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INCOME DIVERSIFICATION, BANK MONITORING AND RISK: EVIDENCE DURING THE COVID-19 PANDEMIC

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ABSTRACT

This article investigates the relationship among income diversification, bank monitoring and financial risk in the context of commercial banks in Indonesia. Using panel data of 91 Indonesian commercial banks operating during the COVID-19 pandemic, we find that income diversification can reduce bank risk, while monitoring is negatively associated with that risk. While our investigation does not indicate that monitoring can alter the impact of income diversification on bank risk, the results suggest that policymakers should adopt banking transformation by diversifying their income, particularly during a crisis such as the COVID-19 pandemic. We also suggest that banks enhance monitoring to obtain a good external perception that can ultimately increase a bank's stability.

Keywords: Bank, income diversification, monitoring, risk, Indonesia

INTRODUCTION

Diversification in the banking industry means that banks do not just carry out activities that generate interest income. Banks can expand their business activities to activities that generate noninterest income (fees, trading and others). Diversification in the banking industry occurs due to globalisation and liberalisation factors (Berger et al., 2004; Yildirim & Efthyvoulou,

2018). Globalisation factors, for example, cause financial market integration so that banks can operate in various countries. This condition allows banks to offer new products and services according to market needs. On the other hand, liberalisation factors can also cause the emergence of financial market deregulation, which allows banks to be freer in developing new products and services.

The economy of scope theory (Panzar & Willig, 1981) reveals that banks can obtain low-risk income when they carry out new activities. This is because the information that banks obtain from engaging in traditional banking activities can be used to offer new activities to the same quality customers. Through this theory, diversification helps banks gain economies of scope by spreading fixed costs over different products (Laeven & Levine, 2007), thus bringing management capabilities and skills to produce different products and markets (Iskandar-Datta & McLaughlin, 2007) and reducing the risk of bankruptcy (Berger et al., 2000). As such, based on the economy of scope theory, bank diversification can effectively reduce the level of risk (Boyd & Runkle, 1993).

However, diversification also means that banks become more complex. This is due to the increasing number of correlated business lines of noninterest income activities. As a result, bank monitoring activities become more difficult to carry out, thus causing monitoring costs to increase (Laeven & Levine, 2009). Qu (2020) revealed that income diversification results in monitoring difficulties, which can affect bank risk. This is because banks increasingly have many business lines to monitor, which can make monitoring less efficient. Therefore, increasing noninterest activities should encourage banks to increase monitoring to ensure that noninterest activities are not harmed and worsen the bank's specific risks and financial stability (Ashraf et al., 2016).

In addition, Liang et al. (2020) and Yang et al. (2020) found that increased diversification can lead to a greater contribution of systemic risk from banks. Systemic risk in this case can occur because of the similarity of portfolios between banks, which can cause the diversification built to have strong connections. As a result, the failure of one or several banks can increase systemic risk. Thus, to ensure banking stability in diversifying income, monitoring is needed to ensure overall economic stability. Moreover, in its development, commercial banking operations have begun to shift from noninterest income, which has so far only supported and facilitated

intermediation activities, to balancing bank income, especially during the COVID-19 pandemic. Typically, banks will limit lending due to an economic downturn caused by a financial crisis and increase noninterest income to balance bank income. This is because interest income from credit is sensitive to a decline in economic conditions, which can impact the quality of a bank's credit portfolio (Köhler, 2014).

This study therefore asks if implementing noninterest income during a pandemic can reduce risks. It has to be noted that banks' diversification is not only from fees and related activities, banks can also carry out trading activities (buying and selling financial assets, commodities and nonfinancial assets), which can increase bank risk. Lepetit et al. (2008) stated that trading activities depend on volatile market conditions, which became apparent during the COVID-19 pandemic. In addition, developing noninterest products requires considerable investment in technology and banking professionals in the early stages (Rossi et al., 2009). Moreover, the success of banking services that generate fees and commissions is also highly dependent on customer acceptance and satisfaction (Wong & Tong, 2013). Therefore, monitoring income diversification activities carried out by banks is critical, as it ensures that noninterest activities do not exacerbate a bank's financial risks and stability during a crisis.

Market discipline is a form of investor monitoring to help ensure banks operate safely and soundly. Elfers and Koenraadt (2022) stated that market discipline is a concept based on investors who have the incentives and ability to monitor a bank's risk position. Investors will react if a bank takes too high a risk by demanding higher returns or withdrawing their funds. Therefore, investors can exercise market discipline to determine whether activities to increase noninterest income are necessary to maintain bank income. In addition, market discipline is important during a crisis, which can put pressure on banks to improve their performance (Uchida & Satake, 2009).

In contrast to previous studies that focused on the relationship between income diversification and risk, this study contributes to the literature by examining bank monitoring, which is expected to clarify the relationship between income diversification and risk, thereby providing new insights into the debate on bank income diversification. Fortin et al. (2010) stated that excessive bank risk-taking behaviour and inadequate monitoring and regulatory schemes are the main causes of a bank's financial vulnerability. Therefore, Kazdal et al. (2024) stated the need for banking regulations that

emphasise control mechanisms facilitated by parties outside the bank. An example of the mechanism in question is market monitoring, as studied by Bliss and Flannery (2002) and Godspower-Akpomiemie and Ojah (2021), who support the existence of market monitoring as an effective market discipline that is able to monitor and influence bank behaviour.

In addition, Nier and Baumann (2006) stated that if market discipline can function well, the possibility of excessive bank risk-taking will decrease. Thus, we argue that external bank monitoring can be a tool to monitor and influence risk-taking behaviour in diversification. In addition, this study was conducted explicitly during the COVID-19 pandemic, as the income diversification carried out by banks was predicted to change. Banks are likely to make more efforts to increase noninterest income sources to maintain income stability, as interest income from credit decreased during the pandemic. Thus, bank monitoring is expected to strengthen the negative relationship between income diversification and risk.

External monitoring is typically conducted by market participants who have limited access to bank information due to bank secrecy and regulatory factors. However, although market participants have less access to bank information than supervisors in an effort to enforce a market, participants still have access to market-based tools. Li et al. (2023) explained that market discipline can use market-based tools such as credit ratings or market-based pricing mechanisms, which allow market participants to assess the risk and performance of financial institutions. Apart from that, Costa et al. (2023) stated that capital, assets, management, earning liquidity and market sensitivity (CAMELS) are among the tools most widely used in internal monitoring to evaluate the health of financial institutions.

Based on the description above, this research aims to examine the effect of income diversification on bank risk during the COVID-19 pandemic and test whether bank monitoring could moderate the relationship. The bank monitoring in this research uses bank ratings issued by *Infobank Magazine* as a tool that allows market participants to assess bank risks. *Infobank Magazine*, which is used as a reference for bankers because of its excellence in analysis and reporting, is a leading special banking and finance magazine in Indonesia. *Infobank Magazine* routinely (annually) gives awards to banks (Infobank Awards) and carries out bank ratings based on study results from the Infobank Research Bureau.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Literature Review

There have been many studies on the relationship between income diversification and risk, resulting in different results according to the sample. The literature shows that diversification can reduce bank risk. Lee et al. (2014), using a sample of 22 Asian countries during 1995–2009, found a negative relationship between noninterest income and risk (risk reduction). Moudud-Ul-Huq et al. (2018), in their study on ASEAN countries, found that banks overall benefit from diversification; that is, diversified banks have lower risk. Hunjra et al. (2020), who studied banks in four South Asian countries (Pakistan, Sri Lanka, India and Bangladesh), found that noninterest income has a negative impact on bank risk. Research on the benefits of income diversification during the COVID-19 pandemic was also conducted by Li et al. (2021) in the United States, who found that noninterest income was negatively related to risk during the pandemic.

Another strand of literature empirically shows that, when banks pay more attention to activities outside of their business model, their risk can substantially increase. DeYoung and Roland (2001), for example, argued that noninterest income is less stable because fee-based noninterest income fluctuates more due to information and competition costs. Next, the expansion of business lines in fee-based income requires extra labour costs and may lead to an increase in operating leverage. Last, there are no rules requiring capital reserves for fee-based income sources so that the volatility of noninterest income is greater. Lepetit et al. (2008) that banks expanding into noninterest income activities lead to higher risk and cause higher insolvency risk. Liang et al. (2020) found that increased income diversification leads to more systemic risk contribution from banks, which is caused by higher activity and portfolio similarity among banks as diversification develops. The results are supported by Yang et al. (2020), who found that income diversification is significantly associated with greater systemic risk.

To ensure banking diversification activities do not harm and worsen bank financial stability during a financial crisis, such as the COVID-19 pandemic, monitoring is needed to ensure banks operate safely and soundly. Bliss and Flannery (2002) explained monitoring as one of the main components in market discipline, i.e., monitoring is the process of reviewing business

activities, financial condition and bank risk-taking carried out by shareholders, depositors and market participants. Elfers and Koenraadt (2022) stated that market discipline is a concept based on investors having incentives and the ability to monitor bank risk positions. Investors will react if banks take too high a risk by demanding higher returns or withdrawing their funds.

In carrying out monitoring, shareholders, depositors and market participants certainly have limited access to bank information compared to supervisors. However, based on the concept of market discipline, market participants can use market-based tools to predict bank financial difficulties. Bliss and Flannery (2002) found that market information can make a significant contribution in monitoring a bank's financial health. According to Costa et al. (2023), market information can also be used to complement supervisory and accounting information in assessing bank risk by adding new sources of information. Li et al. (2023) stated that market-based tools can be credit ratings or market-based pricing mechanisms, which allow market participants to assess the risk and performance of financial institutions.

In addition to using market information to monitor the financial health of banks, bank monitoring can also use accounting-based indicators. This is because indicators derived from financial reports can provide information on the financial health, profitability, asset quality and risk of banks, which helps in assessing overall financial health. Männasoo and Mayes (2009) show that CAMELS factors are important in distress detection and warning. Costa et al. (2023) also stated that the CAMELS rating system is an internal monitoring tool to evaluate the health of financial institutions.

Hypothesis Development

Income diversification and bank risk

The portfolio theory states that efficient investment diversification is diversification that can reduce risk (Markowitz, 1952). This theory further explains the importance of investors diversifying by investing in several financial assets to reduce risk. This means that, when investment activities or bank operations are diversified, the risk of loss due to changes in economic conditions will be reduced. This is because interest income from credit is

sensitive to declining economic conditions (Köhler, 2014). The economy of scope theory (Panzar & Willig, 1981) also states that banks can reduce risk by offering more diverse services and products, thereby reducing their dependence on traditional activities alone. Thus, diversification carried out by banks makes them more resilient to changes in economic conditions. This is because banks with various financial services and products offered tend not to experience losses due to a decline in one or more products or services.

The economy of scope theory also explains that banks can earn low-risk income when they undertake new activities. For example, a bank's information from its traditional activities can be used to offer new activities to the same qualified customers. Through this theory, diversification helps banks gain economies of scope by spreading fixed costs over different products (Laeven & Levine, 2007), thus bringing management capabilities and skills to different products and markets (Iskandar-Datta & McLaughlin, 2007) and reducing risks of bankruptcy (Berger et al., 2000). Thus, based on the economy of scope theory, bank diversification can effectively reduce a bank's risk level (Boyd & Runkle, 1993).

Some researchers argue that since banks are highly leveraged, they should diversify to reduce the chance of experiencing costly financial distress. Froot et al. (1993) and Froot and Stein (1998) concluded that diversification is a means of hedging against default risk, thereby reducing the occurrence of costly financial distress. Furthermore, major empirical works show a negative association between diversification and bank risks, meaning that diversification can favor bank stability and reduce risk. Li et al. (2021) found that income diversification during the COVID-19 pandemic in the United States had an effect on reducing risk. Wang and Lin (2021), who researched bank income diversification on risk in Asia Pacific countries, showed that bank diversification could reduce risk in developing countries in Asia Pacific. Using a Tunisian sample, Alouane et al. (2022) also showed the same results, i.e., that noninterest income activities can increase bank stability and reduce risk. Based on these arguments, the following hypothesis can be developed:

H1: Income diversification has a negative and significant effect on bank risk.

Bank monitoring and risk

Bank monitoring ensures that banks operate safely and soundly, especially during an economic crisis, such as the crisis resulting from the COVID-19 pandemic. The financial crisis during COVID-19 made market participants such as investors want to know the condition of banks due to credit restructuring policies and bank efforts to maintain the stability of bank income by increasing noninterest activities. Kazdal et al. (2024) stated that, after the global financial crisis, there was a reform of banking regulations that emphasised control mechanisms facilitated by parties outside the bank. This is because excessive risk-taking behaviour by banks coupled with inadequate monitoring and regulatory mechanisms have been identified as the main causes of bank vulnerability during a global financial crisis (Fortin et al., 2010). Therefore, market discipline mechanisms are important to control a bank's risk-taking behaviour. Nier and Baumann (2006) argued that, by implementing strict market discipline, the possibility of excessive risk-taking by banks can be reduced.

Xie et al. (2024) stated that market discipline is based on the idea that if banks know that market participants are monitoring them, then banks will act responsibly and transparently. This is because investors have the incentive and the ability to monitor a bank's risk position and can react by demanding higher returns or withdrawing their funds if the bank takes too much risk. As a result, bank management will act more cautiously and tend to adjust risk-taking to avoid funding problems, excessive capital costs, and supervisory intervention (Elfers & Koenraadt, 2022). In addition, Basel III also stipulates in Pillar 3, which gives banks less flexibility regarding the frequency and information to be reported. The standardisation of bank reports is also expected to reduce the costs of collecting information, thus making market participants better equipped to assess the financial health of banks (Costa et al., 2023). It can be concluded that monitoring, as one of the main components in market discipline, can be a potential complement to supervising banks to help control a bank's risk-taking. Therefore, based on the arguments above, the hypothesis regarding the effect of monitoring on bank risk is as follows:

H2: Bank monitoring has a negative and significant effect on bank risk.

Income diversification and risk with bank monitoring as a moderator

Income diversification causes banks to become increasingly complex with more business lines that correlate between noninterest income activities. In addition, during the COVID-19 pandemic, noninterest activities continued to increase along with restrictions on social interactions. This actually accelerated the transformation of banking services into digital-based services, which ultimately accelerated public acceptance of digital banking services. The increase in noninterest income in a bank's efforts to maintain income stability requires monitoring. This monitoring is useful to ensure that noninterest activities are not used in a way that can harm and worsen the specific risks and financial stability of the bank (Ashraf et al., 2016).

Market discipline as a monitoring effort is carried out by market participants on a bank's operational activities. Moreover, monitoring of diversification activities carried out by banks is helpful in preventing actions that can be detrimental and increase risks. This is because investors have the incentive and ability to monitor a bank's risk position and can react by requesting higher returns or withdrawing their funds if a bank takes too much risk. Bliss and Flannery (2002) identified market monitoring as one of the main components of market discipline, which relates to the ability of financial markets to analyse bank risk and change the value of the bank according to the results of market monitoring. This monitoring process is carried out by shareholders, depositors and other market participants to systematically review a bank's business activities, financial condition and risk-taking behaviour.

Market discipline through investor or market participants' monitoring can encourage banks to maintain a strong and healthy financial position during a crisis, such as the COVID-19 pandemic, as a strong and healthy financial position can affect bank performance and mitigate risk. Xie et al. (2024) found that market discipline can also lead to increased competition between banks, which ultimately results in better consumer products and services. Thus, bank management will be more careful in diversifying activities during a crisis to build trust and confidence among consumers and investors, which ultimately leads to a stronger financial system. As such, market discipline plays a role in encouraging bank diversification by encouraging banks to improve performance and reduce risk. Based on the above arguments, the following hypotheses can be developed:

H3: Bank monitoring strengthens the negative influence between income diversification and bank risk.

METHOD

Sample and Data

The samples used in this study are commercial banks in Indonesia consisting of government commercial banks (four banks), national private commercial banks (57 banks), regional development banks (25 banks), and branch offices of banks domiciled overseas (five banks). This study also uses quarterly data from banks' financial statements during the COVID-19 pandemic, from March 2020 to March 2022. Furthermore, the data used in this study were obtained from the Indonesian Financial Services Authority website (*Otoritas Jasa Keuangan*/OJK). Other data, such as GDP and inflation data, are obtained from the Central Bureau of Statistics (CBS) (*Badan Pusat Statistik*/BPS) report.

Econometrics Specifications

The estimation model below is based on the first and second hypotheses, which test the negative effect of income diversification on bank risk and the negative effect of bank monitoring on risk is as follows:

$$RISK_{it} = \alpha_{it} + \beta_1 DIV_{it} + \beta_2 MONITORING_{it} + \Sigma_{k\gamma k} CONTROL_{it}^{k} + \varepsilon_{it} \quad (1)$$

Based on Equation 1, RISK is the bank risk measured by risk-adjusted ROA (SHROA). DIV is income diversification measured using FOCUS, FOCUS-FTO and NII. Monitoring is measured using the numerical score from ratings issued by Infobank. CONTROL is a control variable consisting of size, loans, deposits, equity, loan loss provisions (LLP), GDP and inflation rate (INF). A summary of the variables used in this study is shown in Table 1.

TABLE 1
Variables definitions

Variable	Definition and description	References
RISK	Profit or potential profit from an investment, which takes into account the level of risk that must be accepted to achieve it. Risk Adjusted ROA (SHROA): ROA/ σROA Risk Adjusted ROE (SHROE): ROE/ σROE	Chiorazzo et al. (2008); Meslier et al. (2014)
FOCUS	It is a measure of income diversification. Focus: (non-interest income/operating income)^2 + (interest income/operating income)^2	Stiroh & Rumble (2006); Meslier et al. (2014)
FOCUS-FTO	It is a measure of diversification that divides non-interest income into three components: fee, trade, and others. Focus-FTO: (Fee/operating income)^2 + (trade/operating income)^2 + (others/ operating income)^2 + (interest income/ operating income)^2	Meslier et al. (2014)
NII	It measures the share of non-interest income over operating income. NII: Non-interest income/operating income	Meslier et al., (2014)
MONITORING	Bank ranking value from Infobank	Ahn & Choi (2009); Kusumawati & Hermawan (2013)
Size	Logarithm of the total assets	Stiroh & Rumble (2006); Baele et al. (2007); Sanya & Wolfe (2011)
Loans	The ratio of total loans to total assets	Ahamed (2017)
Deposits	The ratio of total deposits to total assets	Trujillo-Ponce (2013)
Equity	The ratio of total equity to total assets	Ahamed (2017)
LLP	The ratio of loan loss provision to total assets	Mergaerts & Vennet (2016)
GDP inflation rate	Gross domestic product Inflation rate (INF)	Sissy et al. (2017)

This article also examines the moderating function of bank monitoring via the following approach:

$$RISK_{it} = \alpha_{it} + \beta_1 DIV_{it} + \beta_2 MONITORING_{it} + \beta_3 DIV_{it} * MONITORING_{it} + \sum_k \gamma_k CONTROL_{it}^k + \varepsilon_{it} \quad (2)$$

Bank monitoring can successfully moderate the impact of diversification on bank risk when β_3 is significant. This study uses pooled ordinary least squares (OLS), which assumes no heterogeneity or individuality among units so that the same coefficient can be considered for all units. Our study does not have heterogeneity or individuality in cross-sectional units such as in various companies/firms/countries but only uses banks as conducted by Sharma et al. (2023). However, to strengthen the assumption of homogeneity, this study also conducted a homogeneity test. The assumption of homoscedasticity (constant error variance) is important to obtain valid and reliable results from OLS (Wooldridge, 2016). This study further uses a homogeneity test following Hashem Pesaran and Yamagata (2008) with the null hypothesis being that the same coefficient captures the nature of all units, namely, the stable pooled method, while the alternative hypothesis is that the same coefficient is unstable, and therefore heterogeneity remains among units. The results of the homogeneity test provide a *p*-value greater than 0.05, which means the null hypothesis is accepted. It can be concluded that all units show homogeneity; as such, the pooled OLS will be used in further analysis.

Measurements of Variables

Risk in this study is the dependent variable, while income diversification is the independent variable, and the moderating variable is monitoring. This study also adds control variables in the form of bank-specific control variables (size, loans, deposits, equity and loan loss provision [LLP]) and macroeconomic control variables (GDP and inflation rate). The risk measures used in this study consist of risk-adjusted ROA (SHROA) and risk-adjusted ROE (SHROE). SHROA and SHROE are the potential profits from an investment that take into account the level of risk that must be accepted to achieve it. The higher the risk-adjusted SHROA or SHROE, the more optimal the performance because the bank's profitability becomes more stable or the risk is reduced.

To measure revenue diversification, this study uses the Herfindahl-Hirschman index following Stiroh and Rumble (2006) and Meslier et al. (2014). The FOCUS and FOCUS-FTO variables measure the level of bank specialisation. A higher FOCUS or FOCUS-FTO value indicates a more focused (less diversified) bank; conversely, a lower FOCUS or FOCUS-FTO value indicates a more diversified bank. This study also measures the share of noninterest income over operating income (NII) as a measure of bank revenue diversification in addition to FOCUS and FOCUS-FTO.

Li et al. (2023) stated that market discipline involves the use of market-based tools, such as credit ratings or market-based pricing mechanisms, which allow market participants to assess the risk and performance of financial institutions. Besides using market information to monitor bank performance, bank monitoring can also use accounting-based indicators. Männasoo and Mayes (2009) show that CAMELS factors play an important role in distress detection and warning. Costa et al. (2023) stated that the CAMELS rating system is an internal monitoring tool to evaluate the health of financial institutions.

Furthermore, within the risk management framework, reputation risk is one of the main factors that determines a bank's ability and credibility. Therefore, this study uses bank ratings as per Ahn and Choi (2009), as a measure to describe a bank's reputation. A bank's reputation is related to external perceptions of the bank's performance and image. The bank rating used in this study is the same as in Kusumawati and Hermawan (2013), namely, the bank rating issued by *Infobank Magazine* in Indonesia, which follows the regulator's health assessment component in reference to risk profile, GCG, profitability and capital. At the same time, the Infobank Research Bureau adds components such as efficiency and growth. Furthermore, the values of each component are then summed up to obtain the final results as follows: banks that have a score ≥ 81 are given the predicate "very good"; banks that have a score of $66 < N \leq 81$ are given the predicate "good"; banks that have a score of $51 < N \leq 66$ are given the predicate "quite good"; and banks that have a score ≤ 51 are given the predicate "less good." Table 2 presents the Infobank rating assessment components used in this study.

TABLE 2
Infobank rating assessment components

No.	Components	Weight (%)
1.	Risk management profile ranking	15
2.	GCG Composite Value Rating	15
3.	Capital: Capital Adequacy Ratio (CAR) (7.5%) Core Capital Growth (2.5%)	10
4.	Asset Quality: Non Performing Loan (NPL) (12.5%) Growth in Credit provided (7.5%)	20
5.	Profitability: Return on Average Assets (ROAA) (7.5%) Return on Average Equity (ROAE) (2.5%) Profit Growth for the Year (5.0%)	15
6.	Liquidity: Loan to Deposit Ratio (LDR) (7.5%) Third-party funds: Growth in third-party funds (2.5%) Cheap funds/third-party funds (2.5%)	12.5
7.	Efficiency: Operating Expenses/Operating Income (7.5%) Net Interests Margin (5%)	12.5
	Total	100

Source: Nugroho (2022)

Bank risk in this study not only depends on each bank's income diversification but is also influenced by the characteristics of the bank itself along with macroeconomic conditions. For this reason, several control variables, such as size to control for differences in bank size, are used in this study. Larger banks may have a better chance of diversifying their income because they can reach new markets and reduce income volatility (Stiroh & Rumble, 2006; Baele et al., 2007; Sanya & Wolfe, 2011). The next control variable is loans, which measures how much bank lending activity is compared to total assets. A higher level of bank activity in lending will have an impact on that bank's performance. Deposits, which measure third-party funds from the bank (current accounts, savings and time deposits) compared to assets, is the next control variable. With competition to obtain third-party funds, some banks charge higher interest rates on deposits, which can have an impact on a bank's risk-taking.

Next, equity is a control variable that can affect the risk faced by the bank. Banks with higher capital are able to absorb any negative shocks and are considered to have a lower risk of bankruptcy. Higher capital can also encourage shareholders to monitor management activities, thereby reducing the possibility of excessive risk-taking by managers (Ahamed, 2017). The LLP ratio is a forward-looking measure of a bank's loan quality, reflecting its assessment of loan quality (Mergaerts & Vennet, 2016). Finally, GDP and inflation are control variables used to control for general economic development, macroeconomic stability, and institutional framework, which are likely to also affect a bank's performance (Sissy et al., 2017).

RESULT AND DISCUSSION

Descriptive Statistics

Our descriptive statistics are presented in Table 3. The SHROA variable is the risk-adjusted ROA whose value is obtained by dividing ROA by the standard deviation of ROA, which measures a bank's risk. If the SHROA value is positive, it means that the bank has stable profitability and vice versa. The average SHROA value is 4.312%, which means that, on average, the bank's profitability remained quite stable during the COVID-19 pandemic, as is the average SHROE value. The average value of risk-adjusted ROE is positive with a value of 4.207%.

TABLE 3
Descriptive statistics

Variable	Obs	Mean	S.D.	Min	Max
SHROA (%)	762	4.3115	4.0699	–3.0941	21.8235
SHROE (%)	762	4.2066	4.0538	–3.1788	18.5883
FOCUS	762	0.7759	0.1224	0.5000	0.9949
FOCUS-FTO	762	0.7627	0.1397	0.3498	0.9952
NII (%)	762	14.6905	11.5283	0.2581	72.1124
MONITORING	762	79.1007	12.4022	44.7400	98.8600
Size (mill. IDR)	762	108,776,427	273,916,881	954,425	1,734,074,740
Size (logarithm)	762	7.4680	0.6365	5.9797	9.2391

(*Continued on next page*)

TABLE 3 (*Continued*)

Variable	Obs	Mean	S.D.	Min	Max
Loans (%)	762	56.3324	13.5640	7.7112	80.5712
Deposits (%)	762	69.4482	15.1453	10.3617	90.9261
Equity (%)	762	17.6036	11.7804	0.3331	88.0884
LLP (%)	762	1.9837	1.4187	0.0017	13.6530
GDP (%)	762	1.3013	4.1163	–5.3200	7.0700
INF (%)	762	1.8775	0.5452	1.3300	2.9600

The variables FOCUS and FOCUS-FTO are measures of bank income diversification. The diversification measure in this study uses the basic concept of the Herfindahl-Hirschman index; as such, the value of FOCUS and FOCUS-FTO is between 0 and 1. If the value of FOCUS and FOCUS-FTO is close to 0, it means that the bank's income diversification tends to be high (low focus). Conversely, if FOCUS and FOCUS-FTO are close to 1, then the bank will have a low level of income diversification (high focus). Based on Table 3, the average FOCUS and FOCUS-FTO values are 0.776 and 0.763. The lowest values of the variables FOCUS and FOCUS-FTO are 0.500 and 0.350. The highest values of the variables FOCUS and FOCUS-FTO are 0.995 and 0.995. Another measure of diversification is NII, which measures the proportion of noninterest income to total bank operating income or the shift to noninterest income. The average NII value is 14.691%, which indicates that, on average, the bank has a noninterest income level of 14.691% of the bank's total operating income.

The following variable is being monitored. Rating from Infobank is a proxy of bank monitoring in the form of a value or score rating. Based on the descriptive statistics table, the bank's average score rating from Infobank is 79.101. This value is included in the "good" category. The highest value of the variables monitored is 98.860. This value is included in the "very good" category. The lowest value of the variables monitored is 44.740. This value is included in the "less good" category. This means that, during the COVID-19 pandemic, the average bank remained in good condition.

The size variable controls for differences in bank size, where larger banks may have better opportunities to diversify earnings, as they can reach new markets and reduce earnings' volatility. Based on Table 3, the average size value is IDR108,776,427 million. Next, the loans variable measures how

much a bank's lending activity is compared to its total assets. The higher the bank's lending activity, the higher the impact on bank risk. On average, loans during the COVID-19 pandemic reached 56.332% of total assets. Furthermore, the deposits control variable measures funds from third-party banks (current accounts, savings and time deposits) against assets.

The next control variable is equity, which measures the level of bank capitalisation compared to assets. The higher the equity, the more the bank is able to absorb negative shocks, such as those resulting from COVID-19 pandemic. LLP is a bank's credit risk control, which reflects loan quality. The higher the LLP, the more prepared a bank is to face a credit risk. GDP is associated with national economic activity, which measures the total volume of production from a region (country). When GDP increases, people's income will increase, which will have an impact on increasing their ability to save and pay off their obligations. The lowest GDP occurred in the second quarter of 2020 with a GDP rate of –5.32%, while the highest GDP occurred in the second quarter of 2021 with a GDP rate of 7.07%.

Although the COVID-19 pandemic caused per capita income in Indonesia to fall into the negative, economic recovery in all sectors can still be carried out well enough to improve economic growth. Inflation is a proxy for a country's economic growth, which can also impact the decline in the value of money or wealth. High inflation can cause macroeconomic instability, which has an impact on bank risk. Inflation can affect a bank's efforts to obtain funds from the public and change the value of a bank's assets and liabilities. During the research period, the highest inflation rate occurred in the first quarter of 2020 with an inflation rate of 2.96%.

Table 4 shows a correlation matrix that reveals a strong relationship between the independent variables measuring bank diversification, namely, FOCUS, FOCUS-FTO and NII. The correlation coefficient value between FOCUS and FOCUS-FTO is 0.992, while the correlation coefficient values between NII and FOCUS and between NII and FOCUS-FTO are –0.926 and –0.950, respectively. Therefore, to eliminate the problem of multicollinearity, this study will separately estimate the variables FOCUS, FOCUS-FTO, and NII in the estimation model.

TABLE 4
Correlation matrix

	FOCUS	FOCUS-FTO	NII	MONITORING	Size	Loans	Deposits	Equity	LLP	GDP	INF
FOCUS	1										
FOCUS-FTO	0.9923	1									
NII	–0.9260	–0.9499	1								
MONITORING	0.1274	0.1202	–0.1240	1							
Size	–0.4022	–0.4071	0.3132	0.2572	1						
Loans	0.2816	0.3013	–0.3462	0.2703	0.0668	1					
Deposits	0.2235	0.2391	–0.2386	0.1378	0.1081	0.2107	1				
Equity	0.1307	0.1460	–0.1728	–0.1463	–0.3953	–0.1405	–0.6020	1			
LLP	–0.1120	–0.1040	0.0338	–0.1814	0.3619	0.1723	0.1514	–0.0759	1		
GDP	–0.0424	–0.0449	0.0366	–0.0115	0.0430	–0.1649	0.0154	0.0338	–0.0234	1	
INF	–0.0072	–0.0145	0.0300	0.0855	–0.0135	0.0657	–0.0447	0.0019	0.0340	0.2075	1

Effect of Income Diversification on Bank Risk

Table 5 presents the results of H1 and H2. Based on estimation results, FOCUS and FOCUS-FTO variables show a negative and significant coefficient at 1% significance. It means that, on average, the lower the value of FOCUS (the more diversified the bank is in terms of income), the higher the risk-adjusted ROA (SHROA) or low risk and vice versa. Furthermore, the coefficient value of NII is positive and significant at 1%, indicating that the higher the proportion of noninterest income (NII) to bank income, the higher the SHROA or lower risk.

TABLE 5
Baseline regressions

Variable	SHROA		
	(1)	(2)	(3)
FOCUS	–2.549*** (0.000)	–	–
FOCUS-FTO	–	–2.307*** (0.000)	–
NII	–	–	0.0242*** (0.000)
MONITORING	0.0150** (0.041)	0.0154** (0.037)	0.0154** (0.036)
Size	1.807*** (0.000)	1.787*** (0.000)	1.817*** (0.000)
Loans	0.0332*** (0.000)	0.0332*** (0.000)	0.0344*** (0.000)
Deposits	0.00153 (0.821)	0.00190 (0.778)	0.00270 (0.689)
Equity	0.0175* (0.083)	0.0178* (0.077)	0.0193* (0.055)
LLP	–0.179*** (0.001)	–0.179*** (0.001)	–0.181*** (0.001)
GDP	–0.00379 (0.692)	–0.00381 (0.690)	–0.00261 (0.786)
INF	0.147* (0.092)	0.143 (0.103)	0.130 (0.140)
quarter	Yes	Yes	Yes
_cons	–10.56*** (0.001)	–10.68*** (0.001)	–13.15*** (0.000)
N	762	762	762
R^2	0.1703	0.1698	0.1643

Notes: ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The figures within the parentheses are the *t*-values.

Based on this test's results, H1 is accepted, i.e., income diversification has a negative and significant effect on risk. The results of this study are in line with Lee et al. (2014), Meslier et al. (2014), Köhler (2014), Nisar et al. (2018) and Hunjra et al. (2020), which state that income diversification can reduce risk. The results of this study also consistently support Li et al. (2021), Taylor (2022) and Alouane et al. (2022), which reached the same conclusion, i.e., income diversification had a negative effect on bank risk during the COVID-19 pandemic.

Risk-adjusted ROA is the calculation of profit or potential profit from an investment that considers the level of risk that must be accepted to achieve it. The higher the risk-adjusted ROA, the more optimal the performance because a bank's profitability becomes more stable. The results showed that income diversification increases risk-adjusted ROA (low risk). The results are in line with the classic theory of diversification. Ross et al. (2016) stated that the principle of diversification is to spread investment across many assets to reduce risk. This finding means that income diversification contributes to a banking sector's stability by increasing risk-adjusted profitability. Banks whose income is diversified will be better able to withstand future crises and will be more stable than other banks with lower income diversification. In other words, banks with more diversified revenues are more stable in facing a crisis, such as the COVID-19 pandemic, than other banks with lower income diversification.

The control variables whose coefficients are significant in the estimation equation are size, loans, equity, LLP and inflation. The coefficient of the size variable that controls the difference in bank size shows a positive and significant coefficient. This means that larger banks have a better chance of diversifying income and at the same time reducing income volatility (Stiroh & Rumble, 2006; Baele et al., 2007; Sanya & Wolfe, 2011). Furthermore, the loans variable shows a positive and significant coefficient on SHROA. This means that the higher the loan-to-asset ratio, the more aggressive the bank is in increasing profitability, which has an impact on increasing bank interest income (Claeys & Vennet, 2008; Hesse & Poghosyan, 2009), which could potentially support bank health. The significant positive coefficient between equity and SHROA indicates that banks with higher capital are able to absorb any negative shocks and are considered to have a lower risk of bankruptcy. Higher capital can also encourage shareholders to monitor management activities, thereby reducing the possibility of excessive risk taking by managers (Ahamed, 2017).

The next control variable is LLP, which shows a significant negative relationship to SHROA. This means that the lower the LLP, the lower the risk indicated by the increasing SHROA values. This means that the quality of assets owned by the bank is increasing. Finally, the inflation coefficient shows a significant positive direction. The positive relationship between INF and SHROA reveals that banks can reduce the risk of rising inflation by increasing bank income through adjustments to credit and deposit interest rates.

Effect of Monitoring on Bank Risk

Monitoring in this study is measured by the Infobank rating value. The higher the rating value, the better a bank's supervisory function. The results in Table 5 show that the monitoring coefficient significantly and positively impacts SHROA. This means that a high bank monitoring can have an impact on reducing bank risk. The results of this research support Elfers and Koenraadt (2022), showing that bank management will act more carefully and tend to adjust risk-taking in the presence of market discipline. Based on this test's results, H2 is accepted, i.e., monitoring has a negative and significant effect on risk. Thus, bank monitoring helps banks proactively manage risks and minimise their impact on operations.

Effect of Income Diversification with Risk Moderated by Bank Monitoring

The estimation results in Table 6 show that none of the revenue diversification measures (FOCUS, FOCUS-FTO and NII) are statistically significant to SHROA. Furthermore, the coefficient of the monitoring variable is positive and significant to SHROA for the model with FOCUS and FOCUS-FTO as dependent variables. Only the interaction variable FOCUS*MONITORING is statistically significant to SHROA. Based on the estimation results, it can be concluded that H3 is rejected, which means that bank monitoring is not statistically proven to strengthen the negative effect of revenue diversification on bank risk.

TABLE 6
Interaction effect: the role of monitoring

Variable	SHROA		
	(1)	(2)	(3)
FOCUS	2.464 (0.368)	–	–
FOCUS-FTO	–	1.445 (0.558)	–
NII	–	–	–0.0127 (0.660)
MONITORING	0.0678** (0.020)	0.0538** (0.037)	0.00776 (0.405)
FOCUS* MONITORING	–0.0679* (0.060)	–	–
FOCUS-FTO* MONITORING	–	–0.0504 (0.118)	–
NII*MONITORING	–	–	0.000495 (0.191)
Size	1.775*** (0.000)	1.763*** (0.000)	1.797*** (0.000)
Loans	0.0325*** (0.000)	0.0327*** (0.000)	0.0337*** (0.000)
Deposits	0.00156 (0.816)	0.00188 (0.779)	0.00287 (0.670)
Equity	0.0176* (0.080)	0.0180* (0.074)	0.0193* (0.055)
LLP	–0.179*** (0.001)	–0.179*** (0.001)	–0.181*** (0.001)
GDP	–0.00314 (0.742)	–0.00330 (0.730)	–0.00246 (0.797)
INF	0.152* (0.082)	0.146* (0.094)	0.134 (0.126)
quarter	Yes	Yes	Yes
_cons	–14.19*** (0.000)	–13.34*** (0.000)	–12.40*** (0.000)
N	762	762	762
R^2	0.1764	0.1741	0.1676

Notes: ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The figures within the parentheses are the *t*-values.

The possibility of monitoring, which influences the relationship between diversification and bank risk, is more related to internal monitoring carried out directly by a bank compared to external monitoring, which comes from Infobank's rating. Bank monitoring using bank ranking measures in this study may be less relevant for describing the specific risks of diversification carried out by banks. This is because the components used in determining bank rankings from *Infobank Magazine* only consider factors originating from overall financial reports, which include risk profile, GCG, profitability, capital, efficiency and growth. Thus, Infobank's rating is a form of external monitoring that focuses on the perspective of external parties to ensure whether the bank is operating effectively.

In addition, Ashraf et al. (2016) stated internal monitoring is needed to ensure in real time that noninterest activities are not used in a way that could harm and worsen a bank's specific risks and financial stability. Thus, bank diversification activities can be monitored through the effectiveness of the role of the board of commissioners in carrying out internal monitoring functions and compliance with regulations. Zulfikar et al. (2020) stated that the board (board of commissioners, audit committee and risk monitoring committee) can encourage better management of bank governance and monitoring aspects in managing risks from diversification activities during the COVID-19.

Furthermore, based on Table 6, the coefficient of the size variable shows a positive and significant coefficient. This means that larger banks have a better chance of diversifying income and at the same time reducing income volatility (Stiroh & Rumble, 2006; Baele et al., 2007; Sanya & Wolfe, 2011). Next, the loans variable also shows a positive and significant coefficient on SHROA. The means that the higher the loan-to-asset ratio, the more aggressive a bank is in increasing profitability, which has an impact on increasing bank interest income (Claeys & Vennet, 2008; Hesse & Poghosyan, 2009) and which has the potential to support bank health. The significant positive coefficient between equity and SHROA indicates that banks with higher capital are able to absorb any negative shocks and are considered to have a lower risk of bankruptcy. The next control variable is LLP, which shows a negative and significant relationship to SHROA. The lower the LLP, the lower the risk indicated by the increasing SHROA value. This shows that the quality of assets owned by a bank is increasing. Finally, the inflation coefficient shows a significant positive direction. This relationship explains that banks can reduce the risk of rising inflation by increasing bank income through adjustments to credit and deposit interest rates.

Robustness Test

The study's robustness test, which features alternative risk measures in the form of risk-adjusted ROE (SHROE) and the generalised method of moment (GMM), is used to maintain the consistency of the research results. First, the robustness test uses a risk measure in the form of SHROE (the estimation results are presented in Table 7). Based on Table 7, the

results are consistent with previous results when using risk measures in the form of SHROA. The negative and significant coefficient value at 1% significance on the FOCUS and FOCUS-FTO variables indicates that, on average, the lower the focus (the more diversified the bank is in income) will affect the higher SHROE or low risk and vice versa. Furthermore, regarding the proportion of noninterest income (NII), the coefficient value of NII is positive and significant at 1% level of significance. On average, the higher the proportion of noninterest income, the higher the SHROE or the lower the risk. Increased risk-adjusted ROE indicates more optimal bank performance because banks can obtain higher profitability for the same amount of risk or lower risk from noninterest activities in the bank.

TABLE 7
Robustness test 1

Variable	SHROE		
	(1)	(2)	(3)
FOCUS	−2.026*** (0.001)	–	–
FOCUS-FTO	–	−1.829*** (0.001)	–
NII	–	–	0.0222*** (0.001)
MONITORING	0.0205*** (0.006)	0.0208*** (0.005)	0.0209*** (0.005)
Size	1.567*** (0.000)	1.552*** (0.000)	1.571*** (0.000)
Loans	0.0269***(0.000)	0.0269***(0.000)	0.0280***(0.000)
Deposits	−0.00324 (0.636)	−0.00293 (0.669)	−0.00229 (0.738)
Equity	−0.0121 (0.237)	−0.0118 (0.248)	−0.0108 (0.289)
LLP	−0.200*** (0.000)	−0.200*** (0.000)	−0.202*** (0.000)
GDP	0.00620 (0.525)	0.00619 (0.526)	0.00714 (0.464)
INF	0.00698 (0.938)	0.00319 (0.972)	−0.00904 (0.919)
quarter	Yes	Yes	Yes
_cons	−8.202*** (0.008)	−8.305*** (0.007)	−10.28*** (0.001)
N	762	762	762
R^2	0.1423	0.1419	0.1428

Notes: ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The figures within the parentheses are the *t*-values.

This finding means that income diversification contributed to the stability of bank performance during the COVID-19 pandemic. Thus, the robustness test results with alternative risk measurement in SHROE proved robust

in testing H1, which states that income diversification has a negative and significant effect on bank risk. The positive monitoring coefficient on SHROE in Table 7 shows results consistent with H2. The influence of monitoring on SHROE is stronger than the previous results using SHROA. This can be demonstrated by the higher level of monitoring significance on SHROE (with alpha 1%) compared to the level of monitoring significance on SHROA (with alpha 5%).

The explanation of this finding begins with SHROA, which is an important measure concerning bank management, in contrast to SHROE, a measure that concerns investors (external) related to the performance of assets owned by investors. This result is in line with the finding that the Infobank rating is a monitoring tool used by external parties to determine the good or bad performance of a bank. The significant monitoring coefficient at alpha 5% on SHROE shows that external monitoring (Infobank rating) remains important for banks because it is related to reputation and a picture of a bank's financial performance achievements.

The second robust test uses GMM to overcome the endogeneity problem. Endogeneity problems often affect empirical studies with observational data in corporate finance, which can substantially weaken the conclusions or inconsistencies of the pooled OLS estimator. Therefore, to test the robustness of the results as well as the endogeneity problem in this study, GMM-Sys (Blundell & Bond, 1998) is used. GMM-Sys allows the use of instruments that are only sequentially exogenous based on the lag factor of the regressor.

TABLE 8
Robustness test 2

Variable	SHROA		
	(1)	(2)	(3)
L.SHROA	0.405*** (0.000)	0.406*** (0.000)	0.387*** (0.000)
FOCUS	–4.081*** (0.000)	–	–
FOCUS-FTO	–	–3.835*** (0.000)	–
NII	–	–	0.0409*** (0.000)
MONITORING	0.00436(0.543)	0.00511 (0.471)	0.00664 (0.352)
Size	0.326 (0.398)	0.302 (0.434)	0.383 (0.318)

(*Continued on next page*)

TABLE 8 (*Continued*)

Variable	SHROA		
	(1)	(2)	(3)
Loans	0.00740 (0.448)	0.00684 (0.479)	0.00458 (0.626)
Deposits	0.0248*** (0.000)	0.0248*** (0.000)	0.0242*** (0.000)
Equity	0.0239* (0.068)	0.0238* (0.072)	0.0235* (0.081)
LLP	–0.254*** (0.002)	–0.242*** (0.002)	–0.255*** (0.002)
GDP	–0.00256 (0.686)	–0.00280 (0.657)	–0.00529 (0.413)
INF	0.346*** (0.000)	0.336*** (0.000)	0.331*** (0.000)
_cons	0.0930 (0.975)	–0.00456 (0.999)	–3.964 (0.179)
N	667	667	667
Diagnostic Test:			
Sargan test	0.0785	0.0815	0.0728
AR (1)	0.0000	0.0000	0.0000
AR (2)	0.9750	0.9365	0.9403

Notes: ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The figures within the parentheses are the t values.

Based on the estimation results using the two-step system GMM in Table 8, the regression coefficient of the L.SHROA variable is positive and significant, which means that the lag value of the dependent variable is positively related to the variable. This reveals the dynamic behaviour of the two dependent variables $SHROA_{i,t}$, thus giving rise to a dynamic panel model. Furthermore, based on the GMM diagnostic test, the Sargan test with Ho, the instrument is valid, showing that the p-value > 0.05, which means that the instrument in the model is valid. Furthermore, the Arrelano bond test of Order 2 also shows a p-value > 0.05, which means that the model is consistent. It can be concluded that the results of this study are not affected by potential endogeneity bias and are proven to be robust.

CONCLUSION

This study aims to investigate the negative effect of income diversification and monitoring on bank risk during the COVID-19 pandemic. The results of panel data regression model with robust standard errors shows that income

diversification can reduce bank risk. Thus, banks with diversified income will be in a more stable and better position during economic turmoil. We also find that bank monitoring negatively and significantly affects risk. Bank monitoring helps banks to manage risks and minimise their impact on bank operations proactively. In this study, the empirical testing failed to prove the moderating impact of bank monitoring. We argue that the proxy of bank monitoring we use in this paper is "external monitoring" using Infobank rating measures, which may be less relevant to describe the specific risks of diversification carried out by banks. In this context, "internal monitoring" such as shareholders or directors monitoring, might be more appropriate. Therefore, banks should improve their monitoring to obtain good external perceptions, ultimately improving bank stability.

This study has several limitations. First, the study did not distinguish the effect of each component of noninterest income, which consist of fees, trading and others, which may have a different impact on risk, especially during the COVID-19 pandemic. The various sources of income can produce different risks. Second, this study only analyses the effect of income diversification on risk during the COVID-19 pandemic when economic conditions are abnormal, and the results may be different when economic conditions are normal. We suggest future research to use board effectiveness (board of commissioners, audit committee, and risk monitoring committee) as a measure of bank internal monitoring, which can directly control risks from bank noninterest activities. Future research can also compare the effect of income diversification on profitability and risk pre-COVID-19 and post-COVID-19 to determine the consistency of the benefits of income diversification.

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