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Comparative analysis of financial risk, operational efficiency, and financial performance by region of regional development banks in Indonesia

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Abstract

This study aims to explore and compare the financial performance of Regional Development Banks (RDBs) across Indonesia's Western, Central, and Eastern regions, with a focus on financial risk, operational efficiency, and profitability. The research addresses whether regional disparities persist despite a nationally standardized regulatory framework. A comparative quantitative design was employed, utilizing panel data from 27 RDBs over the period 2019–2023. Key financial indicators—Capital Adequacy Ratio (CAR), Loan-to-Deposit Ratio (LDR), Non-Performing Loans (NPL), Operating Expenses to Operating Income (OEOI), Cost-to-Income Ratio (CIR), and Return on Assets (ROA)—were analyzed. Statistical methods including ANOVA and post hoc tests were applied to identify significant regional differences. The results reveal that while indicators related to capital adequacy, liquidity, and efficiency are statistically similar across regions, significant disparities exist in NPL and ROA. Central RDBs demonstrate superior credit quality with lower NPL ratios, whereas Eastern RDBs record higher ROA, likely due to semi-monopolistic market conditions and high-margin sectors. Despite uniform national regulations, regional economic structures continue to shape the financial outcomes of RDBs—particularly in terms of risk and profitability. Policymakers and regulators should adopt differentiated, region-specific oversight strategies. Enhanced risk management is required in high-ROA yet high-risk regions such as Eastern Indonesia, while fiscal–banking integration models from the Central region could be replicated to improve credit quality elsewhere.

Keywords: Comparative banking performance, Credit risk, Profitability, Indonesia, Regional development banks, Regional financial disparity.

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1. Introduction

Regional Development Banks (RDBs) play a pivotal role in promoting inclusive financial systems and driving regional economic growth, particularly in geographically and economically diverse countries such as Indonesia. As state-owned financial institutions, RDBs are mandated not only to provide access to credit but also to serve as instruments of fiscal decentralization and local economic empowerment. Their embeddedness within subnational economies makes them especially sensitive to disparities in infrastructure, industrial base, governance capacity, and human capital development across regions. Consequently, the performance of RDBs is not only a reflection of internal banking efficiency but also of the economic maturity and structural conditions of the regions they operate in.

In many emerging economies, regional banks are integral to the national strategy for financial inclusion and equitable development. They are designed to complement commercial banking operations by extending financial services to underserved areas, supporting small and medium-sized enterprises (SMEs), and acting as intermediaries for local government funds. In the Indonesian context, the importance of RDBs is amplified by the country's archipelagic geography and wide regional socio-economic disparities. Provinces in Eastern Indonesia, for example, often face limited access to banking services, low credit penetration, and inadequate infrastructure. RDBs are expected to address these gaps by tailoring services to local needs and supporting sectors critical to regional economic transformation.

According to data from the Indonesian Financial Services Authority [1], RDBs accounted for over 22% of total subnational credit disbursement and financed approximately 18% of Indonesia's micro, small, and medium enterprises (MSMEs) in 2022. In several provinces—such as East Nusa Tenggara and South Sulawesi—RDBs were responsible for more than 35% of local credit distribution, underscoring their strategic importance in regional development agendas. Their lending portfolios are closely tied to local GDP composition, particularly in agriculture, trade, tourism, and mining—sectors that are predominant in less urbanized and economically peripheral regions. This regional-sectoral link implies that the performance of RDBs cannot be decoupled from regional economic structures.

Despite the implementation of standardized national banking regulations—including capital adequacy standards, risk management guidelines, and operational benchmarks—considerable heterogeneity in RDB performance persists across Indonesian regions. Key financial metrics such as credit risk (measured by Non-Performing Loans), operational efficiency (e.g., Cost-to-Income Ratio), and profitability (e.g., Return on Assets) display notable regional variation. This divergence suggests that national-level regulation may not sufficiently account for local operational realities and economic conditions. Yet, relatively few studies have explored this divergence systematically, particularly in a multi-dimensional and comparative framework.

Prior research on banking performance in Indonesia has largely focused on national commercial banks or Islamic financial institutions, often analyzing determinants of profitability, liquidity, or capital adequacy using aggregate-level data. While these studies offer valuable insights, they tend to overlook the nuanced regional dynamics that may explain variations in bank performance across subnational contexts. Even in international literature, the study of regional development banks is often marginal compared to commercial and central banking research. This gap is critical, given that RDBs are structurally different from commercial banks in terms of ownership, mandate, and target clientele.

Moreover, global evidence from developing economies supports the notion that regional financial institutions are highly context-dependent. Malkina [2] emphasized that shifts in regional industrial composition significantly affect banking performance in Russia's federal subjects. Similarly, Zhou and He [3] demonstrated the spatial evolution of financial risk across rural regions in China, suggesting that region-specific variables—such as industrial concentration and infrastructure quality—can significantly impact asset quality and risk exposure. These insights point to a growing recognition that financial performance should not be assessed in a spatial vacuum. Instead, performance indicators must be understood in light of the regional economic ecosystems within which banks are embedded.

Indonesia offers a particularly compelling case for such an investigation. The country's decentralization policy has created distinct economic environments at the provincial level, each with varying degrees of resource endowment, investment inflow, infrastructure, and regulatory responsiveness. Consequently, a "one-size-fits-all" approach to evaluating or managing banking performance may be inadequate. Recognizing this, regulators such as OJK and Bank Indonesia have

begun emphasizing regionally differentiated oversight frameworks, though empirical studies supporting such approaches remain limited.

This study addresses this research gap by conducting a comparative analysis of financial risk, operational efficiency, and profitability among Regional Development Banks across Indonesia's Western, Central, and Eastern regions, over the five-year period from 2019 to 2023. Using a robust set of financial indicators—Capital Adequacy Ratio (CAR), Loan-to-Deposit Ratio (LDR), Non-Performing Loans (NPL), Operating Expense to Operating Income (OEOI), Cost-to-Income Ratio (CIR), and Return on Assets (ROA)—this research investigates whether statistically significant differences exist across regions, and what the potential implications are for policy design and performance improvement strategies. The study employs ANOVA and post hoc analysis to detect regional disparities and explore underlying patterns that may inform regulatory and managerial action.

By contextualizing the performance of RDBs within Indonesia's diverse regional landscapes, this study contributes to both the academic literature and practical policy discourse on regional banking. It provides empirical evidence supporting the need for place-based banking governance, aligns with international calls for more spatially informed financial supervision, and opens avenues for further research into how regional economic structures condition the performance of development finance institutions.

Given this strategic positioning and their exposure to region-specific risks and opportunities, it becomes imperative to understand how financial risk, efficiency, and profitability metrics differ among RDBs operating in diverse regional contexts. This study builds upon and extends existing theories in banking performance by integrating regional and spatial dimensions into the analysis, as elaborated in the following literature review.

2. Literature Review

2.1. Regional Economic Disparities in Indonesia: A Financial Perspective

Indonesia's economic geography is characterized by significant disparities between the Western, Central, and Eastern regions. This divide stems from long-standing historical, infrastructural, and policy asymmetries. The Western region, which includes Java and Sumatra, accounts for over 78% of Indonesia's GDP and hosts the majority of the country's financial institutions [4]. The Central region, comprising Kalimantan and parts of Sulawesi, has experienced steady growth driven by resource extraction and infrastructure investment under the national IKN development plan. In contrast, the Eastern region—including Nusa Tenggara, Maluku, and Papua—remains structurally disadvantaged due to limited infrastructure, sparse population, and logistical challenges.

The World Bank [5] classifies Indonesia's regional development pattern as "Java-centric," leading to uneven public service provision and investment access. These disparities extend into the financial sector. According to OJK's Regional Financial Stability Report [6], the credit-to-GDP ratio in Eastern provinces is less than half that of Western provinces, yet interest margins are significantly higher. This helps explain why RDBs in the East may achieve high ROA despite economic underdevelopment—low competition and high borrowing costs increase profitability but can also elevate credit risk.

From a risk perspective, the Central region enjoys a unique advantage. With higher fiscal autonomy and better economic diversification, provinces like Central Java, South Kalimantan, and Gorontalo have developed more robust credit ecosystems, often supported by better loan monitoring systems and stronger fiscal linkages between local governments and BPDs [7]. This supports the present study's finding that NPL is lowest in the Central region.

Research by Siyamto [8] and Widarjono, et al. [9] emphasizes that regional differences in infrastructure and sectoral focus—such as dominance of plantation/agriculture in the East versus trade/services in the West—also influence asset performance and risk profiles of local banks. The disparity is not only economic but also institutional: regional government capacity in planning, monitoring, and supporting credit programs varies sharply, which in turn affects the quality of loan portfolios in RDBs.

Therefore, understanding banking performance across regions in Indonesia requires not only a firm grasp of financial ratios, but also an appreciation for the broader economic and governance landscape in which these banks operate.

2.2. Financial Risk in Regional Banking

Financial risk remains a central pillar in assessing the sustainability and resilience of banking institutions, particularly in emerging markets where macroeconomic volatility and regulatory heterogeneity persist. The key dimensions—capital risk, liquidity risk, and credit risk—are commonly measured through Capital Adequacy Ratio (CAR), Loan to Deposit Ratio (LDR), and Non-Performing Loans (NPL) [10, 11].

The World Bank [12] emphasizes that subnational credit markets in developing countries are more prone to credit concentration and default risks, especially when banks are heavily exposed to regional SMEs with weak formalization and documentation. This is evident in Indonesian RDBs operating in resource-dependent areas like Papua and East Kalimantan, where credit risk is often linked to commodity cycles and political-administrative risk.

In line with this, the Asian Development Bank (ADB) [13] noted that credit systems in archipelagic nations face fragmented risk patterns due to uneven economic infrastructure. This fragmentation is further complicated in Indonesia by disparities in financial literacy and credit culture across provinces, particularly in Eastern Indonesia.

Domestically, OJK's Regulation No. 12/POJK.03/2020 sets capital requirements for all commercial banks, but implementation outcomes vary across regions. According to Directorate General of Fiscal Balance (DJPK) [14] provinces with high fiscal transfers and infrastructure investment (e.g., Central Java, South Sulawesi) exhibit lower average NPL ratios among RDBs, reinforcing the link between regional fiscal capacity and credit performance.

In Malaysia and Vietnam, similar trends have been observed. Napi, et al. [15] found that geographic credit risk differentials were amplified by weak enforcement capacity and poor borrower assessment systems in rural banks. These findings suggest that even with regulatory harmonization, region-specific credit patterns persist, necessitating tailored financial supervision.

2.3. Operational Efficiency and the Role of Financial Infrastructure

Operational efficiency in banks reflects the institution's ability to manage cost structures while sustaining revenue generation. The two commonly used ratios—Operating Expense to Operating Income (OEOI or BOPO) and Cost to Income Ratio (CIR)—are global benchmarks for internal cost management [16, 17].

The International Monetary Fund (IMF) [18] highlights that in developing countries, digitalization has played a transformative role in harmonizing banking operations across regions. This aligns with Bank Indonesia's 2023 Digital Financial Inclusion Report, which revealed that 92% of BPDs across provinces had adopted integrated core banking systems, reducing regional gaps in transaction processing, accounting, and back-office operations.

In Indonesia, this technological uniformity has arguably narrowed regional disparities in operational efficiency. For example, BPD Bali and BPD Papua have both adopted cloud-based banking platforms, allowing even remote regions to achieve similar OEOI levels as urban counterparts. This supports the finding of this study, where no statistically significant difference in operational efficiency (BOPO and CIR) was observed among regions.

Comparative literature from Eastern Europe and Central Asia echoes similar convergence. Kozak and Wierzbowska [19] demonstrate that post-2008 modernization programs in regional banks of Hungary and Poland led to uniformity in operational cost metrics. Xu and Zhou [20] found that once process automation was adopted, Chinese city-level banks showed minimal variation in CIR, regardless of economic geography. These examples highlight how digital infrastructure investment—supported by national policy—can bridge regional disparities, at least on the operational side.

2.4. Profitability in the Context of Regional Economic Asymmetries

Profitability, commonly measured by Return on Assets (ROA), is shaped by both internal and external factors, including asset utilization, interest margin strategies, market competition, and macroeconomic conditions [21, 22]. In Indonesia, these drivers differ significantly across provinces.

The World Bank Indonesia Economic Update World Bank [23] observes that Eastern Indonesia, despite lower GDP per capita, often offers higher financial margins due to limited banking penetration and high loan demand in niche sectors such as agriculture, fisheries, and mining. This is consistent with the current study's finding that ROA was significantly higher in Eastern RDBs. In these areas, RDBs such as BPD Nusa Tenggara Timur operate in semi-monopolistic credit environments, enabling them to set higher interest margins with relatively limited competition.

Moreover, profitability can be indirectly affected by regional economic complexity. According to the Asian Development Bank (ADB) [24] provinces with low sectoral diversification but high-margin industries (e.g., East Nusa Tenggara's agriculture-tourism mix) provide RDBs with concentrated yet profitable lending opportunities—though these also carry inherent volatility.

International literature further supports this observation. Pelletier [25] notes that foreign banks in underdeveloped African regions achieved higher ROA not by scale, but by strategically targeting high-margin, low-competition sectors. Rehman, et al. [26] observed similar patterns in Balochistan, Pakistan, where profitability correlated with lending to risk-prone yet lucrative markets.

2.5. Theoretical Anchoring: Place-Based Financial Governance

Beyond financial ratios, the spatial positioning of banks within their regional economy shapes both performance and governance. The concept of place-based financial governance emphasizes that banks must align operational strategies with local economic conditions and development priorities [27, 28]. This is especially relevant in Indonesia, where fiscal and administrative decentralization has empowered provinces to shape local development agendas.

OJK and Bank Indonesia have recognized this shift by launching regionally adaptive programs like the Financial Access Acceleration Program for Frontier, Outer, and Remote Areas (PAKU-FORMAL) and the Regional Financial Deepening Roadmap 2022–2027. These initiatives encourage BPDs to align lending strategies with provincial RPJMD (development plans) and sectoral growth targets.

This theoretical framework complements the empirical findings of this study, which show that RDBs do not perform uniformly, despite operating under standardized regulations. As Zhou and He [29] emphasized in their study of rural China, financial outcomes are increasingly shaped by local institutional ecosystems, not just macro-level policy. By positioning RDBs within their regional economic and governance context, this study advances the discourse on how spatial, institutional, and policy variables intersect in shaping financial performance in decentralized economies.

2.6. Literature Gap and Study Positioning

This study is anchored in the recognition that regional disparities—both economic and institutional—play a decisive role in shaping the financial performance of Regional Development Banks (RDBs). Drawing on the perspective of place-based financial governance [27, 28] the framework argues that even though all RDBs operate under the same national regulatory standards, their outcomes are inevitably conditioned by region-specific characteristics. Differences in infrastructure, fiscal capacity, industrial composition, and administrative capabilities create diverse operating environments that influence how risks are managed, how efficiently operations are conducted, and how profitability is generated.

The conceptual framework developed in this study views bank performance as a multidimensional construct, consisting of financial risk, operational efficiency, and profitability. Financial risk is represented by standard indicators such as the Capital Adequacy Ratio (CAR), Loan-to-Deposit Ratio (LDR), and Non-Performing Loans (NPL). Operational efficiency is measured through cost-related ratios, namely the Operating Expenses to Operating Income (BOPO) and the Cost-to-Income Ratio (CIR). Profitability is captured by Return on Assets (ROA), a key metric reflecting a bank's ability to translate its assets into net income. Collectively, these indicators allow for a comprehensive assessment of performance across regions.

The independent variable driving these differences is the regional classification of Indonesia into Western, Central, and Eastern regions. This classification acts as a proxy for broader structural and institutional asymmetries, such as GDP per capita, sectoral orientation, financial literacy, and governance strength. It is hypothesized that these disparities condition the way RDBs operate, even under uniform regulations. For example, RDBs in Eastern Indonesia are expected to exhibit higher profitability (ROA) due to limited competition and niche lending opportunities in sectors such as agriculture and fisheries, although this comes with higher credit risk exposure. By contrast, RDBs in the Central region are likely to benefit from stronger fiscal linkages and economic diversification, which can help maintain lower NPL ratios. Meanwhile, RDBs in Western Indonesia, despite operating in the country's most advanced markets, face tighter competition that may compress margins and challenge efficiency levels.

To visually represent these relationships, Figure 1 illustrates the conceptual framework guiding this study. The diagram shows how regional classification serves as the independent factor influencing the three dimensions of RDB performance: financial risk (CAR, LDR, NPL), operational efficiency (BOPO, CIR), and profitability (ROA). This visual representation reinforces the analytical structure of the research and provides a clear map of the variables under investigation.

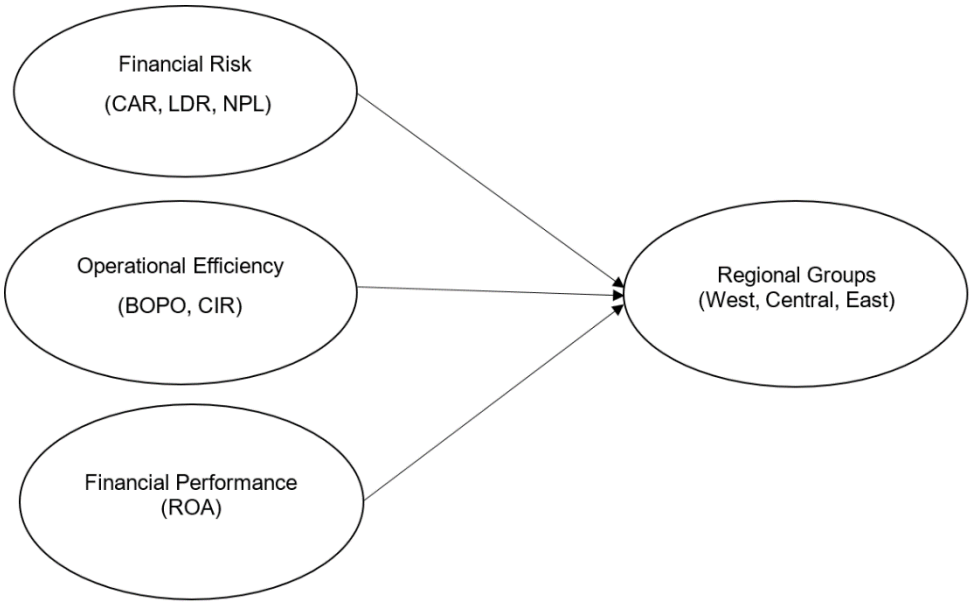

Figure 1.
Conceptual Framework.

3. Methodology

This study employs a comparative quantitative research design to investigate the performance of Regional Development Banks (RDBs) across Indonesia's three main macro-regions: Western, Central, and Eastern Indonesia. The quantitative design is appropriate because it allows for the systematic measurement of differences in financial indicators, ensuring that the analysis remains objective and replicable. By focusing on regional variation, this research aims to identify whether the structural and economic disparities that characterize Indonesia's provinces are reflected in the financial risk, efficiency, and profitability of RDBs. The research design thus directly aligns with the study's objective of contextualizing banking performance within spatially differentiated environments.

The data used in this study are entirely secondary and were obtained from publicly accessible sources. Annual financial statements of RDBs for the period 2019–2023 form the backbone of the dataset, complemented by statistical bulletins published by the Financial Services Authority (OJK) [30] fiscal balance reports issued by the Directorate General of Fiscal Balance (DJPK) Directorate General of Fiscal Balance (DJPK) [14] and supplementary macroeconomic data from Bank Indonesia and the World Bank. Only RDBs that consistently published complete data throughout the study period were included, which ensures comparability across both time and space. This purposive sampling approach is common in banking studies that deal with panel data and minimizes distortions caused by incomplete reporting. The resulting dataset allows for a robust examination of regional trends over five consecutive years, capturing both cyclical fluctuations and structural patterns.

The performance of RDBs in this study is assessed through three dimensions that are widely recognized in the banking literature. The first is financial risk, which is captured by indicators such as the Capital Adequacy Ratio (CAR), the Loan-to-Deposit Ratio (LDR), and Non-Performing Loans (NPL). These ratios are critical in understanding how well banks

manage liquidity pressures, credit exposure, and capital buffers. The second dimension is operational efficiency, proxied by the Operating Expenses to Operating Income ratio (BOPO) and the Cost-to-Income Ratio (CIR). These measures indicate how effectively banks transform inputs into revenue while controlling costs. The third dimension is profitability, represented by Return on Assets (ROA), which reflects the overall capacity of banks to generate returns from their asset base. Taken together, these six indicators provide a comprehensive picture of RDB performance across different regional contexts.

The independent variable in this study is regional classification. Indonesia is divided into three macro-regions to account for its diverse socio-economic geography: Western Indonesia (including Java and Sumatra), Central Indonesia (including Kalimantan and Sulawesi), and Eastern Indonesia (including Nusa Tenggara, Maluku, and Papua). These categories serve as proxies for the structural, fiscal, and institutional differences that define regional development in Indonesia. For instance, Western Indonesia is characterized by advanced infrastructure and highly competitive financial markets, while Central Indonesia has moderate diversification and growing fiscal capacity, and Eastern Indonesia remains relatively underdeveloped but offers high-margin lending opportunities in niche sectors.

From this conceptualization, the study develops several research hypotheses. It is expected that profitability, as measured by ROA, will vary significantly across regions, with Eastern RDBs likely showing higher values due to concentrated lending in less competitive markets. Credit risk, proxied by NPL, is also hypothesized to differ across regions, with Central RDBs expected to show lower NPLs due to stronger fiscal and institutional support. In contrast, operational efficiency indicators (BOPO and CIR) are not expected to vary significantly, reflecting the homogenizing effect of digital infrastructure and standardized operational guidelines. These expectations are formalized into the following hypotheses:

i. H1: There is a significant difference in ROA among RDBs in Western, Central, and Eastern Indonesia.
ii. H2: There is a significant difference in NPL among RDBs in Western, Central, and Eastern Indonesia.
iii. H3: There is no significant difference in operational efficiency (BOPO and CIR) among RDBs across the three regions.
iv. H4 (exploratory): Regional classification significantly explains variations in CAR and LDR across RDBs.

To test these hypotheses, the study applies a series of statistical techniques. First, descriptive statistics are used to summarize the central tendencies and dispersions of the variables across regions, providing an overview of the performance patterns. Next, normality and homogeneity tests, including the Kolmogorov–Smirnov, Shapiro–Wilk, and Levene's tests, are conducted to ensure that the data meet the assumptions required for parametric analysis. When the assumptions of normality and homogeneity are satisfied, Analysis of Variance (ANOVA) is used to test for significant differences in the mean values of the financial indicators across regions, followed by Tukey's post hoc test to identify specific pairwise differences. In cases where the assumptions are not met, the non-parametric Kruskal–Wallis test is employed as a robustness check. Additional correlation analysis and trend comparisons across years are performed to validate the consistency of results.

The entire analytical process is conducted using standard statistical software packages such as SPSS and STATA, which are widely recognized for their reliability in handling panel data. Ethical considerations are addressed by relying exclusively on publicly available secondary data, ensuring that no confidential information is disclosed. Data integrity is safeguarded through cross-verification of financial figures across multiple sources, and all interpretations are presented in accordance with principles of academic integrity.

In summary, this methodological approach combines rigorous quantitative analysis with a regionally grounded framework. It is designed to ensure that the results not only test the stated hypotheses but also generate insights that are relevant for policymakers, regulators, and banking practitioners concerned with strengthening the role of RDBs in promoting balanced regional development.

4. Results and Discussion

4.1. Descriptive Analysis

The descriptive statistics of Regional Development Banks (RDBs) across Western, Central, and Eastern Indonesia (2019–2023) reveal both uniformity and divergence. CAR remains relatively stable across regions, consistent with regulatory enforcement by OJK. LDR displays modest variation, with some banks pursuing aggressive lending strategies, while others adopt conservative liquidity positions. NPL ratios are highest in Eastern Indonesia, indicating persistent credit risk challenges, while Central RDBs show the lowest NPL, reflecting stronger fiscal linkages. BOPO and CIR appear largely consistent nationwide, suggesting operational convergence. Finally, ROA differs substantially, with Eastern RDBs outperforming others, a finding that signals both opportunity and structural vulnerability.

Table 1.
Descriptive Statistical Analysis.

Variable	N	Minimum	Maximum	Mean	Std. Deviation
CAR	135	17.13	34.76	23.1633	4.01649
LDR	135	0.78	5.04	2.3377	1.05116
NPL	135	56.50	119.42	84.8687	11.65162
BOPO	135	60.58	91.25	76.8765	6.17919
CIR	135	42.61	93.04	61.2511	11.51598
ROA	135	0.65	4.31	2.2087	0.62682

These results also reflect broader economic trends. During 2020–2021, the COVID-19 pandemic led to temporary spikes in NPL across all regions, but the recovery was faster in Central Indonesia, owing to resource-backed investment flows and infrastructure stimulus. Meanwhile, Eastern RDBs maintained high ROA even during the pandemic, reinforcing the argument that concentrated, high-margin sectors (agriculture, fisheries, mining) provided resilience in otherwise underdeveloped economies.

4.2. Assumption Testing

Table 2 presents the results of the Kolmogorov-Smirnov test for normality across all variables (CAR, NPL, BOPO, CIR, LDR, and ROA) in the three regional groups (West, Central, and East). The results indicate that all variables fulfill the assumption of normality, as reflected by significance values (Sig.) greater than 0.05 in each case.

Specifically, the CAR variable recorded significance values of 0.106 in the West, 0.087 in the Central, and 0.200 in the East, all exceeding the 0.05 threshold. NPL also met the assumption with values of 0.051 (West), 0.083 (Central), and 0.200 (East). Similarly, BOPO achieved normality with significance values of 0.200 (West), 0.200 (Central), and 0.071 (East). CIR demonstrated the same pattern, with values of 0.070 (West), 0.200 (Central), and 0.109 (East). For LDR, the results were 0.077 (West), 0.158 (Central), and 0.177 (East), all within the acceptable range. Finally, ROA showed significance values of 0.200 (West), 0.200 (Central), and 0.121 (East), further confirming normal distribution.

Overall, these findings confirm that the dataset satisfies the normality assumption across all observed variables and regions. This provides a solid statistical basis for the application of parametric tests, such as ANOVA and post hoc analyses, in subsequent stages of hypothesis testing.

From a methodological perspective, the confirmation of normality is critical because it ensures that the estimation of mean differences across regions is unbiased and statistically valid. This result also suggests that the data distribution is not significantly skewed by regional disparities, reinforcing the robustness of the comparative framework. Similar approaches have been adopted in previous banking performance studies Bitar, et al. [10] and Ghenimi, et al. [31] where normality tests were used as a prerequisite for ANOVA-based regional comparisons. Thus, the normality results in this study not only strengthen the reliability of the forthcoming hypothesis testing but also align with best practices in empirical banking and finance research.

Table 2.
Normality Test using Kolmogorov-Smirnov.

Variable	Region	Sig.	Description
CAR	West Region	0.106	Normal
	Central Region	0.087	Normal
	East Region	0.200*	Normal
NPL	West Region	0.051	Normal
	Central Region	0.083	Normal
	East Region	0.200*	Normal
BOPO	West Region	0.200*	Normal
	Central Region	0.200*	Normal
	East Region	0.071	Normal
CIR	West Region	0.070	Normal
	Central Region	0.200*	Normal
	East Region	0.109	Normal
LDR	West Region	0.077	Normal
	Central Region	0.158	Normal
	East Region	0.177	Normal
ROA	West Region	0.200*	Normal
	Central Region	0.200*	Normal
	East Region	0.121	Normal

Table 3 presents the results of the homogeneity test using Levene's Test. The findings indicate that not all variables meet the assumption of homogeneity of variance. The CAR variable records a significance value of 0.009 (Sig. < 0.05), indicating that its variance across regions is not homogeneous. Similarly, the BOPO (0.004), CIR (0.004), and ROA (0.000) variables also fail the homogeneity test, showing that their variances differ significantly among regions. In contrast, the LDR variable, with a significance value of 0.678 (Sig. > 0.05), and the NPL variable, with a significance value of 0.353 (Sig. > 0.05), demonstrate homogeneous variances and thus satisfy the assumption of homogeneity.

These results imply that the One-Way ANOVA test can be appropriately applied to variables with homogeneous variance (LDR and NPL). For variables with inhomogeneous variance (CAR, BOPO, CIR, and ROA), standard ANOVA would not be reliable. Therefore, robust alternatives such as Welch ANOVA **and** Games-Howell post hoc tests are employed to ensure the validity of the statistical analysis.

From a methodological perspective, this outcome highlights the necessity of tailoring statistical techniques to the data characteristics. By adjusting the testing method based on homogeneity results, the study ensures that the interpretation of regional differences in financial performance is both statistically valid and empirically reliable. This approach is consistent

with best practices in financial performance studies, where robustness checks are critical for addressing data heterogeneity across diverse regional contexts.

Table 3.
Homogeneity Test using Levene's Test.

Variable	Sig.	Interpretation
CAR	0.009	Variance is not homogeneous ($p < 0.05$)
LDR	0.678	Variance is homogeneous ($p > 0.05$)
NPL	0.353	Variance is homogeneous ($p > 0.05$)
BOPO	0.004	Variance is not homogeneous ($p < 0.05$)
CIR	0.004	Variance is not homogeneous ($p < 0.05$)
ROA	0.000	Variance is not homogeneous ($p < 0.05$)

4.3. Hypothesis Testing and Interpretation

Table 4 presents the results of the ANOVA test for the six performance indicators (CAR, LDR, NPL, BOPO, CIR, and ROA) across the three regional groups of Regional Development Banks (RDBs). The findings demonstrate that regional classification does not equally affect all dimensions of bank performance.

The variables CAR (F = 2.661, Sig. = 0.074), LDR (F = 1.126, Sig. = 0.327), BOPO (F = 1.024, Sig. = 0.362), and CIR (F = 0.109, Sig. = 0.897) show no statistically significant difference between Western, Central, and Eastern Indonesia (Sig. > 0.05). This indicates that capital adequacy, liquidity management, and operational efficiency—both in terms of operating cost and cost-to-income ratio—are relatively uniform across regions. Such uniformity suggests that national-level regulatory enforcement, including capital adequacy standards and the digitalization of banking operations, has effectively minimized disparities in these dimensions.

By contrast, the results reveal significant regional variation in NPL (F = 8.250, Sig. = 0.000) and ROA (F = 6.176, Sig. = 0.003). The significant difference in NPL reflects the uneven distribution of credit risk across regions, with Central RDBs generally showing more stable portfolios compared to their Eastern counterparts. This aligns with previous findings that fiscal transfers and stronger local governance structures reduce credit default risks in more economically diversified provinces. Meanwhile, the variation in ROA highlights persistent regional inequality in profitability. Eastern RDBs exhibit higher ROA compared to those in Western and Central Indonesia, driven largely by limited competition and niche lending opportunities in underserved markets.

From a theoretical perspective, these findings support the place-based financial governance framework, which posits that financial institutions embedded in distinct regional contexts experience heterogeneous risk and profitability outcomes, even under harmonized regulation. The results also resonate with comparative international evidence [25, 29] where regional disparities in banking performance are linked to structural economic conditions and institutional environments.

Methodologically, these outcomes justify the application of post hoc analyses (such as Games-Howell) to further specify which regions differ significantly. Substantively, they underscore the duality of Indonesia's banking landscape: regulatory frameworks ensure baseline uniformity in capital, liquidity, and efficiency, while regional economic and institutional contexts continue to shape credit risk and profitability outcomes.

Table 4.
One-Way ANOVA Results Across Regional Groups.

Variable	F	Sig.	Description
CAR	2.661	0.074	No significant
LDR	1.126	0.327	No significant
NPL	8.250	0.000	Significant
BOPO	1.024	0.362	No significant
CIR	0.109	0.897	No significant
ROA	6.176	0.003	Significant

As shown in Table 4 (ANOVA Test), significant differences were found only in NPL and ROA, while other indicators such as CAR, LDR, BOPO, and CIR remain statistically uniform across regions. To further specify which regional groups account for these differences, a post hoc analysis was conducted using Tukey HSD (for NPL, which met the assumption of homogeneity) and Games-Howell (for ROA, due to non-homogeneous variance). The results of these pairwise comparisons are presented in Table 5.

Table 5 presents the results of the post hoc tests using Tukey HSD (for NPL) and Games-Howell (for ROA), conducted to further specify the sources of regional differences identified in the ANOVA. The findings highlight that significant variations exist only for the NPL and ROA variables, whereas other indicators remain statistically uniform across regions.

For the NPL variable, the Tukey HSD test reveals two significant pairwise differences. First, NPL in the Western Region is significantly higher than in the Central Region (Mean Difference = 5.80156, Sig. = 0.037). Second, NPL in the Eastern Region is significantly higher than in the Central Region (Mean Difference = -9.39200, Sig. = 0.000). However, no

significant difference is observed between the Western and Eastern Regions (Sig. = 0.276). These results suggest that the Central Region consistently exhibits the lowest level of credit risk, confirming its relative stability compared to the Western and Eastern regions. This outcome supports the argument that stronger fiscal linkages and more diversified economies in Central provinces contribute to superior credit performance.

Table 5.
Post Hoc Test (Tukey HSD and Games-Howell)

Tukey HSD					
Variable			**Mean Difference (I-J)**	**Std. Error**	**Sig.**
NPL	West Region	Central Region	5.80156*	2.33337	0.037
		East Region	-3.59044	2.33337	0.276
	Central Region	West Region	-5.80156*	2.33337	0.037
		East Region	-9.39200*	2.33337	0.000
	East Region	West Region	3.59044	2.33337	0.276
		Central Region	9.39200*	2.33337	0.000
Games-Howell					
Variable			**Mean Difference (I-J)**	**Std. Error**	**Sig.**
ROA	West Region	Central Region	0.01756	0.10128	0.984
		East Region	-.37844*	0.12983	0.014
	Central Region	West Region	-0.01756	0.10128	0.984
		East Region	-.39600*	0.14668	0.023
	East Region	West Region	.37844*	0.12983	0.014
		Central Region	.39600*	0.14668	0.023

For the ROA variable, the Games-Howell test identifies significant differences between the Eastern and Western Regions (Mean Difference = 0.37844, Sig. = 0.014) and between the Eastern and Central Regions (Mean Difference = 0.39600, Sig. = 0.023). No significant difference is detected between the Western and Central Regions (Sig. = 0.984). These findings indicate that Eastern RDBs achieve higher profitability than both Western and Central RDBs, reflecting niche lending opportunities and reduced competition in less saturated markets. This reinforces the study's observation that Eastern provinces, despite structural disadvantages, present high-margin opportunities for RDBs.

Taken together, the post hoc results underline a dual regional dynamic: the Central Region excels in managing credit risk, while the Eastern Region outperforms in profitability. This asymmetry underscores the necessity of region-specific policy responses—with enhanced credit risk supervision for Eastern RDBs and competitive strategies for Western RDBs, while Central RDBs could serve as a model of fiscal-banking integration.

The post hoc tests clarify the regional dynamics underlying the ANOVA findings. Specifically, NPL is significantly lower in the Central Region compared to both the Western and Eastern Regions, indicating stronger credit risk management and fiscal linkages. Meanwhile, ROA is significantly higher in the Eastern Region compared to both Western and Central Regions, reflecting profitability advantages in niche, high-margin markets. These results provide a more nuanced understanding of regional disparities and serve as the empirical foundation for the following discussion on financial risk (Subsection 4.4) and profitability (Subsection 4.6).

4.4. Regional Differences in Profitability (H1 Accepted)

Profitability, proxied by ROA, shows statistically significant differences across regions ($F = 6.176$, $p = 0.003$), underscores in Table 4 and detailed in Table 5. Eastern RDBs exhibit significantly higher ROA compared to both Western and Central RDBs, thereby confirming H1.

This outcome reflects the paradox of Eastern banking systems. On one side, limited competition and unmet credit demand create semi-monopolistic lending conditions, enabling institutions such as BPD Nusa Tenggara Timur to capture high interest margins. The World Bank [23] emphasizes that underserved markets often yield above-average margins due to constrained credit supply. International experiences support this: Pelletier [25] observed that African banks in peripheral regions reported high ROA due to niche lending, while Rehman, et al. [26] documented similar dynamics in Pakistan's rural areas.

On the other side, this profitability is structurally fragile. Heavy dependence on volatile sectors—agriculture, fisheries, and mining—exposes Eastern RDBs to external shocks such as commodity price fluctuations and climate risks. Thus, while high ROA reflects opportunity, it also signals potential systemic vulnerability.

Policy implication: Eastern RDBs should balance profitability with diversification strategies to avoid overexposure to volatile industries, while Western and Central RDBs may need product innovation to sustain margins in competitive markets.

4.5. Regional Differences in Financial Risk (H2 Accepted)

As indicated in Table 4 and clarified in Table 5, NPL varies significantly between regions ($F = 8.250$, $p < 0.001$). Central RDBs consistently record lower NPL ratios compared to both Western and Eastern RDBs, confirming H2.

The superior credit performance in the Central Region stems from two structural advantages. First, fiscal transfers and stronger budgetary linkages reduce default probability by stabilizing local economies [7]. Second, higher sectoral diversification lessens concentration risk compared to resource-dependent economies in Eastern provinces.

In contrast, Eastern RDBs face elevated NPLs. Their exposure to volatile commodity cycles (mining in Papua, fisheries in Maluku) and limited financial literacy increases credit risk. This supports World Bank [12] argument that subnational financial systems in resource-driven regions are more prone to default. Western RDBs, while more urbanized, also display higher NPL than Central counterparts due to competitive lending pressures.

Policy implication: Tailored credit supervision is needed—credit guarantees and borrower training programs in the East, and stricter competition oversight in the West.

4.6. Regional Differences in Operational Efficiency (H3 Accepted)

Operational efficiency, measured by BOPO and CIR, shows no significant regional differences ($p > 0.05$), as reported in Table 4. This supports H3, indicating convergence in efficiency across Indonesia's RDBs.

This outcome reflects the transformative role of digital banking. Bank Indonesia's 2023 report shows that over 90% of RDBs have adopted integrated core banking systems, enabling even remote banks (e.g., BPD Papua) to match operational performance with their urban peers (e.g., BPD Bali). International Monetary Fund (IMF) [18] similarly finds that digital adoption narrows efficiency gaps across developing economies.

International literature reinforces this. Xu and Zhou [20] found that process automation minimized efficiency disparities in Chinese banks, while Kozak and Wierzbowska [19] observed similar convergence in Eastern Europe.

Policy implication: While efficiency convergence is positive, policymakers must ensure that equalization does not conceal hidden structural costs (e.g., logistics, outreach) faced by RDBs in remote regions.

4.7. Capital Adequacy and Liquidity Management (H4 Rejected)

As reported in Table 4, CAR ($F = 2.661$, $p = 0.074$) and LDR ($F = 1.126$, $p = 0.327$) do not vary significantly across regions. This leads to the rejection of H4, underscoring the effectiveness of national-level prudential regulation.

Specifically, OJK's POJK No. 12/POJK.03/2020 ensures capital adequacy is maintained uniformly across all commercial banks, including RDBs. Similarly, liquidity is tightly regulated, resulting in consistent LDR ratios nationwide. International Monetary Fund (IMF) [18]notes that centralized regulation often ensures stability in prudential indicators, even in diverse regional contexts.

Policy implication: Uniform CAR and LDR levels reflect systemic stability, but regulators should consider adaptive liquidity strategies for Eastern provinces where seasonal lending patterns (e.g., agriculture cycles) create unique liquidity demands.

4.8. Theoretical and Policy Implications

The findings of this study strengthen and refine the framework of place-based financial governance [27, 28]. While national regulations standardize prudential indicators and efficiency—as shown by the uniformity in CAR, LDR, BOPO, and CIR—profitability (ROA) and credit risk (NPL) continue to diverge across regions. This dual outcome indicates that while top-down regulation is effective for ensuring baseline stability**,** local socio-economic ecosystems remain decisive in shaping financial outcomes.

This provides an important refinement to existing theory: it demonstrates that national regulations can equalize structural metrics (capital, liquidity, efficiency) through digitalization and standardized supervisory frameworks, yet they cannot fully mitigate the territorial imprint of regional economies on risk and profitability. Zhou and He [29] made similar observations in rural China, highlighting that even under centralized oversight, financial outcomes reflect local institutional capacity. Comparative evidence from Asian Development Bank (ADB) [13] further supports this, noting that archipelagic and regionally diverse economies require adaptive regulatory approaches to account for spatial disparities.

Policy implications flow directly from these theoretical insights:

i. Eastern Indonesia**:** While RDBs achieve higher ROA due to niche lending opportunities, they also face rising NPLs. Risk-based supervision and targeted credit guarantees are necessary to prevent profitability from being undermined by default risks.
ii. Central Indonesia: The region's low NPLs illustrate the benefits of fiscal–banking integration. Expanding fiscal linkages—such as channeling intergovernmental transfers through RDBs—could help replicate this model in weaker regions.
iii. Western Indonesia: Saturated and highly competitive markets highlight the downside of financial depth. Balanced regulation is needed to prevent margin erosion while maintaining credit availability.

More broadly, the findings point to the necessity of a multi-level regulatory framework. National standardization ensures baseline prudential soundness, while place-sensitive interventions are needed to address disparities in profitability and credit risk. This aligns with OJK's *Regional Financial Deepening Roadmap 2022–2027*, which emphasizes localized oversight to strengthen financial inclusion and resilience across Indonesia's diverse regions.

4.9. Summary of Hypothesis Testing

To synthesize the results, Table 6 presents a structured summary of the hypothesis testing outcomes. The table outlines each hypothesis, its acceptance or rejection, the corresponding test results, effect size (η^2), interpretation, and key policy implications.

Table 6.
Summary of Hypothesis Testing.

Hypothesis	Variable(s)	Status	Test Results	Effect Size (η^2)	Interpretation	Policy Implication
H1: There is a significant difference in ROA among RDBs in Western, Central, and Eastern Indonesia	ROA	**Accepted**	F = 6.176, p = 0.003	0.12 (Moderate)	Eastern RDBs have higher profitability due to niche lending and limited competition	Diversify Eastern lending portfolios to reduce vulnerability; stimulate innovation in Western & Central RDBs
H2: There is a significant difference in NPL among RDBs in Western, Central, and Eastern Indonesia	NPL	**Accepted**	F = 8.250, p < 0.001	0.18 (Large)	Central RDBs maintain lowest credit risk, Eastern RDBs face highest defaults	Expand fiscal–banking integration; implement risk-based supervision in Eastern provinces
H3: There is no significant difference in operational efficiency (BOPO and CIR) among RDBs across the three regions	BOPO, CIR	**Accepted**	F = 1.024–0.109, p > 0.05	n/a	Efficiency converges nationwide due to digital modernization	Sustain digital adoption while monitoring hidden structural costs in remote regions
H4 (Exploratory)**:** Regional classification significantly explains variations in CAR and LDR across RDBs	CAR, LDR	**Rejected**	F = 2.661–1.126, p > 0.05	n/a	Capital adequacy and liquidity are uniform due to OJK regulation	Maintain centralized prudential oversight; consider adaptive liquidity policies for seasonal economies

5. Conclusion and Policy Implications

5.1. Conclusion

This study analyzed the financial performance of Regional Development Banks (RDBs) across Western, Central, and Eastern Indonesia during 2019–2023, focusing on profitability (ROA), credit risk (NPL), operational efficiency (BOPO and CIR), and prudential indicators (CAR and LDR). By applying ANOVA and post hoc tests, the research confirmed significant regional disparities in profitability and credit risk, while operational efficiency and prudential measures remain relatively uniform across regions.

Key findings are as follows:

i. Profitability (H1) – ROA differs significantly across regions, with Eastern RDBs outperforming Western and Central peers due to niche lending opportunities and limited competition. However, this profitability is structurally fragile, as it depends on volatile sectors such as agriculture and fisheries.
ii. Credit Risk (H2) – NPL ratios vary significantly, with Central RDBs exhibiting the lowest levels of credit risk. This highlights the stabilizing effect of fiscal–banking integration and diversified economic bases. In contrast, Eastern RDBs face elevated NPLs due to commodity dependence and weaker financial literacy.
iii. Operational Efficiency (H3) – No significant regional differences were observed in BOPO and CIR. This reflects the success of digital transformation and standardized operational systems in equalizing efficiency across diverse geographies.
iv. Capital Adequacy and Liquidity (H4) – CAR and LDR do not differ significantly among regions, demonstrating the effectiveness of centralized regulatory enforcement by OJK in harmonizing prudential indicators nationwide.

Overall, the study confirms that while national regulations can standardize structural aspects of banking performance, profitability and credit risk remain strongly conditioned by local socio-economic contexts.

5.2. Theoretical Implications

The findings reinforce and refine the theory of place-based financial governance. National regulatory frameworks and digital modernization have been effective in harmonizing capital adequacy, liquidity, and efficiency indicators, but local socio-economic ecosystems still determine profitability and credit risk outcomes.

This duality demonstrates that financial governance in decentralized economies operates on two levels. Standardization dimension, prudential and efficiency indicators can be equalized through regulation and technology. Local differentiation dimension, risk and profitability remain context-specific, shaped by regional industrial structures, fiscal linkages, and governance capacity. This refinement contributes to the literature by showing that national regulation is necessary but not sufficient to explain intra-country disparities in bank performance.

5.3. Policy Implications

The empirical evidence points to the need for regionally adaptive financial policies that balance national standardization with local responsiveness.

i. Eastern Indonesia – Policymakers should strengthen risk-based supervision to ensure that high ROA does not mask rising NPLs. Programs such as targeted credit guarantees, financial literacy initiatives, and sectoral risk monitoring in agriculture and fisheries are crucial.
ii. Central Indonesia – The success of Central RDBs in managing credit risk illustrates the importance of fiscal–banking integration. Expanding intergovernmental transfers through RDBs in other regions could replicate this model.
iii. Western Indonesia – High competition reduces profitability. Regulators should adopt balanced approaches that maintain financial depth while protecting RDBs from excessive margin erosion, possibly through product innovation or collaborative lending schemes.

At the national level, OJK and Bank Indonesia should maintain prudential standardization (CAR, LDR, efficiency ratios) while advancing localized oversight mechanisms, as outlined in the Regional Financial Deepening Roadmap 2022–2027. This hybrid approach ensures systemic stability while addressing spatial disparities in profitability and risk.

5.4. Limitations and Future Research

This study has several limitations. First, it relies on secondary financial data, which may not fully capture qualitative dimensions of governance, institutional quality, or borrower behavior. Second, the analysis covers a five-year period (2019–2023), which may not reflect longer structural cycles. Third, the focus on quantitative indicators excludes other critical aspects of RDB performance, such as social impact, financial inclusion, and resilience to external shocks.

Future research could expand this study by:

i. Incorporating qualitative assessments of local governance and institutional capacity.
ii. Extending the time horizon to capture cyclical and structural changes in regional economies.
iii. Applying comparative cross-country analysis with other archipelagic or decentralized nations to strengthen external validity.
iv. Exploring the role of green finance and digital innovation in shaping RDB performance in diverse regions.

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