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Does Income Diversification Improve Bank Performance? A Panel Study Of Regional Development Banks And Commercial Banks In Indonesia

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ABSTRACT

This study examines the effect of income diversification on bank performance in Indonesia using a Fixed Effect model with clustered standard errors. Bank performance is measured by ROA, ROE, SHROA, SHROE, and Z_SCORE, while income diversification is proxied by DIV_ADJ. The model also includes bank type, digitalization, and several control variables such as bank size, capital adequacy, operational costs, credit risk, and macroeconomic conditions. The results show that income diversification has a positive and significant effect only on risk-adjusted performance (SHROA and SHROE), but not on conventional profitability or stability. The moderating effects of bank type and digitalization are partial and inconsistent. Among control variables, bank size is the most consistent determinant of performance, while capital adequacy improves stability and credit risk reduces performance. Overall, income diversification mainly enhances bank performance through risk-adjusted measures, and its effectiveness depends on bank characteristics and risk management quality.

INTRODUCTION

The COVID-19 pandemic created significant disruptions to the global economy, with the World Bank estimating a global economic contraction of 5.2%, marking the deepest recession since the end of World War II. Alongside the economic downturn, the pandemic accelerated digital transformation across various sectors, particularly in financial services. Restrictions on physical interaction encouraged the rapid adoption of digital payment systems and electronic financial transactions, especially in developing countries. The World Bank (2021) reported that approximately 18% of adults in developing economies began using digital financial transactions after the pandemic. Similar conditions occurred in Indonesia, where changes in consumer behavior accelerated the digitalization of payment systems. Bank Indonesia (2022) recorded substantial growth in electronic money transactions and digital banking transactions, indicating that financial digitalization has become an important driver of national economic recovery.

For commercial banks, digital transformation has become an unavoidable strategy to maintain competitiveness and improve operational performance. Previous studies suggest that although digital transformation may initially reduce efficiency due to adjustment and investment costs, it contributes positively to profitability and long-term performance (Xiang & Jiang, 2023). Furthermore, Citterio, King, and Locatelli (2024) found that the COVID-19 pandemic strengthened the relationship between digital transformation and bank profitability. At the same time, the pandemic also caused declining loan demand and tighter lending standards, forcing banks to seek alternative sources of revenue beyond traditional interest income. Consequently, income diversification through non-interest income activities has become increasingly important in maintaining bank sustainability and financial resilience.

Income diversification is commonly viewed as a strategy to improve bank stability and reduce dependence on traditional lending activities. Non-interest income, including fee-based services, commissions, digital banking services, and other financial products, may increase risk-adjusted returns and broaden revenue sources. However, the impact of diversification on bank performance remains inconclusive. Chiarazzo et al. (2008) argued that non-interest income diversification can improve risk-adjusted returns, particularly for smaller banks, while the benefits tend to diminish for larger banks. Similarly, DeYoung and Rice (2004) explained that although non-interest income expands bank revenue sources, it may also increase earnings volatility and operational complexity, creating a trade-off between profitability and stability.

Several international studies also demonstrate inconsistent findings regarding the effectiveness of diversification strategies. Berger, Hasan, and Zhou (2010) found that diversification reduced profitability and increased operational costs among banks in emerging markets. In Germany, low interest rate conditions pressured the profitability of Sparkassen savings banks, encouraging them to increase fee and commission income to stabilize revenues (Kohler, 2018). In Japan, Shinkin Banks faced inefficiencies due to excessive concentration in lending and revenue structures, emphasizing the need for portfolio diversification (Ozaki & Kozo, 2021). Meanwhile, studies conducted in Turkey and Italy reported that diversification positively affects risk-adjusted profitability, although the magnitude of the impact varies across bank types and sizes.In Indonesia, the relevance of income diversification has become increasingly important amid rapid technological developments and regulatory transformation in the banking industry. Although non-interest income has continued to grow, significant disparities remain between large banks with strong capital capacity and smaller regional banks with limited resources. Regional Development Banks (Bank Pembangunan Daerah/BPD), in particular, still rely heavily on interest income, while fee-based income and foreign exchange services contribute relatively little to total revenue. This condition creates challenges for operational efficiency and digital transformation. To address these issues, the Financial Services Authority (OJK) introduced the Regional Development Bank Strengthening Roadmap 2024–2027, which emphasizes capital strengthening, digital transformation, operational efficiency, innovation, and greater support for productive sectors and MSMEs.

Despite the increasing importance of income diversification, previous empirical studies continue to show inconsistent results regarding its impact on bank profitability and stability. Some studies found that diversification improves profitability and risk-adjusted returns, while others concluded that diversification increases operational risk and earnings volatility. Moreover, the impact may differ depending on bank size, ownership structure, institutional conditions, and market characteristics. These inconsistencies indicate that the relationship between income diversification and bank performance remains an important issue requiring further investigation, particularly in the Indonesian banking sector.Therefore, this study aims to examine the effect of income diversification on the performance and stability of conventional banks in Indonesia, including Commercial Banks and Rural Banks (BPR). Specifically, this study investigates whether income diversification improves bank performance and how diversification affects bank stability measured by the Z-score. By focusing on the Indonesian banking industry, this research is

expected to contribute to the banking and financial literature while also providing practical implications for regulators, policymakers, and bank management in designing optimal diversification strategies to support sustainable banking performance and financial stability.

LITERATURE REVIEW

Income Diversification and Profitability

Income diversification in banks is commonly evaluated using risk-adjusted performance indicators such as SHROA and SHROE, as these measures capture the return–volatility trade-off that may not be fully reflected in conventional ROA or ROE measures (Chiorazzo et al., 2008). The concept of risk-adjusted profitability is also consistent with the stability framework that links profitability to earnings volatility, where indicators such as RAROA = ROA/SDROA are used as determinants of financial stability (Köhler, 2015). From this perspective, diversification through a greater proportion of non-interest income may improve risk-adjusted performance when non-interest activities provide cross-selling opportunities and broaden product lines without proportionally increasing return volatility (Köhler, 2015).

H1 : Income diversification positively affects bank performance.

Bank Type (Regional Development Banks Vs Commercial Banks) Plays An Important Role In Determining The Effect Of Income Diversification On Bank Profitability

International literature on retail and community banking suggests that non-interest income diversification may enhance bank stability because fee-based activities tend to generate more stable revenue streams (Köhler, 2018). In Indonesia, the Financial Services Authority (OJK) highlights that Regional Development Banks (BPDs) still depend heavily on traditional lending income, while contributions from fee-based services and foreign exchange products remain limited, making income diversification an important strategic agenda (OJK, 2024).The BPD Roadmap further emphasizes the need for BPDs to expand recurring fee-based activities such as trade finance, cash management, and loan fees, particularly in response to digital transformation and increasing banking competition. However, diversification capabilities among BPDs remain constrained by limited infrastructure and operational capacity.

Previous studies have also shown that the effects of income diversification may vary across bank business models and characteristics. Retail- and community-oriented banks generally exhibit different income structures and risk profiles compared to market-based banks, leading to heterogeneous impacts of diversification on profitability and stability (Huq et al., 2018; Köhler, 2015). Therefore, examining BPDs is important because their operational characteristics, ownership structure, and market orientation differ substantially from national commercial banks, potentially resulting in different outcomes of income diversification strategies in terms of risk-adjusted profitability and bank stability.

H2 : Bank type (Regional Development Banks vs Commercial Banks) plays an important role in determining the effect of income diversification on bank profitability.

METHODS

This study employs a quantitative approach using panel data regression to examine the effect of income diversification on bank performance in Indonesia. The study uses secondary data from 93 commercial banks, consisting of 71 national commercial banks and 22 Regional Development Banks (BPD), during the period 2020–2025, resulting in 1,823 bank-year observations. Data were collected from Capital IQ Pro, the Financial Services Authority of Indonesia (OJK), annual reports, and official bank websites.

The dependent variables include Return on Assets (ROA), Return on Equity (ROE), Risk-Adjusted Return on Assets (SHROA), Risk-Adjusted Return on Equity (SHROE), and Z-score as

measures of profitability and bank stability. The main independent variable is income diversification (DIV), measured using the Herfindahl–Hirschman Index (HHI) approach following Philip E. Striroh. Control variables include bank size, bank type, digital banking services, foreign exchange bank status, Capital Adequacy Ratio (CAR), Non-Performing Loans (NPL), Operational Costs (OPC), and Gross Domestic Product (GDP).

Table 1. Operationalization of Research Variables

No	Variable	Formula	Reference
Dependent Variable			
1	Risk Adjusted Return on Asset (SHROA)	= Return On Asset / Standard Deviation ROA	Adai, Bismark (2022) Chiorazzo et al., (2008)
2	Risk Adjusted Return on Equity (SHROE)	= Return On Equity / Standard Deviation ROE	Adai, Bismark (2022) Chiorazzo et al., (2008)
3	Return on Asset (ROA)	= Profit Before Tax / average total assets	Adai, Bismark (2022)
4	Return on Equity (ROE)	= Profit Before Tax / average core capital	Adai, Bismark (2022)
5	Z-Score	$\frac{\left(ROA_{i,t} + \frac{E_{i,t}}{TA_{i,t}}\right)}{\sigma\left(ROA_{i,t}\right)}$	(Brighi, et al., 2016)
Independent Variable			
6	Income Diversification (DIV)	= 1 – Herfindahl Hirschman Index	(Chiorazzo et al., 2008) (Stiroh, 2006)
7	Herfindahl Hirschman Index (HHI)	= (Interest Income Share^2) +(Non Interest Income Share ^2)	(Chiorazzo et al., 2008) (Stiroh, 2006)
8	Interest Income Share (IIs)	= Interest Income / (Interest Income + Non Interest Income)	(Chiorazzo et al., 2008) (Stiroh, 2006)
9	Non Interest Income (NIIs)	= Non Interest Income / (Interest Income + Non Interest Income)	(Chiorazzo et al., 2008) (Stiroh, 2006)
10	Assets	Ln (Assets)	Berger, Hasan and Zhou (2010)
11	Type of Bank	Dummy: 1 = Commercial Bank 0 = Regional bank	(Gurbuz, Yanik & Ayturk (2013)
12	Foreign Exchange Bank	Dummy: 1 = Foreign Exchange Bank 0 = Non-Foreign Exchange Bank	
13	Bank with digital services	Dummy: 1 = The bank has digital services 0 = The bank does not have digital services	
14	NPL	= total non-performing loans / total credit	(Chiorazzo et al., 2008) Zhao, Mei and Wang (2024)
15	CAR	=Capital Funds/ Total Assets	Adai, Bismark (2022)
16	OPC	= Operational Cost / Total Assets	Adai, Bismark (2022)
17	GDP	Ln(GDP)	Zhao, Mei And Wang (2024)

The analysis was conducted using panel regression models, including Pooled Least Squares (PLS), Fixed Effects (FE), and Random Effects (RE). Model selection was determined using the Chow test, Hausman test, and Lagrange Multiplier (LM) test. To ensure robust results, the final estimations were corrected using cluster-robust standard errors to address heteroskedasticity and within-bank residual correlation.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 2. Descriptive Statistics Summary

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	1.823	0,7448	4,319	-139,1702	7,3948
ROE	1.823	6,5634	18,4767	-216,7627	169,296
OPC	1.823	870.316	2.556.781	-359.063	5,47E+07
CAR	1.823	36,0886	29,9974	9,0087	371,2688
NPL	1.823	1.866.006	4.823.309	0	7,46E+07
GDP	1.823	3,5831	3,7006	-5,32	10,08
SHROA	1.823	1,5756	1,6493	-4,3222	8,5241
SHROE	1.823	1,5613	1,7498	-16,9667	13,9089
Z_SCORE	1.823	47,7427	41,6197	-1,6568	515,5353
DIV	1.823	-34,6577	120,618	-5.338,70	0,5
DIV_ADJ	1.823	0,2477	0,146	0	0,5
Ln_ASSETS	1.823	17,4202	1,3673	12,798	22,1931

Source: Eviews Output Data (2025)

The descriptive statistics indicate that bank profitability variables show an average ROA of 0.7448 and ROE of 6.5634, suggesting that banks in the sample generally maintained positive financial performance. However, the negative minimum values of ROA and ROE imply that several banks experienced performance pressures during certain periods. This condition is further reflected in the relatively high standard deviations, indicating substantial variation in profitability across banks and observation periods.Risk-adjusted performance indicators, namely SHROA and SHROE, also report positive mean values of 1.5756 and 1.5613, respectively, indicating that banks generally maintained positive performance after accounting for risk. In addition, the average Z-score of 47.7427 suggests that the overall stability of banks in the sample was relatively strong, although the variation across observations remained considerable. These findings imply that bank performance in this study should be evaluated not only from conventional profitability measures, but also from risk-adjusted profitability and stability perspectives.

The main independent variable, income diversification (DIV), exhibits extreme negative values, with a minimum value of −5,338.7, a mean of −34.658, and a very large standard deviation. This condition indicates the presence of negative income components in certain periods, causing the diversification index to become disproportionate and potentially distort the regression results. Conceptually, an income diversification index should reflect the degree of balance across bank income sources rather than generate extreme negative values. Therefore, this study constructs an adjusted diversification variable (DIV_ADJ) by transforming negative DIV values into zero while retaining positive values. This adjustment was conducted to ensure that the diversification variable remains statistically reasonable, more representative, and more reliable for regression analysis.

Classical Assumption Test Results

Table 3. Results of the Classical Assumption Tests for Model I

Dependent Variable	Selected Model	Shapiro-Wilk W	Prob > z	Shapiro–Wilk Decision	Normality Conclusion
ROA	FE	0,3736	0,0000	Reject H0	Not Normally Distributed
ROE	FE	0,56358	0,0000	Reject H0	Not Normally Distributed
SHROA	FE	0,94722	0,0000	Reject H0	Not Normally Distributed
SHROE	FE	0,88193	0,0000	Reject H0	Not Normally Distributed
Z_SCORE	FE	0,62842	0,0000	Reject H0	Not Normally Distributed

Source: Eviews Output Data (2025)

Based on the residual normality tests for Model 1, all selected models use the Fixed Effect Model (FE). The Shapiro–Wilk and Skewness–Kurtosis tests show probability values of 0.0000 for all dependent variables, indicating that the residuals are not normally distributed.However, since the study uses a relatively large sample size (1,823 observations), the violation of the normality assumption is not considered a major issue in panel data regression. Therefore, the analysis can still proceed by focusing on other important assumptions, such as heteroskedasticity, autocorrelation, and multicollinearity.

Table 4. Results of the Classical Assumption Tests for Model II

Dependent Variable	Selected Model	Shapiro-Wilk W	Prob > z	Shapiro–Wilk Decision	Normality Conclusion
ROA	FE	0,37568	0,0000	Reject H0	Not Normally Distributed
ROE	FE	0,56404	0,0000	Reject H0	Not Normally Distributed
SHROA	FE	0,94727	0,0000	Reject H0	Not Normally Distributed
SHROE	FE	0,88065	0,0000	Reject H0	Not Normally Distributed
Z_SCORE	FE	0,62908	0,0000	Reject H0	Not Normally Distributed

Source: Eviews Output Data (2025)

The normality test for Model 2 was conducted on the residuals of the selected final models, all of which used the Fixed Effect Model (FE). The Shapiro–Wilk and Skewness/Kurtosis tests show probability values below 0.05 for all models, indicating that the residuals are not normally distributed.

However, given the relatively large number of observations in this study, violations of residual normality do not significantly affect panel regression analysis. Therefore, the estimation process can still proceed while focusing on other important assumptions and robustness tests.

Table 5. Multicollinearity Test Results for Model I

Variable	VIF	1/VIF	Description
NPL	7,8200	0,1278	No Serious Multicollinearity Detected
OPC	6,7700	0,1477	No Serious Multicollinearity Detected
Ln_ASSETS	2,4400	0,4104	No Multicollinearity Detected
DUMMY_BANK_DEVISA	1,3900	0,7201	No Multicollinearity Detected
CAR	1,2900	0,7754	No Multicollinearity Detected
GDP	1,1600	0,8604	No Multicollinearity Detected
DIV_ADJ	1,1600	0,8605	No Multicollinearity Detected
DUMMY_TYPE_BANK	1,1400	0,8736	No Multicollinearity Detected
DUMMY_DIGITAL	1,0500	0,9553	No Multicollinearity Detected
Mean VIF	**2,69**	-	**Relatively Safe**

Source: Eviews Output Data (2025)

Based on the multicollinearity test results for Model 1, all independent variables have VIF values below 10 and tolerance values (1/VIF) above 0.10, indicating that there is no serious multicollinearity problem in the model.

The highest VIF values are found in NPL (7.82) and OPC (6.77), suggesting moderate multicollinearity; however, these values remain within acceptable limits. Other variables show relatively low VIF values below 5. Therefore, Model 1 satisfies the multicollinearity assumption, and all independent variables are considered appropriate for the panel regression model.

Table 6. Results of the multicollinearity test in Equation II after centering

Variable	VIF	1/VIF	Description
c_DIV_ADJ	18,51	0,054038	There is still an indication of high multicollinearity
c_DIV_ADJ × DUMMY_DIGITAL	13,83	0,072296	There is still an indication of high multicollinearity
NPL	7,84	0,127586	Moderate multicollinearity, still tolerable
c_DIV_ADJ × DUMMY_TYPE_BANK	7,06	0,141582	Moderate multicollinearity, still tolerable
OPC	6,80	0,147029	Moderate multicollinearity, still tolerable
DUMMY_BANK_DEVISA	3,34	0,299745	No serious multicollinearity occurs
c_DIV_ADJ × DUMMY_BANK_DEVISA	3,11	0,321867	No serious multicollinearity occurs
Ln_ASSETS	2,47	0,404571	No multicollinearity occurs
CAR	1,30	0,771226	No multicollinearity occurs
DUMMY_TYPE_BANK	1,23	0,814313	No multicollinearity occurs
DUMMY_DIGITAL	1,18	0,847837	No multicollinearity occurs
GDP	1,17	0,858084	No multicollinearity occurs
Mean VIF	**5,65**	-	**Multicollinearity decreased after centering**

Source: Eviews Output Data (2025)

After centering the DIV_ADJ variable, the multicollinearity level in Equation 2 decreased, as indicated by the reduction in Mean VIF from 10.74 to 5.65. Most interaction variables no longer showed serious multicollinearity. However, c_DIV_ADJ and c_DIV_ADJ × DUMMY_DIGITAL still had relatively high VIF values, which is common in moderation models involving interaction terms. Overall, centering improved the multicollinearity condition of the model.

Table 7. Results of the autocorrelation test after applying clustered standard errors in Equation I

Variable	ROA	ROE	SHROA	SHROE	Z_SCORE
DIV_ADJ	0,2276	4,1943	0,9095***	1,0229***	-8,7468
DUMMY_DIGITAL	0,9177	-1,4555	1,0777**	0,2529	-21,3283***
Ln_ASSETS	1,9891***	7,3285***	0,5863***	0,7363***	10,9435***
CAR	-0,0067	-0,018	0,0017	-0,0026	0,7472***
OPC	1,44e-07**	1,27e-06***	1,49e-07***	1,50e-07***	-2,93E-07
NPL	-8,91E-08	-7,17e-07*	-5,24e-08*	-5,60e-08*	1,24E-07
GDP	-0,0464*	-0,0824	0,011	0,0108	0,4600**
R-squared within	0,0301	0,0279	0,0833	0,0725	0,5654
Prob > F	0,0000	0,0000	0,0000	0,0000	0,0000
Model	FE Cluster	FE Cluster	FE Cluster	FE Cluster	FE Cluster

Source: Eviews Output Data (2025)

Based on the Fixed Effect estimation with clustered standard errors, all Equation 1 models are jointly significant (Prob > F = 0.0000). After correcting for autocorrelation and within-bank residual dependence, DIV_ADJ has a positive and significant effect on SHROA and SHROE, but not on ROA, ROE, and Z_SCORE. This suggests that income diversification contributes more to risk-adjusted performance than to conventional profitability or bank stability.

Table 8 Results of the autocorrelation test after applying clustered standard errors in Equation II

Variable	ROA	ROE	SHROA	SHROE	Z_SCORE
c_DIV_ADJ	0,3724	23,4761**	3,2060***	3,1368***	-5,2541
c_DIV_ADJ × DUMMY_TYPE_BANK	-1,8415	-11,6926*	-1,1192*	-1,0165	-7,7508
DUMMY_DIGITAL	1,0653	-2,1938	0,9531**	0,1358	-20,8070***
c_DIV_ADJ × DUMMY_DIGITAL	1,4718	-11,1046	-1,5565**	-1,4369**	2,9771
c_DIV_ADJ × DUMMY_BANK_DEVISA	1,2381	1,4277	-0,6448	-1,0844	4,6502
Ln_ASSETS	1,9826***	7,3034***	0,5840***	0,7399***	10,9191***
CAR	-0,0092	-0,0182	0,0017	-0,0025	0,7465***
OPC	1,42e-07**	1,29e-06***	1,53e-07***	1,55e-07***	-2,96E-07
NPL	-8,20E-08	-7,31e-07*	-5,53e-08*	-5,95e-08**	1,25E-07
GDP	-0,0459*	-0,0847	0,0104	0,0102	0,4615**

Variable	ROA	ROE	SHROA	SHROE	Z_SCORE
R-squared within	0,0309	0,0298	0,0884	0,076	0,5656
Prob > F	0,0000	0,0000	0,0000	0,0000	0,0000
Model	FE Cluster	FE Cluster	FE Cluster	FE Cluster	FE Cluster

Source: Eviews Output Data (2025)

Based on the Fixed Effect model with clustered standard errors at ENTITY_ID level, all Equation 2 models remain jointly significant (Prob > F = 0.0000), indicating robustness after autocorrelation correction.

c_DIV_ADJ has a positive and significant effect on ROE, SHROA, and SHROE, but is not significant for ROA and Z_SCORE. Interaction results are mixed: c_DIV_ADJ × DUMMY_DIGITAL is negative and significant for SHROA and SHROE, while other interaction terms are mostly insignificant or weakly significant. Overall, income diversification improves performance, especially risk-adjusted measures, but moderation effects are not consistent.

Table 9 Results of heteroskedasticity correction in Equation I

Variable	ROA	ROE	SHROA	SHROE	Z_SCORE
DIV_ADJ	0,2276	4,1943	0,9095***	1,0229***	-8,7468
DUMMY_DIGITAL	0,9177	-1,4555	1,0777**	0,2529	-21,3283***
Ln_ASSETS	1,9891***	7,3285***	0,5863***	0,7363***	10,9435***
CAR	-0,0067	-0,0181	0,0017	-0,0026	0,7472***
OPC	1,44e-07**	1,27e-06***	1,49e-07***	1,50e-07***	-2,93E-07
NPL	-8,91E-08	-7,17e-07*	-5,24e-08*	-5,60e-08*	1,24E-07
GDP	-0,0464*	-0,0824	0,011	0,0108	0,4600**
R-squared within	0,0301	0,0279	0,0833	0,0725	0,5654
Prob > F	0,0000	0,0000	0,0000	0,0000	0,0000
Model	FE Cluster	FE Cluster	FE Cluster	FE Cluster	FE Cluster

Source: Eviews Output Data (2025)

After correcting for heteroskedasticity using Fixed Effect with clustered standard errors, all Equation 1 models remain jointly significant (Prob > F = 0.0000).DIV_ADJ has a positive and significant effect on SHROA and SHROE, but is not significant for ROA, ROE, and Z_SCORE, indicating a stronger impact on risk-adjusted performance. Ln_ASSETS is consistently positive and significant across all models, making it the most robust determinant. CAR is only significant for Z_SCORE, while OPC is positive for profitability and risk-adjusted measures. NPL negatively affects performance, and GDP mainly improves Z_SCORE, indicating stronger effects on stability than profitability.

Table 10 Results of heteroskedasticity correction in Equation II

Variabel	ROA	ROE	SHROA	SHROE	Z_SCORE
c_DIV_ADJ	0,3724	23,4761**	3,2060***	3,1368***	-5,2541
c_DIV_ADJ × DUMMY_TYPE_BANK	-1,8415	-11,6927*	-1,1192*	-1,0165	-7,7508
DUMMY_DIGITAL	1,0653	-2,1938	0,9531**	0,1358	-20,8070***
c_DIV_ADJ × DUMMY_DIGITAL	1,4718	-11,1046	-1,5565**	-1,4369**	2,9771
c_DIV_ADJ × DUMMY_BANK_DEVISA	1,2381	1,4277	-0,6448	-1,0844	4,6502
Ln_ASSETS	1,9826***	7,3034***	0,5840***	0,7399***	10,9191***
CAR	-0,0069	-0,0182	0,0017	-0,0025	0,7465***
OPC	1,42e-07**	1,29e-06***	1,53e-07***	1,55e-07***	-2,96E-07
NPL	-8,82E-08	-7,31e-07*	-5,53e-08*	-5,95e-08**	1,25E-07
GDP	-0,0460*	-0,0847	0,0104	0,0102	0,4615**
R-squared within	0,0309	0,0298	0,0884	0,076	0,5656
Prob > F	0,0000	0,0000	0,0000	0,0000	0,0000
Model	FE Cluster	FE Cluster	FE Cluster	FE Cluster	FE Cluster

Source: Eviews Output Data (2025)

Based on the Fixed Effect model with clustered standard errors, all Equation 2 models are jointly significant (Prob > F = 0.0000).

c_DIV_ADJ positively affects ROE, SHROA, and SHROE, but is not significant for ROA and Z_SCORE, indicating stronger effects on equity-based and risk-adjusted performance. The interaction with DUMMY_DIGITAL weakens this relationship, while interactions with DUMMY_TYPE_BANK are weakly significant and DUMMY_BANK_DEVISA is not significant.

Among controls, Ln_ASSETS is consistently positive and significant across all models, making it the strongest determinant. CAR affects only Z_SCORE, OPC improves profitability, NPL reduces performance, and GDP mainly enhances stability (Z_SCORE).

CONCLUSION

This study shows that income diversification does not consistently improve all bank performance indicators. Positive effects are only found in SHROA and SHROE, meaning that income diversification is more effective in improving risk-adjusted performance than conventional profitability such as ROA and ROE. Therefore, H1 is partially supported.

The interaction between income diversification and bank type has a negative effect on ROE, indicating that the impact of diversification is weaker in commercial banks than in BPDs. In addition, digitalization weakens the effect of diversification on risk-adjusted performance. Thus, the effectiveness of diversification depends on bank characteristics, especially bank type, digital readiness, and risk management quality.

For commercial banks, diversification strategies should focus on stable and productive non-interest income sources. Large asset size supports performance and stability, while operational costs can improve performance when used productively. Capital adequacy strengthens stability, but digitalization may reduce stability if technology and operational risks are not managed properly.

For BPDs, income diversification can support competitiveness and strengthen risk-adjusted performance, especially through regional ecosystem-based services such as local government services, payroll systems, MSME financing, and regional digital transactions. However, BPDs still need to strengthen digital governance, operational efficiency, asset quality, and credit risk management to support sustainable performance.

For banks, income diversification improves risk-adjusted performance, although its impact on profitability and stability is still inconsistent. Therefore, banks should apply selective and risk-based diversification strategies by developing productive and stable non-interest income sources while maintaining good risk management and operational efficiency.

For BPDs, the benefits of income diversification are relatively stronger, especially for ROE and SHROA. BPDs are encouraged to expand non-interest income through regional ecosystem services such as local government services, payroll systems, MSME financing, digital transactions, and cooperation with regional institutions. However, diversification should still be managed carefully to avoid higher operational and credit risks.

For regulators, the findings suggest that income diversification can improve bank performance, particularly risk-adjusted performance. However, since diversification does not significantly affect stability (Z_SCORE), regulators should continue strengthening capital adequacy, governance, risk management, operational efficiency, and credit quality.

Future studies are recommended to use alternative diversification measures, include additional macroeconomic and bank-specific variables, and apply more robust estimation methods such as clustered standard errors, Driscoll–Kraay, or GMM to produce more reliable results.

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