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Capital Resilience in the Carbon Era: Bank Efficiency and Physical Risk Interaction in High-Income and Middle-Income Countries

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ABSTRACT

In an era with heightened financial uncertainty and an increase in climate risk shocks, the capital level of banks has become one of the crucial tools to increase depositor trust and promote long-term stability while remaining resilient. The study investigates the capital decision of Islamic and conventional banks across High-Income and Middle-Income countries over a period of 28 years. The study further examines the relationship between cost efficiency and bank capital across different level of physical risk exposure. The estimation using random effect model of cluster standard errors discloses a significantly positive relationship between transition risk, profitability, and economy with the capital level. Meanwhile, cost efficiency and bank size are negatively correlated with the capital level. The capital level of banks is found to be significantly different between crises and non-crisis periods, between bank specializations, and between country groups. Additionally, the findings reveal that physical risk negatively moderates the relationship between cost efficiency and bank capital, with the interaction effect being more pronounced for banks operating in high physical risk environments. Regulators are recommended to ensure both Islamic and conventional banks consistently uphold high capital level while implementing stricter monitoring on larger bank size to mitigate moral hazard.

Keywords: *banks, conventional banks, Islamic banks, physical risk, transition risk*

INTRODUCTION

The concern for building a sustainable world for future generations has become a global phenomenon that affects not just communities and government, but also the financial institutions. Banking institutions are highly exposed to climate-related risks, which related to the United Nations Sustainable Development Goal (SDG) 13, aiming to combat climate change. As a key intermediary that channels the funds from those with extra money to those who are in need of the money, banks need to ensure that they are resilient in managing any risks. Therefore, Basel Committee on Banking Supervision (BCBS) introduced capital

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adequacy ratio to enhance banks' stability by serving as a cushion in withstanding any unexpected financial distress. The Basel Committee on Banking Supervision (2021) highlights two distinct types of climate-related risk drivers that may affect the banking institutions, namely physical risk and transition risk. Following the BCBS, physical risk refers to weather- and climate-related hazards that can cause damage to economic activity and financial asset values. On the other hand, the transition to a low-carbon economy, which includes policy reforms, technological advancements, and structural market changes, gives rise to transition risk. The negative effect of climate risk on the financial stability of banks occurs through the transmission channels, where changes in the climate lead to financial risks for banks.

The severity of the climate risk exposures also varies by geographic location, as differences in climate patterns, environmental conditions, political frameworks, and public sentiment influence how risks materialize (Basel Committee on Banking Supervision, 2021). This study focuses on ten countries that are categorized as High-Income and Middle-Income following the country classification by the World Bank Group (2025). Empirical evidence from Dafermos (2023) highlights that Bangladesh banks are vulnerable to climate risk due to the rising occurrence and seriousness of climate catastrophes such as floods, cyclones, and others. Likewise, Duong and Ha (2024) reveal a negative impact of climate risk on the banking stability of 18 emerging countries. However, focusing only on 39 European countries, Bakkar (2023) asserts that increasing climate risk awareness among European banks resulted in a robust capital ratio when faced with high climate risk exposure, reflecting increased banking stability.

In addition, Islamic banks operate within the same intense market environment as conventional banks despite having a distinct operational framework. Founded upon Shariah principles, Islamic banks operate with an interest-free model, asset-backed transactions, and a risk-sharing mechanism. Meanwhile, conventional banks operate using interest-based financing with a risk transfer mechanism. Given the different operational frameworks between both banks, Islamic banks may exhibit unique strength and resilience in absorbing climate-related risk events. This point is supported by the consistently strong average capital adequacy ratio of global Islamic banks from the first quarter of 2020 to the third quarter of 2024. Figure 1 presents the global Islamic banks' average capital adequacy ratio for the years 2020Q1 to 2024Q3. A comparative analysis between Islamic and conventional banks may provide insights into assessing their ability to absorb shocks while remaining resilient in the face of intensifying climate risk.

Banking institutions are presumed to proactively play a role in supporting the development of sustainable goals while managing climate risk and maintaining adequate capital level to increase financial stability. In this context, the study is interested in investigating the capital decision of Islamic and conventional banks across HIMI countries spanning 28 years. The study contributes to the banking and finance literature by providing interesting insights related to the interaction effects of physical risk on the relationship between cost efficiency and capital level. This interaction highlights the moderating role of physical risk apart from the direct relationship. The findings might reveal intriguing results in the context of climate change, where banks must strategically allocate their capital level to maintain both stability and profitability in achieving a climate-resilient banking institution.

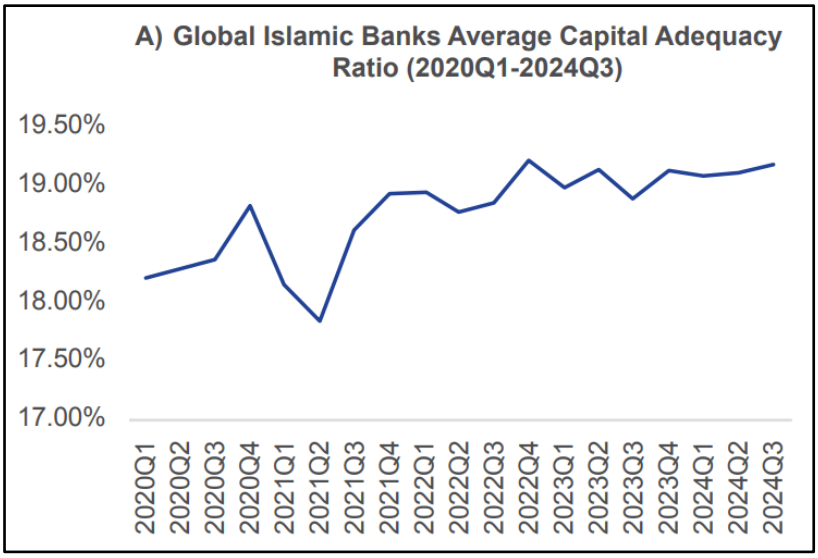

Figure 1: Global Islamic Banks' Average Capital Adequacy Ratio for the Years 2020Q1 to 2024Q3
Source: Islamic Financial Services Board (2025)

LITERATURE REVIEW

The Basel Committee on Banking Supervision (1988) first introduced the minimum of 8 percent capital ratio under Basel 1 in 1988 that must be consistently maintained always across all banking institutions. Basel I is later enhanced by incorporating risk-sensitive capital requirements with an emphasis on supervisory review and market discipline, known as Basel II. However, following the episodes of Lehman Brothers bankruptcy due to the GFC in 2007 to 2009, Basel III is introduced. Basel III aims at strengthening the capital ratios with higher minimum requirements and additional buffers such as the Capital Conservation Buffer (CCoB) and Countercyclical Buffer (CCyB). According to the Basel Committee on Banking Supervision (2010), the additional buffers are to improve banks' resilience during periods of financial stress. In short, bank capital serves as a security against any unexpected financial shocks by absorbing potential loan losses and enabling banks to continue operations while at the same time instilling confidence in the banking system. Nevertheless, the signaling hypothesis posits that banks uphold capital levels above the 8 percent capital to signal their financial soundness to the market. Therefore, well-capitalized banks tend to operate more prudently compared to undercapitalized banks.

Credit risk represents one of the significant threats in any banking institution. A positive correlation between credit risk and the capital level of banks is reported in most prior studies. Consistent with the risk absorption hypothesis, banks inject capital when there is a surge in the credit risk to increase the risk absorption capability against high financing risks (Boubaker et al., 2023). Conversely, a study by Toh and Zhang (2022) documented that increases in credit risk indicate poor asset quality, leading to high monitoring costs and a deterioration in the capital position of the banks.

H_A: There is a significant relationship between credit risk and the capital level of banks.

Similarly, an elevated liquidity risk induces banks to increase their capital reserves to meet the withdrawal demands due to the decline in the liquidity level (Antoun et al., 2021). However,

banks may trade off the holding of higher capital despite the higher liquidity risk to grant more financing in the economy, which can lead to a negative relationship (Le et al., 2022).

H_A: There is a significant relationship between liquidity risk and the capital level of banks.

Transition risk and the capital level of banks is discovered to be positively associated. Alessi et al. (2024) reveal that when the country is transitioning to a low-carbon economy, banks are encouraged to strengthen their capital position in response to the elevated financing on high-carbon activities. Garcia-Villegas and Martorell (2024) validate that banks are susceptible to transition risk in countries heavily reliant on oil, gas, or coal, necessitating robust capital reserves to protect against the possible financial risks.

H_A: There is a significant relationship between transition risk and the capital level of banks.

A rise in physical risk is found to correspond with higher capital holdings among banks. Banks affected by the natural disaster are documented by Schuwer et al. (2019) to increase their capital ratios as a buffer against future potential shocks compared to those unaffected banks. Mandel et al. (2021) found the opposite relationship, where massive financial losses may incur in an extreme physical climate risk, resulting in the erosion of bank capital.

H_A: There is a significant relationship between physical risk and the capital level of banks.

Being cost efficient helps banks to protect their future earnings while remaining competitive in the market. According to the trade-off theory, highly efficient banks hold lower capital due to robust assessment and monitoring process of the credit risk, leading to a decrease in the banks' overall risk (Alzoubi et al., 2022). From another perspective, cost-efficient banks may behave prudently by maintaining high capital levels to protect their future earnings during times of financial distress, as theoretically suggested by the franchise value hypothesis (Do Van, 2021).

H_A: There is a significant relationship between cost efficiency and the capital level of banks.

Despite the positive and negative relationship found between cost efficiency and capital level of banks, physical risk may moderate the relationship between the two variables. In a low physical risk environment, a highly cost-efficient bank may channel the surplus of profit to other business activities due to the less pressure to increase capital buffers (Ranger et al., 2022). Conversely, efficient banks operating in countries with high physical risk exposure may prefer to strengthen the capital level to secure their long-term profitability from any event of bankruptcy (International Monetary Fund, 2025).

H_A: There is an interaction effect of physical risk on the relationship between cost efficiency and capital level of banks.

Profitability reflects how efficiently banks utilize their resources to generate income. Prior literature mostly reveals that profitable banks uphold high amounts of capital reserves. Evidently, banks strengthen their capital position by reinvesting the accumulated profits because it is cheaper and easy to grow (Etudaiye-Muhtar & Abdul-Baki, 2021). On the other hand, high capital level holding by low profitable banks serve as a buffer against elevated risk-taking, aiming to recover their losses (Naili & Lahrichi, 2022).

H_A: There is a significant relationship between profitability and capital level of banks.

Following the 'Too-Big-to-Fail' (TBTF) theory, bank size is disclosed to be negatively related to the capital level of the banks by many pieces of literature. Bellia et al. (2022) argue that government intervention to bail out larger-sized banks during difficult times leads to less market discipline, which encourages these larger banks to engage in high-risk activities while maintaining lower capital levels. In contrast, smaller-sized banks rely more on their capital to weather unexpected losses as they do not benefit from the TBTF phenomenon (Mohanty & Mahakud, 2021).

H_A: There is a significant relationship between bank size and capital level of banks.

Apart from the bank-specific variable, economy is considered as one of the macroeconomic factors that causes a depreciation in the capital reserves held by banks. During boom periods, banks reduced their capital level to create more room to pursue profitable investments, taking advantage of improved credit ratings at the time to extend additional financing (Nam et al., 2022). From another perspective, banks may prefer to enhance their capital buffer during robust economic conditions by reducing their financing activities, causing bank capital to move positively with the economy (Wu et al., 2022). Klein and Turk-Ariss (2022) assert that the preference for building capital buffers during economic upturns is to prepare for potential loan losses during a recession.

H_A: There is a significant relationship between the economy and the capital level of banks.

Numerous past literatures confirm that capital position of banks is adversely impacted during crises period relative to normal times. Thereby, the study includes a crises period dummy to investigate the significant difference in the capital level during crises and non-crisis period while also controlling for the time variation over the 28-year period. The capital level of banks is found to be depleted during crises periods due to the surge in increases in the non-performing loans, which stem from the improper financing activities undertaken during excellent times (Moudud-Ul-Huq et al., 2022). During these periods, a larger capital buffer enhances bank stability by mitigating the unforeseen materialization of loan losses (Berger & Demirgüç-Kunt, 2021).

H_A: There is a significant difference in the capital level of banks between crises periods and non-crisis periods.

This study uses bank specialization to distinguish between Islamic and conventional banks, coding one as Islamic banks and zero otherwise. The capital level of Islamic banks is found to be lower relative to conventional banks, despite operating in the same competitive market due to the low market penetration in many countries (Jubilee et al., 2021). Consequently, Islamic banks may struggle to access financial resources as they are still in the growth phase, leading to a decline in capital reserves. Unlike Islamic banks, conventional banks can easily raise capital because of their well-established presence in the market and longer history of operation (Sobol et al., 2023). As a result, conventional banks benefit from economies of scale and have easier access to resources in the capital market.

H_A: There is a significant difference in the capital level between Islamic banks and conventional banks.

The country group dummy is to distinguish between High-Income countries and Middle-Income countries with one representing the former and zero representing the latter. This

dummy variable enables the investigation of significant differences in capital levels between banks in different country groups. Banks based in High-Income countries are highly capitalized due to their effective governance and better regulatory framework (Mutarindwa et al., 2021). Similarly, Donnellan and Rutledge (2019) support the view that High-Income banks gain a competitive advantage from their resource strength; thus, they are better positioned to maintain higher capital ratios compared to the Middle-Income banks reflecting the resource-based theory. On the other hand, the World Bank Group (2020) highlights that lack of a strong regulatory framework in Middle-Income countries driven by political instability, corruption, and others may result in the lower capital holdings of the banks.

H_A: There is a significant difference in the capital level of banks between High-Income countries and Middle-Income countries.

RESEARCH METHODOLOGY

This study employs panel data, which integrates both cross-sectional and time-series observations spanning multiple years. Specifically, it utilizes annual secondary data from 1995 to 2022, covering a 28-year period. All data are retrieved from the Fitch Ratings PRO database except for economy, transition risk, and physical risk. Economic data, measured as the ratio of current price GDP to constant price GDP, are sourced from the International Monetary Fund (IMF). Meanwhile, information on transition risk and physical risk is collected from the World Bank database. The study utilizes unbalanced panel data due to the possibility of data unavailability for certain periods. To compare the capital decision of Islamic and conventional banks, the study includes banks that offer dual banking practices. Although global regulators such as Basel and IFSB have set the minimum capital requirement, it remains important to examine the capital decisions of both Islamic and conventional banks because these banks are postulated to behave differently in the sense of capital decision. To further scrutinize, the study focuses on 10 countries offering both Islamic and conventional banking systems, categorized into High-Income and Middle-Income (HIMI) groups. Among them, six (6) are High-Income countries and four (4) are Middle-Income countries, as summarized in Table 1. The classification of HIMI countries follows the World Bank's income group standards where High-Income countries are those with a gross national income (GNI) per capita exceeding USD 13,935, while Middle-Income countries are those with a GNI per capita between USD 1,136 and USD 13,935. The following Table 2 represents income groups based on GNI per capita (USD).

Table 1: List of HIMI countries

High-Income Countries	Middle-Income Countries
Bahrain	Bangladesh
Brunei	Jordan
Kuwait	Malaysia
Qatar	Pakistan
Saudi Arabia	
United Arab Emirates	

Table 2: Income Group based on Gross National Income (GNI) per capita (USD)

Income Group	GNI per Capita (2024, USD)	Definition
Low-Income	≤ 1,135	Economies with a GNI per capita of USD1,135 or less
Lower Middle-Income	1,136 – 4,495	Economies with a GNI per capita between USD 1,136 and USD 4,495
Upper Middle-Income	4,496 – 13,935	Economies with a GNI per capita between USD 4,496 and USD 13,935
High-Income	≥ 13,936	Economies with a GNI per capita of more than USD 13,935

Source: The World Bank Group (World Bank Group, 2025)

For the model development, the study notes the latent dependent variable for this study is bank capital. It is a ratio calculated as equity to total assets. A higher proportion indicates that banks hold greater capitalization. Drawing on the literature reviewed in the preceding section, the study determines several potential determinants of bank capital decisions. These include credit risk, liquidity risk, transition risk, physical risk, profitability, cost efficiency, bank size, and overall economic conditions. While these factors are expected to directly influence bank capital decisions, the study further posits an interaction effect of physical risk on the relationship between cost efficiency and bank capital. Table 3 provides a list of variables and proxies used in this study. To account for variations in economies and time periods, the study includes control variables related to economic conditions and crises periods. It is worth noting that both liquidity risk and cost efficiency are measured using inverse proxies; however, their signs are adjusted in the subsequent section for clarity and ease of interpretation.

Table 3: List of Variables and Proxies

Variable	Notation	Proxy	References
Dependent:			
Capital Level	CAP	Equity to total assets (%)	Ali et al., (2023)
Independent:			
Credit Risk	CR	Loan loss allowances to gross loans (%)	Sobarsyah et al. (2020)
Liquidity Risk	LR	Liquid assets to deposits and short-term funding (%)	Amran and Ahmad (2021)
Transition Risk	TR	Fossil fuel energy consumption (% of total)	Barnett (2024)
Profitability	PROFIT	Operating profit to average total assets (%)	Abbas et al., (2021)
Cost Efficiency	CE	Non-interest expenses to average total assets (%)	Yin (2021)
Bank Size	SIZE	Natural logarithm of total assets (%)	Obadire et al., (2023)
Bank Specialization	B	1 for Islamic banks and 0 for conventional banks	Chazi et al., (2024)
Country Group	CG	1 for High-Income countries and 0 for Middle-Income countries	Klein & Turk-Ariss, (2022)
Control:			
Economy	EC	Current price GDP to constant price GDP (%)	Kanago (2023)
Crises Period	CP	1 is crises period and 0 is non-crisis period	Adem, (2023)
Interaction:			
Physical Risk	PR	Carbon dioxide emissions (metric tons per capita/total)	Sean Paul et al. (2022)

The study applies the Stata 12 statistical package for data analysis. It checks the available data for any possible issues and remedies if necessary. It also diagnoses potential issues using preliminary tests, which include the outlier test, descriptive statistics, correlation test, multicollinearity test, heteroscedasticity test, serial correlation test, and stationarity test. In achieving the proposed objectives, the study utilizes static panel data analysis, which includes Pooled Ordinary Least Squares (POLS), Fixed Effects Model (FEM), and Random Effects Model (REM). The study tests the F-Chow test, Breusch-Pagan Lagrange Multiplier (BPLM), and Hausman test to decide the best-fit model. The study proposes the following mathematical equation (1) to further scrutinize bank capital decision- making:

$$CAP_{it} = \beta_0 + \beta_1 CR_{it} + \beta_2 LR_{it} + \beta_3 TR_{it} + \beta_4 PR_{it} + \beta_5 PROFIT_{it} + \beta_6 CE_{it} + \beta_7 SIZE_{it} + \beta_8 EC_{it} + \beta_9 CP_{it} + \beta_{10} B_{it} + \beta_{11} CG_{it} + \beta_{12}(CE_{it} * PR_{it}) + e_{it} \quad (1)$$

RESULTS AND DISCUSSION

The dataset comprises 1,305 observations collected from 129 banks across ten High-Income and Middle-Income (HIMI) countries over a 28-year period. The lengthy time span indicates no endogeneity issue for the proposed capital model. The diagnostic testing for the static panel data removes identified extreme values and then detects heterogeneity and serial correlation issues. There are no serious multicollinearity and unit root issues identified in the model. The panel data testing hypothesizes generalized least squares provides the most appropriate estimations in comparison to the ordinary least squares. The final model, which incorporates cost efficiency and physical risk interaction on banks' capital proceeds with the generalized least squares random effect model (REM) for the unbalanced panel estimation. Table 4 exhibits both the basic model and the extended model with interaction variables using cluster regression with the aim to remedy the earlier identified heterogeneity and serial correlation issues. Recall, for clarity of interpretation, the proxies for liquidity risk and cost efficiency which originally measured as inverse ratios, are adjusted by reversing their coefficient signs to reflect the true direction of relationships. The model estimations for both basic and extended models display significant Wald chi-squared at 99 percent confidence intervals with the coefficient of determination at 81 percent. The two models are robust with similar hypotheses that can be substantiated along with the similar relationship direction for every independent variable and capital level.

Referring to both models, all variables evidently show significant associations with bank capital except for credit risk and liquidity risk. Additionally, the extended model is unable to find the direct relationship between physical risk and bank capital, but it is then translated to the significant interaction effect of physical risk on the relationship between cost efficiency and capital. Despite the interaction hypothesis, the direct linkage between cost efficiency and bank capital remains significant and negative. This suggests that banks demonstrating higher cost efficiency tend to maintain lower capital level, consistent with the trade-off theory between capital and the credit monitoring mechanism (Alzoubi et al., 2022). Contrariwise, banks that spend less effort on monitoring costs and other operating expenses have more capability to prioritize capital. The discussion on cost efficiency and capital is getting more interesting with the incorporation of physical risk as the moderating factor. Table 5 and Figure 1 display the marginal effect of cost efficiency on capital level in response to physical risk. Physical risk, as measured aggregately, segregates banks into countries with higher and lower physical risk. Banks in countries with lower carbon emissions focus more on inefficiency risk and are less concerned about physical risk. These banks operate consistently with the risk absorption hypothesis where a decrease in the cost efficiency will have higher capital in low physical risk countries, while those banks in higher physical risk countries would have even higher capital to capture both inefficiency and physical risks (Ranger et al., 2022). On the contrary, the capital level decreases when cost efficiency increases in both high- and low-physical risk countries. The effect is more severe for banks operating in high physical risk countries. Banks operate in a lower carbon emission economy by using funding derived from cost-efficient activities to channel sources from earnings into financing activities that respond to massive opportunities for green financing. In this scenario, capital increment is not crucial due to lower physical risk. The capital decline is more extensive when cost efficiency increases for banks operating in a

high physical risk economy. This decline is explainable when these banks use both earnings and capital to monitor borrowers in ensuring high cost efficiency and green compliance.

Table 4: Basic Model and the Extended Model with the Interaction Variables using Cluster Regression

	Basic Model	Interaction Model
Credit Risk	-0.0255 (0.0189)	-0.0280 (0.0191)
Liquidity Risk	0.0075 (0.0058)	0.0087 (0.0058)
Transition Risk	0.0756*** (0.0095)	0.0764*** (0.0096)
Physical Risk	0.0039*** (0.0011)	0.0005 (0.0023)
Profitability	1.0528*** (0.0586)	1.0508*** (0.0587)
Cost Efficiency	-0.5510*** (0.1188)	-0.3056* (0.1836)
Bank Size	-0.0234*** (0.0051)	-0.0211*** (0.0049)
Economy	0.0154*** (0.0035)	0.0143*** (0.0036)
Crises Period	-0.2420** (0.1017)	-0.2391** (0.1013)
Bank Specialization	-1.0041*** (0.1945)	-1.0490*** (0.1978)
Country Group	3.3113*** (0.2451)	3.2117*** (0.2482)
Cost Efficiency*Physical Risk		-0.0020* (0.0011)
Constant	-2.1433*** (0.7640)	-1.6213** (0.8081)
Number of Observations	1852	1852
Number of Group	129	129
Minimum Observation per Group	3	3
Average Observation per Group	14.357	14.357
Maximum Observation per Group	28	28
Wald Chi-Squared	1143.425***	1121.925***
Within R^2	0.3341	0.3379
Overall R^2	0.6770	0.6757
Between R^2	0.8105	0.8063

Table 5: Marginal Effect of Cost Efficiency on Capital Level in Response to Physical Risk

Physical Risk	Capital Level/ Cost Efficiency	Delta-method Standard Error	95% Confidence Interval	
0	-0.306	0.184	-0.666	0.054
41	-0.388	0.150	-0.682	-0.093
82	-0.470	0.126	-0.716	-0.223
123	-0.552	0.116	-0.778	-0.325
164	-0.634	0.124	-0.876	-0.391
205	-0.716	0.147	-1.004	-0.428
246	-0.798	0.180	-1.150	-0.446
287	-0.880	0.217	-1.306	-0.454
328	-0.962	0.258	-1.468	-0.456
369	-1.044	0.301	-1.633	-0.455
410	-1.126	0.344	-1.800	-0.451
451	-1.208	0.388	-1.969	-0.447
492	-1.290	0.433	-2.139	-0.441
533	-1.372	0.478	-2.310	-0.434
574	-1.454	0.524	-2.481	-0.427
615	-1.536	0.569	-2.652	-0.420

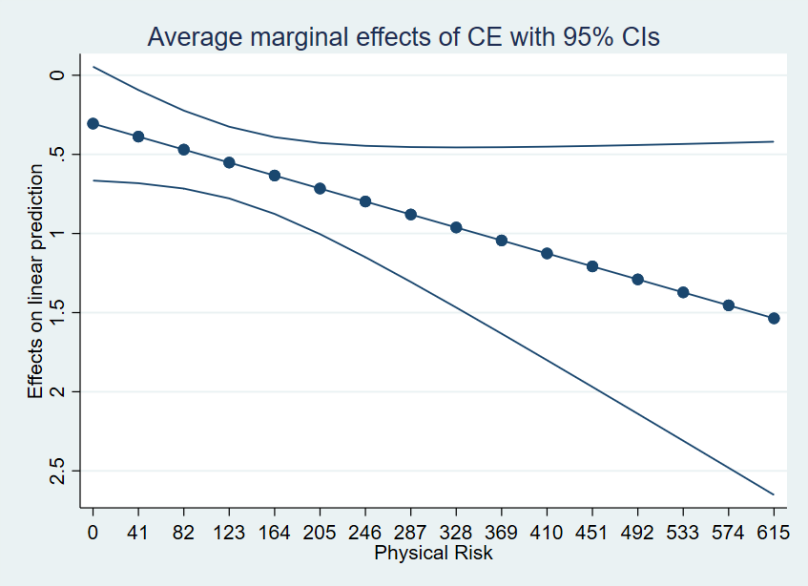

Figure 1: Marginal Effect of Cost Efficiency on Capital Level in Response to Physical Risk

Other than physical risk the findings also confirm a significant relationship between transition risk and capital levels. The positive coefficient suggests that banks operating in environments with higher transition risk tend to hold greater capital buffers, indicating a precautionary response to potential uncertainties arising from economic and regulatory transitions. Countries with higher transition risk are predicted to be far away from the UN SDG-targeted goals of net-zero economies and have greater uncertainty in terms of policy and regulations. Due to these reasons, banks in these countries must maintain a sufficient cushion to absorb future unexpected losses (Schuwer et al., 2019). In contrast, banks operating in lower transition risk would be able to loosen up a bit on their capital buffer.

Unsurprisingly, the finding reveals increase in bank profitability caused to increase in bank capital level fully supported by ample resources by the banks (Etudaiye-Muhtar & Abdul-Baki, 2021). Banks with lower earnings will sacrifice capital buffers to trade off other needs in banking operations. The profitability and size strategy is somehow unique. The results uncover the potential moral hazard of too-big-to-fail for larger-sized banks when capital decreases in response to an increase in size (Bellia et al., 2022). The decline in size creates more urgency for the banks to inject more capital despite their lack of resources.

The model includes an economy, crises, bank specialization, and country group to control time and individual variations. All these control variables are found to be statistically significant at the 1 percent level. The finding discovers a countercyclical economic pattern where banks tend to hold higher levels of capital when the economy grows. Although there is high financing opportunity during this period, in accordance with the Basel III countercyclical approach, banks are encouraged to use the resources to prepare more capital cushions and be more selective in their financing activities (Wu et al., 2022). Meanwhile, during a decline in the economy, banks use capital to support financing activities based on a countercyclical strategy, thus reflecting a decline in capital. This is further supported by significant negative evidence during crises, indicating that capital is expected to be lower than in normal periods. During crises periods, capital is utilized to absorb losses from non-performing financing due to economic and external shocks.

The dummy countries prove banks operating in High-Income countries hold significantly more capital than banks in Middle-Income countries. The estimations also discover statistical evidence that the conventional banks tend to hold greater capital compared to Islamic banks. Both findings can be explained by the resource-based theory, which suggests that conventional banks and those operating in High-Income countries are typically well-established, exhibiting more resilient strategies and resource stability to hold greater capital than their counterparts in Middle-Income countries (Donnellan & Rutledge, 2019).

CONCLUSION

To sum up, the study investigates banks' capital strategies considering that both Islamic and conventional banks operate in High-Income and Middle-Income countries. The difference between countries is captured by controlling the economy, while crises that are both global and country-specific are included throughout the 28-sample period. Four types of risks that are credit risk, liquidity risk, physical risk, and transition risk are considered in the estimations. While the study does not provide empirical support for the hypotheses of the former two risks, intriguing findings were substantiated for the physical and transition risks. Particularly, the estimations show the important role of physical risk in moderating the influence of cost efficiency on bank capital. Banks operate in countries that are exposed to high carbon emissions and are more sensitive to capital decisions in response to cost-efficiency outcomes. Banks operating in less physical risk, as well as transition risk have lesser uncertainty and thus can be more relaxed in their capital decision.

The model also further supports that profitability and size are important institutional factors that affect how much capital banks need to uphold. Cost efficiency does not only have a direct effect on capital decisions, but also depends on the carbon environment in the country, which influences capital. The external factors of economic condition and crises period are also crucial in strategizing a sufficient capital buffer to absorb unexpected future shocks.

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AUTHORS' CONTRIBUTION

Ahmad, W., Amran, N. H., and Rokeman, N. S. conceived and planned the study. Rokeman, N. S. was responsible for the data preparation and carried out the estimation under the supervision of Ahmad, W. and Amran, N. H. While the introduction and literature review were conducted by Rokeman, N. S. Amran, N. H. took the lead in writing the methodology. Ahmad, W. was in charge of writing the data analysis and conclusion. All authors provided critical feedback, with Rokeman, N. S. reviewing and editing the manuscript.

CONFLICT OF INTEREST DECLARATION

The authors certify that the research has not received prior publication and is not under consideration for publication elsewhere. All authors have contributed significantly to the work, validity, and legitimacy of the data and its interpretation for submission to Jurnal Intelek.

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