and during the COVID-19 pandemic. Several limitations of this study need to be accommodated for future research. First, the low variation of government ownership data can distort the research conclusions. Therefore, it is recommended that future research increase data variation by using and comparing cross-country studies. Future research

can also include other ownership characteristics, such as public ownership and family ownership. Second, the measurement of climate-based insurance products is calculated using dummy variables. Future research can be improved by looking at the number of product variations. Third, it is recommended to conduct additional analysis or robustness with a lagged variable test or endogeneity test.

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REFERENCES

Andersson, M., Baccianti, C., & Morgan, J. (2020). Climate change and the macro economy. *European Central Bank Occasional Paper series, No. 243*. Available at: https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op243~2ce3c7c4e1.en.pdf

Bachir, M., Gokhale, N., & Ashani, P. (2019). *Climate risk: Regulators sharpen their focus*. Deloitte Center for Financial Services. Available at: https://www2.deloitte.com/content/dam/Deloitte/us/Documents/financial-services/us-fsi-climate-risk-regulators-sharpen-their-focus.pdf

Batten, S. (2018). Climate change and the macro-economy: a critical review. *Bank of England working papers 706*, Bank of England. https://dx.doi.org/10.2139/ssrn.3104554

Borin, A., & Mancini, M. (2016). Foreign direct investment and firm performance: an empirical analysis of Italian firms. *Review of World Economics, 152*, 705–732. http://dx.doi.org/10.1007/s10290-016-0255-z

Bykova, A., & Jardon, C. M. (2018). The mediation role of companies' dynamic capabilities for business performance excellence: Insights from foreign direct investments. The case of transitional partnership. *Knowledge Management Research & Practice, 16*(1), 144–159. http://dx.doi.org/10.1080/14778238.2018.1428070

Caporale, G. M., Cerrato, M., & Zhang, X. (2017). Analysing the determinants of insolvency risk for general insurance firms in the UK. *Journal of Banking & Finance, 84*, 107–122. https://doi.org/10.1016/j.jbankfin.2017.07.011

Chache W. O., Mwangi, C. I., Nyamute, W., & Angima, C. (2020). Risk-Based Capital and Investment Returns of Insurance Companies in Kenya: Moderating Effect of Firm Size. *European Scientific Journal, 16*(31), 227–244. https://doi.org/10.19044/esj.2020.v16n31p227

Cheong, A., Yoon, K., Cho, S., & No, W. G. (2021). Classifying the contents of cybersecurity risk disclosure through textual analysis and factor analysis. *Journal of information Systems, 35*(2), 179–194. http://dx.doi.org/10.2308/ISYS-2020-031

Clark, T. S., & Linzer, D. A. (2015). Should I Use Fixed or Random Effects?. *Political Science Research and Methods, 3*(2), 399–408. 10.1017/psrm.2014.32

Day, A. (2023). *Climate changed ranked biggest risk facing reinsurers: PwC*. Insurance Insider. Available at: https://www.insuranceinsider.com/article/2c5yu4t8uu7e2z9oedcsg/reinsurers-section/climate-change-ranked-biggest-risk-facing-reinsurers-pwc

de Haan, L., & Kakes, J. (2010). Are non-risk based capital requirement for insurance companies binding?. *Journal of Banking and Finance, 34*(7), 1618–1627. http://dx.doi.org/10.1016/j.jbankfin.2010.03.008

Diantini, N. Y. A., Darmayanti, N. P. A., & Candraningrat, I. R. (2023). Green Investing, Environmental Performance, and Firm Valuation: Evidence from Indonesia. *Indonesian Journal of Sustainability Accounting and Management, 7*(2), 329–343. https://doi.org/10.28992/ijsam.v7i2.724

Djalante, R., Garschagen, M., Thomalla, F., Shaw, R. (2017). Introduction: Disaster Risk Reduction in Indonesia: Progress, Challenges, and Issues. In *Disaster Risk Reduction in Indonesia* (pp. 1–17). Cham: Springer. https://doi.org/10.1007/978-3-319-54466-3_1

Estiningtyas, W. (2015). Agricultural insurance based climate index: Farmers empowerment and protection option towards climate risk. *Jurnal Sumberdaya Lahan, 9*(1), 51–64. Available at: https://media.neliti.com/media/publications/140190-ID-asuransi-pertanian-berbasis-indeks-iklim.pdf

Fahlevi, H., Indriani, M., & Oktari, R. S. (2019). Is the Indonesian disaster response budget correlated with disaster risk?. *Journal of Risk Disaster Studies, 11*(1), 1–9. https://doi.org/10.4102/jamba.v11i1.759

Kahn, M. E., Mohaddes, K., Ryan N. C. N., Pesaran, M. H., Raissi, M., & Yang, J. (2019). Long-term macroeconomic effects of climate change: A cross-country analysis. *IMF Working Paper No. 2019/215*. Available at: https://www.imf.org/-/media/Files/Publications/WP/2019/wpiea2019215-print-pdf.ashx

Karyani, E., & Agusman, A. (2024). Risk Transmission of Bank Foreign Subsidiary: Evidence from ASEAN Emerging Countries. *Etikonomi, 23*(1), 129–146. https://doi.org/10.15408/etk.v23i1.32703

Kusuma, A., Jackson, B., & Noy, I. (2018). A viable and cost-effective weather index insurance for rice in Indonesia. *The Geneva Risk and Insurance Review, 43*(2), 186–218. https://doi.org/10.1057/s10713-018-0033-z

Li, K.-F., & Liao, Y.-P. (2017). The effect of directors' and officers' insurance on audit fees: The case of an emerging economy. *Asian Review of Accounting, 25*(2), 174–190. https://doi.org/10.1108/ARA-04-2016-0045

Mughron, M. M., Hariani, D., & Djumiarti, T. (2016). Efektifitas Badan Penanggulangan Bencana Daerah (BPBD) Dalam Pelaksanaan Program Kelurahan Siaga Becana Di Kota Semarang. *Journal of Public Policy and Management Review, 5*(1), 1–8. https://doi.org/10.14710/jppmr.v5i1.10317

Nobanee, H., Dilshad, M. N., Abu Lamdi, O., Ballool, B., Al Dhaheri, S., AlMheiri, N., Alyammahi, A., & Alhemeiri, S. S. (2022). Insurance for climate change and environmental risk: a bibliometric review. *International Journal of Climate Change Strategies and Management, 14*(5), 440–461. https://doi.org/10.1108/IJCCSM-08-2021-0097

Pradnyani, N. L. P. S. P., Suartana, I. W., Sari, M. M. R., & Budiasih, I. G. A. N. (2023). Implementation of Corporate Governance on Environmental Performance and Bank Risk in Indonesia. *Indonesian Journal of Sustainability Accounting and Management, 7*(2), 518–526. https://doi.org/10.28992/ijsam.v7i2.986

PricewaterhouseCoopers (PwC). (2024). Cyber and digital technology risks are a key concern for businesses and risk leaders, even as 60% see GenAI as an opportunity. Available at: https://www.pwc.com/id/en/media-centre/press-release/2024/english/pwc-global-risk-survey-2023.html

Qiu, J. (2020). Pandemic risk: Impact, modeling, and transfer. *Risk Management and Insurance Review, 23*(4), 1–12. https://doi.org/10.1111/rmir.12160

Quynh Le, H. N., Nguyen, T. V. H., & Schinckus, C. (2022). Bank lending behaviour and macroeconomic factors: A study from strategic interaction perspective. *Heliyon, 8*(11), 1–16. https://doi.org/10.1016/j.heliyon.2022.e11906

Ren, S., Hao, Y., & Wu, H. (2022). The role of outward foreign direct investment (OFDI) on green total factor energy efficiency: Does institutional quality matters? Evidence from China. *Resources Policy, 76*, 102587. https://doi.org/10.1016/j.resourpol.2022.102587

Riabichenko, D., Oehmichen, M., Mozghovyi, Y., & Horsch, A. (2019). Ownership structure and risk profile of banks in emerging economies. *Risk Governance and Control: Financial Markets & Institutions, 9*(3), 46–65. http://doi.org/10.22495/rgcv9i3p4

Ruza, C., de la Cuesta-González, M., & Paredes-Gazquez, J. (2019). Banking system resilience: An empirical appraisal. *Journal of Economic Studies, 46*(6), 1241–1257. http://dx.doi.org/10.1108/JES-06-2018-0199

USAID. (2017). *Climate Risk Profile: Indonesia*. United States Agency for International Development. Available at: https://www.climatelinks.org/resources/climate-risk-profile-indonesia

Wang, J., Hu, Y., Liao, F., & Xu, S. (2023). Governance of non-state-owned shareholders and corporate capital structure decision: A mechanism test from the opportunistic behavior of management. *PLoS ONE, 18*(1), 1–18. https://doi.org/10.1371/journal.pone.0281120

Woetzel, J., Tonby, O., Krishnan, M., Yamada, Y., Sengupta, S., Pinner, D., Fakhrutdinov, R., & Watanabe, T. (2020). *Climate risk and response in Asia*. McKinsey Global Institute. Available at: https://www.mckinsey.com/capabilities/sustainability/our-insights/climate-risk-and-response-in-asia

World Economic Forum. (2024). *The Top Global Risk report 2024*. World Economic Forum. Available at: https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2024.pdf

Zeitun, R. & Tian, G. G. (2007). Does ownership affect a Firm's performance and default risk in Jordan?. *Corporate Governance: International Journal of Business in Society, 7*(1), 66–82. https://doi.org/10.1108/14720700710727122