



The Impact of Climate Related Risks on Financial Stability: A Global Economic and Financial Perspectives

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ABSTRACT

Studies related to the influence of climate risk on financial stability have been conducted, but rarely explore the gap of how climate change, both from the transition risk, physical risk, and opportunities derived from the efficiency of resources and energy sources needed for the company. Climate-related risks have not been empirically explored or discussed to date. Institutional theory is employed to determine what factors affect the financial stability gap regarding climate-related risks. The test was conducted quantitatively with 548 samples, where the data was collected from the data of companies listed on the Indonesia Stock Exchange. The results exhibited that climate-related risk harms financial stability, while size is able to mediate the relationship between climate-related risk and financial stability. The results display increased adaptation costs or losses due to climate change, such as costs incurred to mitigate climate-related transition risks in technology, reputation, markets, and policies and regulations. The practical implication of these results is that companies must implement proactive measures to manage climate-related risks. Companies, particularly those in sectors vulnerable to climate change, such as mining, agriculture, or manufacturing, must administer resources to mitigate the negative impacts of climate risks. Meanwhile, small companies can consider cooperation and collaboration to improve their operations, which may strengthen their financial stability in facing risks.

Keywords: Climate-related Risk, Size, Financial Stability, Institutional Theory

JEL Classifications: Q56, F64, P47

1. INTRODUCTION

Most major corporations worldwide have upscaled sustainability-related investments in the past year as CEOs become more concerned about the impact of climate change on business and focus on the tangible business benefits and opportunities presented by climate and sustainability initiatives.

Physical and transition risk mechanisms may contribute to the rising frequency of economic damages and bank credit risk. Transition risk is the result of solid market volatility caused by the impact of climate policies (Liu et al., 2021), while according to Cheng et al. (2023), transition risk broadly refers to the risks faced in the transition from a high economy to climate-related regulatory policies. However, companies with low profitability are

more responsive to climate change (Oguntuase, 2020). Thus, an imbalance arises where policies should not be merely in the form of climate-related regulations. However, risk and risk mitigation actions in the form of reporting are crucial, so the existence of new IFRS S1 and S2 regulations may affect the company's financial stability.

The Paris Agreement sets a goal to limit average global warming to 2 degrees Celsius by 2100 and seeks efforts to limit further warming to 1.5 degrees Celsius. Accounting for GHG emissions is the first step towards achieving the Paris Agreement. Organizations that emit GHGs need to account for them before they can start mitigating them. To do this, organizations must first build a GHG inventory to understand what GHGs they emit, how much, and from which sources.

Climate change may adversely affect the financial stability of companies with low capital (Le et al., 2023; Talbi et al., 2024). Inconsiderable commitment to the environment (Ben-Amar et al., 2022). The unpredictability of changing climate policies (Ge et al., 2024). Nevertheless, climate change can present opportunities for products and resilience (Fabris, 2020). Therefore, it is pivotal to study climate change from transition risks, physical risks, and opportunities derived from the efficiency of resources and energy sources needed for companies. Overcoming the potential negative impact on financial stability due to climate change requires the contribution of the government and financial institutions that aim to increase capacity in measuring and implementing climate-related risks. In addition, there is a requirement to strengthen regulation and transparency on sustainable investments that support the transition to a low-carbon economy, such as renewable energy and technological innovation.

In addition, climate change regulation and risk mitigation actions in developing countries are voluntary; for instance, in India, managing transition risks and financial professionals are not independent (Colenbrander et al., 2023). Indonesia's economic growth follows the long-term trajectory of developing countries, where economic growth tends to be slower (Ben-Amar et al., 2022). Yet, no studies examine how to strengthen innovation in the financial sector through the sustainable development of climate change, such as how to integrate climate risk into monetary policy and how to model companies that are exposed to climate-related risks.

Climate policies can hinder economic growth, increase financial fragility, and negatively impact financial stability due to the measurement of three main climate scenarios designed by the 4NGFS for the financial sector: Current Policy Scenario, Delayed Transition Scenario, and Net Zero 2050 (Ge et al., 2024). Despite that, the policy regulation of climate-related risk in IFRS S1 may minimize the weaknesses of policies implemented in developing countries. COVID-19 is categorized as a physical risk in climate change risk. Government focus, developed countries accelerate the energy transition, developing countries balance economic growth and sustainability - equalize post 2030.

Conversely, with climate-related risks, both transition risks and physical risks and their relationship to financial stability, what is the role of institutional theory development in this context?

In answering the question, it is essential to review some previous research, where this theory can contribute to understanding how financial institutions respond to regulatory, social, and market pressures to manage increasing climate risk, ESG reporting standards, and sustainability policies, as well as social norms that demand more environmentally responsible business practices, encouraging financial institutions to adapt and integrate climate risk into strategy. Meanwhile, as attested by (D'Orazio and Popoyan, 2019), the current inadequate international policy and regulatory framework will adversely affect climate-related risks, and it will be challenging to provide understanding to businesses for risk mitigation action efforts.

Corporate stability is paramount in measuring corporate sustainability; hence, responding positively and quickly to systemic risk is imperative, aligning financial stability objectives with climate-related risk objectives (D'Orazio and Popoyan, 2019; Fundji, 2024). Beyond that, climate sentiment and transition risks can yield trade-offs for financial stability, so a credible policy framework that builds trust is needed (Dunz et al., 2021).

Another aspect that might need to be developed within the institutional theory framework to explain CRR and financial stability is where the theory adapts to changes in regulations, social norms, and market pressures in the long term. At that point, a company is allowed to emulate successful risk mitigation practices following regulatory pressures and respond to the development of innovations in climate risk management or green investment opportunities that will aim to support the financial stability of a company.

Thus, the question of whether there is potential for implementing climate-related risks to affect financial stability or financial stability in the context of climate-related risks in companies listed on the Indonesia Stock Exchange is expected to be a novelty in this study. Additionally, size acts as an intermediary factor influencing the correlation, so this research is a breakthrough in academic studies that has rarely been studied before. Based on the above considerations, this study aims to determine the effect of climate-related risks with size mediating the relationship in influencing financial stability in its application in the context of companies in Indonesia.

2. LITERATURE REVIEW AND HYPOTHESIS

The literature on institutional theory suggests that a firm not solely mobilizes resources but must ensure and respond to accountability and transparency in resource use (Lopes and Albuquerque, 2023). With regard to climate risk, many firms are currently ignorant of their exposure to physical climate risk, which leads to significant financial losses. Therefore, they may adopt innovative methodologies for risk assessment in corporate finance models (Bressan et al., 2022).

This theory enables an understanding of how financial institutions respond to regulatory, social, and market pressures to manage increasing climate risk. ESG reporting standards and sustainability policies, as well as social norms demanding more environmentally responsible business practices, push financial institutions to adapt and integrate climate risk into their strategies.

In emerging markets, companies are focusing on alternative financing through investments in climate finance to support strategies. This perspective is in line with the necessity for companies to engage in investment strategies that mitigate risks due to the adverse impacts of climate change on food security and other sectors (Janssens et al., 2020). The interaction between financial regulation and climate-related risk management may be critical to maintaining financial stability. The subsequent framework explains the relationship between regulation, environmental pressure, normative pressure, and institutional consequences formed in institutional theory.

Climate-related risks are associated with climate change and its impacts on different sectors, systems, or assets. These risks include risks arising from physical changes such as extreme weather, sea level rise, and changes in precipitation patterns, as well as transition risks associated with the shift towards a low-carbon economy, such as policy changes, technological advances, and market changes.

Figure 1 shows multi-case study approach and adopting an Institutional Theory lens, the researchers assess whether the pandemic is likely to strengthen or weaken institutional pressures for climate change risk disclosure and predict how climate-related risk reporting may evolve post-pandemic (Ben Amar and Sayadi, 2022). Unlike companies in regions more affected by coercive isomorphism, such as Europe, which face higher institutional pressure to demonstrate climate change efforts to gain legitimacy and better climate change governance performance (Monasterolo, 2020).

Climate change risks also affect energy prices, which are prone to volatility. Energy systems incur losses due to system disruptions and high financial support needs for the recovery process. Climate change disruptions require financial support to ensure climate change disaster risk financing (Pujiwati et al., n.d.). Meanwhile, countries facing greater transition risks due to climate change tend to face higher bond yields (Cheng et al., 2023).

Concurrently, (Liu et al., 2021) assert that climate risk negatively affects financial stability due to differences in economic development, financial development, and competition between countries so that the quality of good national governance can withstand the impact of climate risk on financial stability. Financial stability has a good impact on climate change, and it affects the balance sheet of financial institutions. Climate change poses a financial risk, and the outcome should be formulated into models to effectively manage these risks (Fabris, 2020).

From several of the literature and research findings, this study proposes the following research hypothesis:

H₁: The effect of climate-related risks on financial stability

H₂: The effect of size on financial stability.

3. METHODOLOGY

This study investigates the relationship between climate-related risk and size on financial stability. The research method used is quantitative, with a population consisting of companies. The samples were all companies listed on the Indonesia Stock Exchange, as many as 274 companies, with an observation period in 2021–2022, so the total sample used is 548. The data for this study were collected from the companies' financial statements.

Financial stability utilizes the debt-to-asset ratio. The debt-to-asset ratio can demonstrate the extent to which a company's assets can be financed by debt, meaning the extent to which the company's assets are funded by creditors compared to those financed by shareholders. Companies with a healthy capital structure may have a moderate ratio, indicating a better ability to withstand unstable financial conditions or economic crises (Bracking and Leffel, 2021; Ozili, 2020).

The measurement used in the disclosure of climate-related risk is related to debt service coverage (EBIT/interest expense) since the direct impact of climate-related risk is a company's operating income. If a company faces operational disruptions due to climate change, the ability to pay debt may be disrupted (Defina, 2021; Oguntuase, 2020). Size is measured using Ln total assets.

Data analysis was undertaken using STATA's linear regression method to determine the extent to which the independent variables, namely Climate-related risk, size, and the financial stability application. In addition, descriptive statistical analysis was conducted to describe the data distribution of the variables, including the mean and variation between firms in the sample. The results of this study are expected to provide an understanding of how climate-related risk affects financial stability.

4. RESULTS AND DISCUSSION

Before assessing the impact of climate-related risk and Size on Financial stability, the analysis begins by examining the linear relationships between climate-related risk and Size on Financial stability, as well as between climate-related risk and Size on Financial stability.

According to figure 2 the majority of the data appears to be centered in the range of values between 0 and 60, with a few higher-valued outliers. This distribution is significantly tilted to the right, indicating that the majority of companies have a financial stability score of less than 60. This suggests that the vast majority of organizations in the sample face minimal climate-related risks, with only a handful facing severe risks. This distribution is more regular, with ESG ratings ranging from 40 to 80, showing that most organizations' ESG performance is about in the middle, albeit there is significant variety within the sample.

Table 1 reveals that 548 samples were used. The average value of climate-related risks obtained was 1.41, with a total standard deviation of 2.58, indicating considerable variation in the

Figure 1: Institutional theory framework

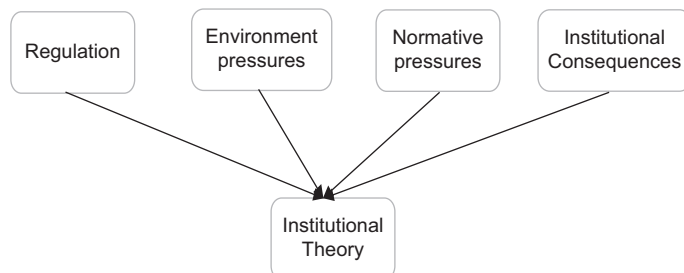
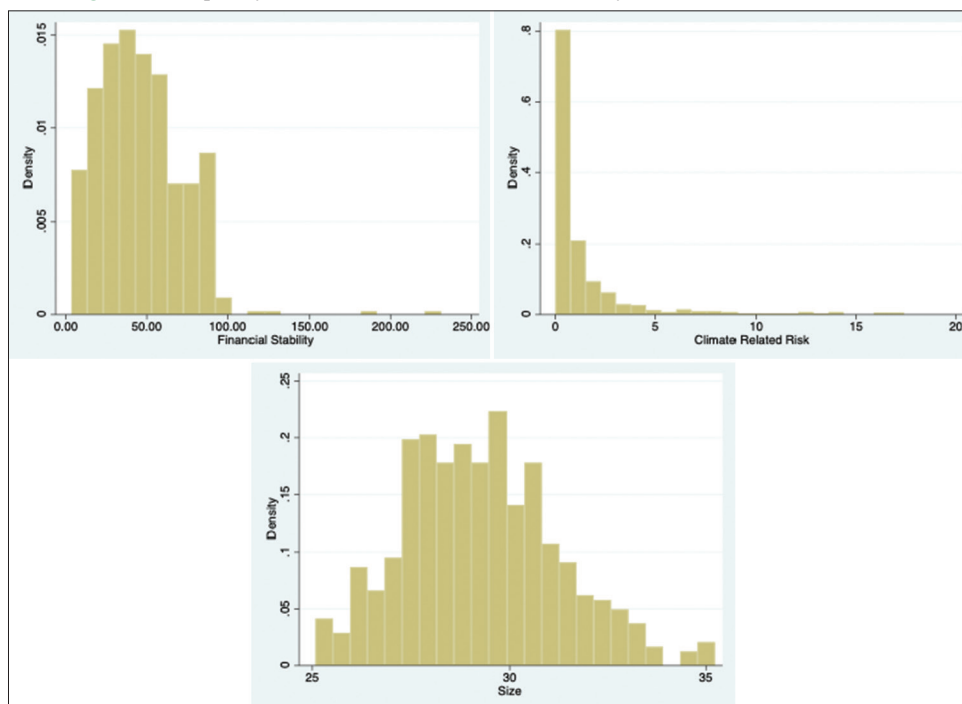


Table 1: Descriptive statistical testing

Variable	Obs	Mean	SD	Min	Max
Climate Rel-k	548	1.411543	2.580885	00128	17.39427
Financial Stability	548	46.4159	25.73566	3.266091	231.1944
Size	548	29.27038	1.961621	25.08115	35.22819

Table 2: Multiple regression statistical testing

Financial Stability	Coef.	SE	t	P>t	95% Conf.	Interval
Climate Related Risk	-1.611114	0.3827152	-4.21	0.000	-2.362891	-0.859336
Size	5.354294	0.5035347	10.63	0.000	4.365187	6.3434

Figure 2: Frequency data distribution of financial stability, climate-related risks and size

climate-related risk data. The sample value of financial stability was found to be widely spread, ranging from 3.27 to 231.19.

The F statistical value denotes the overall model significance test, with an F value of 67.74 and $\text{Prob} > F = 0.0000$, which signifies that the regression model significantly explains the variation in the data at the 1% significance level. This result implies that the independent variables in the model collectively have a significant relationship with the dependent variable.

However, the R-squared value of 0.1991 indicates that the model can describe only 19.91% of the variation in the dependent variable, while the rest (80.09%) cannot be justified by the independent variables used. The Adjusted R-squared of 0.1962 reflects a modest reduction, accounting for the number of predictor variables, yet still suggest that the model has limited predictive ability.

Derived from Table 2, it can be inferred that climate-related risk has a coefficient of -1.611114, meaning that each one-unit increase in climate-related risk is associated with a 1.61-unit decrease in financial stability, with a profoundly high significance level ($p\text{-value} = 0.000$). The 95% confidence interval points that this negative effect falls from -2.362891 to -0.859336. On the other hand, the Size variable has a significant positive effect on financial stability, with a coefficient of 5.354294. This result denotes that the larger the firm size, the higher the financial stability, with a one-unit increase in size associated with an increase in financial

stability of 5.35 units. Overall, the model indicates that climate-related risk has a negative impact on financial stability, while firm size contributes positively to stability.

5. DISCUSSION AND CONCLUSION

This study aims to examine the effect of climate-related risks and size on financial stability, climate-related risks consist of transition and physical risks. Transition risks are divided into several components, namely regulatory and regulatory risks, technology, market, and reputation, while physical risks are divided into acute and chronic risks. Financial stability occurs due to several factors; climate-related risk factors are the main ones in this study; the test results show that climate-related risks impair financial stability. The negative effect of climate-related risks on Financial Stability reflects that increasing climate-related risks have an impact on the financial stability of companies, which may be caused by increased adaptation costs or losses due to climate change, for instance, costs incurred to mitigate climate-related transition risks in the form of technology, reputation, markets or policies and regulations. It is in line with research (Cheng et al., 2023), which states that countries facing more significant transition risks due to climate change tend to face higher bond yields, financial markets, and investors take transition risks into account when making investment decisions. Therefore, although Indonesia's economic growth follows the long-term trajectory of developing countries, where economic growth tends to be slower as the economy advances. (Liu et al., 2024) stability due to differences

in economic development, financial development, and competition between countries. Therefore, good national governance quality can withstand the impact of climate risk on financial stability. If there is a disorderly low-carbon transition, more robust market conditions enable achieving more ambitious climate policies at the same level of financial risk (Roncoroni et al., 2021).

However, size affects financial stability as larger companies have a better capacity to face risks and maintain their financial stability through economies of scale, and from broader access to capital, they have better risk capabilities. Of course, companies with larger sizes tend to have more reliable resources to manage uncertainty over climate-related risks. The results of this study align with (Le et al., 2023) which states that the negative impact of climate risk on company size where smaller companies and companies with low capital. In addition, it was found that better institutional governance, bank supervision, and regulation harm climate risk. Besides, large companies can manage debt more effectively, reducing financial difficulties and risk (Muigai and Muriithi, 2017), stable economic growth is pivotal for maintaining financial health (Wijaya, 2023).

On the other hand, small companies often face notably significant challenges and ultimately damage their financial stability. For example, micro companies are not too exposed to financial and foreign markets, but micro companies are vulnerable to impacts due to limited resources (Ferreira and Saridakis, 2017), not only micro businesses but MSMEs may also have difficulty in terms of financial resilience due to increasing borrowing costs and inflation (Msomi, 2023).

From the explanation above, it can be concluded that with the large number of companies in Indonesia on a small scale, some policies and regulations can minimize climate-related risks, ultimately stabilizing finances for both small and large companies. The role of the government is highly needed to respond to policies and regulations so that companies possess sufficient innovation to mitigate climate-related risks.

6. IMPLICATIONS AND LIMITATION

The practical implication of these results is that companies must execute proactive measures to manage climate-related risks. Companies, especially those operating in sectors vulnerable to climate change, such as mining, agriculture, or manufacturing, need to allocate resources to mitigate the negative impacts of climate risk. At this time, financial conditions, especially in Indonesia, are influenced by multiple uncertainties. Every company should mitigate risks, specifically climate-related risks. For large companies, risk-based technological innovation is essential and continues to be pursued, then enhance climate risk management strategies, increase investment in environmentally friendly technology, and develop infrastructure that is more resilient to climate change risks (Chaudhury, 2020).

Small companies can consider cooperation and collaboration to improve operations, which are expected to strengthen financial stability in dealing with risks (Oguntuase, 2020). The role of

the government in implementing climate-related risks lies in the direction and objectives of policies and regulations. The Indonesian government has issued many policies and regulations to address climate risk, primarily through the National Action Plan for Climate Change (RAN-PI). In addition, Indonesia is committed to reducing greenhouse gas (GHG) emissions by 29% on its own or up to 41% with international assistance by 2030 following the Paris Agreement, although policies and regulations such as Taskforce climate disclosure and global reporting initiative. GHG protocol (Institute for Sustainable Finance, 2022). In Indonesia, the policy on risk mitigation actions is supported by regulations from the Ministry of Environment on Environmental Assessment Ratings (Siregar et al., 2019), Sustainability Development Goals (Doni et al., 2020).

This study practically contributes an in-depth picture in a broad perspective for the government, financial institutions, and the business sector to be more proactive with the impacts of climate change. By knowing and apprehending the impacts of climate risk, such as physical risks in the form of natural disasters, rising global temperatures, to the impact on the financial sector. Therefore, stakeholders can design the right mitigation strategy to minimize economic losses. Meanwhile, scientific contributions are expected to enrich the science of the relationship between climate-related risks and financial stability, especially in developing countries such as Indonesia, which are highly vulnerable to climate change. Although this study contributes to expanding the science of the relationship between climate-related risks and financial stability, which remains limited in the literature, this study has several limitations arising from variations in economic development, financial development, and competition among countries, particularly in developing nations such as Indonesia.

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