BANK DIVERSIFICATION STRATEGY AND STOCK PRICE VOLATILITY DURING COVID-19 IN AN EMERGING COUNTRY

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How to cite this paper: Defung, F., Paminto, A., Setyadi, D., & Yudaruddin, R. (2026). Bank diversification strategy and stock price volatility during COVID-19 in an emerging country. *Corporate and Business Strategy Review, 7*(2), 129–139. https://doi.org/10.22495/cbsrv7i2art12

ISSN Online: 2708-4965
ISSN Print: 2708-9924

Received: 01.08.2025
Revised: 11.12.2025; 27.02.2026
Accepted: 20.03.2026

JEL Classification: C23, G01, G21, G32
DOI: 10.22495/cbsrv7i2art12

Abstract

This study examines the impact of the COVID-19 pandemic on stock price volatility in the Indonesian banking sector and evaluates the moderating role of income diversification. The analysis covers 27 listed commercial banks during the 2017–2023 period across three phases: pre-pandemic, pandemic, and post-pandemic. Grounded in the efficient market hypothesis (EMH) and portfolio diversification theory, which suggest that markets rapidly reflect new information and that diversification can reduce risk, the study employs a fixed-effects regression model to assess volatility dynamics (Fama, 1970; Markowitz, 1952). The findings show that stock price volatility significantly increased during the pandemic, reflecting heightened market uncertainty, and gradually normalized in the post-pandemic phase. While income diversification does not significantly influence volatility in normal periods, it proves to be an effective risk-mitigation strategy during crisis periods. Banks with higher levels of diversification experienced lower volatility amid the pandemic, highlighting the stabilizing role of diversified income sources in times of market distress. These findings underscore the importance of strategic income diversification for enhancing resilience in the banking sector, contributing empirical evidence on how diversification interacts with systemic shocks, and offering practical implications for risk management and regulatory strategies in emerging financial markets.

Keywords: Stock Price Volatility, Income Diversification, COVID-19 Pandemic, Indonesian Banking Sector

Authors' individual contribution: Conceptualization — F.D. and A.P.; Methodology — F.D., A.P., D.S., and R.Y.; Investigation — F.D., A.P., D.S., and R.Y.; Resources — F.D., A.P., and R.Y.; Data Curation — A.P. and R.Y.; Writing — Original Draft — F.D., A.P., D.S., and R.Y.; Writing — Review & Editing — A.P. and R.Y.; Supervision — A.P.; Project Administration — F.D., A.P., and D.S.; Funding Acquisition — F.D., A.P., and D.S.

Declaration of conflicting interests: The Authors declare that there is no conflict of interest.

1. INTRODUCTION

The COVID-19 pandemic has profoundly disrupted global financial systems, with banking sectors in emerging markets experiencing heightened uncertainty and volatility. In Indonesia, banks play a central role in financial intermediation, and their stability is critical for maintaining economic resilience. The pandemic not only altered the risk landscape but also intensified stock price volatility, reflecting increased investor uncertainty and rapidly changing expectations (Murape & Mpofu, 2025;

Yensu et al., 2022). Prior studies have confirmed that the pandemic significantly increased firm-level volatility (Al-Rimawi & Kaddumi, 2021; Umoru et al., 2023), particularly in regions such as Asia and Oceania, where economic shocks were more pronounced. However, most of these studies have focused on broad corporate samples, leaving a gap in understanding how the banking sector in emerging markets, especially in Indonesia, was affected across different phases of the pandemic.

At the same time, income diversification has emerged as a potentially important factor in enhancing bank resilience during periods of economic stress. While some evidence suggests that diversification into non-interest income can reduce risk and improve performance (Li et al., 2021; Taylor, 2022; Meslier et al., 2014), other studies caution that diversification may increase fragility under certain conditions (Šeho et al., 2023; Le et al., 2022). More recently, Yang et al. (2020), Ye et al. (2025), and Maghyereh and Yamani (2022) emphasized that well-structured diversification strategies and financial innovation can help banks withstand adverse market shocks. Despite these insights, few studies have examined how diversification interacts with stock price volatility during different stages of the pandemic. This study is motivated by the need to explore this relationship in the context of Indonesian banking, where the effectiveness of diversification as a volatility-mitigating strategy remains underexplored.

Despite the growing body of research examining the financial impact of the COVID-19 pandemic across sectors and countries, there remains limited empirical evidence specifically focused on the dynamics of stock price volatility in the Indonesian banking sector across distinct phases: before the pandemic, during the pandemic, and after the pandemic. Most existing studies concentrate on broader market performance, banking stability, profitability, or systemic risk, but they often treat the pandemic period as a single, uniform shock (Elnahass et al., 2021; Shabir et al., 2023; Tomczak, 2025). This approach overlooks the potential variation in stock price volatility responses that may have occurred across different stages of the crisis. Moreover, while studies such as Chamzallari et al. (2022) and Khan et al. (2024) highlight increased volatility during the pandemic, these findings are predominantly global or regional in nature and lack a specific focus on the Indonesian context. Therefore, there is a clear need to explore how bank stock volatility in Indonesia evolved throughout the pandemic and whether there were distinct patterns of response during the recovery phase.

In addition, although the literature acknowledges the potential stabilizing role of bank income diversification, the findings remain inconclusive and highly dependent on the context (Li et al., 2021; Taylor, 2022; Meslier et al., 2014). Some studies report that diversification enhances resilience during times of crisis, while others warn that it may increase instability, especially when poorly structured or overly concentrated in specific segments (Šeho et al., 2023; Yang et al., 2020; Ye et al., 2025). However, few studies have investigated how income diversification affects stock price volatility, particularly within emerging markets such as Indonesia. Most prior research focuses on measures like performance, default risk, or broader financial soundness, rather than market-based volatility indicators. Furthermore, there appears to be a lack of comprehensive investigation into how income diversification influences stock price volatility, particularly in the context of emerging markets such as Indonesia. While existing studies have focused on aspects like performance, default risk, or broader financial soundness, relatively few have explored this relationship using market-based volatility measures. Additionally, limited research has specifically assessed the extent to which diversification moderates volatility across the distinct phases of the COVID-19 pandemic. This study seeks to contribute to filling this gap by examining the evolution of stock price volatility in Indonesian banks and the potential role of income diversification before, during, and after the crisis.

The primary objective of this study is to examine the impact of the COVID-19 pandemic on stock price volatility in the Indonesian banking sector across three distinct periods: before, during, and after the pandemic. This research aims to capture how volatility dynamics evolved in response to the crisis and whether such patterns persisted or normalized in the post-pandemic period. Furthermore, the study explores the moderating role of bank diversification in influencing stock price volatility across these periods. By assessing the interaction between diversification strategies and volatility, the study seeks to provide deeper insights into how Indonesian banks navigated market uncertainties and whether diversification served as an effective risk management tool during turbulent times.

This study provides three key contributions to the existing literature on financial market volatility and banking resilience during systemic crises. First, it offers empirical evidence on the evolution of stock price volatility in Indonesian banks across the pre-pandemic, pandemic, and post-pandemic periods, addressing gaps in earlier research that documented heightened volatility but did not differentiate between phases of the crisis (Baek et al., 2020; Chamzallari et al., 2022; Li, 2022). Second, it advances the understanding of bank income diversification by showing that diversification does not significantly reduce volatility in stable periods but becomes an effective stabilizing mechanism under crisis conditions, thereby enriching previous findings on the mixed effects of diversification on risk and performance in the banking sector (Li et al., 2021; Taylor, 2022; Meslier et al., 2014). Third, the study offers valuable policy implications by demonstrating that diversification can strengthen banks' resilience during turbulent periods, thereby supporting the development of regulatory strategies that encourage prudent revenue diversification and improved risk management in emerging financial markets.

This paper is structured into several key sections. Section 2 reviews the existing literature concerning the influence of the COVID-19 pandemic and bank diversification strategies on stock price volatility, highlighting relevant empirical findings and theoretical perspectives. Section 3 explains the research methodology, including data sources, variable definitions, and the econometric techniques employed. Section 4 presents and discusses the empirical results, focusing on the observed volatility patterns across different pandemic periods

and the role of diversification. Finally, Section 5 concludes the study by summarizing the main findings and offering policy implications and suggestions for future research.

2. LITERATURE REVIEW

The COVID-19 pandemic had a profound impact on the economic and financial performance of several vulnerable industries, especially those heavily affected by mobility restrictions and declining demand. Sectors such as hospitality, leisure, arts, consumer goods, and energy experienced significant downturns in performance during the pandemic (Coutinho dos Santos et al., 2023; Deviyanti et al., 2023; Irwansyah et al., 2023; Nurlia et al., 2023). In countries like Vietnam and other emerging markets, industries that were more exposed to government policy responses suffered greater losses (Ngo & Duong, 2024; Shen et al., 2020). Small enterprises, particularly those lacking digital capabilities, were also more severely affected, whereas those adopting e-commerce or innovation strategies demonstrated relatively stronger performance (Achmad et al., 2023; Lestari et al., 2021; Riadi, Heksarini, et al., 2022; Surahman et al., 2023). These cross-industry shocks are highly relevant for the banking sector because banks are fundamentally interconnected with the real economy through their roles as financial intermediaries. When firms across diverse industries experience declining revenues, liquidity constraints, or heightened business risks, these conditions directly transmit to banks through reduced loan demand, weakened repayment capacity, and rising credit risk exposures. Thus, although the banking industry is structurally different from other sectors, the deterioration in real-sector performance creates significant spillover effects that influence banks' balance sheets, profitability, and ultimately stock price volatility. This transmission mechanism provides a clear rationale for linking pandemic-induced disruptions in various industries to the financial pressure experienced by the banking sector.

In line with this systemic connection between industry performance and financial institutions, the pandemic disrupted banking sector stability, with the impact varying depending on bank size, ownership, and digital adaptability (Maria et al., 2022; Wahyuni et al., 2024; Yudaruddin, 2023a, 2023c; Riadi, Hadjaat, et al., 2022). Despite widespread disruptions, the technology sector emerged as a relative winner during the pandemic, as the risk of stock price crashes significantly decreased compared to other sectors (Hossain et al., 2023). This resilience reflects the sector's ability to capitalize on the accelerated shift to digitalization. Additionally, the pandemic caused a sharp rise in global stock market connectedness, though this surge was short-lived, lasting only about two months (Dong et al., 2022). Various studies also revealed shifts in capital structure, earnings management, and stock market performance across countries and sectors, often influenced by government responses to the crisis (Deviyanti et al., 2023; Lesmana & Yudaruddin, 2024). In Indonesia, social assistance programs played a crucial role in mitigating poverty and preserving socio-economic stability, with public spending proving to be an essential tool during the pandemic (Anwar et al., 2024; Langi et al., 2023).

The theoretical foundation of this study is grounded in the efficient market hypothesis (EMH) and portfolio diversification theory. According to EMH, financial markets fully reflect all available information, implying that stock prices adjust rapidly to new events, such as the COVID-19 pandemic, which could trigger increased volatility (Fama, 1970). Meanwhile, portfolio diversification theory suggests that spreading investments across different assets or business lines can reduce overall risk and stabilize returns during periods of uncertainty (Markowitz, 1952). The banking sector experienced widespread and multifaceted impacts due to the COVID-19 pandemic, with both global and regional evidence pointing to a general decline in performance and stability. Empirical findings from global datasets confirm that the pandemic significantly deteriorated bank profitability, cost efficiency, and raised key financial risks, including credit and capital risks (Shabir et al., 2023; Heitmann et al., 2023; Elnahass et al., 2021). These global patterns highlight an important theoretical mechanism in which macroeconomic shocks disrupt borrower cash flows and increase uncertainty, thereby elevating bank risk exposures through deteriorating loan quality, rising provisioning needs, and heightened sensitivity among market participants regarding financial stability. These adverse effects were not uniform because outcomes varied according to country income levels, regulatory environments, and institutional quality. Larger banks with stronger capitalization, greater diversification, and lower non-performing loans tended to be more resilient (Demir & Danisman, 2021), while depositors in emerging markets became more risk-sensitive, exerting stronger market discipline under heightened uncertainty (Xie et al., 2024). The Islamic banking sector experienced similar pressures in the form of declining profitability and rising insolvency and asset risks (Abdallah & Bahloul, 2024).

Region-specific studies, including those focusing on Indonesia, indicated that despite relatively stable capital positions, declining loan quality created significant latent risks that required policy attention (Siregar et al., 2021). These findings reinforce global evidence showing that credit risk pressures were more pronounced in emerging markets due to limited buffers and higher exposure to real-sector disruptions. Some country-specific studies, such as from Nigeria, reported that banking efficiency remained stable during the pandemic (Jaiyeoba et al., 2024). However, the broader evidence consistently demonstrates that the pandemic tested banking sector resilience and revealed critical vulnerabilities. These patterns support the theoretical view that large and sudden systemic shocks amplify financial fragility by triggering loan deterioration, increasing uncertainty, and intensifying negative investor sentiment. These conditions create an environment in which bank stock prices become more volatile and more sensitive to unfavorable macroeconomic information.

The COVID-19 pandemic also had a pronounced effect on global stock market volatility, exposing deep vulnerabilities and generating unprecedented levels of uncertainty across financial systems. Stock markets in both developed and emerging economies experienced heightened and persistent volatility, and empirical evidence shows that negative news had a greater

impact than positive developments. This pattern reflects a consistent negativity bias in global financial markets (Baek et al., 2020; Khan et al., 2024). Volatility was particularly asymmetric and highly sensitive to adverse shocks, as observed in markets such as the United States, the United Kingdom, China, India, and Pakistan (Khan et al., 2024). At the industry level, total and idiosyncratic risks increased sharply, although the degree of exposure varied according to sector characteristics. Country-level fundamentals such as institutional quality, financial development, and economic resilience were found to mitigate volatility to some extent (Uddin et al., 2021). In the case of China, systemic risk in A-Share banks increased due to spillover effects from the United States, while state-owned banks maintained relatively greater stability (Li, 2022). Banks globally contributed more to systemic risk, a trend particularly visible among large institutions in developed markets with high loan-to-deposit ratios (Yan et al., 2023). Although these developments indicated elevated stress, there was no conclusive evidence that the period constituted a full-scale banking crisis. Even so, systemic pressures clearly intensified during the pandemic (Tomczak, 2025). Complementing this, Chamzallari et al. (2022) found that increases in COVID-19 cases and fatalities significantly raised stock return volatility across sixty-three countries, with stronger effects in firms operating in Oceania and Asia. The combination of global and local evidence supports a strong theoretical position. The COVID-19 pandemic created severe macro-financial disruptions that weakened bank fundamentals, increased uncertainty, and heightened perceptions of risk among investors. These mechanisms collectively provide a clear theoretical rationale for expecting an increase in stock price volatility in the banking sector during the pandemic.

H1: The COVID-19 pandemic significantly increases stock price volatility in the banking sector.

During the COVID-19 pandemic, income diversification played an important yet complex role in moderating stock price volatility in the banking sector. From a theoretical perspective, diversification reduces risk by allowing banks to generate income from multiple sources, thereby reducing dependence on interest income and mitigating the impact of credit shocks. Empirical studies support this mechanism. Li et al. (2021) found that banks with greater reliance on non-interest income reported lower risk and improved performance, which indicates that diversified revenue streams can buffer against credit deterioration. Taylor (2022) reported that income diversification improved bank performance during periods of tightened credit conditions. In the context of emerging economies, Meslier et al. (2014) documented that non-interest activities improved profitability and risk-adjusted returns.

Some studies, however, emphasize that diversification is not always stabilizing. Šeho et al. (2023) warned that diversification could worsen instability when banks are insufficiently diversified or excessively dependent on particular non-interest segments. Le et al. (2022) noted that diversification reduced default risk for Vietnamese banks, although its effectiveness was shaped by the specific composition of non-interest income. Yang et al. (2020) argued that business model transformation, which included diversified income sources, strengthened bank resilience during volatile conditions. Ye et al. (2025) found that banks with well-structured diversification strategies adapted more effectively to stock price shocks linked to pandemic-related uncertainty. Maghyereh and Yamani (2022) added that banks with diversified revenue streams experienced reduced exposure to downside risks, particularly in countries with stronger institutional frameworks. This evidence forms a clear theoretical rationale for expecting income diversification to influence the relationship between COVID-19 and bank stock volatility. Diversification provides an alternative buffer against credit and liquidity pressures, reduces reliance on traditional interest-based activities, and enhances operational flexibility during periods of systemic stress. These mechanisms suggest that diversification should moderate the impact of pandemic-related shocks on stock price volatility.

H2: Income diversification moderates the relationship between the COVID-19 pandemic and stock price volatility.

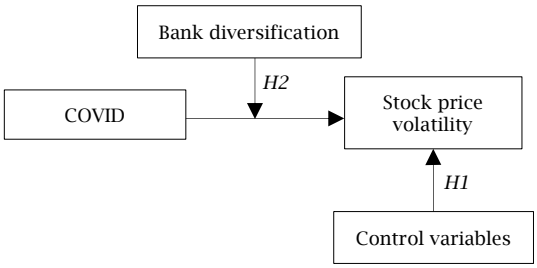
3. METHODOLOGY

This study seeks to analyze how the COVID-19 pandemic influenced stock price volatility in the Indonesian banking sector by distinguishing among the periods before, during, and after the pandemic. Rather than treating the pandemic as a single disruptive event, the study adopts a chronological approach to capture the evolution of volatility patterns over time. The analysis focuses specifically on commercial banks listed on the Indonesia Stock Exchange (IDX) because listed banks provide publicly available, high-frequency market data that are essential for examining stock price dynamics. From a total population of 46 commercial banks, 27 banks were selected using purposive sampling. The selected banks met two strict criteria: they remained continuously listed throughout the 2017–2023 period, and they provided complete and consistent data for all variables required in the analysis. These criteria ensured the construction of a balanced panel dataset, which enhances comparability across banks and improves the reliability of the statistical estimation. Stock price data were obtained from the IDX, bank-specific financial variables were sourced from audited annual reports, and macroeconomic indicators were retrieved from the Central Bureau of Statistics (CBS) Indonesia.

Table 1 presents the definitions, measurements, and expected signs of all variables used in the study. The dependent variable is stock price volatility (*SPV*), calculated as the standard deviation of stock returns, which captures the degree of fluctuation in bank stock prices over time. This variable is particularly relevant in the context of the COVID-19 pandemic, which significantly increased global financial uncertainty and amplified volatility across both developed and emerging markets. As Baek et al. (2020) and Khan et al. (2024) highlight, volatility during this period was asymmetrically influenced by negative news, reflecting a broader market sensitivity to adverse events. The key independent variables include dummy variables capturing distinct pandemic phases — pre-COVID

(2017–2019) (*PRECOVID*), COVID (2020–2021) (*COVID*), and post-COVID (2022–2023) (*POSTCOVID*) — to identify how volatility patterns evolved. Another independent variable, bank diversification, is proxied by the ratio of non-interest income to total income, reflecting the extent to which banks rely on income sources beyond traditional lending.

Figure 1. Conceptual framework



Prior research suggests that diversified banks may experience lower volatility due to reduced dependence on interest-sensitive assets. Several control variables are also included to isolate the effects of these factors: bank size (*SIZE*), profitability (*ROA*), capital adequacy (*CAR*), credit risk (*NPL*), market concentration (*HHI*), inflation (*INF*), and gross domestic product (*GDP*) growth. These variables account for differences in bank characteristics and macroeconomic conditions, both of which may influence stock price dynamics. Uddin et al. (2021) and Yudaruddin (2023b) emphasize that countries with strong institutional and economic fundamentals tend to exhibit lower volatility, while Yan et al. (2023) and Tomczak (2025) note that systemic risk in the banking sector intensified during COVID-19, particularly in large and highly leveraged banks. Therefore, controlling for these factors enhances therobustness of the analysis in capturing the true relationship between COVID-19, bank diversification, and stock price volatility.

Table 1. Dependent, independent, and control variables

Variable	*Notation*	*Definition and measure*	*Expected sign*
Stock price volatility	*SPV*	$SPV = \sqrt{\frac{1}{N-1}\sum_{t=1}^{N}(R_t - \bar{R})^2}$ where, R_t — stock return at time *t*; R — mean (average) return, N — number of observations.	
COVID	*PRECOVID*	This dummy variable has a value of 1 if the year of the COVID-19 pandemic (2017–2019), or 0 otherwise.	-
	COVID	This dummy variable has a value of 1 if the first year the COVID-19 pandemic occurred (2020–2021), or 0 otherwise.	+
	POSTCOVID	This dummy variable has the value 1 if it is the second year of the COVID-19 pandemic (2022–2023), or 0 otherwise.	-
Bank diversification	*NII*	Non-interest income / Total income	-
Bank size	*SIZE*	Log natural total asset	-/+
Profitability	*ROA*	Net profit / Total asset	-
Capital	*CAR*	Ratio of total capital to risk-weighted assets	-
Credit risk	*NPL*	Non-performing loan	+
Bank concentration	*HHI*	Herfindahl-Hirschman index of bank assets	-
Inflation	*INF*	Indonesia Inflation Rate	+
Gross domestic product	*GDP*	Growth of GDP	-

This study employs a two-stage econometric methodology to analyze the impact of COVID-19 and bank diversification on stock price volatility in the Indonesian banking sector. In the first stage, the analysis estimates three separate regression models as represented in Eqs. (1) to (3), where Eq. (1) covers the pre-COVID period, Eq. (2) represents the COVID-19 period, and Eq. (3) addresses the post-COVID period. Each model includes COVID-19 indicators, bank diversification, and a comprehensive set of control variables such as bank diversification, and a comprehensive set of control variables such as bank size, profitability, capital, credit risk, market concentration, inflation, and GDP growth. In the second stage, Eqs. (4) to (6) are formulated by incorporating interaction terms between COVID-19 and bank diversification for each respective period, allowing the study to assess whether the relationship between diversification and stock price volatility changes across different stages of the pandemic. Therefore, the following model was adopted to predict stock price volatility.

$$SPV_{i,t} = \beta_0 + \beta_1 PRECOVID_t + \beta_2 NII_{,i,t} + \beta_3 SIZE_{i,t} + \beta_4 ROA_{i,t} + \beta_5 CAR_{i,t} + \beta_6 NPL_{i,t} + \beta_7 HHI_t + \beta_8 INF_t + \beta_9 GDP_t + \varepsilon_{i,j} \quad (1)$$

$$SPV_{i,t} = \beta_0 + \beta_1 COVID_t + \beta_2 NII_{,i,t} + \beta_3 SIZE_{i,t} + \beta_4 ROA_{i,t} + \beta_5 CAR_{i,t} + \beta_6 NPL_{i,t} + \beta_7 HHI_t + \beta_8 INF_t + \beta_9 GDP_t + \varepsilon_{i,j} \quad (2)$$

$$SPV_{i,t} = \beta_0 + \beta_1 POSTCOVID_t + \beta_2 NII_{,i,t} + \beta_3 SIZE_{i,t} + \beta_4 ROA_{i,t} + \beta_5 CAR_{i,t} + \beta_6 NPL_{i,t} + \beta_7 HHI_t + \beta_8 INF_t + \beta_9 GDP_t + \varepsilon_{i,j} \quad (3)$$

$$SPV_{i,t} = \beta_0 + \beta_1 PRECOVID_t + \beta_2 NII_{,i,t} + \beta_3 PRECOVID * NII_{,i,t} + \beta_4 SIZE_{i,t} + \beta_5 ROA_{i,t} + \beta_6 CAR_{i,t} + \beta_7 NPL_{i,t} + \beta_8 HHI_t + \beta_9 INF_t + \beta_{10} GDP_t + \varepsilon_{i,j} \quad (4)$$

$$SPV_{i,t} = \beta_0 + \beta_1 COVID_t + \beta_2 NII_{,i,t} + \beta_3\ COVID * NII_{,i,t} + \beta_4 SIZE_{i,t} + \beta_5 ROA_{i,t} + \beta_6 CAR_{i,t} + \beta_7 NPL_{i,t} + \beta_8 HHI_t + \beta_9 INF_t + \beta_{10} GDP_t + \varepsilon_{i,j} \quad (5)$$

$$SPV_{i,t} = \beta_0 + \beta_1 POSTCOVID_t + \beta_2 NII_{,i,t} + \beta_3 POSTCOVID * NII_{,i,t} + \beta_4 SIZE_{i,t} + \beta_5 ROA_{i,t} + \beta_6 CAR_{i,t} + \beta_7 NPL_{i,t} + \beta_8 HHI_t + \beta_9 INF_t + \beta_{10} GDP_t + \varepsilon_{i,j} \quad (6)$$

where, *i* refers to an individual bank, *t* refers to the year. The dependent variable is stock price volatility (*SPV*), while the main independent variables include indicators of the COVID-19 pandemic, represented by *PRECOVID*, *COVID*, and *POSTCOVID*, as well as bank diversification, measured by *NII*. Control variables consist of bank-specific characteristics such as bank size (*SIZE*), return on assets (*ROA*), capital adequacy ratio (*CAR*), and non-performing loans (*NPL*), along with macroeconomic factors including Herfindahl-Hirschman index for market concentration (*HHI*), inflation (*INF*), and economic growth (*GDP*).

This study employs panel data analysis to capture both the cross-sectional differences among banks and the time-series changes from 2017 to 2023. The use of panel data offers important advantages, particularly in addressing empirical challenges such as multicollinearity, heteroscedasticity, and potential estimation bias, as highlighted by Wooldridge (2010). To estimate the regression models, three approaches were considered: the common effect model, the random effect model, and the fixed effect model (FEM). To determine the most suitable method, the Chow test and the Hausman test were conducted. Based on these tests, the FEM was selected as the most appropriate specification for this analysis. The application of the FEM enables the study to generate consistent and unbiased coefficient estimates, making it well-suited for evaluating the relationship between stock price volatility, bank diversification, and the COVID-19 period in Indonesian listed banks. Additionally, to ensure the accuracy and stability of the results and to address potential endogeneity concerns, additional tests were conducted using an alternative methodological approach through the two-step system generalized method of moments (GMM) estimation, which provides further robustness and strengthens the reliability of the empirical findings.

4. RESULT

The descriptive statistics in Table 2 provide an overview of the variables used in this study based on 189 observations. The dependent variable, *SPV*, has a mean of 0.027 and a standard deviation of 0.066, indicating moderate variation among the observed banks. The period dummy variables, namely *PRECOVID*, *COVID*, and *POSTCOVID*, are fairly distributed across the sample with proportions of 42.9%, 28.6%, and 28.6%, respectively, reflecting a balanced representation of each time period. *NII* shows a mean of 14.23 and a standard deviation of 7.576, highlighting variation in income structures across banks. Control variables such as *SIZE*, *ROA*, *CAR*, *NPL*, *HHI*, *INF*, and *GDP* also display reasonable ranges and standard deviations. Importantly, the mean values of all variables are greater than their respective standard deviations, indicating that the dataset does not suffer from serious issues related to normal distribution. This confirms the appropriateness of the data for subsequent panel regression analysis.

Table 2. Descriptive statistics for all variables

Variables	*Mean*	*Std. dev.*	*Min*	*Max*
SPV	0.027	0.066	0.000	0.416
PRECOVID	0.429	0.496	0.000	1.000
COVID	0.286	0.453	0.000	1.000
POSTCOVID	0.286	0.453	0.000	1.000
NII	14.23	7.576	1.956	37.36
SIZE	18.13	1.601	15.17	21.25
ROA	1.059	1.997	-8.500	4.030
CAR	25.07	8.599	11.51	62.24
NPL	3.295	1.710	0.930	8.540
HHI	716.7	52.11	651.7	814.8
INF	3.037	1.195	1.680	5.550
GDP	7.849	5.038	-2.524	15.42

Note: Obs. = 189.

Table 3 presents the correlation matrix among all independent and control variables used in this study, based on 189 observations. The correlation coefficients indicate the degree of linear association between variables, and the results reveal that all correlation values are below the threshold of 0.80. This finding suggests that there is no serious multicollinearity issue in the model, allowing all variables to be included in the regression analysis without concern for inflated standard errors or distorted coefficient estimates. The highest correlation appears between *INF* and *GDP*, with a coefficient of 0.783, which is still within the acceptable limit. According to Gujarati and Porter (2009), multicollinearity is typically considered problematic when the correlation coefficient exceeds 0.80. Therefore, the values reported in Table 3 confirm that the independent variables are sufficiently distinct from one another, supporting the robustness of the subsequent regression results.

Table 3. Correlation matrix

Variables	*PRECOVID*	*COVID*	*POSTCOVID*	*NII*	*SIZE*	*ROA*	*CAR*	*NPL*	*HHI*	*INF*	*GDP*
PRECOVID	1.000										
COVID	-0.548***	1.000									
POSTCOVID	-0.548***	-0.400***	1.000								
NII	-0.073	0.039	0.041	1.000							
SIZE	-0.095	0.023	0.081	0.418***	1.000						
ROA	0.075	-0.221***	0.139*	0.229***	0.469***	1.000					
CAR	-0.365***	0.066	0.334***	-0.098	-0.297***	0.113	1.000				
NPL	0.136*	0.051	-0.200***	-0.131*	-0.255***	-0.431***	-0.304***	1.000			
HHI	-0.773***	0.199***	0.648***	0.029	0.091	-0.007	0.401	-0.174**	1.000		
INF	0.085	-0.646***	0.554***	0.027	0.016	0.126*	0.022	-0.073	-0.202***	1.000	
GDP	0.108	-0.520***	0.402***	0.024	0.018	0.047	0.068	-0.096	-0.006	0.783***	1.000

*Note: ***, **, and * are significant at 1%, 5%, and 10% confidence levels, respectively.*

Table 4 presents the regression results examining the relationship between the COVID-19 pandemic and bank diversification on stock price volatility in the Indonesian banking sector. The results show that the *PRECOVID* variable has a negative and statistically significant effect on stock price volatility (column 1), indicating that bank stock prices in Indonesia were relatively stable before the pandemic, with lower risk levels. In contrast, the *COVID* variable has a positive and significant effect on stock price volatility (column 2), suggesting that during the pandemic, bank stock prices experienced high levels of fluctuation, reflecting increased risk and market uncertainty. After the pandemic, the *POSTCOVID* variable again shows a negative and significant effect (column 3), implying a return to more stable stock prices in the post-pandemic period. Regarding the key independent variable, bank diversification, the results indicate no significant impact on stock price volatility across all models. This suggests that, in the Indonesian banking context, diversification strategies did not play a substantial role in mitigating or amplifying stock price volatility during the observed periods (columns 1–3).

Regarding the control variables, the *SIZE* variable exhibits a negative and statistically significant effect on stock price volatility (column 2), indicating that larger banks tend to experience lower stock price fluctuations. This suggests that *SIZE* contributes to greater market confidence and price stability. Additionally, the *HHI* also shows a negative and significant impact on stock price volatility (columns 1 and 3), implying that a more concentrated banking market is associated with greater stock price stability, possibly due to reduced competition and more predictable market behavior. As for *INF*, the results reveal mixed effects: in column 1, *INF* has a negative and significant influence, while in column 3, the impact is positive and significant. This indicates that the relationship between *INF* and stock price volatility may vary depending on the time period or economic context. Interestingly, contrary to expectations, the *GDP* variable consistently shows a positive and significant relationship with stock price volatility across all columns (1–3). This suggests that higher economic growth is accompanied by increased volatility in bank stock prices, possibly due to heightened investor activity, speculative behavior, or changing market expectations during periods of rapid economic expansion.

Table 4. Impact of COVID-19 and bank diversification on stock price volatility

Variables	*Dependent variables (SPV)*		
	(1)	*(2)*	*(3)*
PRECOVID	-0.0714***		
	(-4.18)		
COVID		0.0599***	
		(4.25)	
POSTCOVID			-0.2210***
			(-3.43)
NII	-0.0012	-0.0011	-0.0007
	(-1.36)	(-1.32)	(-0.88)
SIZE	-0.0320	-0.0343*	-0.0317
	(-1.63)	(-1.74)	(-1.57)
ROA	-0.0004	-0.0002	-0.0018
	(-0.13)	(-0.07)	(-0.51)
CAR	0.0002	0.0002	0.0005
	(0.25)	(0.25)	(0.58)
NPL	0.0001	-0.0003	-0.0015
	(0.03)	(-0.09)	(-0.37)
HHI	-0.0005***	-0.00003	-0.0016***
	(-3.45)	(-0.26)	(-3.12)
INF	-0.0341***	-0.0080	0.0673**
	(-4.77)	(-1.12)	(2.52)
GDP	0.0064***	0.0036**	0.0064*
	(3.92)	(2.52)	(-1.80)
CONS.	1.1172***	0.6645**	-0.6561
	(3.06)	(2.07)	(-1.55)
R-squared	0.4808	0.4782	0.4806
F-statistic	4.25	4.32	3.54
Prob. > F	0.0001	0.0001	0.0001
Number of obs.	189	189	189

*Note: ***, **, and * are significant at 1%, 5%, and 10% confidence levels, respectively.*

Table 5 presents the regression results examining the interaction between the COVID-19 pandemic and bank diversification in relation to stock price volatility in the Indonesian banking sector. The primary objective of this interaction analysis is to further explore the role of bank diversification strategies in mitigating stock price fluctuations across different phases of the pandemic, namely the pre-COVID-19 period, the COVID-19 period, and the post-COVID-19 period.

Table 5. Impact interaction between COVID-19 and bank diversification on stock price volatility

Variables	*Dependent variables (SPV)*		
	(1)	*(2)*	*(3)*
PRECOVID	-0.0943***		
	(-3.64)		
COVID		0.1113***	
		(4.27)	
POSTCOVID			-0.2277***
			(3.47)
NII	-0.0019*	-0.0008	-0.0011
	(-1.78)	(-0.90)	(-1.04)
*PRECOVID * NII*	0.0014		
	(1.17)		
*COVID * NII*		-0.0034**	
		(-2.33)	
*POSTCOVID * NII*			0.0007
			(0.55)
SIZE	-0.0383*	-0.0381*	-0.0289
	(-1.89)	(-1.96)	(-1.38)
ROA	-0.0002	0.0001	-0.0019
	(-0.08)	(0.04)	(-0.52)
CAR	0.00006	0.0002	0.0006
	(0.07)	(0.22)	(0.66)
NPL	0.0004	0.0002	-0.0015
	(0.10)	(0.07)	(-0.37)
HHI	-0.0005***	-0.00001	0.0015***
	(-3.34)	(-0.14)	(2.99)
INF	-0.0336***	-0.0078	0.0651**
	(-4.70)	(-1.10)	(2.41)
GDP	0.0064***	0.0036**	-0.0049*
	(3.93)	(2.56)	(-1.72)
CONS.	1.2333***	0.7148**	-0.6678
	(3.27)	(2.26)	(-1.57)
R-squared	0.4621	0.4786	0.4928
F-statistic	3.97	4.54	3.20
Prob. > F	0.0000	0.0000	0.0000
Number of obs.	189	189	189

*Note: ***, **, and * are significant at 1%, 5%, and 10% confidence levels, respectively.*

The findings indicate that bank diversification during the COVID-19 period has a negative and statistically significant effect on stock price volatility, as shown in column 2. This suggests that banks with higher levels of income diversification experienced lower stock price volatility during the health crisis. In other words, greater diversification contributed to more stable stock prices for banks amid the heightened market uncertainty and economic disruptions brought on by the pandemic. These results highlight the protective function of diversification in reducing exposure to specific risks and enhancing resilience during times of crisis. The stabilizing impact of diversification is particularly important in situations where income streams from various sources can offset potential losses in specific segments, thereby supporting overall financial stability. Hence, bank diversification plays a critical role in moderating fluctuations in stock prices and maintaining investor confidence in the banking sector during periods of severe external shocks.

Additional tests were conducted to ensure the accuracy and stability of the results, and to address potential endogeneity concerns, an alternative methodological approach was employed using the two-step system GMM estimation. As shown in Table 6, the *PRECOVID* variable has a negative and significant effect on stock price volatility (column 1), indicating relatively stable bank stock prices before the pandemic. During the pandemic, the *COVID* variable shows a positive and significant effect (column 2), reflecting heightened volatility, while the *POSTCOVID* variable again has a negative and significant effect (column 3), suggesting improved stability after the crisis. Bank diversification shows no significant impact in columns 1–3, implying limited influence on volatility across the full period. However, in the COVID-specific model (column 5), diversification exhibits a negative and significant effect, indicating that more diversified banks experienced lower stock price volatility during the pandemic.

Table 6. Robustness check with alternative econometric methodology: The two-step system GMM estimation

Variables	*Dependent variables (SPV)*					
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
SPV (*t* – 1)	-0.3570***	-0.3095***	-0.2838**	-0.4007***	-0.2077**	-0.2749**
	(-3.55)	(-2.90)	(-2.55)	(-2.85)	(-2.30)	(-2.01)
PRECOVID	-0.0492***			-0.0611**		
	(-2.76)			(-2.02)		
COVID		0.0410**			0.0985**	
		(2.51)			(-2.58)	
POSTCOVID			-0.1304**			-0.1253**
			(-2.40)			(-2.30)
NII	-0.0001	-0.0001	-0.0001	-0.0005	0.00007	0.00008
	(-0.20)	(-0.20)	(-0.24)	(-0.35)	(0.14)	(0.14)
*PRECOVID * NII*				0.0006		
				(-0.67)		
*COVID * NII*					-0.0034**	
					(-2.00)	
*POSTCOVID * NII*						-0.00001
						(-0.01)
CONS.	0.5389***	0.1927***	-0.5772*	-0.56023***	0.1207**	-0.5444*
	(3.38)	(3.28)	(-1.90)	(-2.80)	(2.14)	(-1.81)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Diagnostics						
Wald test	143.51***	133.39***	138.02***	244.60***	170.29***	180.73***
AR(2) test	0.051	0.074	0.070	0.064	0.170	0.082
Hansen-J test	0.135	0.108	0.168	0.111	0.175	0.175
Number of instruments	14	14	14	15	15	15
Number of groups	27	27	27	27	27	27
Number of obs.	162	162	162	162	162	162

*Note: ***, **, and * are significant at 1%, 5%, and 10% confidence levels, respectively.*

5. DISCUSSION

The findings of this study reveal that the COVID-19 pandemic had a substantial impact on stock price volatility in the Indonesian banking sector. Before the onset of the pandemic, stock price volatility in the sector remained relatively low, suggesting a stable financial environment characterized by manageable levels of risk and investor confidence. However, with the arrival of the COVID-19 crisis, volatility increased significantly, reflecting heightened uncertainty, investor panic, and systemic financial stress. In the post-pandemic period, a gradual reduction in volatility was observed, which indicates that the market began to stabilize as economic activity resumed and public health concerns were mitigated. These observations are consistent with previous studies by Baek et al. (2020) and Khan et al. (2024), who documented sharp increases in market volatility during the pandemic, largely driven by investor overreactions to adverse news and uncertainty. Furthermore, this result aligns with the findings of Uddin et al. (2021), who emphasized the role of macroeconomic resilience in cushioning financial markets during periods of crisis and facilitating recovery in the post-shock phase, particularly in emerging economies such as Indonesia.

In addition, the results from the baseline regression model indicate that bank diversification, measured by the proportion of non-interest income to total income, did not have a statistically significant impact on stock price volatility when considered independently from the COVID-19 variable. This implies that in a relatively stable macroeconomic environment, income diversification strategies do not necessarily translate into reduced volatility in stock prices. The limited effect of diversification in normal periods may stem from the composition or volatility of non-interest income itself, which could introduce other forms of risk or revenue instability. This result is in line with prior studies by Šeho et al. (2023) and Le et al. (2022), who suggest that the benefits of diversification are context-dependent and vary according to the structure, sustainability, and risk profile of alternative income sources. Moreover, their findings highlight the importance of considering broader external conditions, such as macroeconomic shocks or market disruptions, when assessing the effectiveness of diversification strategies.

However, the analysis of interaction terms between bank diversification and the COVID-19 period provides more nuanced insights into the conditional benefits of diversification under crisis conditions. The empirical evidence demonstrates that during the COVID-19 pandemic, banks with higher levels of income diversification experienced significantly lower stock price volatility. This suggests that income diversification served as an effective risk-buffering mechanism in times of heightened uncertainty. By spreading revenue sources beyond traditional interest income, diversified banks were better positioned to absorb shocks and maintain investor confidence, thereby reducing fluctuations in their stock prices. These findings are consistent with those reported by Li et al. (2021), Taylor (2022), and Ye et al. (2025), who argue that diversification can strengthen bank resilience during periods of financial turmoil. Furthermore, Maghyereh and Yamani (2022) underscore that banks with well-structured and strategically managed income diversification are more likely to maintain their market value and avoid severe stock price declines, especially when operating within financial systems that are supported by robust institutional and regulatory frameworks.

6. CONCLUSION

This study set out to investigate the impact of the COVID-19 pandemic on stock price volatility in the Indonesian banking sector by analyzing three distinct phases: before, during, and after the pandemic. Using panel data from 27 commercial banks listed on the IDX between 2017 and 2023 and employing an FEM, the research provides empirical evidence on how volatility patterns evolved across periods of crisis and recovery. The results indicate that stock price volatility was significantly higher during the pandemic, while both the pre-pandemic and post-pandemic periods were associated with lower volatility, suggesting a return to relative market stability. Furthermore, while bank diversification did not show a significant effect on volatility in general, it became a critical stabilizing factor during the pandemic. Banks with more diversified income structures experienced lower volatility, highlighting the importance of income diversification as a risk management tool during periods of heightened financial uncertainty.

The findings of this research carry important implications for banking sector policymakers, regulators, and financial institutions in Indonesia and similar emerging economies. The evidence underscores the need for banks to proactively develop and implement diversification strategies that enhance income stability and operational flexibility, especially during systemic shocks. Regulatory authorities should consider encouraging prudent income diversification as part of broader risk management frameworks. In times of crisis such as the COVID-19 pandemic, diversified income streams can act as financial shock absorbers, helping to stabilize bank valuations and preserve investor confidence. These results also support the formulation of macroprudential policies that integrate crisis contingency planning and resilience-building measures in the banking system to minimize the transmission of market stress across financial institutions. Beyond the banking sector, the findings are relevant to other financial institutions, including finance companies, non-bank financial intermediaries, and fintech firms, which similarly face exposure to market volatility and systemic shocks. For these institutions, adopting diversified revenue models and strengthening risk management practices can help reduce vulnerability to crisis-driven fluctuations and enhance overall financial system resilience.

Despite offering valuable insights, this study has certain limitations that should be acknowledged. The analysis focuses exclusively on listed commercial banks in Indonesia, as stock price volatility can only be measured for publicly traded institutions. Consequently, the exclusion of unlisted financial institutions is necessary due to

the unavailability of stock price data for such entities. While this approach ensures consistency in measuring volatility, it also means that the findings may not capture broader dynamics affecting non-listed or smaller financial institutions. In addition, the measure of diversification used in this study is based solely on the proportion of non-interest income, without accounting for the composition, volatility, or strategic quality of those income sources. Future research could expand on these findings by incorporating more detailed measures of diversification, exploring cross-country comparisons, or examining the role of institutional factors such as regulatory strength and digital banking adoption. Furthermore, incorporating market sentiment indicators or real-time investor behavior metrics may offer richer insights into the mechanisms through which diversification affects volatility during financial crises.

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