Analysis of Factors Affecting Profitability Digital Bank In Indonesia

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Abstract.

Rapid technological advances in recent years have encouraged banks to become digital banks, especially after the COVID-19 outbreak which accelerated the use of digital financial services. This study aims to examine the effect of CAR, BOPO, LDR, and bank size on the profitability of digital banks in Indonesia. Profitability is measured through ROA as the dependent variable, CAR, BOPO, LDR, and bank size as independent variables. This study uses quantitative methodology using panel data regression analysis. The research sample consists of 9 digital banks (neobanks) in Indonesia selected with a purposive sampling approach. The sample selection criteria include digital banks (neobanks) that are registered in Indonesia and have disseminated quarterly financial reports from Q1 2022 to Q4 2023 in the financial statements of the Financial Services Authority (OJK). The results show that CAR has a positive and significant effect on ROA, while BOPO has a negative and significant effect on ROA. Furthermore, LDR and bank size show a favorable and sizable impact on ROA.

Keywords: Digital Bank, Capital Adequacy Ratio, operational efficiency, Loan to Deposit Ratio and bank size.

I.   INTRODUCTION

The relatively rapid development of technology in recent times has brought society into the digital era. In Indonesia, the integration of technology into everyday life is increasingly widespread, especially in the financial and banking sectors. This trend has been further accelerated by the COVID-19 pandemic, which has driven increased consumer demand for faster and more practical digital services. As a result, banks are required to transform into digital banks in order to maintain their business(Yulita.,2023). By utilizing digital banking technology, commercial financial services are provided primarily through mobile applications, enabling easier access without geographical limitations.(Wu et al., 2023). Digital banks offer a variety of innovative features, such as online account opening, transfers, investments, payments, deposits and account closings made via smartphone without visiting the nearest bank office.(Litvishko et al., 2020).This allows people in remote areas to access financial products such as savings, credit and investments without visiting a branch office.In its operations, digital banks need to pay attention to profitability to ensure business sustainability and long-term growth. Strong profitability is needed to finance technology investments, such as digital technology development, big data management, and artificial intelligence integration to improve operational efficiency. One of the commonly used measurement parameters for profitability is*return on assets*(ROA), which reflects the efficiency of asset management in providing profitable results.(Sianturi & Rahadian., 2020). High ROA illustrates the bank's capability in managing assets efficiently to generate profit, indicating the effectiveness of asset management and positive profitability. Conversely, a lower ROA indicates constraints in optimizing assets to achieve profit. However, the average ROA value of digital banks fluctuates and is below the average for conventional banks.

The average ROA value of digital banks in Indonesia is below conventional banks. During 2022, digital banks experienced*Return on Assets*(ROA) is negative, which illustrates the challenges of digital banks in generating profitability. Although in 2023*Return on Assets*(ROA) digital banks have strengthened, but*Return on Assets*(ROA) is still below conventional banks which tend to be stable above 1.50%. This data is in line withThe Greatest Showman (2023), which states that the performance of digital banks in 2022 is disappointing compared to large conventional banks. This shows that conventional banks have a more mature financial structure, while digital banks are still in the development stage to improve operational performance and profitability. In addition, digital banks face the challenge of high investment costs in technological infrastructure, such as digital application development, cybersecurity, and artificial intelligence(Putri & Pangestuti., 2024). As well as increasingly tight competition with fintech companies and conventional banks that require digital banks to offer low-cost products, which can ultimately impact profit

margins.(Wibowo et al., 2023).One of the variables that affects bank profitability is capital adequacy. Capital adequacy refers to the amount of capital a bank has to support operations and address financial risks that may arise.(Nuryanto et al., 2020). The main indicators used to assess capital adequacy are:*Capital Adequacy Ratio*(CAR), which measures the comparison between bank capital and risk-based assets.

This ratio is an important indicator to ensure that the bank has sufficient reserves to withstand potential losses without disrupting its operational continuity. According toHanaffy (2023)The higher the capital adequacy ratio, the better the bank's condition in generating profits. High capital adequacy has a strong financial buffer to overcome the risk of loss. Greater capital adequacy can reduce capital costs and increase operational efficiency, thus supporting increased profitability.(Nuryanto et al., 2020).Another factor that affects bank profitability is operational efficiency.Operational efficiency refers to a bank's ability to maximize revenue by minimizing operating costs.(Setiawan, 2024). In general, to measure operational efficiency, the operating cost ratio indicator is used to operating income (BOPO). This ratio describes how effectively the bank controls costs in its operational activities,Khatiwada et al (2024).BOPO has a negative impact on bank profitability. A higher BOPO ratio indicates a bank's inefficiency in carrying out its operations. This inefficiency causeshigher operational cost expenditure, which can ultimately reduce the bank's profit income. On the other hand, the smaller the BOPO ratio, the more effective the bank is in managing its operational costs, therefore it can reduce costs and increase profits.(Hanaffy., 2023; Rahman et al., 2020).Liquidity risk relates to the bank's capacity to meet its short-term financial commitments,(Olofin et al., 2024). such as withdrawal of funds by account holders, without causing disruption to the overall operational efficiency of the institution.

Typically, liquidity risk assessment is carried out through*Loan to Deposit Ratio*(LDR). LDR functions as an indicator of the bank's capacity to meet the demands of depositor withdrawals by utilizing disbursed loans as a source of liquidity. LDR has a positive impact on bank profitability. (Rahagi et al., 2023). A higher LDR indicates that the bank is providing more credit distribution, which in turn can increase the interest income earned by the bank. This increase in interest income directly contributes to an increase in the bank's net profit, which ultimately affects the level of profitability.Bank size refers to the total capacity owned by the financial institution, which can be measured through various indicators, such as total assets, equity, transaction volume, and number of registered customers.(Prasanjaya & Ramantha., 2013). The study shows that bank size has a significant impact on profitability, which is multidimensional. In general, banks with large valuations have higher efficiency than banks with smaller valuations.(Batten & Vo, 2019; Jayaraman & Srinivasan, 2019; Karaduic & Dalovic, 2021). Larger digital banks have a number of competitive advantages, especially in terms of access to resources to expand their business.This researchaims to review the impact of CAR, LDR, BOPO, and bank size on the profitability of digital banks in Indonesia. The novelty of this study lies in its focus on digital banks, which are still rarely studied compared to Islamic banks or conventional banks. From a theoretical perspective, this study is expected to contribute to enriching the literature related to the determinants of profitability in the digital banking sector in Indonesia.

II.   METHODS

This study applies quantitative methods to investigate the correlation between independent and dependent variables in the context of digital banks. The dependent variable in this study is ROA, which serves as the main metric for assessing the profitability of digital banks. Meanwhile, the independent variables include several important factors, namely liquidity risk (LDR), BOPO, CAR, and the size of digital banks.This study uses a population of digital banks recorded in Indonesia. From this population, researchers took a sample consisting of 9 digital banks, namely Bank Neo Commerce, Bank Raya Indonesia, Bank Allobank Indonesia, Bank Jago, Bank Digital BCA, Bank Amar, and Bank Hibank, Bank Krom Indonesia. Sample selection was carried out using a purposive sampling approach. The criteria are that digital banks have complete financial reports from the first quarter of 2022 to the fourth quarter of 2023, which are published by the Financial Services Authority (OJK). This data includes relevant information related to ROA, LDR, BOPO, CAR, and bank size. The use of data sourced from OJK is very important in increasing

the validity and reliability of the information used in the analysis. So it can be ascertained that the findings of this study have high credibility and provide a significant contribution to understanding the dynamics of digital banks.The data analysis process will be carried out using Eviews software version 12. In this analysis, researchers will apply panel data regression to identify the effect of operational efficiency, capital adequacy, liquidity risk, and bank size on profitability as measured by ROA. The panel data regression model can be expressed in the following mathematical equation:

$Y\ it = \beta0 + \beta1X1it + \beta2X2it + \beta3X3it + \beta4X4it + \mu it$

Explanation:

Yit　　: Profitability,

β　　: Constanta,

X1　　: Capital adequacy ratio,

X2　　: BOPO

X3　　: Loan to Deposit Ratio,

X4　　: Bank size

i　　: Digital banking company,

t　　: Period / time

μ　　: Error term

III.　　RESULTS AND DISCUSSION

Table 1. Descriptive statistics

	Mean	Median	Maximum	Minimum	Std, Dev,
CAR	87.93	80.68	283.38	19.72	59.02
BOPO	87.64	93.30	192.34	16.14	29.92
LDR	125.39	81.48	649.04	36.17	119.08
Bank Size	16.19	16.34	17.30	14.86	0.64
ROA	0.72	0.81	5.12	-13.23	3.33

Source: Research Data, 2025

Descriptive statistics provide an initial view of the characteristics of the data used in the study. The Capital Adequacy Ratio (CAR) ratio has an average value of 87.93 with a median of 80.68. The maximum CAR value was recorded at 283.38, while the minimum value was 19.72. The spread of CAR data is quite large, indicated by a standard deviation of 59.02. Furthermore, the Operating Expense to Operating Income (BOPO) ratio has an average value of 87.64 with a median of 93.31. The maximum BOPO value was recorded at 192.34, while the minimum value was 16.14. The standard deviation is 29.92. The Loan to Deposit Ratio (LDR) ratio has an average of 125.39 with a median of 81.48. The maximum LDR value reached 649.04, while the minimum value was 36.17. The standard deviation is 119.08. Bank size, measured by the logarithm of total assets, has an average value of 16.19 with a median of 16.34. The maximum bank size is 17.30 and the minimum is 14.86, with a relatively small standard deviation of 0.64.

The Return on Assets (ROA) ratio shows an average of 0.72 with a median of 0.81. The maximum ROA value reaches 5.12, while the minimum value records a negative number, namely -13.23, indicating that the bank is experiencing losses. The standard deviation is 3.33.　　Before conducting hypothesis testing, a crucial initial step in panel regression analysis is to determine the most appropriate model for the study. The selection of the optimal model is carried out through a series of statistical tests, namely the Chow Test, the Hausman Test, and the Lagrange Multiplier Test. These three tests are used to compare the three main panel regression models, namely the common effects model (CEM), the fixed effects model (FEM), and the random effects model (REM). The results of these tests will determine the most appropriate model to use in panel regression analysis to obtain more accurate estimates.

Table 1. CHOW Model Selection Test

Effects Test	Statistics	d,f,	Prob,
Cross-section F	11.02	(8.59)	0.00
Cross-section Chi-square	65.83	8	0.00

Source: Research Data, 2025

The results of the Chow test conducted in this studyshows that the probability value (p-value) obtained is close to 0.00. This value is far below the significance limit of 0.05. This indicates that the most appropriate model to use in this study is FEM. Ensuring whether FEM is really better than REM, Therefore, the next stage in the analysis process is to carry out the Hausman test. This test aims to compare the two models by testing the correlation between the independent variables and individual effects. If the results of the Hausman test indicate that FEM is more appropriate, then this model will be used in the study. Conversely, if REM is more appropriate, then the random effects model will be the main choice in the analysis.

Table 3. Hausman Test Model Selection Test

Test Summary	Chi-Sq, Statistics	Chi-Sq, d,f,	Prob,
Random cross-section	2.12	4	0.71

Source: Research Data, 2025

The Hausman test findings show that the p-value obtained is 0.71 > 0.05. This shows that the most appropriate model to be used in this study is REM. In order to determine whether REM is superior to CEM in explaining data variation. If the LM test results show that REM is more appropriate, then the random effects model will be used. Conversely, if CEM is more appropriate, then the ordinary effects model will be the choice in this regression analysis.

Table 4. Lagrange Multiplier Model Selection Test

	Cross section	Time	Both
Breusch Pagan	64.08	0.63	64.72
	(0.00)	(0.42)	(0.00)

Source: Research Data, 2025

The results of the Lagrange Multiplier test show that the p-value for Cross-section is 0.00, this value is below the Significance limit of 0.05. Therefore, it can be concluded that the most suitable model for this study is REM. Based on the findings of the Chow, Hausman, and Lagrange multiplier tests, it shows that the most suitable method is the REM model.

Regression equationrandom effects model.

$Y = -23.9255539394 + 0.0139843178324*X1 - 0.0742496575309*X2 + 0.00618955547027*X3 + 1.79997593366*X4 + [CX=R]$.

Based on the regression equation, it can be concluded regarding the relationship between the independent variables (X1, X2, X3, X4) and the dependent variable (Y).. The constant value obtained is -23.92 indicating that if all independent variables (X1, X2, X3, and X4) are zero, then the value of the Y variable, namely ROA, is estimated to be at -23.92. The X1 variable or Capital Adequacy Ratio (CAR) has a positive coefficient value of 0.0139. This shows that every CAR that increases by one unit will cause an increase in ROA of 0.0139 or vice versa. The coefficient for the X2 variable or BOPO is negative at -0.0742. Explaining that if the BOPO ratio increases by one unit, then ROA will decrease by 0.0742 or vice versa. The coefficient for the X3 variable or liquidity risk (LDR) is positive 0.0061. Every one unit increase in LDR will contribute to an increase in the ROA of digital banks by 0.0061 or vice versa. The coefficient for the X4 variable or bank size is positive and quite significant at 1.7999. This shows that every one unit increase in bank size will contribute to an increase in ROA by 1.7999 or vice versa.

Table 5. Random Effect Model Hypothesis Testing

Variable	Coefficient	Std, Error	t-Statistic	Prob,
ROA	-23.92	12.46	-1.91	0.05
CAR	0.01	0.00	2.66]	0.00
BOPO	-0.07	0.00	-9.88	0.00
LDR	0.00	0.00	3.79	0.00
Bank Size	1.79	0.74	2.41	0.01

Source: Research Data, 2025

The effect of CAR on ROA. The CAR variable has a coefficient value of 0.01, with a p-value of 0.00 <0.05. Indicates that CAR has a positive and significant effect on ROA partially. Thus, the hypothesis that CAR has a positive impact on the profitability of digital banks can be accepted. The higher the CAR, the

greater the bank's capability in managing potentially problematic credit risks. Banks with a high level of capital adequacy not only have the capacity to cover potential losses. But also able to carry out its operational activities more efficiently and effectively, thus having a positive impact on overall financial performance. In addition, large capital provides flexibility for bank management in allocating funds for profitable investments, which can ultimately increase profitability. Increasing the capital adequacy ratio can also increase public trust in banks(Setiawati et al,, 2017). Banks with strong capital are considered more capable of facing financial risks, thus attracting more depositors to save their funds in the banking institution. This condition, in turn, increases the bank's lending capacity and expands income opportunities. This finding is in line with previous research on the effect of CAR on bank profitability, a study conducted byHanaffy (2023), Khalifaturofi'ah Oktavi s & Ulum Saiful A (2022), Parlindungan et al (2024), Rahman et al (2020), Rayamajhi & Bhandari (2024), Saleh & Afifa (2020)also confirmed that CAR has a positive and significant relationship with ROA. The effect of BOPO on ROA.

The BOPO variable has a coefficient value of -0.07, with a p-value of 0.00 <0.05. This finding shows that BOPO has a significant negative impact on ROA. Therefore, the hypothesis that BOPO has a negative impact on the profitability of digital banks can be accepted.Higher operational efficiency is reflected in the low BOPO ratio, which contributes to increasing digital bank profits.. The relatively low BOPO ratio indicates that digital banks have successfully managed their operational costs optimally, resulting in cost reductions that have a positive impact on profitability. This increased efficiency allows banks to allocate resources to developing better products and services and strengthening their competitiveness in the market. This finding is in line with research conducted byFajari & Sunarto (2017), Hanaffy (2023) Khatiwada et al (2024), Parlindungan et al (2024), Rahman et al (2020), Athari (2021), Al-Sharkas & Al-Sharkas (2022)which also concluded that BOPO has a negative influence on ROA.The effect of LDR on ROA. The LDR variable has a coefficient value of 0.00, with a p-value of 0.00, <0.05. This finding shows that LDR has a positive and significant impact on ROA partially. Therefore, the hypothesis that LDR has a positive impact on the profitability of digital banks can be accepted.   A high LDR ratio indicates that the digital bankhave a larger proportion of funds to be distributed as credit to borrowers, thus reducing the amount of idle funds in the bank. When banks are able to distribute more credit, the interest income generated also increases. This arises because the amount of credit given to debtors is greater. As long as the non-performing loan (NPL) ratio remains within tolerable limits, the interest income earned by the bank will increase.

This increase in interest income ultimately contributes to bank profitability, which is reflected in a higher ROA value. This achievement is consistent with research byDewi & Ariyanto (2018), Karadayi (2023), Rahagi & Rahadi (2024), Rahagi et al (2023)which also concluded that LDR has a positive impact on ROA.The Effect of Bank Size on ROA, The bank size variable has a fairly high coefficient, which is 1.79, with a probability value (p-value) of 0.01 <0.05. This finding shows that bank size has a positive and significant impact on ROA. Therefore, the hypothesis that bank size has a positive impact on the profitability of digital banks can be accepted.The larger the size of the digital bank, the higher the level of profitability that can be achieved.. On the other hand, smaller digital banks tend to experience a decline in profitability. The size of a bank not only reflects its operational capacity, but also includes aspects such as the amount of assets, the number of customers, and the scope of services offered. Larger banks have access to broader resources, including funding, technology, and stronger market networks.Abundant resources allow digital banks to make larger investments, which in turnultimately can increase profitability. For example, large-scale banks can develop banking service technology, improve infrastructure, and expand the bank's market reach. Improvements in these aspects contribute to increased revenue and operational efficiency, which ultimately have a positive impact on ROA. The findings of this analysis are in line with research conducted byBatten & Vo (2019), GrZeta et al (2023), Jayaraman & Srinivasan (2019), Karaduic& Dalovic (2021)which also explains that company size (bank) has a positive influence on ROA.

Table 6. Determinant Coefficient Test

Root MSE	1.11	R-squared	0.67
Mean dependent variable	0.16	Adjusted R-squared	0.669
S,D, dependent var	1.98	S,E, of regression	1.15
Sum squared residual	90.00	F-statistic	35.53
Durbin-Watson stat	1.57	Prob(F-statistic)	0.00

Source: Research Data, 2025

Table 6 presents the results of the determination coefficient test, which provides an overview of how much the independent variables in this study can provide an explanation of the dependent variable. The Adjusted R-squared value obtained is 0.669, or around 66%. This means that 66% of the variation in profitability measured using ROA can be explained by changes in the CAR, BOPO, LDR, and bank size variables. Thus, the regression model used in this study can be categorized as a relatively good model in explaining the relationship between all of these variables. Meanwhile, the remaining 34% is influenced by other factors that are not included in this research model.

In addition, Table6 also presents the results of the F statistical test, which aims to test the significance of the overall model. The test findings show that the probability value of the F statistic is 0.00 <0.05 (5%). This finding shows that simultaneously, the independent variables CAR, BOPO, LDR, and bank size have a significant impact on the dependent variable ROA. Thus, the results of this study provide strong evidence that the profitability of digital banks is significantly influenced by these four variables. This confirms that capital, operational efficiency, liquidity management, and bank scale are factors that play a crucial role in determining the performance of digital banks.

IV.   CONCLUSION AND SUGGESTIONS

Based on panel regression analysis with data for the 2022–2023 period, the Random Effects (REM) model proved to be the most appropriate in measuring the influence of CAR, BOPO, LDR, and bank size variables on the profitability (ROA) of digital banks. The findings show that CAR, LDR, and bank size have a significant positive impact on ROA, while BOPO has a negative impact on ROA. Thus supporting the initial hypothesis that these variables significantly affect the financial performance of digital banks. The Adjusted R-squared value of 66% and the strong significance of the F test indicate that this model is able to explain most of the variation in ROA, although this study is limited by the use of data for only two years. The limitation of this study is that the data in this study only uses data from the first quarter of 2022 to the fourth quarter of 2023.. Future research is suggested to use a relatively longer time period to obtain a more comprehensive picture of the dynamics of digital bank profitability. In addition, future research should consider the addition of other variables that may have an influence and the expansion of the sample scope so that the results obtained are more representative and applicable in the context of the digital banking industry.

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