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# Credit Risk Determinants in Regional Development Banks: Intermediation, Capital Structure, and Gender Governance

Kadek Irma Susanti<sup>1</sup>, L. Lutfi<sup>2</sup>

<sup>1,2</sup> Department of Master of Management, Faculty of Economics and Business, Universitas Hayam Wuruk Perbanas, Surabaya, Indonesia. Email: [kadeksusanti86.ks@gmail.com](mailto:kadeksusanti86.ks@gmail.com)<sup>1</sup>, [lutfi@perbanas.ac.id](mailto:lutfi@perbanas.ac.id)<sup>2</sup>

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## ABSTRACT

This research analyzes how credit growth, capitalization, and profitability influence credit risk in Indonesian Regional Development Banks (Bank Pembangunan Daerah, hereafter BPDs), additionally investigating the moderating influence of female commissioners. Based on Agency Theory and Resource Dependence Theory, it suggests that both financial performance and board governance structures affect banks' willingness to take risks and their credit risk results. Using a quantitative approach, the study analyzes panel data from 23 conventional BPDs in Indonesia over the 2018–2024 period through panel data regression, generating 161 bank-year observations. The hypotheses are tested using panel data regression with the Random Effects Model (REM), selected through panel model specification tests. The findings indicate that the expansion of loans and the enhancement of profits notably diminish credit risk, suggesting that cautious lending practices and improved financial performance contribute to better credit quality and risk management. Capital adequacy exhibits a positive yet inconsequential link to credit risk, implying that holding more capital may lead to increased risk-taking behavior. The presence of female commissioners does not significantly influence credit risk and does not affect the relationship between loan growth, capital adequacy, or profitability. In summary, the model demonstrates statistical significance and accounts for 17.06% of the variation in credit risk. Female commissioners have minimal impact on credit risk and its relation to financial factors, indicating limited influence of board gender diversity on oversight. The study enriches banking risk literature by showing that female board representation has limited governance impact in emerging-market regional banks without substantial decision-making power.

**Keywords:** Credit Risk, Credit Growth, Capital, Profitability, Female Commissioners

**JEL Code:** G21, G32, G34, O16

## I. Introduction

Credit risk is one of the most critical risks in the banking industry because it directly affects asset quality, financial stability, and the sustainability of bank intermediation. In banking, credit risk is commonly reflected in the non-performing loan (NPL) ratio, which measures the proportion of problem loans to total loans. A persistent increase in NPLs may weaken bank solvency, reduce lending capacity, and undermine public confidence in the financial system. For banks, particularly Regional Development Banks (Bank Pembangunan Daerah, hereafter BPDs), credit risk management is especially important because BPDs perform



a dual function as financial intermediaries and agents of regional economic development. BPDs prioritize local economic growth and financial inclusion while ensuring prudent banking, unlike commercial banks that focus on profitability. This dual responsibility frequently leads to friction between developmental goals and risk management factors, positioning credit risk as a strategic issue for BPD sustainability (Berger & DeYoung, 1997; Kharabsheh, 2019).

The urgency of credit risk management in Indonesian BPDs is evident from recent banking statistics. Data from the Financial Services Authority (OJK) indicates that between 2018 and 2024, the mean NPL ratio of traditional BPDs was 2.44%, staying beneath the regulatory limit of 5% and thus categorized as stable. Nevertheless, overall indicators obscure significant variation among individual BPDs. Multiple BPDs disclosed NPL ratios surpassing 5%, with the peak recorded NPL ratio nearing 7.45%, signifying a notable decline in loan quality and increased exposure to credit risk. Average loan growth reached 7.99%, average capitalization (ETA) stood at 13.56%, and average profitability (ROA) was 2.27% over the same period. These statistics indicate that BPDs typically sustained satisfactory intermediation performance and financial strength, yet they also highlight a trade-off between expanding credit and maintaining asset quality. This issue grows more significant due to the strategic function of BPDs in funding regional governments, micro and small businesses, and local development projects, areas that frequently exhibit higher information asymmetry and more susceptibility to economic shocks (Fitriani et al., 2025; Naili & Lahrichi, 2022).

The problem gains additional significance in light of post-pandemic economic recovery and worldwide economic instability. Growing inflationary strains, variable commodity rates, and stricter monetary policies have heightened repayment risks for borrowers, especially in local economies that are still significantly reliant on particular industries. As a result, grasping the factors that influence credit risk in BPDs holds significance not only from a banking viewpoint but also from the perspective of regional economic growth. Inadequate handling of credit risk can limit BPDs from fulfilling their developmental role and undermine financial stability in the region. In banking management, credit growth, capital, and profitability are three internal factors that are theoretically central to the formation of credit risk. Credit growth reflects the aggressiveness of a bank's intermediation function and may increase risk exposure when lending expands excessively (Barra & Ruggiero, 2023). Capitalization acts as a financial safeguard against unforeseen losses; nonetheless, based on the risk-taking hypothesis, more robust capital levels might also motivate managers to engage in riskier lending practices as they feel more equipped to handle possible losses (Akhter, 2023). Profit margins indicate how well management operates, the caliber of operations, and the efficacy of risk management frameworks, anticipated to lower the chances of loan default (Berger & DeYoung, 1997). However, practical evidence concerning these connections is still unclear, indicating the necessity for additional research within the distinctive institutional setting of Indonesian BPDs.

Several studies find that credit growth increases credit risk because it encourages more aggressive and riskier lending expansion (Akhter, 2023; Barra & Ruggiero, 2023). In contrast, other studies show that credit growth may reduce or have no effect on credit risk when expansion is conducted selectively and prudently (Jabbouri & Naili, 2019; Misman & Bhatti, 2020). Similar inconsistencies appear in the capital-credit risk relationship. On the one hand, stronger capital is expected to reduce credit risk by increasing loss-absorption capacity (Saleh & Afifa, 2020; Sutanto et al., 2024). On the other hand, stronger capital may encourage greater risk-taking because management perceives a larger financial buffer (Misman & Bhatti, 2020; Naili & Lahrichi, 2022). Likewise, profitability is generally expected to reduce credit risk, yet its effect depends heavily on managerial quality and operational discipline (Abdelaziz et al., 2022; Barra & Ruggiero, 2023; Nikolaidou & Vogiazas, 2017). These inconsistencies suggest that the relationships among credit growth, capital, profitability, and credit risk remain open to further investigation. In addition to financial factors, the quality of governance is becoming a more significant factor in influencing the risk tendencies of banks. A significant aspect of governance attracting considerable academic focus is gender diversity within corporate boards, especially the inclusion of female commissioners. Agency Theory posits that robust oversight systems can alleviate managerial opportunism and reduce excessive risk-taking behavior. Female commissioners are often linked to increased risk aversion, a stronger ethical framework, heightened intensity in monitoring, and more



thorough deliberation processes, which could lead to more cautious lending choices (Birindelli et al., 2020). From the perspective of Resource Dependence Theory, female board members may also contribute diverse experiences, perspectives, and networks that improve board effectiveness and organizational decision-making (Pfeffer & Salancik, 1978).

Regardless of these theoretical anticipations, the impact of female commissioners in Indonesian BPDs is still an unresolved issue. Female representation on BPD boards remains comparatively scarce compared to male representation, and in some BPDs, female commissioners hold just one seat or are completely missing from the board's composition. These circumstances prompt fears about tokenism, where women on boards are mainly there to meet governance standards but have little impact on strategic choices. This occurrence has been noted in governance studies, which contend that diversity on boards might not enhance organizational results when minority members have inadequate representation, power, or involvement in essential committees. The significance of this matter is evident in various Indonesian state-owned and regional financial institutions that have enhanced female representation on boards as a component of comprehensive governance reforms. Although these initiatives are linked to enhancements in transparency, accountability, and stakeholder involvement, the evidence on their effectiveness in diminishing banking risk is still inconclusive. In the BPD environment, where governance frameworks are frequently shaped by regional government control and political factors, the ability of female commissioners to affect risk-related choices might vary significantly from what is seen in private commercial banks. Thus, exploring if female commissioners have a direct impact on credit risk or enhance the connection between financial factors and credit risk is a significant empirical and governance-related issue.

**Table 1. Literature Gap**

Author(s)	Year	Variables	Method	Findings	Research Gap
Musah et al.	2022	Female Board Representation, Risk	Panel Data Regression	Female board representation has a significant effect on risk	Not conducted on Regional Development Banks (BPDs)
Naili & Lahrichi	2022	Capital, NPL	Panel Data Regression	Mixed results (inconsistent effect of capital on NPL)	Gender moderation not examined
Akhter	2023	Loan Growth (LOANg), Non-Performing Loan (NPL)	Panel Data Regression	LOANg has a significant effect on NPL	Not tested on Indonesian Regional Development Banks (BPDs)
This study	2025	Credit Risk (NPL), Loan Growth (LOANG), Capital (ETA), Profitability (ROA), Female Commissioners (FECOM)	Random Effect Model (REM)	...	Conducted on Indonesian Regional Development Banks (BPDs) with gender as a moderating variable

Current research on Indonesian banking mainly centers on commercial banks and seldom considers BPDs as a separate institutional type. Additionally, scarce studies concurrently examine loan expansion, capital adequacy, profitability, and female commissioners within a cohesive analytical framework. Due to the distinct developmental objectives, ownership arrangements, and governance traits of BPDs, insights gained from commercial banks may not translate directly. This research tackles this gap by exploring the factors influencing credit risk in Indonesian BPDs, including female commissioners as a moderating governance factor. This study contributes to the advancement of banking risk literature by providing empirical evidence from emerging-market banking institutions, while also enriching the application of Agency Theory and Resource Dependence Theory in explaining credit risk dynamics. Furthermore, the findings offer practical implications for enhancing

corporate governance effectiveness and strengthening risk management frameworks within Regional Development Banks.

## II. Literature Review and Hypothesis Development

### 2.1. Theoretical Foundation

This study is grounded in Agency Theory, Resource Dependence Theory (RDT), and board gender diversity as the main conceptual foundations for explaining the formation of bank credit risk. Agency Theory explains that conflicts of interest between owners and managers may encourage decisions that are not always aligned with prudential principles. In banking, managers often have incentives to expand lending, increase profitability, and pursue short-term growth, even when such decisions may increase future credit risk (Jensen & Meckling, 1976). From this perspective, credit risk is not merely a consequence of intermediation activities, but also a reflection of managerial behavior and the effectiveness of internal monitoring mechanisms. Resource Dependence Theory further explains that a bank's ability to manage risk is shaped not only by internal resources, but also by its capacity to access and utilize external resources, such as information, networks, and proximity to the surrounding economic environment (Pfeffer & Salancik, 1978). In the context of Regional Development Banks (BPDs), close relationships with local governments, regional businesses, and local economic networks may provide informational advantages that influence credit decisions. This perspective helps explain why credit expansion does not necessarily increase risk, but may instead reflect the bank's ability to exploit information advantages and identify productive lending opportunities more effectively. Finally, the board gender diversity perspective suggests that gender diversity on the board may improve governance quality by introducing more diverse, prudent, and conservative perspectives into strategic decision-making (Birindelli et al., 2020). In the context of risk governance, female commissioners are expected to strengthen monitoring, reduce managerial opportunism, and improve oversight of credit risk. However, the effectiveness of this role depends on the level of representation, actual influence, and substantive involvement of women in board decision-making.

### 2.2. Research Gap and Contribution

Despite a considerable amount of research exploring the factors influencing bank credit risk, three significant shortcomings persist. Previous studies show contradictory results concerning the impacts of loan growth, capital, and profitability on credit risk. While certain research posits that swift loan growth elevates future non-performing loans due to lax screening standards (Akhter, 2023; Barra & Ruggiero, 2023), other studies indicate that credit expansion could enhance portfolio quality when bolstered by enhanced information and monitoring capabilities (Naili & Lahrichi, 2022). Comparable discrepancies are noted in the connections among capital, profitability, and credit risk. Some research claims that fast loan growth leads to future non-performing loans due to lower screening standards (Akhter, 2023; Barra & Ruggiero, 2023), while other studies indicate that credit expansion can enhance portfolio quality if backed by better information and monitoring (Naili & Lahrichi, 2022). Comparable discrepancies are noted in the connections among capital, profitability, and credit risk. Secondly, prior studies on gender diversity in boards have mainly centered around commercial banks in advanced economies. Data from developing nations, especially Regional Development Banks (BPDs), is still scarce. This constraint is significant since BPDs function within distinct institutional contexts, ownership frameworks, and developmental objectives in contrast to traditional commercial banks. Third, earlier research has primarily focused on female commissioners as a direct factor influencing risk. There has been minimal consideration of their possible function as a governance tool that impacts the connection between a bank's internal traits and credit risk. As a result, the ways in which female commissioners affect risk results are not yet fully comprehended. Thus, the current study fills a significant research void by combining internal banking elements and gender-focused governance structures in one analytical model. More precisely,

this research explores whether female commissioners not only affect credit risk directly but also act as a moderator in the connection between loan growth, capitalization, profitability, and credit risk in Indonesian Regional Development Banks. This unified perspective enhances both the literature on banking risks and the studies on corporate governance by broadening the use of Agency Theory and Resource Dependence Theory within the framework of state-run regional banking establishments.

### 2.3. Loan Growth and Credit Risk

Resource Loan Growth reflects a bank's ability to perform its intermediation function by channeling funds to productive sectors. From an agency theory perspective, Loan Growth may increase credit risk because managers have incentives to expand lending in order to boost interest income and short-term performance, even when such expansion increases future default risk (Jensen & Meckling, 1976). Under these conditions, overly aggressive credit expansion may intensify adverse selection and moral hazard, thereby increasing credit risk (Akhter, 2023; Barra & Ruggiero, 2023). However, Resource Dependence Theory offers an alternative perspective by suggesting that Loan Growth does not necessarily increase risk. Loan Growth may also reflect a bank's ability to utilize local information, business networks, and borrower-specific knowledge to allocate credit more selectively and productively (Pfeffer & Salancik, 1978). In the context of Regional Development Banks (BPDs), close relationships with local governments and regional business actors may improve borrower screening and monitoring quality, allowing credit expansion to reduce rather than increase credit risk. Loan Growth may also reflect favorable economic conditions, where stronger economic activity improves borrowers' repayment capacity and reduces non-performing loans (Nikolaidou & Vogiazas, 2017; Waemustafa & Sukri, 2015).

Empirical evidence on the relationship between Loan Growth and credit risk remains inconclusive. Barra & Ruggiero (2023), Akhter (2023), and Kharabsheh (2019) find that loan growth increases credit risk because aggressive expansion raises exposure to problem loans. In contrast, Jabbouri & Naili (2019), Misman & Bhatti (2020), and Naili & Lahrichi (2022) show that loan growth does not necessarily increase credit risk, particularly when expansion is conducted prudently. Based on these theoretical and empirical arguments, the following hypothesis is proposed:

*H1: Loan growth significantly affects credit risk.*

While loan growth represents an increase in income-generating assets, it simultaneously exposes banks to greater credit risk. To manage this exposure effectively, banks are required to maintain adequate capital reserves that function as a safeguard against potential loan losses. Therefore, understanding the determinants of credit risk necessitates an examination of both lending growth and capital adequacy, as the latter reflects a bank's resilience in absorbing unexpected shocks arising from borrower defaults. Accordingly, capital can be regarded as a fundamental determinant of credit risk in the banking sector.

### 2.4. Capital and Credit Risk

Capital reflects a bank's capacity to absorb potential losses and maintain financial stability. In banking theory, capital serves as the primary buffer against risk because higher capital increases a bank's ability to absorb credit losses. However, Agency Theory suggests that stronger capital may also increase managerial tolerance for risk, as managers perceive a larger financial cushion to absorb potential losses (Jensen & Meckling, 1976). Under such conditions, higher capital may encourage more aggressive risk-taking behavior. In this context, capital functions not only as a risk buffer, but also as an enabler of risk-taking when it is used to support lending in riskier segments (Akhter, 2023). This view is consistent with the risk-taking behavior hypothesis, which argues that better-capitalized banks may exhibit greater risk tolerance because they perceive themselves to have stronger loss-absorption capacity (Berger & DeYoung, 1997). Empirical evidence

on the relationship between capital and credit risk remains mixed. Kharabsheh (2019) and Akhter (2023) find that capital has a positive effect on credit risk, suggesting that stronger capital encourages greater risk tolerance. In contrast, other studies show that stronger capital reduces credit risk by enhancing banks' risk-absorption capacity and overall financial resilience (Naili & Lahrchi, 2022). These mixed findings suggest that the relationship between capital and credit risk remains inconclusive and warrants further investigation, particularly in the context of Regional Development Banks. Accordingly, the following hypothesis is proposed:

*H2: Capitalization significantly affects credit risk.*

While capital offers safeguarding against possible losses, the success of capital management is ultimately shown in a bank's financial results. Thus, profitability emerges as a vital measure since it reflects managerial effectiveness, resource allocation, and the durability of risk-taking choices. As a result, the connection between profitability and credit risk requires additional investigation.

## 2.5. Profitability and Credit Risk

The capacity of a bank to generate earnings from its asset base is commonly assessed through profitability. In the banking industry, profitability is widely recognized as an outcome of effective operational management, strategic resource allocation, and comprehensive risk control mechanisms. Agency Theory provides a theoretical explanation for this relationship by arguing that higher profitability signals management's ability to reduce agency costs and enhance organizational value through decisions that are aligned with shareholder interests (Jensen & Meckling, 1976). The relationship between profitability and credit risk can also be explained through the bad management hypothesis proposed by Berger & DeYoung (1997). This hypothesis argues that weak profitability often reflects poor managerial quality, which ultimately contributes to deteriorating loan quality. In contrast, more profitable banks tend to have stronger credit screening, borrower monitoring, and credit control systems, enabling them to reduce credit risk more effectively.

The empirical literature predominantly indicates that profitability plays a mitigating role in the formation of credit risk. Akhter (2023) and Barra & Ruggiero (2023) show that profitability has a negative effect on credit risk, indicating that more profitable banks tend to exhibit stronger managerial quality and better asset quality. However, high profitability may also increase credit risk under certain conditions. Jabbouri & Naili (2019) and Kharabsheh (2019) argue that stronger profitability may encourage managers to increase risk tolerance in order to sustain or improve future returns, potentially leading to looser lending standards and greater exposure to risky borrowers. Based on these arguments, the following hypothesis is proposed:

*H3: Profitability significantly affects credit risk.*

The previous discussion emphasizes that just relying on financial metrics might not adequately account for differences in credit risk. Identical financial circumstances can lead to varied risk results based on the effectiveness of corporate governance. Consequently, focus has progressively moved to board attributes, especially gender diversity, as a governance factor that could affect decisions related to risk.

## 2.6. Female Commissioners and Credit Risk

The presence of female commissioners is one of the most widely discussed dimensions of board gender diversity in the corporate governance literature. From an agency theory perspective, female commissioners are expected to strengthen monitoring because women are generally associated with greater prudence, stronger discipline, and more conservative decision-making behavior (Jensen & Meckling, 1976). Accordingly, the presence of female commissioners is theoretically expected to improve managerial

oversight, including the control of credit risk. From a Resource Dependence Theory perspective, female commissioners may also serve as strategic resources by enriching board perspectives, increasing sensitivity to risk, and improving decision quality (Pfeffer & Salancik, 1978). Female representation on the board may broaden governance perspectives and strengthen the quality of risk oversight (Othmani, 2021). Recent governance studies increasingly suggest that the impact of female board representation relies not only on their numerical presence but also on active involvement in strategic decision-making processes. Critical mass theory indicates that female directors can impact board decisions more effectively when their numbers hit a significant level, enabling their active involvement instead of merely serving as symbols (Birindelli et al., 2020). When women's representation is restricted, their input can be hampered by corporate culture, board relationships, and imbalances of power.

The relevance of this argument is particularly evident in Indonesian Regional Development Banks, where board appointments are frequently influenced by government ownership structures and political considerations. Such institutional characteristics may reduce the substantive participation of female commissioners in board deliberations and constrain their ability to shape governance outcomes. Consequently, the contribution of female commissioners to risk management should be evaluated beyond descriptive measures of board diversity, emphasizing instead their capacity to influence strategic decisions related to credit allocation, capital adequacy, and the overall effectiveness of risk governance mechanisms. Empirical evidence remains inconclusive. Musah et al. (2022) and Setiawan & Khoirotunnisa (2020) find that female board representation reduces bank risk-taking. In contrast, Ain et al. (2020) and Salem et al. (2025) report no significant effect. These mixed findings suggest that the effectiveness of female commissioners depends on institutional context, the level of representation, and the substantive influence of women on the board. Accordingly, the following hypothesis is proposed:

*H4: Female commissioners have a negative effect on credit risk in Regional Development Banks in Indonesia.*

Female commissioners have the potential to strengthen risk governance by enhancing monitoring effectiveness and contributing diverse strategic perspectives to board deliberations. Nevertheless, the extent of their contribution is contingent upon their level of representation, decision-making authority, and active involvement in the board's governance processes.

## 2.7. The Moderating Role of Female Commissioners

Female commissioners may influence credit risk not only directly, but also indirectly by moderating the relationship between internal bank factors and credit risk through stronger board monitoring. The moderating role of female commissioners can be explained through two complementary mechanisms. The first mechanism is enhanced monitoring. Female commissioners may reduce agency conflicts by increasing board scrutiny over managerial decisions related to lending growth, capital allocation, and profitability targets. Stronger monitoring can prevent managers from pursuing excessive risk-taking strategies that may increase future credit risk. From an agency theory perspective, boards are expected to oversee managerial decisions to ensure that they remain prudent and aligned with shareholder interests (Jensen & Meckling, 1976). In this context, female commissioners are expected to strengthen monitoring effectiveness because they are generally associated with greater prudence, stronger conservatism, and higher risk sensitivity in decision-making (Birindelli et al., 2020). These characteristics suggest that female commissioners may influence how loan growth, capital, and profitability translate into credit risk.

In the relationship between Loan Growth and credit risk, female commissioners are expected to weaken the adverse effect of overly aggressive credit expansion by promoting more prudent oversight of lending decisions (Musah et al., 2022; Setiawan & Khoirotunnisa, 2020). In the relationship between capital and credit risk, female commissioners may constrain managerial incentives to use stronger capital buffers to justify greater risk-taking, thereby encouraging more disciplined and conservative capital use (Birindelli et al.,

2020; Kharabsheh, 2019). In the relationship between profitability and credit risk, female commissioners are expected to strengthen the ability of profitability to reduce credit risk by ensuring that earnings are driven by efficiency and asset quality rather than by greater risk-taking (Ain et al., 2020; Berger & DeYoung, 1997).

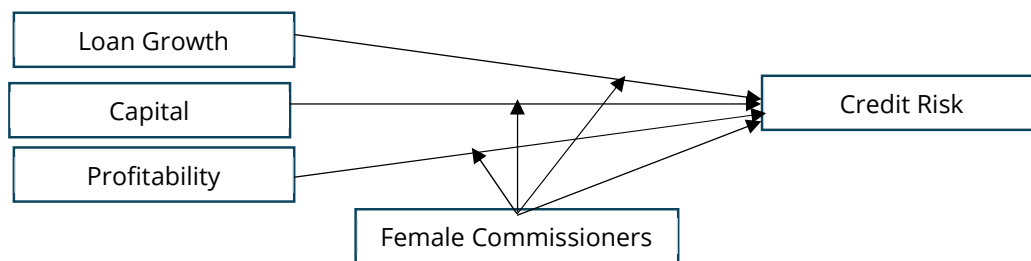
The second mechanism is improved decision quality. From a Resource Dependence Theory perspective, female commissioners may also serve as strategic resources by broadening board perspectives, improving the quality of board deliberation, and increasing sensitivity to risk (Othmani, 2021; Pfeffer & Salancik, 1978). Female commissioners may therefore contribute to more balanced evaluations of lending opportunities, capital management strategies, and performance objectives. However, empirical evidence remains mixed. Some studies find that female board representation strengthens monitoring and reduces risk-taking (Musah et al., 2022); (Setiawan & Khoirotnunisa, 2020), while others report no significant effect when female representation remains limited or largely symbolic (Ain et al., 2020; (Salem et al., 2025). Therefore, female commissioners remain relevant to test as a moderating variable in the relationship between loan growth, capital, profitability, and credit risk. Through these mechanisms, female commissioners are expected not only to influence credit risk directly but also to alter the strength and direction of the relationships between internal bank factors and credit risk outcomes.

*H5: Female commissioners moderate the negative effect of credit growth on credit risk at Regional Development Banks in Indonesia.*

*H6: Female commissioners moderate the negative effect of capital adequacy on credit risk at Regional Development Banks in Indonesia.*

*H7: Female commissioners moderate the negative effect of profitability on credit risk at Regional Development Banks in Indonesia.*

Based on the theoretical arguments and hypothesis development discussed above, this study proposes a conceptual framework in which loan growth, capital, and profitability are expected to influence credit risk in Regional Development Banks. In addition, female commissioners are expected to play both a direct governance role in influencing credit risk and a moderating role in strengthening or weakening the relationships between internal bank factors and credit risk. The conceptual framework of this study is presented in Figure 1.



**Figure 1. Conceptual Framework**

Figure 1 illustrates the integrated theoretical model developed in this study. Loan Growth, Capital, and Profitability represent internal banking factors that directly influence credit risk. These variables reflect managerial decisions regarding lending expansion, capital allocation, and operational efficiency. Female commissioners are conceptualized in this study as both a governance mechanism and a moderating factor. As a governance mechanism, their presence is expected to enhance the effectiveness of board monitoring and strengthen risk governance practices. Furthermore, as a moderating factor, female commissioners are anticipated to shape the relationship between managerial decisions related to loan expansion, capital adequacy, and profitability and the resulting level of credit risk, thereby influencing the effectiveness of these decisions in mitigating or exacerbating risk exposure. The moderating effects proposed in this study are

derived from the complementary perspectives of Agency Theory and Resource Dependence Theory. While Agency Theory underscores the importance of effective monitoring and control mechanisms in reducing managerial opportunism and risk-taking behavior, Resource Dependence Theory argues that board diversity provides valuable resources that enhance the quality of strategic decision-making.

### III. Research Method

#### 3.1. Research Design

This study adopts a quantitative explanatory research design to analyze the determinants of credit risk in Indonesian Regional Development Banks (BPDs) and to assess the moderating effect of female commissioners on these relationships. An explanatory approach is considered appropriate as the study seeks to empirically examine the causal relationships among variables that are theoretically grounded in Agency Theory and Resource Dependence Theory. This approach is consistent with recent banking and corporate governance studies that seek to identify risk determinants through longitudinal financial data and panel-data econometric techniques (Akhter, 2023; Naili & Lahrichi, 2022); (Musah et al., 2022).

The study employs a longitudinal panel-data framework that integrates cross-sectional observations across Regional Development Banks and time-series observations covering the 2018–2024 period. Compared with conventional cross-sectional or time-series methods, panel data analysis offers several methodological benefits, including a larger number of observations, greater degrees of freedom, and enhanced estimation efficiency. Furthermore, this approach allows for the control of unobserved bank-specific characteristics that may affect credit risk, thereby reducing potential estimation bias. By incorporating both cross-sectional and temporal dimensions, panel data analysis is particularly well suited for capturing the dynamic interactions between financial performance, governance mechanisms, and credit risk over time (Barra & Ruggiero, 2023; Naili & Lahrichi, 2022; Akhter, 2023). More importantly, the adopted research framework is designed to provide empirical evidence regarding the study's key theoretical propositions.

- a. Do loan growth, capitalization, and profitability significantly influence credit risk in Regional Development Banks?
- b. Does the presence of female commissioners directly affect credit risk?
- c. Do female commissioners moderate the influence of loan growth, capitalization, and profitability on credit risk?

The theoretical framework combines Agency Theory and Resource Dependence Theory. Agency Theory illustrates how female commissioners help mitigate managerial opportunism through their monitoring function, while Resource Dependence Theory emphasizes the strategic resources, viewpoints, and knowledge female commissioners bring to board decisions. The chosen explanatory panel-data design aligns perfectly with the study's aim to identify causal links among internal banking factors, governance mechanisms, and credit risk in Indonesian Regional Development Banks. Through this approach, the study seeks to offer a more comprehensive understanding of how governance mechanisms interact with financial factors in shaping credit risk within Regional Development Banks.

#### 3.2. Population and Sample

##### a. Population

All conventional Regional Development Banks (BPDs) operating in Indonesia from 2018 to 2024 were included in the study population. The selection of BPDs is theoretically and empirically justified by their unique institutional role, which integrates conventional banking intermediation functions with a developmental mission aimed at fostering regional economic growth. Consequently, these banks provide a particularly

relevant setting for evaluating the effectiveness of governance mechanisms in influencing managerial risk-taking behavior and risk management practices.

b. Sample

The sample was selected using a purposive sampling approach, which is particularly appropriate for studies requiring specific financial and governance-related information. Random sampling was deemed unsuitable due to the limited number of Regional Development Banks operating in Indonesia and the unequal availability of governance disclosures among these institutions, especially those related to female board representation. Furthermore, panel-data estimation requires a consistent set of observations over multiple years; therefore, only banks meeting the established data completeness and comparability criteria were included in the final sample. The purposive sampling criteria are as follows:

1) Inclusion Criteria

- Conventional Regional Development Banks operating continuously during 2018–2024.
- Banks publishing complete annual reports and audited financial statements.
- Banks disclosing information regarding board composition and female commissioners.
- Banks reporting all variables required for model estimation.

2) Exclusion Criteria

- Islamic Regional Development Banks operating separately from conventional entities.
- Banks lacking complete annual reports for one or more years.
- Banks with missing governance disclosures.
- Banks undergoing mergers or structural transformations that materially affect data comparability.

Based on the established selection criteria, 23 conventional Regional Development Banks were included in the final sample, yielding a balanced panel dataset of 161 bank-year observations. While purposive sampling constrains the extent to which the results can be generalized beyond the sampled institutions, it provides a stronger basis for internal validity by minimizing potential biases arising from incomplete or inconsistent data. By restricting the sample to banks that consistently disclose the required financial and governance information throughout the observation period, the study ensures greater data integrity and improves the robustness of the panel-data estimation results.

c. Data Sources and Data Collection Procedures

This research employs secondary data sourced from yearly reports, audited financial statements, and corporate governance documents released by every Regional Development Bank and the Indonesian Financial Services Authority (OJK). Data gathering was performed through a structured documentation approach comprising four phases. The initial phase focused on recognizing all banks that met the set inclusion criteria. The subsequent phase entailed acquiring and storing all annual reports and governance statements from the years 2018 to 2024. The third phase included gathering financial and governance data pertinent to the study variables. In the end, the collected information underwent a validation process through cross-checking with various official sources.

Data selection was guided by strict relevance criteria to ensure alignment with the study objectives. Specifically, only information pertaining to credit risk, lending growth, capital adequacy, profitability, and governance structure was retained for analysis. Information was considered eligible when it originated from audited reports, was publicly disclosed through official institutional channels, and demonstrated consistency across multiple independent sources. The application of these criteria helped minimize measurement errors and strengthened the reliability and validity of the dataset used in the panel-data analysis. Various methods

were adopted to improve the precision and uniformity of data. Initially, all financial ratios were recalculated employing standardized formulas instead of depending only on reported numbers. Secondly, data entry was conducted utilizing a double-entry verification method. Third, inconsistencies found in various reports were resolved by manually reviewing the original disclosures. Fourth, outlier observations were analyzed using the mean  $\pm$  three standard deviations criterion as per Blumberg et al. (2014).

To enhance transparency and replicability, missing data were managed using a predetermined data-handling protocol. Initially, unavailable observations were traced and verified through alternative official sources, including archived annual reports and publications issued by the Financial Services Authority (OJK). When the required information could not be obtained after the verification process, the corresponding observations were excluded from the final sample. Statistical imputation techniques were intentionally avoided because the use of artificially generated values may distort parameter estimates, introduce bias, and compromise the reliability of the empirical results.

### 3.3. Operational Definition and Measurement of Variables

This research utilizes one dependent variable, three independent variables, and one moderating variable to examine the factors influencing credit risk in Indonesian Regional Development Banks (BPDs). The choice of these variables is based on Agency Theory, Resource Dependence Theory, and literature on banking risk management, which indicate that internal financial traits and governance structures collectively impact the extent of credit risk faced by banks. To guarantee construct validity and consistency with earlier studies, all variables are assessed through indicators that have been widely utilized in international banking research and regulatory guidelines. Financial metrics are determined using verified financial statements, while governance metrics are obtained from corporate governance information found in annual reports. The operational definitions, metrics, and relevant citations are shown in Table 2.

**Table 2. Variables, Definition, and Measurements**

Variable	Definition	Measurement	Sources
Credit Risk (NPL)	Credit risk is proxied by the Non-Performing Loan (NPL) ratio, which is calculated as the proportion of non-performing loans relative to total outstanding loans.	$NPL = (\text{Non-performing Loans} / \text{Total Loans}) \times 100$	Kharabsheh (2019); Fitriani et al. (2025)
Loan Growth (LOANG)	Loan growth represents the year-over-year percentage change in the total amount of loans extended by a bank.	$LOANG = ((\text{Loans}_t - \text{Loans}_{t-1}) / \text{Loans}_{t-1}) \times 100$	Abadi & Lutfi (2025); Barra & Ruggiero (2023)
Capital (ETA)	Capital is operationalized as the equity-to-assets ratio.	$ETA = (\text{Total Equity Capital} / \text{Total Assets}) \times 100$	Akhter (2023); Kharabsheh (2019)
Profitability (ROA)	Profitability is proxied by Return on Assets (ROA), calculated to assess the extent to which a bank utilizes its assets to generate profits.	$ROA = (\text{Net Income before Tax} / \text{Average Total Assets}) \times 100$	Barra & Ruggiero (2023); Arnanto & Lutfi (2025)
Female Commissioners (FECOM)	Female commissioners are operationalized as the percentage of female members on the board of commissioners.	$FECOM = (\text{Number of Female Commissioners} / \text{Total Commissioners}) \times 100$	Birindelli et al. (2020); Musah et al. (2022)

To examine the moderating role of female commissioners, interaction variables are constructed by multiplying the female commissioner variable (FECOM) with each internal bank determinant. These interaction terms allow the study to assess whether female board representation strengthens, weakens, or

alters the influence of loan growth, capital, and profitability on credit risk. The use of interaction terms is consistent with moderated regression analysis and has been widely applied in governance and banking research to investigate conditional relationships among variables.

#### 3.4. Validity and Reliability of Measurements

The measurement validity of the study is reinforced by the use of well-established indicators that have been extensively applied in prior empirical banking research and are consistent with regulatory standards. Construct validity is achieved through the careful operationalization of each variable to ensure a close correspondence between the theoretical concepts and their empirical measurements. In addition, content validity is enhanced by adopting definitions, proxies, and measurement approaches that are widely accepted in the banking risk and corporate governance literature, thereby ensuring conceptual consistency and comparability with previous studies. Reliability is guaranteed by utilizing audited yearly reports, financial statements, and corporate governance documents sourced from official channels. All financial ratios were recalculated with standardized formulas to guarantee uniformity among banks and observation years. Furthermore, a cross-validation process was performed among annual reports, audited financial statements, and governance disclosures to reduce measurement errors and improve data accuracy. These methods guarantee that the resulting dataset offers a dependable foundation for empirical analysis and enhances the strength of the study's findings.

#### 3.5. Data Analysis Technique

This study employs panel data regression analysis because the method is more appropriate for accommodating both cross-sectional variation across banks and time-series variation over the observation period, while also controlling for unobserved heterogeneity among Regional Development Banks (Gujarati, 2021). Panel data methodology offers superior estimation efficiency relative to independent cross-sectional or time-series techniques by exploiting both temporal and individual heterogeneity. In this study, three competing panel data estimators are considered, namely the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). The final model specification is determined through sequential statistical testing using the Chow, Hausman, and Lagrange Multiplier (LM) procedures. The data analysis procedure was structured into two stages, consisting of descriptive and inferential analysis. The descriptive analysis was applied to summarize the characteristics of the dataset using statistical measures such as the mean, maximum, minimum, and standard deviation. This preliminary analysis facilitates an understanding of distributional properties, variability, and central tendencies of the variables, thereby informing subsequent inferential statistical procedures.

The inferential analysis employs panel data regression using EViews software. This technique is utilized due to its capacity to integrate cross-sectional (bank-level) and time-series dimensions within a unified framework, thereby improving estimation efficiency and producing more robust results than conventional single-dimension approaches (Gujarati, 2021). The Chow test was used to compare the Common Effect Model and Fixed Effect Model. The Hausman test was employed to determine whether the Fixed Effect Model or Random Effect Model was more appropriate. Finally, the Lagrange Multiplier test was conducted to compare the Common Effect Model and Random Effect Model. The final regression model was selected based on the results of these tests. The baseline model (no moderation) is employed to examine the direct effects of credit growth, capital, profitability, and female commissioners on credit risk, as specified in Equation (1):

$$NPLit = \alpha_1 + \beta_1 LOANGit + \beta_2 ETAit + \beta_3 ROAit + \beta_4 FECOMit + eit \quad (1)$$

To examine the moderating role of female commissioners, the baseline model is extended by incorporating interaction terms between female commissioners and each internal bank factor, as specified in Equation (2):

$$NPL_{it} = \alpha_1 + \beta_1 LOANG_{it} + \beta_2 ETA_{it} + \beta_3 ROA_{it} + \beta_4 FECOM_{it} + \beta_5 FECOM_{it} * LOANG_{it} + \beta_6 FECOM_{it} * ETA_{it} + \beta_7 FECOM_{it} * ROA_{it} + \epsilon_{it} \quad (2)$$

The hypothesis testing in this study was performed using the t-test and F-test with a significance level of 5 percent ( $\alpha = 0.05$ ). The t-test was applied to evaluate the individual (partial) influence of each independent variable on credit risk. This test determines whether each explanatory variable has a statistically significant effect on the dependent variable when the other variables in the model are held constant. Conversely, the F-test was employed to examine the joint (simultaneous) influence of all independent variables on credit risk, thereby assessing the overall explanatory power of the regression model. Furthermore, the coefficient of determination ( $R^2$ ) was used to measure the proportion of variation in credit risk that can be explained by the explanatory variables included in the model. A higher  $R^2$  value indicates a greater ability of the model to explain variations in the dependent variable, reflecting stronger goodness-of-fit. All statistical analyses were conducted using EViews 13, which was selected due to its extensive capabilities for panel-data analysis. The software facilitates a comprehensive range of analytical procedures, including descriptive statistical analysis, panel regression estimation, moderating effect assessment through interaction terms, model specification tests such as the Chow, Hausman, and Lagrange Multiplier (LM) tests, as well as hypothesis testing. These analytical features support the efficient and robust estimation of both direct and moderating relationships, thereby enhancing the reliability of empirical findings derived from panel-data models.

## IV. Result and Discussion

### 4.1. Result

#### a. Descriptive Statistics

Table 3 reports descriptive statistics that offer initial evidence regarding the financial conditions and governance attributes of conventional Regional Development Banks (BPDs) in Indonesia during the 2018–2024 period. Overall, the sample banks demonstrated relatively sound conditions in terms of credit quality, operational efficiency, profitability, and governance. The mean non-performing loan (NPL) ratio of 2.44% indicates that, on average, credit risk remained within a manageable range. However, the relatively high maximum NPL value suggests the presence of heterogeneity among banks, with certain institutions experiencing considerably greater exposure to problematic loans. These findings underscore the existence of substantial inter-bank variation in both risk exposure and operational performance, thereby justifying the use of panel-data analysis to capture such heterogeneity.

**Table 3. Descriptive Statistics of Research Variables**

	<b>NPL</b>	<b>LOANG</b>	<b>ETA</b>	<b>ROA</b>	<b>FECOM</b>
Mean	2.4416	7.9978	13.5564	2.2748	8.4679
Median	2.4800	7.4186	13.4066	2.1800	0.0000
Maximum	7.4500	27.0287	21.1411	4.3100	100.0000
Minimum	0.2900	-5.3965	8.5334	0.6500	0.0000
Std. Deviation	1.2298	5.4868	2.5032	0.7192	17.4692
Coef. of Variation	0.5037	0.6860	0.1847	0.3161	2.0630

Loan growth (LOANG) recorded an average of 7.99%, indicating that Regional Development Banks (BPDs) generally maintained their intermediation function through positive credit expansion. However, the relatively high dispersion in credit growth suggests considerable variation in lending aggressiveness across

BPDs. Capital, proxied by equity to total assets (ETA), averaged 13.56% and was the most stable variable, indicating that the capital structure of BPDs was generally strong and relatively homogeneous. Meanwhile, profitability, proxied by return on assets (ROA), averaged 2.27%, suggesting that BPDs generally maintained a sound level of profitability. In contrast, the proportion of female commissioners (FECOM) averaged only 8.47%, with a median of 0.00%, indicating that more than half of the BPD observations had no female commissioners at all. This finding confirms that female representation on BPD boards remains very low and unevenly distributed.

To a large extent, the descriptive statistics reveal that Indonesian Regional Development Banks (BPDs) exhibited relatively contained credit risk levels during the 2018–2024 period, underpinned by adequate capitalization and profitability. However, substantial cross-bank variation is evident in loan growth and female commissioner representation, reflecting heterogeneity in strategic policies and corporate governance practices. This heterogeneity provides a strong empirical basis for subsequent panel data regression analysis to examine the effects of loan growth, capitalization, profitability, and the moderating role of female commissioners on credit risk.

b. Panel Data Model Selection

The selection of the panel data regression model aimed to identify the most suitable estimation technique for examining the influence of credit growth, capitalization, profitability, and female board commissioners on credit risk in Regional Development Banks (RDBs) in Indonesia. To determine the appropriate specification, a series of model selection procedures, including the Chow test, Hausman test, and Lagrange Multiplier (LM) test, were conducted sequentially. These statistical tests facilitated the comparison among three alternative panel data models, namely the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). Choosing the optimal model is crucial for generating parameter estimates that are efficient, consistent, and unbiased, thereby enabling the empirical framework to adequately reflect the underlying characteristics and unobserved heterogeneity embedded in the dataset.

**Table 4. Panel Data Model Selection**

Testing Stage	Compared Models	Test Statistic	Prob.	Decision	Model Selected
Chow Test	Common Effect Model (CEM) vs Fixed Effect Model (FEM)	Cross-section Chi-square = 131.5901	0.0000	Prob. < .05, H0 rejected	Fixed Effect Model (FEM)
Hausman Test	Fixed Effect Model (FEM) vs Random Effect Model (REM)	Cross-section random = 5.0806	0.2791	Prob. > 0.05, H0 not rejected	Random Effect Model (REM)
Lagrange Multiplier (LM) Test	Common Effect Model (CEM) vs Random Effect Model (REM)	Breusch-Pagan (Both) = 97.0482	0.0000	Prob. < 0.05, H0 rejected	Random Effect Model (REM)

At the initial stage of model selection, the Chow test was conducted to evaluate the relative suitability of the Common Effect Model (CEM) and the Fixed Effect Model (FEM). The estimation results yielded a Cross-section Chi-square statistic of 131.5901 with an associated probability value of 0.0000, which falls below the 5% significance threshold. Therefore, the null hypothesis was rejected, indicating that the Fixed Effect Model (FEM) outperforms the Common Effect Model (CEM) in explaining the observed data structure. This outcome reflects the existence of substantial cross-sectional heterogeneity across Regional Development Banks (RDBs), suggesting that the pooled estimation approach fails to sufficiently account for unobserved bank-specific effects. Hence, incorporating individual-specific effects is necessary to obtain parameter estimates that are statistically efficient, consistent, and capable of more accurately representing the underlying characteristics of each bank.

At the subsequent stage of model selection, the Hausman test was conducted to assess the relative appropriateness of the Fixed Effect Model (FEM) and the Random Effect Model (REM). The test produced a Cross-section Random statistic of 5.0806 with an associated probability value of 0.2791, which exceeds the conventional 5% significance level. Therefore, the null hypothesis was not rejected, suggesting that the Random Effect Model (REM) offers a more appropriate specification than the Fixed Effect Model (FEM). This conclusion was further substantiated by the results of the Lagrange Multiplier (LM) test, which generated a Breusch–Pagan (Both) statistic of 97.0482 with a probability value of 0.0000, indicating the rejection of the Common Effect Model (CEM) in favor of the REM. Consequently, the Random Effect Model (REM) was adopted as the final estimation approach, as it is capable of capturing unobserved random heterogeneity across Regional Development Banks (RDBs) within the panel data structure, thereby ensuring more efficient, consistent, and unbiased parameter estimates.

c. Hypothesis Testing Results

The baseline (no moderation) estimation results reported in Table 5 show that credit growth has a negative and significant effect on credit risk ( $\beta = -0.0282$ ;  $p < 0.05$ ). This finding indicates that higher credit growth is associated with lower credit risk. Economically, the result suggests that credit expansion in Regional Development Banks during the observation period remained broadly within prudent banking limits, implying that credit growth reflected intermediation effectiveness rather than greater risk-taking.

**Table 5. Baseline Model (without Moderation) Results**

Variables	Coefficient	SE	t-Statistic	Prob.	Conclusion
C	2.8549	0.6630	4.3060	0.0000	
LOANG	-0.0282	0.0126	-2.2494	0.0259	Negative and Significant
ETA	0.0982	0.0454	2.1638	0.0320	Positive and Significant
ROA	-0.6791	0.1573	-4.3170	0.0000	Negative and Significant
FECOM	0.0030	0.0049	0.6210	0.5355	Not Significant
R-squared		0.1644			
F-statistic		7.6750			
Prob(F-statistic)		0.0000			

Capital has a positive and significant effect on credit risk ( $\beta = 0.0982$ ;  $p < 0.05$ ). This finding indicates that higher capital is associated with higher credit risk in Regional Development Banks. Economically, the result suggests that stronger capital does not always function as a conservative buffer, but may also encourage greater managerial tolerance for credit risk-taking. Profitability has a negative and significant effect on credit risk ( $\beta = -0.6791$ ;  $p < 0.01$ ). This result indicates that higher profitability is associated with lower credit risk in Regional Development Banks. The finding confirms that stronger profitability reflects better bank management quality, particularly in credit screening, borrower monitoring, and credit risk control. Female commissioners do not have a significant effect on credit risk ( $\beta = 0.0030$ ;  $p > 0.05$ ). This finding suggests that the presence of female commissioners does not have a direct and meaningful effect on credit risk management in Regional Development Banks. Substantively, the result indicates that female board representation in BPDs remains insufficiently influential to shape risk oversight in a meaningful way.

In the moderation model, as reported in Table 6, all interaction terms—FECOM×LOANG, FECOM×ETA, and FECOM×ROA—are statistically insignificant ( $p > 0.05$ ). This finding indicates that female commissioners do not moderate the effects of credit growth, capital, or profitability on credit risk. Accordingly, the presence of female commissioners has not been sufficient to strengthen or weaken the relationship between internal bank factors and credit risk in Regional Development Banks.

**Table 6. Moderation Model Results**

Variables	Coefficient	SE	t-Statistic	Prob.	Conclusion
C	2.9639	0.7489	3.9579	0.0001	
LOANG	-0.0278	0.0133	-2.0892	0.0383	Negative and Significant
ETA	0.0966	0.0552	1.7514	0.0819	Not Significant
ROA	-0.7191	0.1743	-4.1249	0.0001	Negative and Significant
FECOM	-0.0291	0.0305	-0.9542	0.3415	Not Significant
FECOM *LOANG	0.0005	0.0009	0.5699	0.5696	Not Significant
FECOM *ETA	0.0007	0.0020	0.3742	0.7088	Not Significant
FECOM *ROA	0.0075	0.0075	0.9822	0.3276	Not Significant
R-squared		0.1706			
F-statistic		4.4942			
Prob(F-statistic)		0.0001			

Collectively, both the baseline and moderation models are statistically significant at the 1% level, indicating that the explanatory variables are jointly relevant in explaining credit risk in Regional Development Banks. However, the coefficient of determination remains relatively low, at 16.44% in the baseline model and 17.06% in the moderation model. This suggests that the explanatory power of the models remains limited, implying that a substantial portion of the variation in non-performing loans is explained by other factors beyond the model.

#### 4.2. Discussions

##### a. Loan Growth and Credit Risk

The finding that credit growth has a negative and significant effect on credit risk indicates that higher loan growth in Regional Development Banks (BPDs) is associated with lower non-performing loans, suggesting that credit expansion during the observation period did not deteriorate loan quality but instead coincided with lower credit risk. This result implies that credit expansion in BPDs was not aggressive or speculative, but rather selective and broadly consistent with prudent banking principles. In this context, credit growth appears to reflect intermediation effectiveness rather than excessive risk-taking. This interpretation is also supported by the descriptive statistics, which show that average credit growth reached 7.9978%, while average NPL remained at only 2.4416%, still within the sound category under SEOJK No.14/SEOJK.03/2017. This combination suggests that BPDs were able to maintain credit expansion without materially compromising asset quality.

From a theoretical perspective, this result does not fully support Agency Theory, which views credit growth as a potential channel of managerial opportunism, whereby managers may expand lending to boost short-term earnings and performance, even at the cost of higher future credit risk (Jensen & Meckling, 1976). Under this view, aggressive credit expansion is generally expected to increase credit risk through adverse selection and moral hazard (Akhter, 2023; Barra & Ruggiero, 2023). However, the present finding suggests the opposite, indicating that credit expansion in BPDs was not primarily driven by opportunistic managerial behavior. Instead, the result is more consistent with Resource Dependence Theory, which suggests that credit growth may reflect the bank's ability to utilize local information, regional business networks, and borrower-specific knowledge to allocate credit more selectively and productively (Pfeffer & Salancik, 1978). In the context of BPDs, close relationships with local governments, SMEs, and regional economic actors may provide stronger informational advantages that improve credit screening and borrower monitoring, thereby allowing higher credit growth to coexist with lower credit risk.

This finding differs from Barra & Ruggiero (2023), Akhter (2023), and Kharabsheh (2019), who report that credit growth increases credit risk because aggressive loan expansion raises exposure to riskier borrowers. However, it is consistent with Naili & Lahrichi (2022), Jabbouri & Naili (2019), and Misman & Bhatti (2020), who show that credit growth does not necessarily increase credit risk, particularly when lending expansion is

conducted prudently. These differences suggest that the effect of credit growth on credit risk depends heavily on governance quality, market characteristics, and the bank's risk management capacity. In the case of Indonesian BPDs, the dual role of BPDs as financial intermediaries and regional development agents, combined with their stronger local information base and relatively segmented credit markets, likely allows credit expansion to remain more disciplined and relationship-based. Accordingly, the negative effect of credit growth on credit risk suggests that, in the context of Indonesian BPDs, credit growth is more reflective of effective intermediation than excessive risk-taking.

A more thorough comparison with earlier research indicates that the link between loan expansion and credit risk is significantly dependent on institutional and macroeconomic factors. The majority of research indicating a positive link between loan growth and non-performing loans was carried out in competitive banking environments where credit expansion typically signifies assertive lending practices and reduced screening criteria. Conversely, Indonesian Regional Development Banks (BPDs) function within comparatively safeguarded regional markets and sustain strong ties with local governments, public officials, and regionally integrated business networks. These relationship-driven lending frameworks offer enhanced soft information about the quality of borrowers, minimizing information gaps between banks and borrowers. As a result, loan growth in BPDs is more prone to indicate enhanced access to credit and robust regional economic activity instead of reckless risk-taking. This differentiation aids in understanding why the current results differ from research undertaken in more market-oriented banking systems and underscores the necessity of framing credit risk factors within particular institutional contexts.

Additionally, the study period coincided with Indonesia's post-pandemic economic recovery, during which government-supported credit restructuring initiatives and macroprudential measures were effectively implemented to sustain borrowers' repayment capacity. In this context, the expansion of credit may have been primarily directed toward borrowers with relatively stronger financial fundamentals, thereby mitigating the likelihood of future default. These conditions indicate that credit growth should not be interpreted uniformly as a signal of elevated credit risk. Instead, it represents a conditional indicator whose effects depend on institutional quality, the characteristics of borrowers, and the prevailing macroeconomic environment.

#### b. Capital and Credit Risk

Capital has a positive and significant effect on credit risk, indicating that stronger capitalization in Regional Development Banks (BPDs) is associated with higher non-performing loans. This finding suggests that stronger capital does not automatically reduce credit risk, but may instead increase managerial tolerance for risk. With larger capital buffers, banks possess greater loss-absorption capacity and may therefore become more willing to expand lending into riskier segments. In this context, capital functions not only as a protective buffer, but also as a source of greater flexibility for risk-taking. This interpretation is consistent with the descriptive evidence showing that BPDs generally maintain strong and relatively stable capital structures, yet stronger capital is not always used conservatively to contain credit risk and may instead encourage greater risk tolerance in lending decisions.

From a theoretical perspective, this finding is consistent with Agency Theory, which suggests that stronger capital may increase managerial discretion in credit decisions, particularly when shareholder monitoring is imperfect (Jensen & Meckling, 1976). Higher capital may create a false sense of security for managers because banks possess greater capacity to absorb losses. This may encourage management to expand credit exposure toward riskier borrowers or sectors in pursuit of growth and profitability, thereby increasing moral hazard in lending decisions. The finding is also consistent with the risk-taking behavior hypothesis, which argues that better-capitalized banks tend to exhibit greater risk tolerance because they perceive themselves to have stronger loss-absorption capacity (Berger & DeYoung, 1997). In this sense, capital serves not only as a safeguard against risk, but also as an enabler of greater credit risk-taking.

This result is consistent with Akhter (2023) and Kharabsheh (2019), who show that stronger capital may increase credit risk by encouraging more aggressive lending behavior. In the context of Indonesian BPDs, this relationship is particularly plausible because BPDs operate under a dual mandate: maintaining financial

stability while supporting regional economic development. This dual role may create pressure to expand lending into strategic but riskier sectors, particularly those aligned with local development priorities. Under such conditions, stronger capital may enable BPDs to continue expanding credit despite higher risk exposure. Thus, stronger capital in BPDs does not necessarily imply greater conservatism, but may instead increase banks' willingness to assume credit risk.

The positive association between capital and credit risk may also be understood within the distinctive institutional context of Indonesian Regional Development Banks (BPDs). Unlike commercial banks that primarily focus on maximizing shareholder value, BPDs are mandated to balance financial performance objectives with broader regional development goals. This dual mandate often creates a trade-off between maintaining prudent risk management practices and fulfilling developmental responsibilities. As majority shareholders, provincial governments frequently encourage BPDs to channel financing toward strategic regional sectors, infrastructure development initiatives, and micro, small, and medium-sized enterprises (MSMEs). Although these sectors play a crucial role in promoting regional economic growth and social welfare, they are often characterized by higher levels of credit risk, thereby increasing the banks' exposure to potential loan defaults.

As a result, elevated capital levels may not exclusively serve as protection against unforeseen losses. Conversely, enhanced capitalization can offer extra lending ability that allows BPDs to pursue development-focused financing projects that private commercial banks may shy away from. This institutional trait might clarify why the current results diverge from established banking theories primarily formulated in private-sector banking settings. Consequently, the efficiency of capital as a risk-mitigation tool seems to rely not just on its size but also on the strategic goals, ownership arrangement, and governance structure in which the bank functions.

#### c. Profitability and Credit Risk

Profitability has a negative and significant effect on credit risk, indicating that more profitable Regional Development Banks (BPDs) tend to face lower non-performing loans. This finding suggests that banks with stronger profitability generally exhibit better management quality, particularly in credit allocation, borrower screening, loan monitoring, and risk control. In this sense, profitability reflects not only a bank's ability to generate earnings, but also its operational efficiency and effectiveness in managing credit risk. This interpretation is consistent with the descriptive evidence showing that BPDs generally maintain sound profitability alongside relatively stable loan quality, suggesting that stronger earnings performance tends to coincide with better asset quality.

From a theoretical perspective, this finding is consistent with Agency Theory, which suggests that higher profitability reflects managerial effectiveness in utilizing bank resources efficiently and in alignment with shareholder interests (Jensen & Meckling, 1976). More profitable banks indicate that management is able to perform the intermediation function effectively without taking excessive credit risk. The result is also consistent with the bad management hypothesis proposed by Berger & DeYoung (1997), which argues that weak profitability often reflects poor managerial quality and ultimately contributes to deteriorating loan quality. Conversely, banks with stronger profitability are more likely to exhibit better monitoring systems, stronger borrower screening, and more effective risk control, allowing them to maintain lower levels of problem loans. In this context, the negative relationship between profitability and credit risk suggests that profitability serves as an important indicator of credit risk management quality.

This finding is consistent with Akhter (2023), and Barra & Ruggiero (2023), who similarly show that profitability is associated with lower credit risk. In the context of Indonesian BPDs, this relationship is particularly plausible because BPDs generally operate with relatively stable market bases, including payroll lending, local SME financing, and government-related captive markets. This business structure allows BPDs to generate relatively stable earnings with more manageable risk exposure than profit-driven commercial banks operating in highly competitive markets. In addition, BPDs' close proximity to local economic ecosystems may improve borrower monitoring and loan quality oversight. As a result, higher profitability in BPDs is more likely

to reflect stronger managerial efficiency and better credit governance than greater risk-taking. Thus, profitability appears to be an important determinant of credit risk in Indonesian BPDs, where stronger earnings primarily reflect managerial quality, intermediation efficiency, and more effective risk control.

d. Female Commissioners and Credit Risk

Female commissioners do not have a significant effect on credit risk, indicating that female board representation has not been sufficient to directly influence non-performing loans in Regional Development Banks (BPDs). This finding suggests that a higher proportion of female commissioners has not meaningfully reduced or increased credit risk, implying that the presence of women on BPD boards has not yet translated into a governance mechanism strong enough to shape credit risk oversight. This interpretation is consistent with the descriptive evidence showing that female representation on BPD boards remains very limited and unevenly distributed, with more than half of the observations having no female commissioners at all.

From a theoretical perspective, this finding does not fully support Agency Theory, which suggests that female commissioners should strengthen board monitoring because women are often associated with greater prudence, stronger discipline, and more conservative decision-making (Jensen & Meckling, 1976). Under this view, female commissioners are expected to improve managerial oversight, including the supervision of credit risk. However, the result suggests that female commissioners in BPDs have not yet exercised this monitoring role effectively. The finding also offers limited support for Resource Dependence Theory, which views gender diversity as a strategic resource capable of enriching board perspectives, improving oversight quality, and strengthening decision-making (Pfeffer & Salancik, 1978). In the case of BPDs, however, these potential governance benefits do not appear to have materialized in a meaningful way, suggesting that female representation has not yet become substantively influential in shaping credit risk governance.

This finding contrasts with Musah et al. (2022) and Setiawan & Khoirotunnisa (2020), who show that female board representation can strengthen monitoring and reduce bank risk-taking, but is more consistent with Ain et al. (2020) and Salem et al. (2025), who find no significant relationship between female board presence and bank risk. These differences suggest that the influence of female commissioners depends heavily on institutional context, representation levels, and the substantive influence women hold within governance structures. In the context of Indonesian BPDs, board structures remain strongly shaped by bureaucratic, political, and institutional considerations. As a result, the appointment of female commissioners may still be more symbolic or administrative than substantively governance-driven. Coupled with their low representation and likely minority position on the board, female commissioners may have limited ability to influence strategic decisions, including credit risk oversight. Thus, female commissioners in Indonesian BPDs have not yet functioned as an effective governance mechanism in shaping credit risk

e. The Moderating Role of Female Commissioners

Female commissioners do not moderate the effects of credit growth, capital, or profitability on credit risk, indicating that their governance role in shaping the relationship between internal bank factors and credit risk remains limited in Regional Development Banks (BPDs). This finding suggests that female commissioners have not been effective in strengthening or weakening how internal bank conditions translate into non-performing loans. In other words, while female commissioners may be present within the governance structure, their role has not been strong enough to materially influence the transmission of internal bank factors into credit risk outcomes.

From a theoretical perspective, this result provides limited support for Agency Theory. Female commissioners are expected to strengthen board monitoring, constrain managerial opportunism, and promote more prudent decisions in lending, capital management, and profit allocation (Birindelli et al., 2020; Jensen & Meckling, 1976). However, the empirical results suggest that this monitoring role has not been sufficiently strong to influence how internal bank conditions affect credit risk. This implies that the relationships between credit growth, capital, profitability, and credit risk in BPDs are still more strongly shaped

by managerial decisions and internal operational dynamics than by gender-based board oversight. The finding is also broadly consistent with prior studies showing that gender diversity does not necessarily strengthen governance outcomes when female board representation remains limited or structurally constrained (Ain et al., 2020; Salem et al., 2025).

This result is also understandable in the context of Indonesian BPDs, where governance structures remain heavily influenced by bureaucratic and political considerations. Under such conditions, board effectiveness—including that of female commissioners—is not determined solely by competence or individual risk preferences, but also by institutional constraints and limited decision-making influence. Given that female representation remains very low and unevenly distributed across BPD boards, female commissioners are likely to occupy minority positions with limited structural influence over strategic decisions. As a result, their presence has not been sufficient to moderate the effects of credit growth, capital, or profitability on credit risk. Overall, this finding suggests that the governance role of female commissioners in Indonesian BPDs remains more symbolic than substantive in shaping the relationship between internal bank conditions and credit risk.

## V. Conclusion

This study shows that credit risk dynamics in Indonesian Regional Development Banks (BPDs) are primarily shaped by the quality of intermediation, the discipline of capital management, and the bank's ability to generate profits. Credit growth is found to be negatively associated with credit risk, indicating that lending expansion remained broadly prudent and reflected relatively effective intermediation during the observation period. By contrast, capital is positively associated with credit risk, suggesting that stronger capitalization does not necessarily reduce risk and may, under certain conditions, increase banks' tolerance for greater credit exposure. Profitability is found to reduce credit risk, confirming that more profitable banks tend to exhibit stronger asset quality and more effective risk control. In contrast, female commissioners show no meaningful effect, either directly on credit risk or as a moderating variable in the relationships between credit growth, capital, profitability, and credit risk. This suggests that the role of female commissioners in BPDs remains insufficiently strong to influence risk oversight in a substantive way.

Theoretically, this study extends the credit risk literature by showing that the determinants of bank credit risk cannot be explained solely through a conventional risk-return perspective, but must also be understood through the interaction of managerial behavior, institutional context, and governance effectiveness. The findings provide partial support for Agency Theory by confirming that capital may encourage greater managerial risk-taking, while profitability reflects stronger managerial discipline and more effective risk control. At the same time, the negative effect of credit growth provides stronger support for Resource Dependence Theory, suggesting that credit expansion may reflect informational advantages and more effective intermediation rather than excessive risk-taking. The insignificant role of female commissioners further indicates that board gender diversity does not automatically translate into stronger governance outcomes, particularly when female representation remains limited and institutionally constrained. These findings therefore suggest that governance effectiveness depends not only on formal board composition, but also on substantive influence and institutional context.

From a practical perspective, these findings offer several important implications for BPD management and regulators. For bank management, credit risk control should be approached more comprehensively through selective credit expansion, more disciplined capital management, and stronger profitability without compromising asset quality. Strengthening borrower assessment, credit portfolio monitoring, operational efficiency, and productive asset utilization remains essential for preserving credit quality stability. For the Financial Services Authority (OJK), the findings highlight the importance of supervision that goes beyond non-performing loan ratios and places greater emphasis on intermediation quality, risk-taking behavior, and governance effectiveness. Strengthening credit risk management in BPDs therefore requires a more integrated supervisory approach built on sound intermediation, disciplined

capitalization, sustainable profitability, and more effective governance. Future research is encouraged to move beyond conventional direct-effect frameworks and adopt more complex causal models that capture the transmission mechanisms between internal banking factors and credit risk. In particular, variables such as credit assessment quality, loan portfolio diversification, risk governance effectiveness, managerial decision-making discretion, and political intervention stemming from government ownership may serve as important mediating channels. Incorporating these factors could enhance the explanatory capacity of future models and provide deeper insights into the institutional and managerial processes through which credit risk is generated and managed within Regional Development Banks.

From a methodological perspective, future research should employ more advanced longitudinal analytical techniques to better capture the dynamic nature of credit risk determinants. Approaches such as the Generalized Method of Moments (GMM), dynamic panel-data models, and panel vector autoregression (PVAR) offer considerable potential for examining the intertemporal relationships among profitability, capital adequacy, governance mechanisms, and credit risk. By accounting for dynamic adjustments, endogeneity concerns, and feedback effects among variables, these methods can provide more robust evidence regarding the causal processes underlying risk formation and management. Consequently, the application of such techniques may generate deeper insights into the evolving interactions between financial performance, governance structures, and credit risk that are not fully captured by conventional static panel estimations. Future comparative studies might also explore if the factors influencing credit risk vary systematically among Regional Development Banks, State-Owned Banks, Private Commercial Banks, and Islamic Banks. These comparisons would aid in creating a more context-aware theory of credit risk management in developing economies.

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