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Impact of Mobile Banking Usage Intensity On Idx-Listed Banks' Performance: Analysis of Pre- And During-Post Covid-19 Periods

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Abstract

This study investigates the impact of mobile banking usage intensity on the performance of banks listed on the Indonesia Stock Exchange (IDX), specifically focusing on Return on Assets (ROA) and Return on Equity (ROE). The analysis is divided into pre-COVID-19 (2013-2019) and during/after COVID-19 (2020-2023). Data from 14 banks were examined using the Pooled Ordinary Least Squares (OLS) method. The results show that mobile banking usage positively affects bank performance in both periods. Prior to the pandemic, increased mobile banking transactions significantly enhanced profitability and equity returns, indicating improved efficiency in generating earnings from assets and a positive impact on returns to shareholders. This positive effect became more pronounced during and after the pandemic, reflecting a greater reliance on digital banking channels. The COVID-19 pandemic notably shifted consumer behavior towards higher adoption of digital solutions. The study also highlights significant differences between small and large banks. For smaller banks, mobile banking usage did not significantly impact performance metrics, suggesting challenges in leveraging digital banking effectively. In contrast, larger banks experienced significant improvements in ROA and ROE due to mobile banking usage, benefiting from their substantial resources and advanced technological infrastructure. Overall, this research underscores the crucial role of digital transformation in enhancing bank performance, particularly during crises. The findings suggest that continued investment in mobile banking technologies is essential for sustaining and improving financial performance.

Keywords: Mobile Banking Usage; Bank Performance; Return On Assets; Return on Equity

A. INTRODUCTION

The COVID-19 pandemic has profoundly impacted global life and economic activity, with significant repercussions for the banking sector. In Indonesia, the pandemic-induced lockdown led to a 2.07% contraction in GDP in 2020 (BPS, 2021) and negatively affected bank profitability. In response, Bank Indonesia (BI) lowered the benchmark interest rate by 100 basis points to 4.00% through four reductions in 2020 (Bank Indonesia, 2020). Concurrently, the pandemic accelerated the adoption of digital technologies as social distancing measures highlighted the critical role of electronic banking. Electronic banking, encompassing internet banking, ATMs, and mobile banking, enhances economic efficiency and customer satisfaction. Mobile banking has experienced the highest adoption rates among these due to its convenience and accessibility (Shaikh & Karjaluoto, 2015). As of 2023, internet penetration in Indonesia reached 78.19%, with 215.6 million users primarily accessing the Internet through smartphones (APJII, 2023). Major banks like BCA, Bank Mandiri, and BRI have robustly implemented mobile banking services, increasing user adoption (Rahmi & Handayani, 2023).

The Indonesian Financial Services Authority (OJK) categorizes banks based on core capital using the KBMI (Kelompok Bank Berdasarkan Modal Inti) system. This system classifies banks into four groups: KBMI 1 (core capital up to IDR 1 trillion), KBMI 2 (core capital between IDR 1 trillion and IDR 5 trillion), KBMI 3 (core capital between IDR 5 trillion and IDR 30 trillion), and KBMI 4 (core capital over IDR 30 trillion). By 2023, all 23 large banks (KBMI 3 & 4) had adopted mobile banking, maintaining a 100% adoption rate since 2017. In contrast, smaller banks (KBMI 1 & 2) have been slower to adopt mobile banking, with only 15 out of 16 adopting it by 2023, up from 8 out of 22 in 2017. This disparity highlights smaller banks' challenges in adopting new technologies due to limited resources.

The impact of mobile banking on bank performance is evidenced by increased transaction volumes and reduced operational costs, which positively affect Return on Assets (ROA) and Return on Equity (ROE) (Ashiru et al., 2023; Shaikh & Karjaluoto, 2015). Mobile banking also enables banks to provide personalized services, enhancing customer satisfaction and loyalty. Previous research presents mixed results regarding the impact of

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mobile and internet banking on bank profitability. Some studies report positive impacts (Ashiru et al., 2023; Siddik et al., 2016), while others find negligible effects (Okiro & Ndungu, 2013) or mixed results (Adhitya & Sembel, 2020). There is a notable gap in the literature regarding the comparison of mobile banking's impact on bank performance during and after the COVID-19 pandemic in Indonesia, especially given the pandemic's role in accelerating digital banking usage. Consumer behaviour towards mobile banking has evolved significantly due to the pandemic, necessitating banks to adapt their offerings to meet changing needs (Pousttchi & Schurig, 2004). The impact of mobile banking may differ based on bank size and stability, with larger banks potentially benefiting more from their greater resources.

This study aims to evaluate the impact of mobile banking on the performance of banks listed on the Indonesia Stock Exchange (IDX), specifically comparing the periods before and during/after the COVID-19 pandemic. Analyzing data from 2013 to 2023 provides a comprehensive understanding of how mobile banking influences bank performance across different pandemic phases and varying bank sizes.

E-Banking Concept

Electronic banking (e-banking) encompasses the delivery of banking services through electronic channels, allowing customers to perform financial transactions remotely. This includes online account management, fund transfers, bill payments, and access to various financial products (Pousttchi & Schurig, 2004). E-banking has revolutionized traditional banking by enhancing convenience, reducing operational costs, and improving customer satisfaction (Shaikh & Karjaluoto, 2015). Since its inception, e-banking has undergone significant evolution. The introduction of Automated Teller Machines (ATMs) in the 1980s marked the beginning of electronic banking. This was followed by the advent of Internet banking in the 1990s, which enabled customers to access banking services via web browsers (Hernandez & Mazzon, 2007). The 2000s saw the rise of mobile banking, utilizing smartphones and mobile Internet to provide banking services on the go (Laukkanen, 2007).

E-banking has contributed to operational efficiency by reducing the need for physical branches and lowering transaction costs (Mols, 1998). It also enhances customer satisfaction by offering 24/7 access to banking services, which leads to increased customer loyalty and retention (Liao & Cheung, 2002). In developing economies, e-banking fosters financial inclusion by extending banking services to underserved populations. Mobile banking, in particular, has played a crucial role in reaching remote areas with limited banking infrastructure, thereby promoting greater economic participation (Akter et al., 2021). This study aims to assess the impact of mobile banking on the performance of banks listed on the Indonesia Stock Exchange (IDX), comparing the periods before and during/after the COVID-19 pandemic. Analyzing data from 2013 to 2023 provides a comprehensive understanding of mobile banking's influence on bank performance across different pandemic phases and varying bank sizes.

Adoption of Mobile Banking Worldwide

The adoption of mobile banking has surged globally, driven by advancements in mobile technology, increased smartphone penetration, and changing consumer preferences. Mobile banking offers exceptional convenience, enabling users to execute banking transactions anytime and anywhere (Jun & Palacios, 2016). In countries with high smartphone usage, such as South Korea and the United States, mobile banking has become a dominant channel for financial transactions. In South Korea, adoption is influenced by perceived risk, trust, and usefulness, with trust emerging as a particularly strong determinant (Lee, Lee, & Kim, 2007). In the U.S., digital banking has seen significant growth, with mobile banking emerging as the primary method of account access for 48% of Americans in 2023 (Bankrate, 2023).

Emerging markets have also experienced substantial growth in mobile banking. Mobile banking has transformed access to financial services in Africa, especially in areas with limited banking infrastructure. For example, M-Pesa in Kenya has enabled millions of users to transact via mobile phones, significantly enhancing financial inclusion (Mbiti & Weil, 2016). Banks worldwide heavily invest in mobile banking technologies to improve customer experience and reduce transaction times. Despite security concerns and the need for user-friendly interfaces, mobile banking continues to reshape the financial sector by addressing the evolving needs of tech-savvy customers (Laukkanen, 2017).

Pros and Cons of Mobile Banking

Mobile banking offers substantial convenience and accessibility, enabling users to access banking services anywhere and anytime. This flexibility enhances user satisfaction and boosts usage rates, particularly in regions

with limited traditional banking infrastructure (Rahmi & Handayani, 2023). It also plays a pivotal role in financial inclusion, especially in developing countries, by reaching underserved populations and contributing to broader economic growth and financial stability (Akter et al., 2021). The cost-effectiveness of mobile banking is another notable advantage, as it reduces the need for physical branches and their associated costs for banks while lowering travel and time costs for customers (Shaikh & Karjaluoto, 2015). Furthermore, mobile banking enhances customer engagement through personalized services and real-time notifications, increasing customer loyalty and satisfaction (Jun & Palacios, 2016). Integrating advanced technologies such as biometric authentication, AI, and blockchain within mobile banking platforms enhances security, efficiency, and overall user experience (Shaikh & Karjaluoto, 2015).

Despite these benefits, several challenges persist. Security remains a significant concern, with risks such as data breaches, hacking, and identity theft potentially deterring users from adopting mobile banking services. Implementing robust security measures and educating users about safe practices are crucial to addressing these concerns (Rahmi & Handayani, 2023). Technical issues, including poor internet connectivity, software bugs, and device compatibility problems, can negatively impact user experience and transaction success rates (Rahmi & Handayani, 2023). Additionally, mobile banking may have limited functionality compared to traditional or Internet banking, as some users find it lacks the comprehensive services available through other banking channels. This limitation can be a barrier for customers who require more complex banking services, such as loan applications, investment management, and detailed financial advisory (Laukkanen, 2007).

The framework also explores how mobile banking impacts small versus large banks, aiming to understand its influence on bank performance across different phases and sizes.

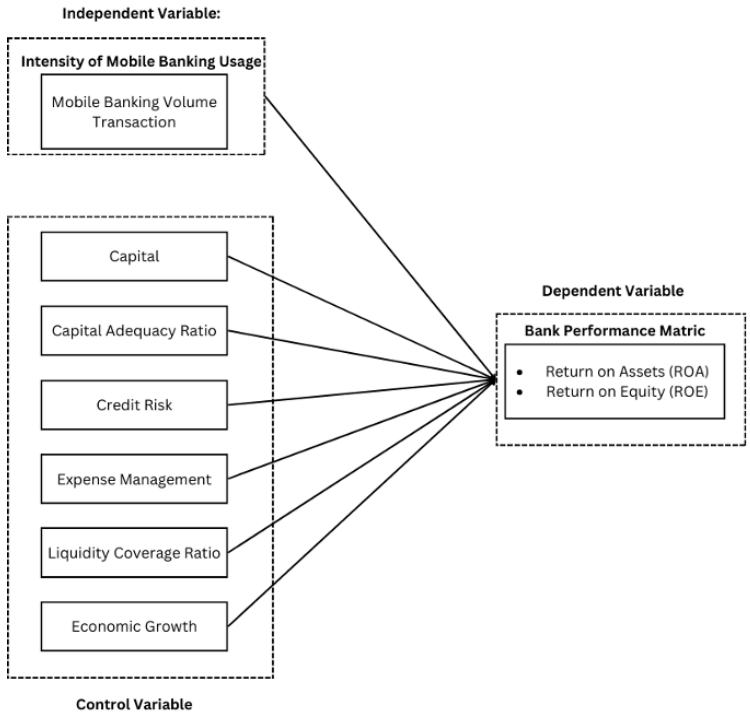

Figure 1. Conceptual Framework

Hypothesis Development

Building on the theoretical foundations and previous research, several hypotheses have been formulated to guide this study. The impact of mobile banking on bank performance has been explored in various contexts, with findings indicating both positive and mixed effects. (Ashiru et al., 2023) demonstrated that financial innovations, including mobile banking, positively influence bank performance by increasing transaction volumes and enhancing revenue streams. (Siddik et al., 2016) observed that e-banking adoption positively impacts Return on Equity (ROE) in Bangladeshi banks after two years, although initial effects on Return on Assets (ROA) and Net Interest Margin (NIM) were not significant. (Hernando and Nieto, 2007) Internet banking adoption positively affects profitability (ROA and ROE) and reduces overhead costs in Spanish banks. In contrast, (Al-Smadi and

Al-Wabel, 2011) reported a negative impact of e-banking adoption on ROE in Jordanian banks, while (Oyewole et al., 2013) observed positive impacts on ROA and NIM in Nigerian banks after a two-year lag, despite initial negative effects.

(Adhitya and Sembel, 2020) highlighted mixed results of mobile banking adoption in Indonesian banks, noting initial declines in ROE and increases in Non-Performing Loans (NPL) but improvements in Capital Adequacy Ratio (CAR) and Loan Deposit Ratio (LDR). (Le et al., 2021) found that fintech innovations, including mobile banking, positively influenced bank performance in Vietnam, benefiting small banks through increased fee-based income and consumer loans. These findings suggest that the impact of mobile banking on bank performance may vary based on investment costs, customer adoption rates, and bank size. The COVID-19 pandemic has further accelerated mobile banking adoption, potentially amplifying its effects on bank performance. This shift has also driven significant changes in consumer behaviour, with increased reliance on digital channels for banking needs, leading to higher transaction volumes and greater customer engagement (Rahmi & Handayani, 2023). Large banks, with their greater resources, are likely to implement advanced mobile banking solutions more effectively, resulting in better performance outcomes compared to smaller banks (Wang et al., 2020). Based on these considerations, the following hypotheses are proposed:

H1: The intensity of mobile banking usage positively impacts the performance of IDX-listed banks before and during/after the COVID-19 pandemic.

H2: The intensity of mobile banking usage has a larger positive effect on the performance of IDX-listed banks during/after the COVID-19 pandemic compared to before the pandemic.

H3: There is a significant difference in the impact of mobile banking usage intensity on the performance of IDX-listed banks between small and large banks.

B. RESEARCH METHOD

This study focuses on banks listed on the Indonesia Stock Exchange (IDX) as of 2023, adhering to stringent reporting standards set by the Indonesian Financial Services Authority (OJK). The research population includes 14 banks that provided data on mobile banking transaction volumes from 2013 to 2023. The data collection process involves three main steps: first, gathering the list of banks from the IDX website; second, extracting mobile banking transaction data from annual reports available on the banks' websites; and third, collecting financial statement data to construct variable proxies from the banks' websites and the OJK's website.

The research evaluates the impact of mobile banking adoption on the financial performance of IDX-listed banks across two distinct periods: pre-pandemic and post-pandemic. Combining the during and post-pandemic periods provides a comprehensive understanding of banks' responses and adjustments, ensuring data continuity, avoiding limitations of a single year post-pandemic, and reflecting the full scope of strategic adjustments, capturing both immediate and sustained impacts on financial performance. Four models are constructed based on different timeframes and groups of banks. Model 1 covers the pre-COVID-19 period (2013-2019), establishing a baseline of mobile banking usage and financial performance during stable economic conditions. Model 2 examines the during and after COVID-19 (2020-2023), analyzing the pandemic's impact and subsequent recovery on mobile banking activities. Models 3 and 4 differentiate banks based on core capital. Model 3 analyzes smaller banks (KBMI 1 and 2) with core capital less than 14 trillion Rupiahs, while Model 4 focuses on larger banks (KBMI 3 and 4) with core capital exceeding 14 trillion Rupiahs.

Models 1 and 2's final dataset includes 96 observations: 47 from 2013-2019 (Model 1) and 50 from 2020-2023 (Model 2). This panel data combines cross-sectional and time-series dimensions, allowing analysis of bank differences and changes over time. In Models 3 and 4, the 14 selected banks are categorized by KBMI classification. The final dataset includes 33 observations from smaller banks (Model 3) and 63 observations from larger banks (Model 4), reflecting annual variations in Tier 1 capital and KBMI categories. The study analyzes the impact of mobile banking usage on bank performance, focusing on the following variables: Intensity of Mobile Banking Usage as the independent variable, Return on Assets (ROA) and Return on Equity (ROE) as dependent variables, and several control variables such as Non-Performing Loans (NPL), Capital Adequacy Ratio (CAR), and Loan to Deposit Ratio (LDR). ROA is calculated as Net Income divided by Total Assets, reflecting the bank's effectiveness in utilizing assets to generate profit. ROE is calculated as Net Income divided by Shareholders' Equity, measuring the bank's profitability relative to shareholders' equity. Control variables provide a comprehensive framework for analyzing the relationship between mobile banking usage and bank performance across various periods and bank sizes.

Table 1. Summary of Variables

Variable	Code	Formula
Intensity of Mobile Banking Usage	VolMbank	Logarithm of Mobile Banking Transaction Volume
Return on Assets	ROA	Net Income / Total Assets
Return on Equity	ROE	Net Income / Total Equity
Capital	ER	Total Equity / Total Assets
Loans	LOANS	Total Loans / Total Assets
Inflation	INF	Rate of Change of the Consumer Price Index (CPI)
Economic Growth	GDP	GDP Growth Rate
Liquidity	NPL	Gross Non-Performing Loan Ratio

Source: Research data, 2024

Statistical Model

The hypotheses are tested using panel data regression analysis, conducted with the statistical software STATA employing Ordinary Least Squares (OLS). This approach aligns with methodologies used in studies by Siddik et al. (2016), Al-Smadi and Al-Wabel (2011), and Oyewole et al. (2013). Pooled OLS, a method that treats combined cross-sectional and time-series data as a single dataset, simplifies the analysis by allowing for the examination of variations within and between banks over time.

To ensure the validity of the regression model, classical assumption tests are performed. These include tests for normality, autocorrelation, multicollinearity, and heteroscedasticity. Normality checks ensure that residuals are normally distributed; autocorrelation tests check for correlations in residuals over time; multicollinearity tests detect correlations among independent variables; and heteroscedasticity tests identify if residuals exhibit non-constant variance.

Drawing from previous research by Al-Smadi and Al-Wabel (2011), Onay et al. (2012), Oyewole et al. (2013), Ashiru et al. (2023), and Siddik et al. (2016), an empirical model is adopted where bank performance, denoted as:

$$BP_{it} = \alpha_0 + \lambda_{it} VolMBank_{it} + \beta_i X_{it} + + \varepsilon_{it}$$

In the model above, BPitBPit represents the performance of bank ii in year tt (dependent variable). We measure BPitBPit using two proxy variables: Return on Assets (ROA) and Return on Equity (ROE). Following the work of Ashiru et al. (2023), we include VolMBankitVolMBankit, which denotes the logarithm of the volume of mobile banking transactions. VolMBankitVolMBankit is a continuous variable that measures this logarithmic volume for bank ii in year tt. XitXit is a matrix of bank-specific control variables for bank ii in year tt. εitεit represents the disturbance error term with a mean of zero and constant variance, i.e., εitεit is independently and identically distributed as N(0,σ2)N(0,σ2). α0α0 is a bank fixed effect term that captures the time-invariant influences specific to bank ii. The coefficient of VolMBankitVolMBankit is of primary interest in this research, as it indicates the impact of mobile banking adoption on bank performance, with other variables included as control variables.

C. RESULTS AND ANALYSIS

Descriptive Statistics

Table 2-4 provides insights into the variables. For Model 1 (Pre-COVID-19), the mean of VolMBankVolMBank is 7.29, ROA is 0.027, and ROE is 0.155. During and after COVID-19 (Model 2), the mean of VolMBankVolMBank increases to 7.454, while ROA decreases to 0.019 and ROE decreases to 0.115. In Model 3, which covers small banks, the mean of VolMBankVolMBank is 6.267, ROA is 0.014, and ROE is 0.085. Conversely, Model 4, which focuses on large banks, shows a higher mean for VolMBankVolMBank at 7.946, ROA at 0.028, and ROE at 0.16. This suggests that larger banks and the periods during and after the pandemic experienced higher mobile banking usage and better performance.

Table 2. Statistical Summary for Model 1

Variable	Obs	Mean	Std. Dev.	Min	Max
VolMbank	47	7.29	1.151	5.531	8.874
ROA	47	.027	.011	.002	.042
ROE	47	.155	.074	.002	.273
ER	47	.145	.021	.094	.186

Variable	Obs	Mean	Std. Dev.	Min	Max
NPL	47	.025	.01	.011	.046
LIQ	47	.63	.085	.415	.743
GDP	47	.051	.002	.049	.056
INF	47	.044	.02	.027	.084

Source: Research data, 2024

Table 3. Statistical Summary for Model 2

Variable	Obs	Mean	Std. Dev.	Min	Max
VolMbank	50	7.454	1.181	5.625	9.215
ROA	50	.019	.013	.002	.042
ROE	50	.115	.076	.002	.273
ER	50	.142	.026	.094	.186
NPL	50	.03	.01	.011	.046
LIQ	50	.56	.091	.415	.743
GDP	50	.041	.024	-.021	.056
INF	50	.037	.019	.017	.084

Source: Research data, 2024

Table 3. Statistical Summary for Model 3

Variable	Obs	Mean	Std. Dev.	Min	Max
VolMbank	33	6.267	.729	5.531	7.926
ROA	33	.014	.009	.002	.031
ROE	33	.085	.062	.002	.188
ER	33	.138	.028	.094	.186
NPL	33	.032	.01	.012	.046
LIQ	33	.573	.113	.415	.743
GDP	33	.051	.002	.049	.056
INF	33	.045	.021	.027	.084

Source: Research data, 2024

Table 4. Statistical Summary for Model 4

Variable	Obs	Mean	Std. Dev.	Min	Max
VolMbank	64	7.946	.904	5.987	9.215
ROA	64	.028	.011	.002	.042
ROE	64	.16	.073	.002	.273
ER	64	.146	.02	.094	.186
NPL	64	.025	.009	.011	.043
LIQ	64	.605	.082	.415	.721
GDP	64	.043	.021	-.021	.056
INF	64	.038	.019	.017	.084

Source: Research data, 2024

Overall results and their discussion

The R-squared values indicate that the models explain 52.8% and 44.4% of the variance in ROA and ROE, respectively, before the pandemic. During and after the pandemic, these values increase to 65.1% for ROA and 58.6% for ROE. For small banks, the R-squared values are 34.3% for ROA and 35% for ROE, while for large banks, they are significantly higher at 81.2% for ROA and 74.5% for ROE. The p-values for the F-tests in Models 1, 2, and 4 are very small (less than 0.05), indicating that the F-values are statistically significant and that at least one of the independent variables is significantly related to the performance metrics (ROA and ROE) in these models. In Model 3, the p-values are 0.000885 for ROA and 0.0619 for ROE. The p-value for ROA is less than 0.05, signifying a significant relationship, whereas the p-value for ROE is slightly above 0.05, indicating that its significance is marginal.

Table 2. Model Evaluation

	Model 1 Before the Pandemic		Model 2 During-After Pandemic		Model 3 Small Banks		Model 4 Large Banks	
Variables	**ROA**	**ROE**	**ROA**	**ROE**	**ROA**	**ROE**	**ROA**	**ROE**
VolMbank	0.00247**	0.015***	0.00363***	0.0231***	0.001	0.000796	0.00146*	0.014
ER	0.0757	-0.537	0.0844	-0.61*	0.0359	-0.299	0.202***	-0.3
NPL	-0.606***	-4.15***	-0.621***	-4.531***	0.000725	-0.193	0.919***	6.499
LOANS	-0.00557	-0.0178	-0.0408***	-0.212**	0.0426***	0.305***	0.0114	0.102
GDP	0.507	3.787	0.0338	0.152	0.214	-0.827	0.0447**	0.188
INF	0.00175	0.233	-0.0804	-0.0561	-0.019	-0.0244	0.0441	0.411
Constant	-0.00935	0.0363	0.0231	0.278**	0.0166	0.356	0.000922	0.167
Observations	47	47	50	50	33	33	64	64
R-squared	0.528	0.444	0.651	0.586	0.343	0.35	0.812	0.745
Adj. R2	0.457	0.361	0.603	0.529	0.191	0.2	0.792	0.718
F-value	12.37	10.28	20.13	15.78	5.484	2.331	55.74	44
p-value > F	7.88E-08	7.12E-07	0	1.77E-09	0.000885	0.0619	0	0
Robust	YES	YES	YES	YES	YES	NO	YES	YES

*Note: * indicates significant at 10%; ** indicates significant at 5%, and *** indicates significant at 1%.*

Source: Research data, 2024

The COVID-19 pandemic accelerated the shift towards digital solutions, significantly impacting the performance of banks listed on the Indonesia Stock Exchange (IDX). This study investigated the relationship between mobile banking usage and bank performance, focusing on periods before and during/after the pandemic. It addressed two hypotheses: H1 posits that mobile banking usage positively impacts bank performance both before and during/after the pandemic, while H2 suggests that this impact is more pronounced during/after the pandemic.

Before the pandemic (2013-2019), increased mobile banking transactions significantly improved bank performance, as evidenced by positive and significant impacts on Return on Assets (ROA) and Return on Equity (ROE). These findings support H1, confirming that mobile banking usage positively impacts bank performance. The effect of mobile banking strengthened during and after the pandemic, with the ROA model's coefficient for VolMBankVolMBank increasing from 0.00247 before COVID-19 to 0.00363 and the ROE model's coefficient rising from 0.015 to 0.0231. This demonstrates improved efficiency in generating earnings from assets and returns on shareholders' equity, supporting H2 and indicating a more pronounced effect during and after the pandemic.

This aligns with existing literature, which highlights that digital banking channels, especially mobile banking, enhance bank performance by providing greater convenience and efficiency. Studies by (Siddik et al., 2016; Oyewole et al., 2013; Le et al., 2021) demonstrate that e-banking and financial innovations, including mobile banking, positively influence financial performance. Additionally, (Hernando and Nieto, 2007) found that Internet banking adoption improved profitability and operational efficiency for Spanish banks. These studies collectively support the notion that mobile banking significantly enhances bank performance.

The pandemic increased mobile banking usage due to social distancing measures and lockdowns. (Rahmi and Handayani, 2023) observed that this led to higher customer engagement and transaction volumes. Banks accelerated their digital transformation efforts to meet this increased demand, thereby enhancing operational efficiency and customer satisfaction (McKinsey & Company, 2020). This shift provided banks with additional revenue streams, improving financial performance metrics such as ROA and ROE.

For small banks, the regression results indicate that mobile banking usage does not significantly impact performance metrics like ROA and ROE. This suggests that small banks may lack the resources to fully capitalize on mobile banking, as highlighted by (Wang et al., 2020). In contrast, large banks experience a significant positive impact from mobile banking usage. The ROA model shows a positive impact at the 10 per cent significance level, while the ROE model exhibits a highly significant positive impact at the 1 per cent significance level. This supports Hypothesis 3, confirming a significant difference between small and large banks. Large banks benefit more due to economies of scale and better resources, allowing them to convert increased transaction volumes into higher returns, as supported by Wang, Xiuping, & Zhang (2020).

D. CONCLUSION

The analysis reveals that mobile banking usage positively impacts the performance of IDX-listed banks, as measured by Return on Assets (ROA) and Return on Equity (ROE). Before the pandemic (2013-2019), increased mobile banking transactions significantly enhanced bank performance, with coefficients that were both

positive and statistically significant. During and after the pandemic (2020-2023), the positive impact of mobile banking on bank performance became even more pronounced, reflecting a heightened reliance on digital channels during the crisis. The coefficients for mobile banking usage were higher and more statistically significant during this period, underscoring the critical role of digital transformation in enhancing bank performance, particularly during crises.

The study also identified differences between small and large banks. For small banks, mobile banking usage did not significantly impact performance, as the coefficients were not statistically significant. In contrast, large banks experienced significant improvements in both ROA and ROE, with positive and statistically significant coefficients. This suggests that large banks, with their extensive resources and advanced technology, benefit more from mobile banking adoption compared to smaller banks. Based on these findings, large banks should continue to invest in mobile banking technologies to enhance efficiency and customer engagement, leveraging their economies of scale. Small banks, on the other hand, should address resource constraints through fintech partnerships and technological investments. Regulators should support digital transformation, particularly for smaller banks, by providing technological and financial assistance. Future research should focus on longitudinal studies to evaluate the long-term effects of mobile banking, extending the observation period beyond the pandemic. Additionally, it should investigate the barriers faced by small banks and explore how large banks optimize their digital infrastructure and customer engagement strategies.

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