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**The 9<sup>th</sup> International Conference on Marketing and Retailing****TRANSFORMATIVE IMPACTS OF GREEN FINANCE ON CO2  
EMISSIONS AND BANK STABILITY**

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**Abstract**

Financial stability is paramount for economic growth, as most transactions in the real economy are made through the financial system. The true value of financial stability is best illustrated in its absence, in periods of financial instability. During these periods, banks are reluctant to finance profitable projects, asset prices deviate excessively from their intrinsic values, and payments may not arrive on time. Concerning the various empirical finding, the relationship between climate change and bank stability also needs to be considered with the implementation of green financing. Therefore, the purpose of this paper is to examine the mediating effect of green financing on the relationship between climate change and bank stability in ASEAN countries. This sample of this study consists of data from 10 countries in ASEAN country. The data analysis was conducted using data stretching from 2010 until 2019 and analysed based on Baron and Kenny's Step Approach. It is expected that the outcome of the study will prove the sustainability of the banking stability will continuously be stable with the injection role of green financing.

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## 1. Introduction

Bank stability describes the condition where the financial intermediation process functions smoothly and there is confidence in the operation of key financial institutions and markets within the economy. As a result, having a solid, stable, and healthy financial system is critical for the effective allocation of resources and risk distribution across the economy. Therefore, the main purpose of the central bank is to promote and maintain monetary and bank stability where it provides sustainable growth in our economy. The determinants of bank stability can be classified into two groups which are internal and external determinants as mentioned in the previous study by Malichová and Ďurišová (2015), Chen et al. (2017), Yahya (2017), Javaid and Alalawi (2018) and Robin et al. (2018). The internal determinants are sometimes called bank-specific factors and the external ones are called micro-economic determinants of banks' stability. Most of them use the following variable such as the size of the bank, liquidity risk, and credit risk as the factor of bank stability. However, there is less concern about the influence of climate change on financial stability or bank stability.

The ever-changing climate has become a challenge for modern economies not only in terms of their survival on earth but also their economic stability and financial stability. Based on Stern and Taylor (2007) believe that climate change will exacerbate the risk of financial transactions and threaten financial stability. Fabris (2020) indicated that climate change does not lead to any new type of risk in financial institutions but translates to the existing ones which are credit risk, market risk, and operational risk. Banks are the ones most exposed to it. For example, climate change could increase the sovereign risk that could further lead to deterioration in a country's credit rating, ultimately affecting the value of government securities held by the banks. In the meantime, operational risk in banks can occur as a result of jeopardized business continuity of a financial institution due to some extreme events such as a flood that would affect its operation. The empirical research on the relationship between climate change and financial stability can be divided into two categories. First, financial risks will rise as a result of climate disaster damages. Lambert et al. (2017) discover the effect of climate-related natural disasters on bank risk and find that natural disasters significantly increase the operational risk of banks in affected areas. Second, the ability of climate disaster losses or climate change to influence financial stability has still been debated by previous studies (Cavallo et al., 2013; Klomp, 2014; Murshed, 2021; Nand & Bardsley, 2020; Strobl, 2011). They argue that the impact of climate-related natural disasters on industrialised countries' economic development and financial stability is insignificant.

Despite the impact of climate change on bank stability the relationship between climate change and bank stability also needs to be considered with the influence of green financing. This is related to the study by Kamran et al. (2020) highlighting that the moderation effect of green financing significantly enhances bank stability in the case country of Malaysia and Thailand. At the same, Dafermos and Nikolaidi (2021) show that green support can reduce the physical risks since they were able to lower carbon emissions by increasing the credit availability for green investment and reducing the credit availability for carbon-intensive investment and even though the impact is quantitatively small but is reinforced when the green supporting factor are implemented simultaneously. Part of that, Dafermos et al. (2018) found that green QE is not by itself capable of preventing a substantial reduction in atmospheric temperature. However, the findings after 2018 showed a consistent insignificance impact of green

financing on banking stability. Therefore, the empirical findings have led this study to evaluate the role of green financing acting as a mediating variable between climate change and Bank Stability in ASEAN countries.

## 2. Problem Statement

The argument arises from the previous empirical studies on the influence of climate change on bank stability. Fabris (2020) points out that climate change can increase credit default which in turn could jeopardize the financial stability of any country. Climate change may cause a drop-in lending activity as a result of rising bad loans, resulting in slower economic development, decreased employment, and a negative impact on welfare. Moreover, Ilhan et al. (2020) figure out that weather catastrophes on Canadian stocks were found to be significant in the short term only, it is expected to be noticeable in the performance and risk of banks because the weather warming in Canada is twice the global warming. In addition, U-Din et al. (2023) used weather catastrophes as represent of climate change and the analyses of the study do not find a significant impact of the weather catastrophes on the performance of the Canadian banks.

Instead of explaining the impact of climate change on banking stability, there were numerous studies also have attempted to investigate the influence of green financing on banking stability. The study by Muganyi et al. (2021) that using the Semi-parametric Difference-in-Differences (SDID) found that China's green finance-related policies have led to a significant reduction in industrial gas emissions in the review period which can lead to the increased economic growth of the countries and the banking sector performance. Next, Ning et al. (2022) found a similar result analysis of the impact of green financing on China's banking stability by implementing the Morlet Wavelet Analysis technique. The empirical findings of the wavelet power spectrum reveal that green finance and banking stability is vulnerable in the short- and long-run analysis. However, some studies also found that green financing does not have predictive power for increasing bank stability in countries. Sharmeen and Yeaman (2020) that utilizing the PCB approach show that green financing is only suitable for Islamic country or Islamic baking operation only and it will not benefit the conventional bank operational.

Bank size is playing an important role in bank stability. The investigation done by Adusei (2015) has reported that the bank size and finding risk have a positive impact on bank stability. Moreover, Louati and Boujelbene (2015) use a stochastic frontier approach (SFA) to measure bank stability and figure out that bank size is a more sensitive variable toward Islamic banking compared to conventional banks in MENA and Southeast Asia. Besides, Ibrahim and Rizvi (2017) stated that the positive association between bank size and the financial stability of the banking sector due to the large banks have greater potential to achieve economies of scale because they have the resources to capably carry out intermediation, monitoring, pricing and diversification strategies. In addition, Chand et al. (2021) figure that bank size is a positive significance on the bank performance which implies that the larger operations bank of Fiji countries will be more stable and able to survive longer than the small operations bank.

Instead of explaining the impact of climate change on banking stability, there were numerous studies also have attempted to investigate the impact of credit risk on bank stability. The result of the study done by DeYoung and Jang (2016) figures out credit and liquidity risk are the two important factors

needed to be considered in the banking industry that can affect the survival of the bank. The finding was supported by Rashid and Jabeen (2016) that shows that credit risk measured by the ratio of loan loss provisions to net interest income can decrease the z-score in small banks in MENA countries. In addition, Zaghoudi (2019) found that there is no relationship between credit risk and bank stability which is represented by z-score return on equity. Amara and Mabrouki (2019) also found a similar result where the credit risk variable is a non-significant impact on Tunisian bank stability.

Liquidity risk has been widely used by other researchers as the determinant of bank stability. Rupeika-Apoga et al. (2020) who had carried out an analysis that analysed the determinants of bank stability based on Latvian banks. The result of the study shows that there is a negative significant impact of liquidity risk on Latvian bank stability. In addition, findings from Ly (2015) also confirm that liquidity risk has a negative relationship with bank stability based on the OL regression. Saif-Alyousfi et al. (2020) stated that the profitability and stability of the banking sector will be lower if the banking industry has low capitalization, liquidity and small size of firms and vice versa. These findings were supporting the result by Hakimi and Zaghoudi (2017) that found liquidity risk significant and a negative sign toward the Tunisian bank performance through the panel data method analysis. Lastly, Cucinelli (2013) pointed out that there is no relationship found between liquidity and bank stability in the long term period.

### **3. Research Questions**

The researcher has outlined a few research questions. The reason of these research questions is to make sure that the researcher is able to consistently focus on the climate change and green financing toward bank stability from the beginning until the end of this research and to help the researcher to achieve all the objectives that are set up in this research. Therefore, every specific research question must tally with every research objective. The research question can be defined as: Does green financing able give an impact on relationship between climate change and bank stability?

### **4. Purpose of the Study**

Concerning the various empirical finding, the relationship between climate change and bank stability also needs to be considered with the implementation of green financing. Therefore, the purpose of this paper is to examine the mediating effect of green financing on the relationship between climate change and bank stability.

### **5. Research Methods**

The period used in this panel data is 10 years ranging from 2012 to 2021 and most banking institutions in Malaysia implementing green financing in their product or services started in the year 2012. There are 10 commercial banks in Malaysia involved in this investigation. In this paper, the following panel regression model was formed to examine the link between bank stability as the dependent variable, with the independent variables which are climate change, organizational quality, bank size, credit risk and liquidity risk and mediating variable of green financing. This regression model is based on Kamran et al. (2020):

$$Z\text{-Score}_{it} = \beta_0 + \beta_1 \text{CO2}_{it} + \beta_2 \text{GF}_{it} + \beta_3 \text{GF}_{it} + \beta_4 \text{SIZE}_{it} + \beta_5 \text{LR}_{it} + \beta_6 \text{CR}_{it} + \epsilon$$

Where the z-score represents the dependent variable, which in this study will be based on the z-score return on asset and z-score return on equity. While the independent variable is present by CO2 (climate change), GF (green financing), SIZE (bank size), LR (liquidity risk), and CR (credit risk). Furthermore, this paper analyses the influence of green financing on the relationship between climate change and bank stability in Malaysia by implementing Baron and Kenny's Step. These basic mediating analyses are suggested by Baron and Kenny (1986). This analysis involves three types of regression such as X – Y, X-M and also the regression of X+M – Y, where x presents the dependent variable, M presents the mediating variable and Y is present of independent variables.

## 6. Findings

This study is examined how green financing can influence the relationship between climate change and bank stability in Malaysia. Table 1 below provides an overview data series of this study. Moreover, the parameters' mode, maximum, mean, standard deviation, minimum, and median are depicted by descriptive statistics. Based on table 1, shows that CO2 has a higher mean which is 7.40069 then followed by CR with a mean of 7.24290. Meanwhile, the Z-ROA, Z-ROE, GF, OQ, BS and LR have means of 5.61594, 3.02854, 00000.7, 0.20764, 269503 and 1.10424 respectively. According to Bacho et al. (2019) stated that the normality range is more than 2 but less than 3. Table 1 shows that only the Z-ROA is normal while the other is not normal and should be logged (ln) to be normal data.

**Table 1.** Descriptive Statistic

Variables	Means	SD	Min	Max	Skewness	Kurtosis
Z - ROA	5.61594	4.093651	-1.7086	14.2266	0.6313589	2.453302
Z - ROE	3.02854	45.80058	-195.776	220.9615	1.0093	13.85181
CO2	7.40069	0.298655	6.9932	7.8	-0.108733	1.429643
GF	00000.7	0.461148	0	1	-0.872871	1.761905
OQ	0.20764	0.126279	0.0295	.4113	0.0391722	1.66276
BS	269503	224427.1	39685.5	888172.4	1.126975	3.491094
CR	7.24290	1.143921	4.720601	10.47379	0.1146431	3.518867
LR	1.10424	0.018330	1.07309	1.16089	0.9825354	4.022621

**Notes:** CO2 -Climate Change, GF -Green Financing, OQ – Organizational Quality, BS – Bank Size, CR – Credit Risk, LR – Liquidity Risk

Furthermore, the correlation analysis has been conducted to identify the correlation between variables in all states and the result is shown in Table 2. The overall result shows that it was a weak correlation between bank stability and other variables. Bank size has the strongest correlation with the bank stability represented by z – roa, while the weakest correlation with z – roa is the organizational quality index. In terms of z-roe shows that organizational quality is the highest correlation, while the lowest correlation is green financing.

**Table 2.** Correlation between variables

	Z – ROA	Z – ROE	CO2	GF	OQ	BS	CR	LR
<b>Z – ROA</b>	1.000							
<b>Z - ROE</b>	-0.226	1.0000						
<b>CO2</b>	-0.118	-0.1241	1.0000					
<b>OQ</b>	-0.023	-0.1782	0.4163	1.0000				
<b>GF</b>	-0.089	-0.0284	0.6718	0.2535	1.0000			
<b>BS</b>	0.435	-0.0998	0.1345	0.1451	0.0595	1.0000		
<b>CR</b>	0.247	0.0817	-0.4338	-0.2669	-0.1491	-0.1629	1.0000	
<b>LR</b>	-0.059	-0.1574	0.4508	0.3414	0.1324	-0.0269	-0.8723	1.0000

**Notes:** CO2 -Climate Change, GF -Green Financing, OQ – Organizational Quality, BS – Bank Size, CR – Credit Risk, LR – Liquidity Risk

Table 3 below presents that the green financing index can reduce the impact of climate change on financial institutions and then improve the banking stability in Malaysia. The result of Table 3 shows that green financing, bank size, credit risk and liquidity risk have a direct effect on the z-score return on asset. Meanwhile, under z-score return on equity, the direct effect came from the variable of climate change, green financing, bank size and credit risk. At the same time, the regression from Table 3 also shows that green financing significantly has an indirect effect between climate change and banking stability which indicates that the mediating effect plays a significant role. The proportion of mediating effect in the total effect for z-score roa and z-score roe is 7.274% and 0.432% respectively. Therefore, the hypothesis of mediating effect has been verified, that is green financing can indirectly promote the improvement of banking stability through the reduction of climate change levels.

**Table 3.** Mediation Regression Analysis

	Z-ROA	Z-ROE
<b>Direct effect (Toward DV)</b>		
Constant	-510.2645 *** (146.5201)	5.050477 (15.57642)
CO2	-7.261758 (5.234122)	-1.831104 *** (0.5564084)
GF	-11.02831 *** (2.409703)	0.7272752 *** (0.2561606)
OQ	12.02247 (10.79134)	0.4840504 (1.147264)
BS	0.0000297 *** (0.0000482)	0.00000307 *** (0.000000512)
CR	4.413674 *** (1.906926)	0.386704 ** (0.2027243)
LR	496.0383 *** (123.484)	7.955388 (15.57642)
<b>Direct Effect (Toward MV)</b>		
Constant	-4.05697 *** (1.162579)	-2.06932 *** (0.67539)
CO2	0.6427738 *** (0.1569645)	0.42738*** (0.104345)
<b>Indirect Effect</b>		
<b>CO2 &gt; GF &gt; Z-Score)</b>	-7.274 *** (2.332)	-0.432 *** (0.184)
Conf. Interval	-12.381 , -3.143	-0.802 , -0.148

**Notes:** Figures in parentheses are robust standard errors (for variables only). \*\*\*, \*\* and \* denotes significance at 1%, 5% and 10% level, respectively.

## 7. Conclusion

This paper examines the effects of climate change and green financing on the banking stability in Malaysia. The main objective of this paper is to investigate the mediating effect of green financing on the relationship between climate change and banking stability. The empirical results adopting the panel analysis estimation suggest that green financing, bank size, credit risk and liquidity risk can influence banking stability if the banking stability is measured using z-score return on asset, while the climate change, green financing, bank size and credit risk have become a significant factor that influences the change of bank stability in Malaysia. At the same time, the results suggest that green financing has a mediating effect on the relationship between climate change and banking stability. Our results suggest that climate change has burdened the economic growth in the development of countries especially in the financial institutions' sector. We also conclude that the implementation of green financing as a tool in financial institutions or the banking sector is a good strategy to reduce the damage from climate change and automatically able to help the financial institutions to have a better performance in their banking stability which can help the growth development of the countries.

As for the practical implications, this paper suggests that green financing is an appropriate solution to generate health banking stability and reduce the burden of climate change issues. Specifically, the banking sector may implement green financing in all types of services or products especially in the loan term. Moreover, the government should work together with the central bank in promoting the development of green financing and discussing improving the green financing policy which can help reduce the damage of the rise of climate change issues.

Lastly, this study also has a few limitations. One of the limitations is the duration of the period of data which is from the year 2012 until 2021 only which leads to the problem of a short research time interval. In addition, the scope of the study is only focused on the impact on bank stability in Malaysia country which is not able to see the overall impact of green financing on developing countries especially Asia countries which more focus on the growth of development. Therefore, future researcher more recommended the extent of the time in order able analysis the mediation role of green financing whether it has a long-term relationship or a short-term period only.

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