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COVID-19 Pandemic: Impact on Net Interest Margin of Indonesia Banking Industry

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Abstract: This study explores the factors that affect the net interest margin (NIM) in the Bank Modal Indonesia Group. Using data from January 2021 to March 2022 and the Error Correction Model, a short-term negative correlation between BOPO and LDR and NIM in KBMI 1 and a long-term positive correlation with BI Rate was found. Meanwhile, KBMI 2 shows a short-term negative correlation between inflation and LDR and NIM. In addition, KBMI 3 showed a short-term negative correlation with Covid-19, LDR, and BOPO with NIM. On the other hand, KBMI 4 experienced the negative impact of BOPO, Covid-19, and LDR on NIM both in the short and long term. This review emphasizes the importance of managing operational costs and lending for NIM stability in the short term and highlights the significant influence of Bank Indonesia's benchmark interest rate policy on NIM in the long term, requiring careful adjustments to prevent excessive fluctuations.

Keywords: Banking Industry, Covid-19 pandemic, Loan to Deposit Ratio, Net Interest Margin, Operational Costs to Operating Income.

Introduction

The COVID-19 pandemic has caused a significant impact on the global economy, reducing the performance of various business sectors around the world (Song & Zhou, 2020). Efforts to prevent the spread of the virus, such as implementing social distancing, maintaining physical distance, and wearing masks, have become standard in various policies implemented by countries around the world. One of the sectors directly affected is the financial services industry, especially the banking sector (Wójcik & Ioannou, 2020). The COVID-19 pandemic created new challenges for the banking industry, prompting the need for rapid and creative adaptation to survive in these uncertain conditions (Peñarroya-Farell & Miralles, 2022). Banks around the world have been forced to face various challenges, such as increased credit

risk, decreased demand for credit, fluctuations in financial markets, and declining revenues. To address these challenges, banks must create innovative and effective strategies, involving the use of digital technologies, operational restructuring, and policy adjustments.

The COVID-19 pandemic has created a situation where economic volatility has increased, triggering changes in market dynamics and exacerbating financial uncertainty (Altig et al., 2020). In this context, banks hedge their Net Interest Margin (NIM)—a fundamental indicator of profitability and efficiency in interest-bearing asset management. NIM reflects the difference between interest income earned from lending activities and interest costs incurred for deposits and other sources of funds, becoming an important barometer of banks' ability to optimize the difference between asset yields and funding costs amid changing economic conditions (Le, 2017). Amid the economic turmoil caused by the pandemic, banks are faced with a range of risks and increasing complexity, ranging from declining credit quality to limited liquidity and fluctuating interest rates. The economic impact caused by the COVID-19 pandemic has disrupted the NIM ratio in Indonesia's national banking industry. Based on data from the Otoritas Jasa Keuangan (2020), the first half of 2020 experienced a continuous decline in the NIM of conventional commercial banks, which was caused by a decrease in overall bank interest income. During 2020, Indonesia's economic performance experienced a significant slowdown compared to previous years. As a result, the profitability of the banking sector was pressured due to the decline in NIM. Strategies aimed at maintaining and enhancing NIM include a variety of initiatives, including optimization of asset-liability management, prudent pricing of loans and deposits, and proactive risk management practices to reduce interest rate and credit risk.

NIM is an indicator used to evaluate a bank's ability to manage risks arising from interest rate fluctuations. Changes in interest rates can have a direct impact on a bank's income and interest expense. NIM reflects the close relationship between a bank's ability to manage its productive assets so as to generate optimal net interest. As mentioned by Saunders and Schumacher (2000), high net interest margins are often associated with a bank's efficiency in managing its portfolio of interest assets and liabilities. In addition, NIM is also considered as one of the indicators of the health of a country's banking system. However, in the Indonesian context, NIM over the past few years has tended to be influenced by banking sources of funds, primarily through a comparison between lower deposit rates and lending rates. The effect of interest rates on NIM has been the focus of previous research, as revealed by Hamadi & Awdeh, (2018). The research provides a deeper understanding of how interest rate fluctuations affect banks' NIM performance, as well as their implications for the stability and health of the banking sector as a whole. Thus, a deeper understanding of the dynamics of the relationship between interest rates and NIM is essential for more effective risk management and monitoring of the health of the banking sector in Indonesia.

The behavior of financial institutions during the COVID-19 pandemic shows a tendency to reduce lending rates, which then has an impact on their interest income. This step was taken with the aim of maintaining liquidity amid uncertain economic conditions due to the pandemic. This is reflected in the decrease in the value of the Loan to Deposit Ratio (LDR) from 93.36 percent in early 2020 to 79.11 percent in September 2021. Research involving the analysis of the influence of LDR on NIM has been conducted by Moussa and Majouj (2016); Lin et al., (2012); Hao et al., (2023); Son, (2024). Today, this research is of major concern to many academics and financial practitioners, as it highlights important relationships in global economic and financial dynamics.

One of the external elements that can cause difficulties in financial management is inflation (Andriana et al., 2023). In the Indonesian economy, there has been a decline in people's purchasing power, which is reflected in the high negative inflation rate (deflation) at the beginning of 2020. This is due to the economic policies implemented by the Indonesian government to reduce inflationary pressures. The impact of this condition is the number of business actors who postpone applying for credit to banking institutions. This phenomenon directly affects the performance of bank loans, which in turn begins to erode the NIM of the banking sector. It is worth noting that previous studies have explored the impact of inflation in this context. Study conducted by Ugur and Erkus (2010) and Amuakwa-Mensah and Marbuah (2015); Doyran (2013); and Islam & Nishiyama, (2016) are some relevant examples. The study provides an in-depth understanding of how inflation can affect various aspects of the economy, including banking performance through its influence on credit demand and overall market conditions.

NIM is one of the key parameters that describe the financial performance of the banking sector. NIM has also experienced a significant decline, not only due to the direct impact of the pandemic, but also by the increasing fierce competition in the digital era (Jameaba, 2024). Banks are currently engaged in intensifying competition to improve their operational efficiency amid the ongoing digital transformation. The Financial Services Authority (OJK) allows banks to make structural changes in their operations through digital transformation, with the aim of maintaining profitability amid NIM pressure. This step is carried out by utilizing technology to optimize operational processes, increase efficiency, and expand the range of services to customers. A number of banks also continue to drive efficiency and automation in their services as part of their efforts to adapt to the new conditions faced by the banking sector. However, in dealing with the impact of the pandemic, banks must also consider the long-term consequences of this crisis on the trust and reputation of the banking industry. Therefore, it is important for researchers and financial practitioners to understand how Operating Expenses Operating Income (BOPO) affect NIM in this context. Previous research conducted by Agoraki and Kouretas (2019); Baskerville et al., (2020); Romdhane, (2021) has explored this relationship, and this study provides valuable insights into risk management strategies and operational efficiencies that banks can implement in the digital era and in the midst of a pandemic.

According to the classification that has been established by Financial Services Authority (2021) The banks are grouped into four Core Capital Bank Groups (KBMI), where each group has a different capital range. KBMI 1 has a core capital of up to six trillion rupiah, KBMI 2 has a core capital of more than six trillion rupiah to fourteen trillion rupiah, KBMI 3 has a core capital of more than fourteen trillion rupiah to seventy trillion rupiah, and KBMI 4 has a core capital of more than seventy trillion rupiah. In the context of financial sector supervisory and regulatory policies, this classification plays an important role in ensuring the existence of standards appropriate to the level of risk and complexity of financial institutions. By grouping banks into categories based on capital size, OJK can apply a proportional and effective supervisory approach, according to the characteristics and needs of each group.

This research is relevant especially in the context of the COVID-19 pandemic which has changed the economic and financial landscape globally. During the economic crisis caused by the pandemic, banks were faced with various challenges that affected their financial performance, including increased credit risk, inhibited lending, fluctuations in operating costs, the impact of inflation, and changes in consumer behaviour. However, there is a

research gap that needs to be further revealed, namely regarding the differences in responses and strategies between banks classified in the Core Capital Bank Group (KBMI) 1, 2, 3, and 4. Through the analysis of the impact of risks associated with the pandemic, this research can provide insights into effective strategies in managing risk and maintaining the financial health of banks. Significant differences in adaptation capacity and resilience to crises between banks with small capital (KBMI 1 and 2) and large (KBMI 3 and 4) are also the main focus of this study.

The study expands the understanding of how banks' capital structures affect the response to crises, particularly during the COVID-19 pandemic. Using the Error Correction Model (ECM) to analyse the Net Interest Margin (NIM) on KBMI 1, 2, 3, and 4 separately, this study identified the short-term and long-term relationship between factors such as BOPO, LDR, BI Rate, inflation, and Covid-19 with NIM for each bank group. The latest lies in the separation approach of regression analysis between KBMI banks, which is rarely done in the literature. This study provides an in-depth look at the impact of external and operational factors on NIM, and reveals differences in responses and strategies between banks in dealing with crises. The results provide important insights for decision-makers in financial institutions and regulators in designing adaptive policies. The novelty contribution of this study is the use of sophisticated ECM for NIM and Covid-19 analysis as a central variable. Thus, this study not only deepens the understanding of the impact of the crisis on NIM, but also provides an overview of the strategies of KBMI banks in maintaining financial stability in the midst of global economic turmoil. The study also provides a basis for further research in risk management, economic policy, and business strategy in the future, especially in the face of increasingly complex global challenges such as the COVID-19 pandemic.

The remainder of the study is outlined as follows: The literature review and development of hypotheses are examined in Section 2. Section 3 explores the data and methodology. The movement of variables, empirical results, and discussion are reported in Section 4. Section 5 concludes and presents policy implications for banks in Indonesia.

Literature Review

Net Interest Margin (NIM) is a key indicator in a bank's performance that shows the difference between interest income from loans and interest paid on deposits relative to assets owned (Ramlall, 2023). To understand the impact of the COVID-19 pandemic on NIM in the Indonesian banking industry, several economic and financial theories have become very relevant. Fisher's interest rate theory links nominal interest rates to inflation and real interest rates. During the pandemic, fluctuating inflation and the reduction of the benchmark interest rate by central banks affected nominal and real interest rates, which in turn affected banks' interest income (Tombini, 2023). The reduction in the benchmark interest rate makes interest income from loans decrease, while interest costs on deposits are also reduced, but not always balanced, so NIM can be depressed.

Business cycle theory explains how economic crises, such as pandemics, can affect various sectors of industry. The pandemic caused a significant economic contraction, reduced credit demand, and increased credit risk, which negatively impacted net interest income (Jou et al., 2024). With the decline in economic activity, credit demand from households and businesses decreases, so interest income from loans also decreases. Risk management theory has become particularly relevant as the pandemic has increased uncertainty and default risk.

Banks must tighten provision policies to anticipate an increase in non-performing loans, which has an impact on profitability and NIM. This increase in provision means that banks will have to set aside more funds to cover potential losses from non-performing loans, thereby reducing net income and NIM.

Research on the factors affecting the Net Interest Margin (NIM) of Conventional Banks has been an important concern in the current financial literature. As part of the external factors that can affect NIM, Loan to Deposit Ratio (LDR) and interest rates have been found to be significant variables in various studies. Study by Quoc Trung (2021) and Muraina, (2018) shows that LDR has a significant impact on the NIM of Conventional Banks. They found that an increase in LDR tended to lower NIM, indicating higher credit risk and pressure on banks' profit margins. Similar findings were also found in research by Weigand (2016), which highlights the importance of credit portfolio management in maintaining healthy NIM. A high LDR can increase a bank's interest income because the amount of loans provided by the bank becomes larger (Rabab'ah, 2015). However, if the loan provided is too high without taking credit risk into account, this can reduce NIM as higher credit risk can result in losses for the bank (Trinugroho et al., 2014).

Interest rates have also been found to be a factor influencing NIM. Research by Klein (2021) and Barik & Raje (2019) shows that changes in interest rates affect NIM, with increases in interest rates likely to increase NIM through a higher effect on interest income than the cost of funds. The study underscores the importance of a good understanding of interest rate dynamics in the management of NIM. When the benchmark interest rate rises, usually banks will also raise lending rates to their customers (Duffie & Stein, 2015). In this case, when the loan interest rate rises faster than the deposit rate paid to the customer, the NIM will increase because the difference between the loan rate and the deposit rate (interest spread) increases (Brunnermeier & Koby, 2018). However, if deposit rates rise faster than lending rates, this may lead to a decrease in NIM as interest spreads shrink. In addition, changes in the benchmark interest rate can also affect bank funding costs. When the benchmark interest rate rises, the bank's funding costs will usually increase because the bank has to pay higher interest to get funds from the financial markets. This can reduce NIM because higher funding costs reduce the difference between interest income and interest expense.

However, recent changes in the global economic landscape, especially with the advent of the Covid-19 pandemic, have brought a significant impact on the banking industry. Research by Mateev et al., (2022) and Shabir et al., (2023) shows that the impact of Covid-19 on Conventional Bank NIM is not only through traditional factors such as LDR and interest rates, but also through increased credit risk and changes in customer behaviour patterns. The COVID-19 pandemic may lead to a deterioration in asset quality and an increase in credit risk for banks (Disemadi & Shaleh, 2020). Sluggish economic conditions and high uncertainty can lead to an increase in the number of non-performing or defaulted loans (Balgova et al., 2018). Banks may then need to increase reserves to cover losses that may result from bad loans, which can lead to a decrease in NIM. Stimulus policies and government interventions to respond to the pandemic may also affect banks' NIM. For example, a cut in the benchmark interest rate by the central bank or a credit guarantee program by the government can reduce bank interest income or reduce interest spreads, which can depress NIM.

In addition, inflation is also an important factor that can affect NIM. Research by Jima, (2017) and Singh & Sharma, (2016) found that inflation can affect NIM by affecting the real

value of a bank's assets and liabilities, as well as changing consumer behaviour and investment patterns. This emphasizes the importance of considering the impact of macroeconomic factors such as inflation in a bank's NIM analysis. Inflation tends to lead to an increase in general interest rates in the market (Ascari & Sbordone, 2014). As interest rates increase, funding costs for banks also tend to rise. If banks cannot raise the interest rates charged to borrowers in proportion to the increased cost of funding, their NIM could erode as their interest margins shrink. On the other hand, inflation can also lead to an increase in interest rates charged to borrowers. When interest rates on loans rise due to inflation, banks can experience increased interest income from their loan portfolios (Adzobu et al., 2017). If the increase in interest rates charged to borrowers exceeds the increase in bank funding costs, then the bank's NIM may increase.

This research hypothesis is based on the observation that factors such as Loan to Deposit Ratio (LDR), interest rates, the impact of Covid-19, and inflation have the potential to affect the NIM of Conventional Banks in the Core Capital Bank (KBMI) group 1, 2, 3, and 4. We hypothesized that there was a significant relationship between LDR and NIM, in the hope that an increase in LDR would lead to a decrease in NIM. Similarly, we hypothesize that interest rates have a significant influence on NIM, where a rate hike will have a positive impact on NIM. Furthermore, we anticipate that the impact of Covid-19 will have a significant impact on NIM, assuming that the crisis may depress NIM as a result of increased credit risk and changes in customer behaviour. Finally, we hypothesize that inflation has a significant relationship with NIM, in the belief that an increase in the inflation rate will depress NIM through its effect on the real value of bank assets and liabilities. By testing these hypotheses, we hope to provide a better understanding of the factors affecting Conventional Bank NIM and how they relate to different groups of Core Capital Banks.

Methods

This study analyses the effect of Loan to Deposit Ratio (LDR), Operating Costs on Operating Income (BOPO), Inflation, BI Rate, and confirmed cases of COVID-19 used as independent variables (X) and Net Interest Margin as bound variables (Y), using data from the banking industry in Indonesia. The data used in this study is time series data from the period January 2021 to March 2022. Secondary data types are sourced from the Financial Services Authority (OJK), World meter, and International Monetary Fund. The analysis used in this study is descriptive analysis to analyse movement between variables and quantitative analysis using the Error Correction Model (ECM) method. The equation in the short term is as follows:

$$\Delta NIM = \beta_0 + \beta_1 \Delta LDR_{t-1} + \beta_2 \Delta BOPO_{t-1} + \beta_3 \Delta Inflation_{t-1} + \beta_4 \Delta LNCOV_{t-1} + \beta_5 \Delta Birate_t + \beta_6 ECTe_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(1)$$

While the equation in the long term is as follows:

$$NIM = \beta_0 + \beta_1 LDR + \beta_2 BOPO + \beta_3 Inflation + \beta_4 COV + \beta_5 Birate + e \dots(2)$$

NIM is Net Interest Margin; LDR is Loan to Deposit Ratio; Inflation; BOPO is Operating costs to operating income; COV is a confirmed case of COVID in Indonesia; BI Rate is Bank Indonesia Reference Interest Rate; β is the constant of each variable.

Table 1. **Variable Operational Definition**

Variable	Definition	Formula/Unit	Source
Net Interest Margin (NIM)	Net interest margin (NIM) is a measure of the net return on a bank's productive assets, which include investment securities, loans, and leases. This is the ratio of interest income minus interest expense divided by productive assets (Kumar, 2014).	NIM = Net interest income/Productive assets Net interest income = Interest income − Interest expense	Financial Services Authority
Loan to Deposit Ratio (LDR)	A structural indicator used to capture potential risks associated with commercial banks' liquidity and funding (Boďa &; Zimková, 2021).	LDR = (Credit Granted / Total Funds Received) x 100%	Financial Services Authority
Inflation	In this study, inflation was measured using the Consumer Price Index (CPI). The Consumer Price Index (CPI) is a measure of the average change over time in prices paid by urban consumers for a set of consumer markets for consumer goods and services (U.S. Bureau of Labor Statistics, 2024).	Inflation = (CPI of this period- CPI of the previous period) / CPI of the previous period) x 100	International Monetary Fund
Bank Indonesia Interest Rate	In this study using Bank Indonesia's benchmark interest rate (BI Rate). BI Rate is an interest rate policy set by Bank Indonesia. Currently, the term has been changed to BI-7 Day Repo Rate (BI7DRR).	%	Financial Services Authority
COVID-19	In this study using the number of confirmed cases of COVID-19 as a proxy for the variable COVID-19 pandemic. Confirmed cases of COVID-19 are cases with laboratory-confirmed infection using real-time PCR (El-Gilany, 2020).	Number of confirmed cases of COVID-19	Worldometer

Variable Movement Analysis

The number of confirmed cases of the COVID-19 virus has continued to increase globally since the start of the pandemic. Figure 1 shows the variable movement of confirmed cases of COVID-19 in Indonesia with KBMI NIM of 1, 2, 3 and 4. The COVID-19 pandemic has a positive trend. The Covid-19 pandemic has brought changes to the world with various challenges that were never imagined before. In Indonesia, Covid-19 has infected more than 1.3 million people since the first case was announced in March 2020. However, efforts to inhibit the spread of the COVID-19 virus have hampered economic activities and the impact on the level of social welfare is increasingly felt by the community. Indonesia's economy in the first quarter of 2020 against the first quarter of 2019 grew by 2.97 percent (y-on-y), slowing down compared to the achievement in the first quarter of 2019 of 5.07 percent.

The government's decision to implement Large-Scale Social Restrictions (PSBB) in several regions since April 2020 has had a broad impact on the production, distribution, and other operational activities that ultimately disrupt economic performance (Kumala, 2020). The second quarter was the culmination of all economic downturns as almost all business sectors were closed to prevent the spread of the SARS-CoV-2 virus that causes Covid-19. PSBB as a step to handle the Covid-19 pandemic applied to several regions in Indonesia is a factor that caused a contraction in economic growth in the second quarter of 2020. Indonesia's economy in the second quarter of 2020 compared to the previous quarter experienced a growth contraction of 4.19 percent (q-to-q) (Halimatussadiah et al., 2020). The PSBB policy to prevent the spread of the Covid-19 pandemic has caused limited mobility and community activities which have an impact on reducing domestic demand. People's incomes that have decreased due to the pandemic have caused most business sectors to reduce their activities or close completely.

Figure 1. **Variable Movement**
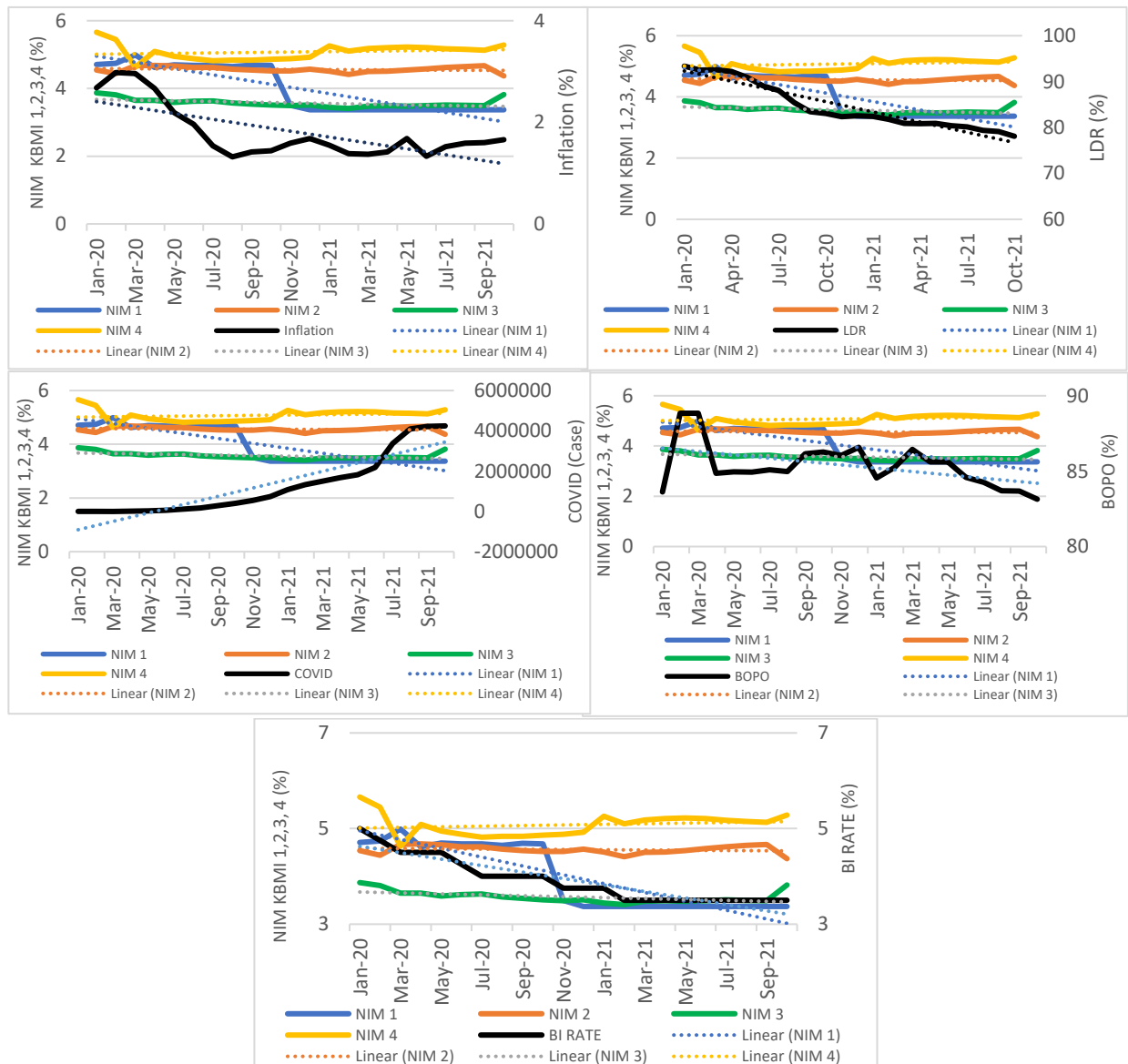
Source: Financial Services Authority, data processed, 2022

The banking sector is facing a double shock from the physical economy and financial markets. The virus pandemic is highly contagious, and its differences in strategies and levels of prevention and control make the risk of international crossover and mutual transmission higher. Central banks and financial regulators in various countries and regions around the world have launched various policies to encourage and support the banking sector to actively support companies and individuals.

The movement of the Loan to Deposit Ratio tends to decrease. The weak lending trend during the Corona Virus (Covid-19) pandemic has resulted in the bank's Loan to Deposit Ratio (LDR) declining, based on data from the OJK (2021). The Loan to Deposit ratio (LDR) is decreasing because at the same time the number of third-party funds (DPK) in the banking industry is also still increasing (Shodrokova et al., 2023). The Loan to Deposit Ratio that began to fall was also due to no economic activity, so there was no demand for credit. The existence of regulations regarding PSBB greatly affects the demand for credit in banks (Toni & Goh, 2022).

The decline in demand for credit during the Covid-19 pandemic has resulted in looser bank liquidity (Adrian et al., 2023). This is reflected in the decline in the bank's Loan to Deposit Ratio (LDR), which in January 2021 reached a level of 83.77 percent, much lower than the same period in the previous year which reached 93.36 percent. This situation can be seen from the tendency of people to save money and restrain consumption, as can be seen from the growth of household consumption in the first quarter of 2020 which was only 2.84 percent (year-on-year), down from the same period in 2019 which was 5.02 percent. In addition, data from the Deposit Insurance Corporation (LPS) recorded a surge in public deposits in banks with a value of Rp1 billion to Rp2 billion by 9.3 percent. In addition, according to data from the Financial Services Authority (OJK, 2021), people's savings under IDR 5 billion have increased significantly, namely 14.2 percent when compared to 2019 which only grew 5.6 percent. This change has had an impact on the bank's NIM, which can reduce the income earned by the bank. The decline in bank NIM was also influenced by the sentiment of the increasing number of Covid-19 transmission cases in Indonesia, where profitability is very important for companies because the level of revenue is used to measure the effectiveness of company management obtained from sales and investment revenue.

Related to inflation, data shows that the trend of inflation charts tends to decline during the Covid-19 pandemic. Inflation rates have continued to decline during this period, even several months have printed deflation. The Central Statistics Agency recorded inflation in May 2020 at 0.07 percent, which caused inflation from early January 2020 to May 2020 to be recorded at 0.90 percent ytd and annually at 2.19 percent yoy (Central Bureau of Statistics, 2021). This pattern of inflation is unusual, as Covid-19 has resulted in a drop in demand due to activity restrictions. The decline in people's income also has an impact on decreasing overall demand. Inflation occurs due to price increases indicated by increases in all expenditure group indexes, including food, beverages, and tobacco groups; clothing and footwear; housing, water, electricity, and household fuel; household appliances, equipment and regular maintenance; health; transportation; information, communication, and financial services; recreational, sports and cultural; education; food and beverage suppliers or restaurants; and personal care and other services. This downward trend in inflation is due to the bank's efforts to make efficiency in its operations to survive in difficult conditions. These measures include reducing operational hours, releasing loss-making business units, and reducing employees. In addition, banks have also begun to take advantage of advances in information and communication

technology by streamlining their operational activities through automation and digitalization (Bueno et al., 2024). This supports banking operations in a more efficient manner, especially in the context of the Covid-19 pandemic which limits physical activity.

In addition, the measurement of banking efficiency also refers to the operational efficiency ratio indicator commonly used by the authority, namely operating costs to operating income (BOPO). According to the provisions of the OJK, banks are required to maintain a certain level of BOPO ratio, depending on their Core Capital Bank (KBMI) group. Based on banking data, there was a significant increase in BOPO at the beginning of the Covid-19 pandemic in March 2020, reaching 88.84 percent, compared to January 2020 before the emergence of the Covid-19 pandemic in Indonesia, which was at 83.62 percent. However, then BOPO began to show a downward trend in the following month, indicating that banking operations became more efficient over time.

On the monetary policy side, Bank Indonesia has lowered interest rates in response to the impact of the Covid-19 pandemic. For the first time, the interest rate was lowered on February 20, 2020 by 25 basis points to 4.75 percent, from the previous level of 5 percent (Bank Indonesia, 2020). The decline is in line with accommodative monetary policy consistent with controlled inflation within the target corridor, maintained external stability and pre-emptive measures to maintain domestic economic growth momentum amidst the uncontrolled global economic recovery outlook in light of Covid-19. Furthermore, interest rates fell again by 25 basis points in March 2020 to 4.5 percent, given the impact of the Covid-19 pandemic on the economy. Meanwhile, interest rates held steady at 4.5 percent in April and May. This policy is in line with efforts to maintain external stability amidst the current relatively high global financial market uncertainty (Ekarina & Fedrichson, 2020).

Findings

Core Capital Bank Group (KBMI) 1

The following are the results of the Estimated Error Correction Model (ECM) of Core Capital Bank Group (KBMI) 1 in the short and long term:

Table 2. **Estimation Results, Short-term KBMI 1**

Variables	Coefficient	t-Statistics	Prob.
C	-0.117348	-2.345496	0.0322
D(LOGCOVID)	0.058117	1.894175	0.0764
D(LDR)	-0.041293	-3.978230	0.0011
D(INFLATION)	0.315798	1.531447	0.1452
D(BOPO)	-0.011110	-1.852010	0.0826
D(BIRATE)	-0.242718	-0.478162	0.6390
ECT(-1)	-0.392704	-2.364420	0.0310
			F = 8.277718
	R^2 =0.756344	Adj R^2 = 0.664973	P = 0.000343

Source: Processed data, Eviews, (2022)

In KBMI 1, the results of estimates in the short-term show that the BOPO variable has a negative and significant influence on NIM, in line with the findings reported in a previous study by (Karamoy & Tulung, 2020). This indicates that an increase in operating expenses

relative to operating income could have a negative impact on a bank's profitability. In addition, the variable BI Rate shows a negative but not significant correlation with NIM, indicating that Bank Indonesia's benchmark interest rate does not have a strong impact on the NIM of KBMI 1 bank in the short term. In the context of the Loan to Deposit Ratio (LDR), the analysis results show a negative and significant correlation with NIM. These findings confirm that banks with high LDRs tend to have lower NIM. The interpretation of this finding is that the higher the proportion of loans provided by banks in conjunction with available third-party funds, the lower the likelihood for banks to profit from the difference in interest earned from creditors' activities. This may be due to higher credit risk or suboptimal risk management in a bank's loan portfolio.

The finding that Covid-19 is positively correlated and has a significant effect on NIM in the short term at Bank KBMI 1 is interesting to pay attention to and requires more in-depth analysis. These results are not aligned with the initial hypothesis stating that an increase in Covid-19 cases would lead to a decrease in NIM. Banks in the KBMI 1 category are generally filled by most banks with small core capital which tend to have different credit characteristics compared to large banks. It is important to consider the conditions in which KBMI 1 bank operate. In the conditions of the Covid-19 pandemic, bank management may take steps to optimize their lending, especially to affiliated companies, in an effort to save these companies from the impact of the sluggish economy due to Covid-19. This can result in an increase in interest income earned from lending to affiliated parties, which in turn can increase a bank's NIM in the short term. In addition, data from OJK shows that banks in KBMI 1 and KBMI 2 experienced an increase in capital adequacy ratio. This increase can be caused by a variety of factors, including income from stock premiums, general reserves, current year earnings, retained earnings, fixed asset revaluation reserves, fixed asset write-off allowance, and fixed asset impairment allowance. This increase in credit capital can generate more revenue for banks, which can ultimately increase their NIM in the short term.

Table 3. **Estimation Results, Long-Term KBMI 1**

Variables	Coefficient	t-Statistics	Prob.
C	-3.379085	-1.594413	0.1273
LOGCOVID	0.077295	1.713270	0.1029
LDR	-0.032492	-3.563865	0.0021
INFLATION	0.092821	0.385428	0.7042
BOPO	0.012648	1.110856	0.2805
BIRATE	1.991369	4.689520	0.0002
			F = 18.70698
	R^2 =0.831164	Adj R^2 = 0.786733	P = 0.000001

Source: Processed data, Eviews, (2022)

Based on the results of the analysis from Table 3, it can be concluded that in the long run, there are interesting findings that need attention. First, the findings show a positive correlation between Operating Expenses to Operating Income (BOPO) and NIM. This result confirms that the greater the operational costs borne by the bank, the greater the NIM it has. This factor is related to the bank's strategic decision to set higher margins to cover increased operating costs. This finding is supported by previous research Angori et al., (2019) which showed that greater management of operational costs can provide incentives to banks to improve supervision of loans given to debtors, thus minimizing the risk of non-performing loans. In addition, greater operational costs can also be used for human resource

and technology development, which in turn improves the quality of service and NIM of banks.

Furthermore, the results show that the variable BI Rate is positively and significantly correlated with NIM, signalling that an increase in interest rates results in an increase in NIM in the long run. Although banks may initially incur losses as a result of rising interest rates, in the long run they can benefit from high interest rates. These findings are relevant to the question of how banks react to structural changes in interest rates, as banks' net interest margins have a major impact on their behaviour (Bundesbank and Busch 2015).

Furthermore, the variable Loan to Deposit Ratio (LDR) shows a negative and significant correlation with NIM in the long run. This finding confirms that the higher the proportion of loans provided by banks in conjunction with available third-party funds, the lower the likelihood for banks to profit from the difference in interest earned from creditors' activities. This may be due to higher credit risk or suboptimal risk management in a bank's loan portfolio.

Finally, in the long term, the findings show that Covid-19 has a positive but not significant influence on the NIM of KBMI 1, while the inflation variable shows a positive and significant influence on NIM. The implications of these findings could provide deeper insight into how external factors such as interest rates, loan-to-deposit ratios, and general economic conditions may affect a bank's profitability in the long run.

Core Capital Bank Group (KBMI) 2

The following are the results of the Estimated Error Correction Model (ECM) of the Core Capital Bank Group (KBMI) 2 in the short term (Table 4) and long term (Table 5):

Table 4. **Estimation Results, Short-Term KBMI 2**

Variables	Coefficient	t-Statistics	Prob.
C	-0.061202	-1.772636	0.0932
D(LOGCOVID)	0.075193	2.915193	0.0092
D(LDR)	-0.026972	-2.536325	0.0207
D(INFLATION)	0.030364	0.187703	0.8532
D(BOPO)	-0.000161	-0.011092	0.9913
D(BIRATE)	0.333101	1.027442	0.3178
ECT(-1)	-0.286467	-1.526427	0.0443
			F = 2.210114
	R^2 =0.424197	Adj R^2 = 0.232263	P = 0.089860

Source: Processed data, Eviews, (2022)

The results of short-term analysis reveal that inflation has a positive but not significant correlation with NIM (Table 4). Although inflation as an indicator of macroeconomic conditions showed a positive correlation with NIM, these findings did not reach the expected level of statistical significance. In this context, it should be understood that a higher inflation rate can affect the debtor's ability to pay principal obligations and loan interest, which in turn can increase the number of non-performing loans in the banking sector. These non-performing loans then prompted banks to raise lending rates as a measure to address potential losses. Nonetheless, these findings did not significantly affect NIM according to

statistical analysis, in line with the results of previous studies by (Amuakwa-Mensah & Marbuah, 2015).

In addition, other results show that in KBMI 2, in the short term, BOPO do not show a significant correlation. However, the LDR shows a negative and significant correlation to changes in profits. This negative result is in line with the downward movement of LDR (Figure 1). This finding shows that the greater the ratio of loans provided to third party funds received, the greater the change in NIM in banks. This suggests that banks with a higher proportion of credit tend to have higher NIM.

Furthermore, findings regarding the influence of Covid-19 on NIM in KBMI 2 showed interesting results. The positive and significant correlation between Covid-19 and NIM here shows that banks in KBMI 2, which generally have small core capital, tend to allocate more credit to affiliated companies to overcome the impact of the sluggish economy due to the pandemic. Thus, the bank's management optimizes its lending to support affiliated companies, which ultimately contributes to the bank's financial performance in facing economic challenges caused by Covid-19.

Table 5. **Estimation Results, Long-Term KBMI 2**

Variables	Coefficient	t-Statistics	Prob.
C	0.440026	0.192838	0.8490
LOGCOVID	0.027950	0.660117	0.5167
LDR	-0.023273	-2.002159	0.0590
INFLATION	-0.512960	-3.099094	0.0057
BOPO	0.021223	0.767427	0.4518
BIRATE	1.193436	2.650468	0.0154
			F = 3.717587
R^2 = 0.481703	Adj R^2 = 0.352129		P = 0.015298

Source: Processed data, Eviews, (2022)

The results of long-term analysis in KBMI 2 reveal that inflation has a negative and significant correlation with NIM (Table 5). This finding is interesting because it shows that in the long run, the higher the inflation rate, the lower the NIM held by banks. These results fit with a hypothesis that assumes that high inflation rates can reduce banks' ability to earn higher margins.

However, the test results partially show that Operating Expenses to Operating Income (BOPO) are positively correlated but not significant to NIM. This result is in line with the downward movement of BOPO, as well as NIM. This finding is surprising because it contradicts the hypothesis that there is a negative relationship between BOPO and NIM. This positive correlation suggests that the greater the operational costs borne by the bank, the greater the NIM it has. This phenomenon may be explained by banks' strategic decisions to set higher margins to cover increased operating costs. Despite this, these findings did not reach the expected level of statistical significance.

The statistical results also show that the LDR in KBMI 2 is negatively correlated and significant to NIM. This finding is in line with previous research Durguti et al., (2014) which showed that banks with high lending ratios tend to have lower NIM. Furthermore, the Covid variable showed a positive but not significant influence on NIM in the long term KBMI 2.

This shows that in the context of the Covid-19 pandemic, despite an increase in cases and economic uncertainty, the impact on bank NIM in the long term is not statistically significant. These findings may point to banks' adaptive responses to difficult external conditions, where banks may have implemented strategies to mitigate the negative impact of the pandemic on their financial performance.

Core Capital Bank Group (KBMI) 3

The following are the results of the Estimated Error Correction Model (ECM) of Core Capital Bank Group (KBMI) 3 in the short and long term:

Table 6. **Estimation Results, Short-term KBMI 3**

Variables	Coefficient	t-Statistics	Prob.
C	-0.000189	-0.020552	0.9838
D(LOGCOVID)	-0.016934	-3.079079	0.0065
D(LDR)	-0.002955	-0.649750	0.5241
D(INFLATION)	0.047222	1.441141	0.1667
D(BOPO)	-0.038866	-10.03834	0.0000
D(BIRATE)	0.057454	0.839505	0.4122
ECT (-1)	-1.134451	-4.276143	0.0005
			F = 22.61527
	R^2 = 0.882882	Adj R^2 = 0.843843	P = 0.000000

Source: Processed data, Eviews, (2022)

In the short term, the variable of Covid-19 exhibits a negative and statistically significant correlation with NIM (Table 6). This result is in line with the number of Covid-19 cases which has increased significantly in Figure 1, while the NIM of KBMI 3 has decreased. This phenomenon can be attributed to the implementation of social distancing policies in mid-March 2020, which led to a shift in work patterns towards remote work arrangements. As a result, consumer spending witnessed a decline, with many commercial establishments ceasing operations temporarily. Despite these challenges, the banking sector remained operational, with branches adjusting their operating hours and digital platforms facilitating continued financial transactions. Moreover, many banks-initiated credit restructuring programs in response to government stimuli, further influencing their operational dynamics.

Furthermore, the relationship between BOPO is negatively correlated and demonstrates a significant impact on NIM within KBMI 3. These results are also supported by the movement trend in the number of COVID-19 cases in Figure 1 which shows an increase, but the NIM shows a downward trend. The adverse effects of the Covid-19 pandemic on banking performance in KBMI 3 are evident in the escalating operational cost ratios observed throughout 2020. In addition, findings from short-term and long-term analysis show a negative but not significant relationship between LDR and NIM at KBMI 3. Essentially, banks with higher Loan to Deposit Ratios tend to experience lower Net Interest Margins, emphasizing the impact of extensive loan management practices on diminishing margin prospects. In the short term, although inflation demonstrates a positive effect, its influence on NIM remains statistically insignificant.

Table 7. **Estimation Results, Long-Term KBMI 3**

Variables	Coefficient	t-Statistics	Prob.
C	7.447493	20.50213	0.0000
LOGCOVID	-0.020849	-4.174264	0.0005
LDR	-0.000622	-0.203039	0.8412
INFLATION	0.042239	1.642019	0.1162
BOPO	-0.039117	-12.01757	0.0000
BIRATE	-0.036626	-0.479264	0.6369
			F = 63.74274
	R^2 = 0.940953	Adj R^2 = 0.926191	P = 0.000000

Source: Processed data, Eviews, (2022)

In the long-term analysis, the findings show that BOPO have a significant and negative correlation to NIM. This finding is consistent with the theoretical framework that has been described by previous research, especially in the context of KBMI 3 bank during the Covid-19 pandemic. The theory of interest introduced in previous research, especially Lee et al., (2014) and Köhler, (2014), clarifying that an increase in Operating Expenses to Operating Income has the potential to reduce the bank's interest income, thus negatively affecting Net Interest Margin. These findings are in line with other studies conducted by Merry et al. (2022), which shows a similar impact on banks in a pandemic situation.

In addition, the BI Rate variable also shows a negative and significant correlation with NIM. Policy measures taken by Bank Indonesia to lower the benchmark interest rate gradually and prudently, especially amid the dynamics of the Covid-19 pandemic, are considered appropriate measures. This step is directed to maintain the stability of bank performance, especially in the context of the NIM. Policy consistency is important in maintaining overall financial system stability, and minimizing potential disruptions to the Indonesian economy.

Core Capital Bank Group (KBMI) 4

The following are the results of the Estimated Error Correction Model (ECM) of Core Capital Bank Group (KBMI) 4 in the short and long term:

Table 8. **Estimation Results, Short-term KBMI 4**

Variables	Coefficient	t-Statistics	Prob.
C	-0.000189	-0.020552	0.9838
D(LOGCOVID)	-0.016934	-3.079079	0.0065
D(LDR)	-0.002955	-0.649750	0.5241
D(INFLATION)	0.047222	1.441141	0.1667
D(BOPO)	-0.038866	-10.03834	0.0000
D(BIRATE)	0.057454	0.839505	0.4122
ECT(-1)	-1.134451	-4.276143	0.0005
			F = 22.61527
	R^2 = 0.882882	Adj R^2 = 0.843843	P = 0.000000

Source: Processed data, Eviews, (2022)

In KBMI 4 research, the results of the analysis show that Operating Costs to Operating Income (BOPO) have a negative and significant correlation both in the short and long term, as shown in Tables 7 and 8. These findings are consistent with previous studies, such as those conducted by Mohammad et al. (2022), which investigates the impact of Covid-19 moderation on banking factors in various Asian countries. This result is also in line with the BOPO trend which is decreasing along with the increase in KBMI 4 NIM. The impact of the Covid-19 pandemic, both in the short and long term, on KBMI 4 bank showed negative and significant results. These results are also supported by the movement trend in the number of COVID-19 cases in Figure 1 which shows an increase, but the NIM shows a downward trend. The pandemic has led to a decrease in banks' optimal interest margins, increasing the profitability of credit risk, which in turn can jeopardize banking stability. Capital injections from the government have also encouraged banks to take a more conservative stance in managing credit risk, thus contributing to overall banking stability. In addition, the impact of the Covid-19 pandemic and government intervention also affected the bank's operational efficiency, including in shadow banking operations during the pandemic. Therefore, the Covid-19 event has significant implications for banking behaviour, not only in terms of setting lending rates but also in setting deposit rates in the balance sheet market and shadow banking. These findings are in line with research that has been conducted by other researchers in the same domain.

Furthermore, the analysis shows that the variable Loan to Deposit Ratio (LDR) in the short and long term also shows a negative and significant correlation. This result is supported by the decreasing LDR trend in Figure 1, while the KBMI 4 NIM tends to increase. These findings are in line with findings reported in research by Marinković &; Radović (2014). However, the results of other studies show that LDR is positively correlated with NIM. Currently, limited credit growth is due to the ongoing Covid-19 pandemic, which has an impact on disruption of economic activity due to social distancing policies implemented in various regions. This has significant implications for business activities and fund management in the banking sector.

Table 9. **Estimation Results, Long-Term KBMI 4**

Variables	Coefficient	t-Statistics	Prob.
C	7.447493	20.50213	0.0000
LOGCOVID	-0.020849	-4.174264	0.0005
LDR	-0.000622	-0.203039	0.8412
INFLATION	0.042239	1.642019	0.1162
BOPO	-0.039117	-12.01757	0.0000
BIRATE	-0.036626	-0.479264	0.6369

F statistics = 63.74274

			Prob F(statistics) =
	R^2 = 0.940953	Adj R^2 = 0.926191	0.000000

Source: Processed data, Eviews, (2022)

In the long-term analysis, the findings show that the variable BOPO is negatively and significantly correlated with NIM in KBMI 4 (Table 9). These findings are in line with studies that have been conducted by other researchers, as mentioned by (Entrop et al., 2014). It should be noted that the demand for digital banking services has increased significantly amid the ongoing pandemic. This has accelerated the digitalization of banking services and reduced dependence on physical services at bank branches. However, banks must also pay

attention to the increased operational risks that may arise during the transformation process, including ensuring the security of digital transactions to maintain customer trust.

Meanwhile, related to the variable Interest Rate (BI Rate), the results of the analysis show different relationships in the short and long term. In particular, in the short term, the BI Rate has a negative but not significant relationship to NIM, while in the long run, the relationship is positive but not significant. A decrease in the BI Rate that is not offset by an increase in credit demand may cause a decrease in NIM in the banking industry. In addition, the reduction in the benchmark interest rate can also show bank prudence in lending due to high economic uncertainty, as happened during the Covid-19 pandemic. In this context, government intervention through fiscal policy is important to stimulate national economic recovery. Inflation variables in short-term and long-term analysis showed positive but not significant results on NIM in KBMI 4. Nonetheless, it should be noted that low inflation may benefit the economy, but its impact on banking NIM may not be significant. Therefore, the role of the government in evaluating programs that can support economic recovery is crucial in these conditions.

Conclusion and Recommendation

Based on the results of the Error Correction Model (ECM) estimates carried out on the Loan to Deposit Ratio (LDR), Operating Costs to Operating Income (BOPO), Inflation, BI Rate, and COVID-19 confirmation cases against Net Interest Margin (NIM) in Core Capital Bank Group Banks (KBMI) 1, 2, 3, and 4, there are several conclusions that can be expressed in more depth. KBMI 1, the estimation results show that in the short term, the variables that affect NIM are BOPO, BI Rate, and LDR. It was found that BOPO and LDR variables showed a negative and significant influence on NIM. However, in the long run, the variable that affects NIM is the BI Rate. Meanwhile, KBMI 2, in the short term, the variables that affect NIM are inflation and LDR. The inflation and LDR variables show a negative and significant influence on NIM, according to the hypothesis proposed. However, in the long run, the variables that affect NIM are inflation and BOPO. The inflation variable shows a negative and significant influence on NIM, while the BOPO variable shows a positive but not significant influence on NIM. Then, in KBMI 3, in the short term, Covid, LDR, and BOPO variables are negatively and significantly correlated with NIM. It was also found that in the long run, LDR and BOPO variables were also negatively and significantly correlated with NIM. Meanwhile, KBMI 4, both in the short and long term, the variables that affect NIM are BOPO, Covid, and LDR. BOPO, Covid, and LDR variables have a negative impact on NIM, according to the hypothesis proposed. However, in the short term, the variable BI Rate does not have a significant impact on NIM, while in the long run, the variable BI Rate shows a positive and significant influence on NIM.

Small core capital banks (KBMI 1 and KBMI 2) need to prioritize controlling operational costs, interest rates, and Loan to Deposit Ratio (LDR) to maintain their financial health. Because the variables BOPO, BI Rate, LDR, and inflation have a significant impact on NIM in the short and long term. On the other hand, large core capital banks (KBMI 3 and KBMI 4) should pay attention to the influence of BOPO, Covid, and LDR variables on NIM, while also considering portfolio restructuring and diversification strategies to mitigate the negative impact of potentially adverse external variables. In addition, policy actions that support banking sector stability, such as promotion of financial literacy, better risk management, and incentives for innovation and investment in information technology and digitalization, will

assist banks in facing complex economic challenges. By paying attention to these implications, small and large core capital banks can increase their resilience to market volatility and improve their financial performance over the long term. For future research, it is recommended to include mediator or moderator factors such as risk management or the level of bank digitalization to explore the relationship between variables that affect NIM. In addition, the use of more sophisticated econometric techniques such as Panel-GARCH can provide deeper insights into the volatility and dynamics of these variables. This approach will help provide a more comprehensive picture and more effective strategies for maintaining NIM stability.

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