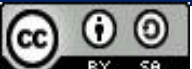


The Role of Digitalization in Moderating the Effect of Corporate Governance on a Bank's Financial Performance

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DATE	ABSTRACT
Accepted: Revised: Published:	Digital transformation is reshaping the banking sector globally, with Indonesian banks like Bank Syariah Indonesia and Bank Mandiri demonstrating significant performance gains through technological adoption. However, the relationship between corporate governance and financial performance remains unclear, with conflicting findings regarding factors such as board size, audit committees, and ownership concentration. This research aims to analyze the effect of digitalization on the relationship between corporate governance and bank performance by examining publicly listed banks in Indonesia. The study utilized a sample of 327 firm-year observations from 38 banking entities publicly listed on the Indonesia Stock Exchange (IDX) for the period 2013–2023. Regression analyses using the random-effects model with robust clustered standard errors were performed on the data set to test the hypotheses. Results of the empirical analyses showed that the size of the board of commissioners and board of directors are both negatively associated with a bank's performance (measured by ROE). When proxies for digitalization were introduced, the results indicated that the interaction term has a positive effect on ROE. This implies that the introduction of digitalization in a bank has a buffering effect on the negative impact of large board sizes. The results remain robust under alternative testing. This research employed the interaction between corporate governance variables and proxies for digitalization as moderating variables, allowing for the examination of how digitalization moderates the relationship between governance structures and bank performance. The findings from this research suggest that digitalization in banks has the potential to mitigate the negative impacts of board size on a bank's performance.
	KEYWORDS Corporate governance, digitalization, banking sector, financial institutions
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INTRODUCTION

In the early 2000s, the stock market was shaken by the collapse of Enron, a leading energy company whose downfall highlighted the glaring inadequacies in corporate governance practices in America. The Enron scandal was largely caused by fraudulent accounting and disregard for ethical standards, which ultimately triggered many regulatory reforms (Khan, 2002). Another prominent example of poor corporate governance resulting in a disastrous outcome is the case of the Lehman Brothers collapse in 2008 (Glover, 2020). The case involved

a series of unsupervised, aggressive risk-taking behaviors, followed by intentional accounting manipulations in an attempt to downplay their risk exposure to the housing market. The subsequent fallout amounted to a staggering \$3.9 billion in losses and triggered the Global Financial Crisis, which is widely known as the most severe worldwide economic crisis since the Great Depression.

In Indonesia, similar cases also abound, with the most recent being the corruption over the government telephony procurement project, commonly known as the Base Receiver Stations (BTS) graft case. The infamous case is estimated to have cost the state Rp8 trillion (\$788.6 million), involving numerous parties inside and outside government bodies, with the main suspect allegedly receiving bribes in cash as payment to cover his travel costs for trips overseas (The Jakarta Post, 2023). Even in the highly regulated banking industry, fraud still occurs, such as the recent case with PT Bank Jago Tbk., in which an employee was reported to have illegally accessed and unblocked 112 customer accounts identified to be associated with criminal activities, transferring approximately IDR 1.39 billion to his own accounts. He used his position as a contact center specialist to bypass security protocols and move the funds for personal use. This highlights the fact that management, regulators, and other stakeholders should remain alert and responsive to issues in good corporate governance design and implementation, especially in the current rapidly changing business landscape triggered by technological innovations.

Monks and Minow (2011) described corporate governance as the way in which public companies are structured and directed to optimally incentivize the executives, the board of directors, and the shareholders to achieve a certain goal or outcome. Without corporate governance in place, a company can easily fall into bad practices, mismanagement, and even fraudulent activities that could be detrimental to all stakeholders.

The significance of corporate governance has been underscored by numerous instances of mismanagement globally, and prior research has consistently demonstrated its critical role within financial institutions. Numerous studies have shown that corporate governance positively impacts the performance of financial institutions (Naushad & Malik, 2015; Okoye et al., 2020; Bhatia & Gulati, 2021; Aljughaiman et al., 2024).

However, results on the exact components of good corporate governance are mixed. For example, the corporate governance variable board size—one of the most commonly studied—refers to the number of members on the board of the entity. Jensen (1993) posited that larger board sizes create inefficiencies that can impact an entity's performance, a notion supported by subsequent research (Fanta, 2013; Naushad & Malik, 2015; Aslam & Haron, 2020; Okoye et al., 2020). However, studies reporting the opposite also exist (Belkhir, 2009; Musdalifah & Himmati, 2021; Hoti et al., 2024). Similar mixed findings can be found in other corporate governance variables used in this study, such as audit committee size, ownership structure, ownership concentration, and gender diversity (as further discussed in Chapter 2).

This study seeks to analyze the correlation between corporate governance and financial performance, with digitalization serving as a moderating element, specifically within the Indonesian banking sector.

In a time of rapid technological development, the banking industry is leading a revolution driven by digitalization. Modern technology has brought about a revolution far more prominent in the financial services industry, transforming conventional banking methods and radically changing financial institutions' environments. Early in 2023, PT Bank Syariah Indonesia Tbk (BRIS)—currently the most prominent Sharia financial institution in Indonesia—announced an IDR 1.5 trillion investment into their IT department to further boost their digitalization efforts (Aprilia, 2024). PT Bank Mandiri Tbk (BMRI)—the fifth biggest publicly listed company in terms of market capitalization—reported a 33.7 percent Year-on-Year (YoY) growth in net income, citing digitalization as the main contributor (Fiska, 2024).

The significance of banking digitalization was also highlighted by the Indonesian Otoritas Jasa Keuangan (Authority for Financial Services, also known as “OJK”) in their 2021-issued Blueprint for Digital Transformation in Banking.

Indeed, the impact of financial innovation on the banking sector has been profound; it has removed inefficiencies in banking transactions and reshaped how society transacts in general (Winata, 2024). Research conducted in COMESA countries has shown that financial innovation accelerates financial development in the long run (Manasseh et al., 2023). Feld et al. (2021) studied the impact of digitalization on banking fees in the Brazilian banking sector and reported that digitalization reduced transport costs, subsequently lowering bank fees charged to customers. Digitalization not only improves economic development and customers’ welfare but has also been shown to improve banks’ performance. This assertion is corroborated by additional research, including a study by Theiri and Hadoussa (2023), which examined the adoption and implementation of digital technologies by Tunisian banks to thoroughly assess the effects of digital transformation on their financial performance. The authors reported a positive effect of digital transformation on Tunisian banks' financial performance.

Similar research in Indonesia has examined the impact of digitalization on banks’ performance. Khairina (2022) studied how Indonesian banks-maintained performance during the 2019 pandemic era and reported an increase in digital transaction volume during that period, which led to increased overall profitability. Pertiwi et al. (2023) identified a significant association between digital transformation and profitability, explaining that digital transformation can reduce operating expenses, enhance customer service, and improve overall risk management in banks. Research on digitalization's impact on the effectiveness of corporate governance in financial institutions remains sparse. Saeed et al. (2024) is currently the only paper providing evidence for the positive implications of new technological adoption on corporate governance practices in the banking sector.

This study aims to analyze the effect of digitalization on the relationship between corporate governance and bank performance in the Indonesian banking sector. Specifically, it seeks to examine how digitalization moderates the impact of corporate governance structures, such as board size, audit committee size, and ownership concentration, on financial performance metrics like Return on Equity (ROE) and Return on Assets (ROA). The findings will provide valuable insights for bank management, regulators, and policymakers on optimizing corporate governance practices in the digital era. Additionally, the study contributes to academic literature by addressing the gap in understanding the interplay between digitalization and corporate governance in emerging markets like Indonesia. Ultimately, this research underscores the potential of digitalization to enhance governance efficiency and improve bank performance, offering practical recommendations for stakeholders in the banking industry.

METHOD

The subjects of this study were banks listed on the IDX as of 31 December 2023. The data were collected from the period 2013–2023, chosen to coincide with the conclusion of the most recent reporting year at the time of the research. Data for the analysis were obtained from the Bloomberg database and the financial reports available on each sample bank’s website.

The dependent variable was banks’ performance, measured by Return on Equity (ROE), consistent with prior studies. The independent variables were corporate governance factors, measured using the variables discussed in Chapter 2: board size (BS_D for board of directors and BS_C for board of commissioners), audit committee size (AC), owner identity (IC), ownership concentration (OC), and board diversity (BD_D for board of directors and BD_C

for board of commissioners). Board size was determined by the number of members on the board of directors and board of commissioners. Audit committee size was proxied by the number of members performing audit committee roles. Owner identity was a categorical dummy variable classifying banks as government-owned, family-private-owned, or foreign-owned. Ownership concentration was measured by the percentage of shares held by the largest shareholder. Board diversity captured the number of female directors or commissioners serving on the board.

The independent and moderating variable in this research was digitalization (DIGITAL). Following Chaarani and El Abiad (2018), digitalization was measured by taking the natural logarithm of the nominal value of intangible assets, excluding goodwill, as reported in the banks' statements of financial position at the end of each reporting year.

Control variables followed those used by Theiri and Hadoussa (2023), including bank size, capital ratio, loan ratio, liquidity ratio, non-performing loans, inflation, and Gross Domestic Product (GDP).

The research model was closely be the empirical model utilized by Theiri & Hadoussa (2023) in their research. The following empirical model will be used to test the first hypothesis:

$$ROE_{i,t} = \alpha_{i,t} + \beta_1 CG_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 CAR_{i,t} + \beta_4 LOAN_{i,t} + \beta_5 LIQUID_{i,t} + \beta_6 NPL_{i,t} + \beta_7 INF_{i,t} + \beta_8 GDP_{i,t} + \varepsilon_{i,t} \quad (1)$$

To test the second hypotheses, the moderating variable is introduced into the model, and thus the model is modified as follows:

$$ROE_{i,t} = \alpha_{i,t} + \beta_1 CG_{i,t} + \beta_2 DIGITAL_{i,t} + \beta_3 CG_{i,t} \times DIGITAL_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 CAR_{i,t} + \beta_6 LOAN_{i,t} + \beta_7 LIQUID_{i,t} + \beta_8 NPL_{i,t} + \beta_9 INF_{i,t} + \beta_{10} GDP_{i,t} + \varepsilon_{i,t} \quad (2)$$

RESULTS AND DISCUSSION

Descriptive Statistics and Correlation Analysis

The final sample is set up as a panel data in the statistical software. Table 1 below shows the results of descriptive statistics of the panel data, windsorised at 1%.

Table 1. Descriptive statistics

Variable	N	Mean	Std. Dev.	Min	Max
ROE	322	1.524	16.776	-90.310	29.810
SIZE	322	31.109	1.849	27.212	35.214
CAR	322	31.789	35.016	6.000	390.500
NPL	322	3.126	2.640	-	22.270
LIQUID	322	105.435	93.192	-	1,145.760
LOAN	322	62.287	11.444	-	86.950
BS C	322	4.857	2.112	2.000	11.000
BD C	322	0.612	0.638	-	3.000
BS D	322	6.528	2.883	2.000	14.000
BD D	322	1.410	2.473	-	27.000
AC	322	4.025	1.146	2.000	8.000
OC	322	58.153	23.438	14.380	99.997

IC	322	2.177	0.915	-	3.000
DIGITAL	322	24.316	4.260	16.589	29.467
INF	322	3.588	1.583	1.560	6.410
GDP	322	4.165	2.232	-2.070	5.560

Results show that ROE, CAR, LIQUID, LOAN, and OC appear to be highly dispersed relative to the other variables, suggesting a non-normal distribution, despite the windsorization which has been performed on the data. However, despite the results, regression assumptions are still met.

To examine the correlation between the variables, the Variance Inflation Factor (VIF) has been performed on the result of the regression analysis without accounting for panel data structure. Results are presented in Table 2.

Table 2. VIF results

Variable	VIF	1/VIF
SIZE	8.090	0.124
BS_D	6.820	0.147
BS_C	4.340	0.230
DIGITAL	2.570	0.389
LOAN	2.040	0.490
CAR	1.940	0.516
AC	1.840	0.543
INF	1.580	0.635
GDP	1.330	0.753
BD_D	1.290	0.777
IC	1.260	0.796
LIQUID	1.240	0.806
BD_C	1.230	0.811
OC	1.210	0.830
NPL	1.180	0.846

Following the works of Belsley et al. (2005), a threshold of 10 for VIF analysis is used to interpret the results, since it is believed to be a practical threshold, balancing between sensitivity and specificity without being overly restrictive. Therefore, although the variables demonstrated a high to moderate level of multicollinearity, it is still below the threshold level, and thus multicollinearity is not a fatal issue within the dataset.

Regression Results

By grouping all firm-year observations based on the firm code, the clustered robust standard error is used to correct for firm-specific fixed effects in order to account for heteroskedasticity. Table 3 below shows the regression analysis results for both empirical models.

Table 3. Regression analyses results for first and second hypotheses testing.

* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

ROE	First Model	Second Model
BS_C	(2.484)***	(13.808)***
BD_C	2.043	(3.508)

BS_D	0.684							(8.897)**
BD_D	0.207							5.831
AC	1.206**							(11.296)*
OC	(0.136)*							(1.132)*
IC	0.753							2.362
MOD_BS_C	-	0.481***						
MOD_BD_C	-		0.217					
MOD_BS_D	-			0.344***				
MOD_BD_D	-				(0.215)			
MOD_AC	-					0.464*		
MOD_OC	-						0.041*	
MOD_IC	-							(0.098)
DIGITAL		(3.382)**	(1.214)	(3.036)***	(0.737)	(2.819)**	(3.126)**	(0.876)
SIZE	4.012**	6.031***	4.256**	4.553***	4.151***	4.147***	4.451***	4.313***
CAR	(0.002)	0.007	(0.005)	0.003	(0.011)	(0.004)	0.009	(0.007)
NPL	(1.819)**	(1.946)**	(1.901)**	(2.027)**	(1.883)**	(1.960)**	(1.920)**	(1.915)**
LIQUID	0.017	0.018	0.017	0.018	0.018	0.019	0.021	0.018
LOAN	0.027	0.025	0.011	0.008	(0.002)	0.008	0.028	0.005
INF	0.751	0.839	0.873	0.785	0.770	0.787	0.683	0.781
GDP	0.073	0.101	0.104***	0.086	0.099	0.099	0.063	0.113

The first column list out the independent, independent and moderating, and control variables tested against ROE. The second column represents the results of the first model regression analysis, whereas the third to ninth column represent the results of the second model regression analyses, each alternatively taking into account only one CG variable.

Results for the first model regression showed significant results for BS_C, AC, and OC for the independent variables. DIGITAL and its interaction with CG has not been included for the purpose of testing the first hypothesis. Out of all the control variables included in the model, only SIZE and NPL are significant, with SIZE having positive coefficients and NPL having negative coefficients.

The second model regression showed significant results for analyses utilizing the CG variables BS_C, BS_D, AC, and OC, with similar significant results mirrored in the DIGITAL and their interaction variables (MOD_BS_C, MOD_BS_D, MOD_AC, and MOD_OC respectively). Consistent with the first model regression, SIZE and NPL are both significant in the second model regression, with similar directions to those found in the first model regression results.

Hypothesis Testing

Comparing the first regression results presented in Table 1 to the first hypothesis, it can be observed that BS_C is significant at 1% with coefficient of -2.484, AC is significant at 5% with coefficient of 1.206, whereas OC is significant at 10% with coefficient of -0.136. This implied that the larger the size of board of commissioners, the worse the performance of the bank. This finding is in line with the notion set forth by Jensen (1993), who stated that relatively larger board size is less efficient compared to the smaller ones due to barriers in effective communication between the members. This idea is still supported today by similar results reported by other corporate governance researches in recent years (Fanta, 2013; Naushad & Malik, 2015; Aslam & Haron, 2020; Okoye et al., 2020).

The negative coefficient of OC implies that the larger the influence of one shareholder, the poorer the performance of the bank. This result goes against the prevailing consensus in the

literature, although it provides evidence to support La Porta et al. (1999) idea that higher ownership concentration is detrimental to an entity's performance. Bai et al. (2004) further expanded this by explaining that too much power held by one block of shareholder gives them too much discretionary powers to direct the use of the entity's resources in a way that will benefit them on a personal level, but is ultimately detrimental to the entity's performance, such as transferring resources out of the entity to a related party at costs below the market value. Additionally, this result is also in line with the observation reported by Wardani & Setiawan (2020).

AC has positive coefficient, suggesting positive contribution to a bank's performance. This finding is inline with a majority of the recent literature (Purwanto et al., 2020; Agyemang, 2020; Anasweh, 2021; Athar et al., 2023; Salasatie et al., 2023), thus supporting the audit committee function in a bank. Therefore, the first hypothesis is confirmed, although it is only specific to the AC component of corporate governance.

The second empirical model is tested against $H_{2a} - H_{2g}$ as stated in the hypothesis development section in previous chapter. Results in Table 3 showed significant results for MOD_BS_C with coefficient of 0.481, MOD_BS_D with coefficient of 0.344, MOD_AC with coefficient of 0.464, and MOD_OC with coefficient of 0.041, and it should be noted that all the coefficients are positive. The statistically significant result indicated that the interaction between DIGITAL and each of the mentioned CG variable has significant and positive effect on ROE.

Considering the negative coefficients for BS_C and OC in the first hypothesis testing, the positive and significant interaction between BS_C and DIGITAL (MOD_BS_C), and OC and DIGITAL (MOD_OC) suggested that as MOD_BS_C and MOD_OC increased, the negative effect of BS_C and OC are reduced respectively. In other words, MOD_BS_C and MOD_OC buffered the negative impact of BS_C and OC on ROE. This imply that the increase in digitalization within a bank has potential to reduce the negative impact of size of board of commissioner, and high ownership concentration. Drawing from the prevailing literature, this may imply that the digitalization in banks has the potential to reduce barriers of communication among the board members, thereby increasing the efficiency of the board, and improves transparency of the majority shareholders, thereby reducing likelihood of majority shareholders making detrimental decisions for the banks.

Alternative Testing

To ensure the robustness of testing results, an alternative testing is performed. In this alternative testing, Return of Asset (ROA) is used as alternative measure of bank's performance. The result are presented in Table 4 below.

Table 4. Alternative regression analyses results for second hypotheses testing.
* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

ROA	First Model	Second Model
BS_C	(0.467)***	(1.594)**
BD_C	0.400*	(1.527)
BS_D	0.103	(1.037)*
BD_D	0.029	1.669**
AC	0.140	(0.431)

OC	(0.012)						(0.159)	
IC	0.211							(1.970)
MOD_BS_C		0.050**						
MOD_BD_C	-		0.074					
MOD_BS_D	-			0.039*				
MOD_BD_D	-				(0.062)**			
MOD_AC	-					0.016		
MOD_OC	-						0.006	
MOD_IC	-							0.082
DIGITAL	-	(0.382)	(0.192)	(0.354)	(0.054)	(0.442)	(0.297)	0.698***
SIZE	0.698***	0.955***	0.615***	0.718***	0.597***	0.648***	0.660***	0.663***
CAR	(0.002)	(0.002)	(0.004)	(0.005)	(0.003)	(0.002)	(0.003)	(0.002)
NPL	(0.197)**	(0.205)**	(0.210)**	(0.219)**	(0.202)**	(0.208)**	(0.211)**	(0.197)**
LIQUID	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
LOAN	0.033	0.032	0.029	0.030	0.028	0.031	0.028	0.033
INF	0.095	0.101	0.109	0.098	0.087	0.089	0.088	0.095
GDP	0.054	0.058	0.057	0.051	0.054	0.052	0.053	0.054

Results for the first model regression showed significant results for BS_C and BD_C only, with BS_C showing negative coefficient of -0.467, whereas BD_C is showing positive coefficient of 0.400, although the p-value suggested that it is only significant at 10%.

The second model regression showed significant results for analyses utilizing the CG variables BS_C, BS_D, and BD_D with similar significant results mirrored only in their interaction variables (MOD_BS_C, MOD_BS_D, and MOD_BD_D respectively). BS_C and MOD_BS_C, and BS_D and MOD_BS_D are still significant, with both pairs showing similar coefficients as those found in the main testing results in section 4.3.

AC, MOD_AC, OC, and MOD_OC did not turn out to be statistically significant in this alternative testing. Instead, BD_D and MOD_BD_D are significant at 5%, with MOD_BD_D showing negative coefficient and thus implying that this interaction term between BD_D and DIGITAL worsen the positive effect of BD_D on ROA. In other words, digitalization weakened the positive effect of board of director's gender diversity on the bank's performance. However, since this result is not found in the main testing, further discussion will not be required. Consistent with the results presented in Table 3, SIZE and NPL are both significant in the first and second model regression in this alternative testing.

The main testing and subsequent alternative testing show consistent results for directions and significance of CG variables moderated by DIGITAL towards bank's performance. This is especially true for the CG variable BS_C and BS_D, which refer to the size of board of commissioners and board of directors respectively. Results from the first model testing in 4.3 and 4.5 consistently show negative and significant coefficient for BS_C and positive but non-significant coefficient for BS_D.

For BS_C, the negative and significant effect persists in the second model testing, whereas for BS_D, the coefficient turned up negative and significant. As previously discussed, this result align with the notion set forth by Jensen (1993) and subsequently supported by other researches demonstrating similar results (Fanta, 2013; Naushad & Malik, 2015; Aslam & Haron, 2020; Okoye et al., 2020), therefore suggesting that the bigger the board size (either supervisory or management board), the higher is likelihood for barriers in communication leading to inefficiencies in the board.

Although AC, MOD_AC, OC, and MOD_OC are significant in the main testing, the same result was not found in the alternative testing. This imply that the results for these

variables are not robust. This implication is further supported by considering that, in the main testing results, these variables are only significant at p-value of 10%.

Interestingly, the control variables SIZE and NPL showed consistent results across all testing, giving further evidence for a strong correlation between those variables and a bank's performance.

CONCLUSION

This study examined the relationship between corporate governance and bank performance in Indonesia, with a focus on the moderating role of digitalization. Motivated by mixed findings in prior research and the rapid technological adoption in Indonesian banking, the study investigated whether digitalization enhances the effectiveness of corporate governance and ultimately improves financial outcomes. Empirical results showed that larger board sizes—both supervisory and management—were negatively associated with bank performance as measured by Return on Equity (ROE), likely due to communication barriers in larger boards. However, when accounting for digitalization, these negative effects were mitigated, indicating that digitalization may enhance board efficiency and shareholder transparency. These findings were consistent when using Return on Assets (ROA) and confirmed that bank size positively, while non-performing loans negatively, influenced performance. Limitations included the digitalization proxy used and a relatively small sample size of just over three hundred firm-year observations. Future research should aim to develop more precise measures of digitalization and extend the analysis to banking institutions beyond Indonesia to improve generalizability and robustness of results.

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