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MSME Loan Composition, Financial Stability, and Government Ownership: Evidence from Indonesia's Banking Sector

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Abstract: The Indonesian government has promoted growth in MSMEs (micro, small, and medium enterprises) by targeting banks to allocate at least 30% by Q2 2022 of their loan portfolios to MSMEs. However, by Q4 2022, this target had not been met, partly due to the high credit risk and information asymmetry in the MSME sector. While past studies often suggest that MSME lending improves bank stability, this study finds otherwise. Using panel data from 96 banks between Q1 2019 and Q4 2022 and applying the GMM method, the result shows that a higher MSME loan share tends to reduce bank stability. Interestingly, when government ownership is considered, the effect turns positive, suggesting that government-owned banks may manage MSME risks better. This may be due to stronger oversight, policy support, their experience with development-focused lending, a broader business focus beyond profits, and their role as agents of change in supporting financial inclusion and economic stability. These findings suggest the need for better MSME policy alignment, risk mitigation tools, and a centralized MSME database to balance financial inclusion with banking sector stability.

Keywords: asymmetric information, bank stability, government-owned Banks, MSME credit
JEL Classification: G21

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Introduction

The contribution of micro, small, and medium enterprises (MSMEs) to economic growth is significant, broadly accounting for more than half of total employment and positively impacting the economy (Banerjee, 2014; Ferrando et al., 2017). According to Fitriati (2015), MSMEs play a role in the economies of both developing and developed countries. Although increased access to credit for MSMEs can boost economic activity, the impact of rising MSME lending on banking stability remains uncertain. Credit constraints often affect MSMEs more severely than large firms or corporations (Beck & Torre, 2007). Funding difficulties for MSMEs are typically caused by asymmetric information, as well as the costs of credit screening and monitoring.

These challenges are often exacerbated by underdeveloped financial systems, particularly in developing countries. Beck et al. (2013) provide evidence that small firms and those operating in countries with weak institutional frameworks tend to use less external financing, especially from banks. Collateral also plays an important role in helping MSMEs get formal credit; however, the need for collateral often makes it hard for MSMEs, especially in developing countries in ASEAN, to access bank loans (Thein et al., 2024).

A study by Brei et al. (2020) shows that the distance to insolvency (a measure of banking system stability as indicated by the Z-score) tends to be lower in developing countries compared to developed countries. This indicates that the banking sector in developing countries faces higher risk. Additionally, the study shows that MSME lending interest rates are significantly higher in developing countries, reflecting the lower creditworthiness of borrowers compared to those in more advanced economies.

Government-owned banks play a crucial role in accelerating economic growth (Lassoued et al., 2016). Research by Behr et al. (2017) indicates that MSME loans from banks acting as channels for government policies are less influenced by economic cycles. Sapienza (2004) concludes that government-owned banks are less profitable than private banks, as they focus more on social objectives than profit optimization. Consequently, government ownership may significantly impact MSME loan growth and bank stability, given its orientation towards social welfare and economic stability.

To maintain financial stability and support MSME access to financing during the COVID-19 pandemic, Bank Indonesia issued Regulation No. 23/13/PBI/2021. This regulation required banks to gradually reach a minimum Macroprudential Inclusive Financing Ratio (RPIM) of 30%, which includes loans to MSMEs, MSME-related corporations, or low-income individuals by June 2024. However, a few months later, Bank Indonesia revised this through Member of Board of Governors Regulation (PADG) No. 24/6/PADG/2022, replacing the June 2024 deadline with a requirement for banks to increase their RPIM gradually each year. Banks that fail to meet the 30% target are required to maintain a special reserve (giro) for RPIM. As of Q4 2022, out of 105 banks in Indonesia, only 15 had reached the 30% MSME loan composition target. This gap is mainly due to differences in each bank's market focus and the persistent issue of asymmetric information in MSME lending (Berger & Udell, 1992).

The motivation for this study stems from the need to understand how increasing MSME loan composition impacts bank stability, particularly in the context of government ownership. While the Indonesian government has implemented various policies to support MSMEs, such as the Regulation of Bank Indonesia (PBI) No. 23/13/PBI/2021 and subsequent amendments, it is crucial to ensure these initiatives do not compromise banks'

financial stability. This research seeks to answer two main questions: Does the increase in MSME loan composition affect bank stability? Does government ownership moderate this effect?

To address these questions, the study employs the Generalized Method of Moments (GMM) on a sample of 96 banks from Q1 2019 to Q4 2022. The GMM method is chosen for its ability to handle potential endogeneity issues and provide robust estimates. The findings reveal that an increase in MSME loan composition negatively impacts bank stability, contrary to Morgan & Pontines (2018). This discrepancy may arise from differences in the study period and the unique characteristics of Indonesian banks. These results suggest that MSME loan portfolios in Indonesian banks have poor collectibility, negatively impacting bank stability. Asymmetric information further exacerbates this issue, leading to a negative impact on stability (Berger & Udell, 1992). The moderating effect of government ownership shows varying results depending on the stability proxy used, highlighting the complexity of this relationship.

This study contributes to the growing literature on bank stability and MSME financing by offering empirical evidence from Indonesia (an emerging economy with a strong policy emphasis on financial inclusion). Specifically, this research highlights the dual-edged nature of increasing MSME loan composition, showing that while such lending aims to promote inclusive growth, it may also introduce credit risk that can weaken bank stability. This finding diverges from prior cross-country studies such as Morgan & Pontines (2018) and Brei et al. (2020), which generally found a positive relationship between MSME lending and financial stability. Unlike these broader regional studies, the present research captures the post-COVID-19 recovery period and focuses on a single-country context, allowing for a deeper exploration of regulatory and institutional dynamics unique to Indonesia. Furthermore, the study adds to the discussion on government ownership in banking by demonstrating its moderating role. While government-owned banks are often associated with agency problems (La Porta et al., 2002; Sapienza, 2004), the findings suggest that in the context of MSME lending, they may be better positioned to manage risk due to policy support, social mandates, and risk mitigation mechanisms. This challenges some of the assumptions in the agency theory by showing that government objectives, when supported by adequate oversight and institutional infrastructure, can contribute positively to financial stability.

Literature Review

Micro, Small, and Medium Enterprises

According to the Republic of Indonesia Act No. 20 of 2008 on Micro, Small, and Medium Enterprises, MSMEs are defined according to their net assets and annual sales. Micro enterprises are businesses with a maximum net asset of IDR 50 million and annual sales of up to IDR 300 million. Small enterprises are those with net assets between IDR 50 million and IDR 500 million and annual sales ranging from IDR 300 million to IDR 2.5 billion. Medium enterprises have net assets between IDR 500 million and IDR 10 billion, with annual sales of more than IDR 2.5 billion up to IDR 50 billion. These classifications exclude land and buildings used for business activities and are intended to provide clear criteria for policy support, financing access, and development programs targeting MSMEs.

Although MSMEs contribute significantly to Indonesia's GDP, their productivity remains low relative to large enterprises. According to Tambunan (2011), their substantial

GDP contribution is primarily driven by their sheer number rather than efficiency or output quality. Key structural constraints such as high raw material costs, marketing difficulties, and lack of capital continue to hinder their growth and competitiveness (Tambunan & Supratikno, 2004). In addition, technology adoption among MSMEs remains a major challenge. As noted by Astuti & Nasution (2014), low technology readiness is driven by factors such as limited digital skills, low perceived usefulness, and fears related to discomfort and security, which contributes to the slow adoption of internet-based commerce and digital platforms. These barriers reduce their ability to compete in increasingly digitized markets and limit opportunities for business expansion. Combined with the high credit risk associated with MSMEs, these structural and technological challenges often translate into elevated interest rates and collateral requirements, particularly in economies with less mature financial systems. Research by Ghosh et al. (2000) indicates that moral hazard issues can arise even in developing countries where lenders may live in close proximity to borrowers. Although increased access to bank credit for MSMEs has the potential to boost economic activity, the impact of MSME lending on financial stability remains uncertain.

Bank Stability

A well-functioning banking system stimulates economic growth (Beck & Levine, 2004) through credit provision (Levine & Zervos, 1998). According to Hu (2022), banks lend to trustworthy borrowers, ultimately benefiting the economy positively. Bank criteria for borrower selection and loan terms are part of bank lending standards that vary across banks. Low screening activities during economic booms create competitive pricing among banks, potentially leading to loans being granted to lower quality borrowers. Banks tighten loan standards during economic downturns to mitigate default risks (Lown & Morgan, 2006). Assessing the feasibility of new business ventures during economic upswings is less stringent compared to downturns (Fishman et al., 2020; Ates & Saffie, 2021).

While increased access to credit for MSMEs has boosted economic activity, its impact on financial stability is still uncertain. MSMEs depend heavily on banks for financing, yet they tend to have lower productivity than larger corporations (Ayyagari et al., 2014), and monitoring their credit carries higher costs (Beck & Torre, 2007). Moreover, according to OJK data, MSMEs in Indonesia have higher NPLs compared to wholesale and consumer loans, which can impact banking stability.

Credit Rationing and Asymmetric Information

The term "credit rationing" was first introduced by Stiglitz dan Weiss (1981) to describe a situation where some borrowers are denied credit even if they are willing to pay higher interest rates. This phenomenon results in a sharp decrease in the supply of bank credit, as banks restrict lending to businesses. According to Berger & Udell (1992), MSMEs are particularly susceptible to credit rationing due to asymmetric information issues, lack of diversification, and short-term orientation. The credit rationing theory assumes the presence of asymmetric information between borrowers and lenders, meaning lenders lack complete knowledge of borrowers' creditworthiness. This information gap can result in financial exclusion due to adverse selection and moral hazard, as illustrated by Stiglitz & Weiss (1981).

Several studies have revealed key reasons why these issues are more prevalent among MSME borrowers. Fixed transaction costs make it inefficient to screen and mon-

itor smaller borrowers, as these costs don't scale proportionally with the size of the business or loan (Beck & Torre, 2007). Additional barriers to credit access for MSMEs include irregular credit histories, limited financial reporting skills, and insufficient collateral (OECD, 2023). On the supply side, foreign banks often either lack the expertise or find the MSME sector less appealing, allowing domestic banks and specialized MSME lenders to dominate this lending space (Haas, 2014). Panjaitan et al. (2020) emphasize that, beyond the scope of regulatory mandates, the limited bankability of Indonesian MSMEs can be primarily attributed to internal structural factors, notably their level of social cognition and organizational readiness for change. These internal limitations constrain their ability to effectively utilize external financial support, thereby impeding their integration into the formal banking system.

Regulatory Setting and Intitutional Environment in Indonesia

Indonesia's regulatory framework reflects a sustained policy commitment to improving access to finance for MSMEs, especially in response to structural challenges and external shocks like the COVID-19 pandemic. Prior to the pandemic, Bank Indonesia Regulation No. 17/12/PBI/2015 mandated a gradual increase in banks' MSME loan composition, targeting at least 20% of total lending by the end of 2018. However, by the end of 2019, MSME loans stagnated at 18.60%, falling short of the target. One of the key obstacles was the high level of non-performing loans (NPLs) in the MSME segment, which discouraged banks from expanding lending to this sector. As noted by Beck & De La Torre (2007), fixed transaction costs make credit screening and monitoring for small borrowers less economical, while challenges such as inconsistent credit histories, limited financial reporting capabilities, and lack of collateral (OECD, 2023) further constrain MSMEs' access to finance.

To strengthen financial inclusion and safeguard financial system stability during the pandemic, Bank Indonesia issued Regulation No. 23/13/PBI/2021, which introduced the Macroprudential Inclusive Financing Ratio (RPIM). This regulation required banks to gradually increase their lending to MSMEs, MSME-related corporations, and low-income individuals to at least 30% of their total loan portfolios by June 2024. This policy was further refined through Member of Board of Governors Regulation No. 24/6/PADG/2022, which shifted the fixed target to a mandatory annual increase and imposed a reserve requirement penalty (Giro RPIM) on banks that fail to meet the target. If banks do not comply by the end of 2024, they face administrative sanctions of up to IDR 5 billion. Despite these policies, by Q4 2022, only 15 out of 105 banks had met the 30% MSME loan composition, indicating persistent structural and institutional barriers, including asymmetric information (Berger & Udell, 1992) and varying bank market segment strategies.

Hypothesis

MSMEs also tend to have lower productivity than larger corporations (Ayyagari et al., 2014) and incur higher monitoring costs for their credit (Beck & De La Torre, 2007). If banks experience non-performing loans (NPLs), they must increase their provisions, which reduces profitability. Research by Morgan & Pontines (2018) indicates a positive relationship between increased MSME credit composition and bank stability, a finding consistent with Khan (2011), who notes that large-scale lending to small borrowers can reduce overall risk and loan portfolio volatility through diversification. Despite MSMEs supporting half of Indonesia's economy, MSME credit in the country carries higher risks

compared to wholesale and consumer credit.

The Indonesian government continues to encourage banks to expand their MSME credit portfolios. Previous research by Morgan & Pontines (2018), conducted from 2005 to 2011, demonstrated that an increase in MSME credit composition positively impacts banking stability. However, changes in economic conditions, government regulations, and banking characteristics in Indonesia over time could influence the findings of earlier studies. Therefore, this study will empirically test the impact of increased MSME credit composition on bank stability using the proxies employed by Morgan & Pontines (2018), focusing on a sample of Indonesian banks. Based on these considerations, the first hypothesis of this study is as follows:

H1: An increase in MSME credit composition has a positive impact on bank stability.

Agency Theory

The agency theory, proposed by Jensen & Meckling (1976), explores the dynamics between owners (principals) and agents (managers) in corporate settings. This theory is especially pertinent in the context of government ownership of banks. While such ownership is anticipated to promote good governance and uphold financial stability, it also significantly contributes to economic and financial development, thereby fostering growth (Lassoued et al., 2016). For instance, government-owned banks frequently finance projects that generate job opportunities, which may be overlooked by the private sector (La Porta et al., 2002).

Nevertheless, the adverse effects of government ownership on bank stability pose a substantial concern. Jensen & Meckling (1976) point out that agency theory-related issues can emerge from conflicts of interest between owners and management. In the case of government-owned banks, management may prioritize government-imposed lending policies aimed at achieving social objectives rather than focusing on financial performance, significantly influencing their decision-making (Faccio et al., 2005). Furthermore, these banks often enjoy explicit or implicit government protections, financial backing, and regulatory advantages (Demirgüç-Kunt & Detragiache, 2002), which may encourage them to take greater risks. This occurs because losses and excess costs are frequently covered by the government, leading to moral hazard.

Studies indicate that government-owned banks tend to operate countercyclically, maintaining stable a credit supply during economic fluctuations. However, their focus on social objectives can result in lending to poorer-quality borrowers compared to private banks, potentially affecting bank stability. Differences in credit growth and NPL patterns suggest that ownership factors can significantly influence the impact of MSME credit growth on bank stability. Notably, Morgan & Pontines (2018) did not examine the moderating effect of government ownership on the relationship between MSME credit composition and bank stability. Based on these considerations, the second hypothesis of this study is:

H2: Government ownership moderates the impact of MSME credit composition on bank stability to become negative.

Methods

Data

This study examines all commercial banks in Indonesia, totaling 105, over the period from Q1 2019 to Q4 2022. The sample includes 4 state-owned banks (persero), 27 regional development banks (BPD), 67 national private banks, and 7 foreign banks. Data on MSME credit for each bank were sourced from the OJK website and quarterly reports submitted by each bank. Banks that did not provide MSME credit at all or only did so in specific periods were excluded from the analysis, resulting in a final sample of 96 banks.

Dependent Variable

Several studies have linked bank stability to risk measures as proxy indicators. In research conducted by Morgan & Pontines (2018), the first proxy used to measure stability is non-performing loans (NPLs), influenced by the increase in MSME credit composition. Banking NPLs reflect potential future capital losses; thus, higher NPL ratios imply lower financial stability (Morgan & Pontines, 2018). Other studies also utilize NPLs to measure bank stability (Danisman & Demirel, 2019; Elnahass et al., 2021; Shabir et al., 2023). NPL is a backward-looking measure of credit risk as it is reported only after the loans have become non-performing (Abuzayed et al., 2018). Higher NPL values indicate weaker credit risk management capabilities (Beck et al., 2013; Abuzayed et al., 2018). Abedifar et al. (2013) and Beck et al. (2013) suggest that these credit risk indicators provide only a partial view of credit portfolio quality, as differences in internal bank policies such as non-performing loan classification, reserve requirements, and loan write-off practices.

Another measure used as a proxy for bank stability is the Altman Z-score (Altman, 1968). This measure uses several financial ratios calculated from company financial statements to determine the Z-score. The Z-score results categorize companies into safe, cautionary, and critical zones. Morgan & Pontines (2018) and Brei et al. (2020) use the Z-score as a proxy measure for banking stability in their studies on the impact of MSME credit. Since most banks in Indonesia are not publicly traded, assuming normal distribution of bank profits (Roy, 1952), the probability of bank failure can be estimated using the Z-Score (Laeven & Levine, 2009).

For the robustness test, the z-score indicator would be used to measure the stability of each bank, as utilized by Pham et al. (2021) and Ali & Puah (2018), with the formula ROA + (equity/assets) / stdev(ROA), where standard deviation of ROA is from data over the current period of the last 12 quarters of previous ROA. The detailed description of all the variable measurements we used in this research, mostly from the OJK, and is disclosed in the appendix.

Moderating Variable

A moderating variable is one that influences the relationship between the independent and dependent variables, thereby potentially altering the original relationship between the two variables (Sekaran & Bougie, 2016). The moderating variable in this study is government ownership, taking into account the differences in the credit composition between government-owned and non-government-owned banks. Government-owned banks often act as the primary channels for government policy implementation (Behr et al., 2017). These banks are frequently subject to social and political priorities, facing pressure to fi-

nance projects with high social and political value—even when such projects may not yield sufficient financial returns (La Porta et al., 2002). The inclusion of a moderating variable is an extension of the study by Morgan & Pontines (2018), which did not previously examine the role of government ownership in moderating the effect of increased MSME credit composition on bank stability.

Control Variables

To ensure consistent research results regarding the effect of the independent variable (MSME loan composition) on bank stability, the study will add variables commonly researched in relation to stability, such as income diversification (Liang et al., 2020), market concentration (Tran et al., 2022), assets (Köhler, 2014), capital adequacy ratio (Tran et al., 2022), and COVID-19 (Elnahass et al., 2021). These control variables were not previously included in the model by Morgan & Pontines (2018). The rationale for including them is as follows:

1. Income Diversification
   As banks expand their MSME lending—which may involve higher credit risk—diversifying income sources becomes an essential strategy to maintain stability. Banking activities that are diversified enhance income stability and reduce risks for banks (Ammar & Boughrara, 2019; Adesina, 2021). Banks often manage risk by diversifying their income streams and assets across various categories, including fees and commissions, trading activities, and other operational income sources (Hsieh et al., 2013; Meslier et al., 2014).
2. Market Concentration
   In analyzing the impact of increasing MSME loan composition on bank stability, the structure of banking market concentration offers two contrasting perspectives. The first perspective is concentration stability, where large banks tend to apply stricter credit assessments because high-quality loans enhance returns and create healthy financial conditions (Boot & Thakor, 2012). In contrast, the concentration fragility view states that a concentrated market structure leads large banks dominating the market to increase loan interest rates (Berger et al., 2010). Large banks with more concentrated market shares find it easier to obtain subsidies due to implicit too-big-to-fail policies from the government. Therefore, these potential subsidies provide incentives for large banks to take on higher risks.
3. Bank Size
   The "too big to fail" hypothesis suggests that banks with large assets may have more incentives to engage in riskier lending activities due to government safety nets (Mishkin, 1999), which may also include aggressive MSME lending. Studies conducted by Boyd & Runkle (1993) conclude an inverse correlation between firm size and ROA fluctuations, while Fu et al. (2014) showed that increasing assets are associated with greater risks. Bertay et al. (2013) indicate that bank size is not significantly related to bank risk measured by Z-score.
4. Capital Adequacy Ratio
   The research by Andersen & Juelsrud (2024) indicates that when bank capital increases, banks enhance their loss-absorbing capacity, thereby reducing banking crisis risks. However, funding costs for banks may rise with increased

capital. If banks pass on higher costs to borrowers, loan interest rates will increase. When assessing bank capital adequacy ratios (CAR), the economic costs of more expensive credit must be weighed against the benefits of reduced banking crises that incur fewer costs. CAR has a positive impact on bank stability (Köhler, 2014). Research by Adem (2023) demonstrates that banking capital regulations prove to be an effective monitoring tool for lowering risks and maintaining stability, suggesting that robust CAR levels can help banks absorb potential shocks from MSME loan portfolios, thereby supporting overall stability.

5. COVID-19
   The COVID-19 pandemic severely disrupted economic activities, leading to reduced incomes for businesses and households, which diminished their ability to repay loans and lowered the demand for banking services. Takeda et al. (2022) show that in eight developing countries across South, Southeast, and Northeast Asia, MSMEs face significant financial constraints, which hinder their ability to repay loans. This, in turn, negatively impacted the performance of the banking sector. (Duan et al., 2021; Elnahass et al., 2021; Beck & Keil, 2022). Elnahass et al. (2021) show that banks in emerging economies experienced significant increases in credit risk and volatility. This aligns with findings by Duan et al. (2021), who document that the pandemic led to deteriorating loan quality and increased non-performing loans (NPLs), especially in sectors most affected by lockdowns. A recent study by Cahyono et al. (2024) indicates that even after the pandemic, MSMEs continue to face significant challenges in repaying their loans. The COVID-19 pandemic is controlled using a dummy variable instead of a continuous one because the pandemic was a sudden, time-specific shock that caused major changes in the economy and banking sector. These changes were not gradual, so a dummy variable is more suitable to capture the clear "before and during" effect. It helps reflect the shift in MSME lending risks and bank performance during the pandemic. This approach also follows Elnahass et al. (2021), who use a similar method.

Overall, the variables used in this study are presented in Table 1 as follows:

Table 1. Variables Measurement and Sources

Variables	Indicator	Reference	Data Source
Dependent			
Bank Stability (NPL)	$\frac{\text{Substandard Loan}_{i,t} + \text{Doubtful Loan}_{i,t} + \text{Loss Loan}_{i,t}}{\text{Total Loan}_{i,t}}$	Morgan & Pontines (2018)	OJK/ Bank Quarterly Report
Bank Stability (Z_Score)	$\frac{\text{ROA}_{i,t} + (Equity_{i,t} / Asset_{i,t})}{\sigma\text{ROA}_{i,t}}$	Ali & Puah (2018) & Pham et al. (2021)	OJK/ Bank Quarterly Report
Independent			
MSME Loan Composition (C_MSME)	$\frac{\text{MSME Loan}_{i,t}}{\text{Total Loan}_{i,t}}$	Morgan & Pontines (2018)	OJK/ Bank Quarterly Report
Moderating			

Government-owned Banks (Gov_Bank)	$\frac{\text{Number of shares owned by the government}_{i,t}}{\text{Total outstanding shares}_{i,t}}$	La Porta et al. (2002), Al-Janadi et al. (2016), Huang (2022)	OJK/ Bank Quarterly Report
Control			
Income Diversification	$1-((\frac{\text{interest income}}{\text{total operating income}})^2 + (\frac{\text{non}-\text{interest income}}{\text{total operating income}})^2)$	Liang et al. (2020)	OJK/ Bank Quarterly Report
Market Concentration	$\sum_{i=1}^{n}\left[\frac{\text{Deposit}_{i,s,t}}{\sum_{i=1}^{n}\text{Deposit}_{i,s,t}}\right]^2$	Tran et al. (2022)	OJK/ Bank Quarterly Report
Asset	Ln (total asset)	Köhler (2014)	OJK/ Bank Quarterly Report
Capital Adequacy Ratio	$\frac{\text{Total Capital}_{i,t}}{\text{Total ATMR}_{i,t}}$	Tran et al. (2022)	OJK/ Bank Quarterly Report
COVID-19	Value of 1 for COVID period and 0 otherwise	Elnahass et al. (2021)	Government Press of the Republic of Indonesia

Notes: *OJK = Otoritas Jasa Keuangan (Financial Services Authority)*

Research Model

Generalized Method of Moment (GMM)

To address endogeneity issues in dynamic panel data, this study uses the generalized method of moments (GMM) (Arellano & Bond, 1991). GMM is a general estimator that provides a framework for comparison, allowing researchers to combine information from different moments and improve estimation efficiency. Furthermore, GMM offers a simpler alternative compared to other estimators, especially compared to maximum likelihood methods, which are often complex and require stricter distribution assumptions. Previous studies related to bank stability (Morgan & Pontines, 2018; Brei et al., 2020; Boulanouar et al., 2021; Pham et al., 2021; Tran et al., 2022; Shabir et al., 2023) have used GMM to address endogeneity. The banking sector's risk levels can affect MSME loans (Brei et al., 2020), which can lead to endogeneity. The GMM method was first introduced by Hansen (1982) and is a parameter estimation method that depends only on applied moment conditions. Moments refer to the expectations or average values of functions of random variables used to estimate parameters. There are two estimation methods used in GMM, namely first-differences GMM (FD-GMM) and system GMM (Sys-GMM).

FD-GMM is an estimation method used to address endogeneity and unobserved fixed effects in panel data. This method was developed by Manuel Arellano & Bond (1991). FD-GMM transforms data by taking the first difference of variables to remove unobserved fixed effects that can affect estimation results. By removing fixed effects, FD-GMM helps mitigate bias that may arise from unobserved variables that remain constant over time periods. The main steps in FD-GMM are differencing, instrumental variables, and estimation. Furthermore, Sys-GMM is an estimation method used to address endogeneity and unobserved fixed effects in panel data. This method was developed as an improvement over FD-GMM by Arellano & Bover (1995) and Blundell & Bond (1998). The steps in

Sys-GMM are similar to FD-GMM but involve adding level equations for instrumental variables. By adding level equations, stronger and more relevant instruments can be used, addressing weaknesses in instruments often seen in FD-GMM. Three criteria for determining between FD-GMM and Sys-GMM are valid instruments, consistency and unbiasedness (Arellano & Bond, 1991; Arellano & Bover, 1995; Blundell & Bond ,1998).

Using the GMM model, the independent variables will include the lagged value (lag -1) of the dependent variable. The model in this study using GMM is as follows:

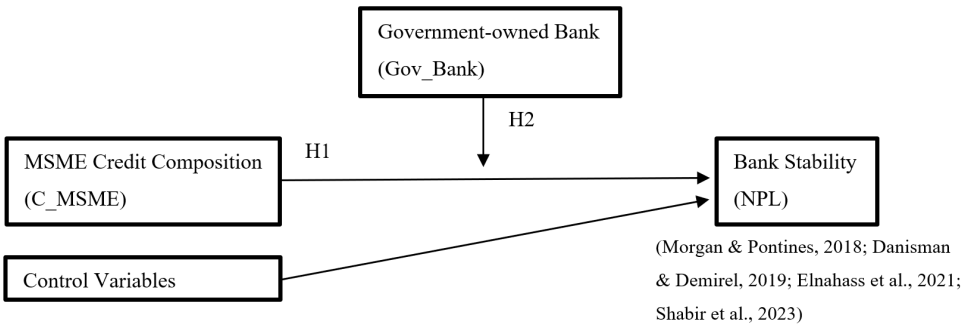

Figure 1. Research Model

For the robustness check of the model, as previously explained in the dependent variable, this study will use the Z-score indicator to measure the stability of each bank (Pham et al., 2021; Ali & Puah, 2018; Morgan & Pontines, 2018).

To elicit the effect of an increase in MSME credit composition on bank stability as well as the moderating effect of government ownership, we adopt prior research estimates (Morgan & Pontines, 2018; Brei et al., 2020), with some modifications, our baseline estimate is as follows;

$$NPL_{i,t} = \beta_0 + \beta_1 NPL_{i,t-1} + \beta_2 C\_MSME_{i,t} + \sum Control_{i,t} + \varepsilon_{i,t} \quad (3.1)$$

$$NPL_{i,t} = \beta_0 + \beta_1 NPL_{i,t-1} + \beta_2 C\_MSME_{i,t} + \beta_3 (C\_MSME_{i,t} \times Gov\_Bank) + \sum Control_{i,t} + \varepsilon_{i,t} \quad (3.2)$$

$$Z\_score_{i,t} = \beta_0 + \beta_1 Z\_score_{i,t-1} + \beta_2 C\_MSME_{i,t} + \sum Control_{i,t} + \varepsilon_{i,t} \quad (3.3)$$

$$Z\_score_{i,t} = \beta_0 + \beta_1 Z\_score_{i,t-1} + \beta_2 C\_MSME_{i,t} + \beta_3 (C\_MSME_{i,t} \times Gov\_Bank) + \sum Control_{i,t} + \varepsilon_{i,t} \quad (3.4)$$

In this study, $NPL_{i,t}$ represents the non-performing loans of bank i in quarter t, and Z_score denotes the Z-score of bank i for the same period, serving as the dependent variables. The independent variable examined is the composition of MSME loans, utilized as a proxy as per Morgan & Pontines (2018).

Previous literature has largely overlooked the moderating influence of government ownership on the relationship between increased MSME loan composition and bank stability. Variations in loan growth patterns and NPL rates suggest that government ownership may amplify, diminish, or alter the impact of increased MSME loan composition on bank stability. The moderating variable Gov_Bank takes a value of percentage of shares owned by the government (La Porta et al., 2002; Al-Janadi et al., 2016; Huang, 2022).

Results

Here we report our descriptive and inferential results. As shown in Table 2, the average non-performing loan (NPL) ratio across all banks during the observation period was 3.22%, with a standard deviation of 2.17%. This moderate average suggests that, overall, banks experienced some level of credit risk, while the variation reflects considerable differences in asset quality among banks. For the Z-score, which serves as a proxy for bank stability, the average value was 8.3572, with a standard deviation of 4.9421. The high standard deviation indicates notable heterogeneity in financial soundness among banks, both across institutions and over time. A lower Z-score implies a greater risk of insolvency, so the widespreadness suggests that while some banks maintained a strong capital buffer and earnings base, others remained vulnerable to financial shocks.

Regarding the MSME loan composition, the average proportion of MSME loans to total loans was 20.32%. However, this indicator displayed extreme variation, with values ranging from as low as 0.01% to nearly full exposure at 99.95%. This substantial spread underscores the diverse lending strategies and market segmentation among banks. Some institutions appear to focus almost exclusively on MSME lending, possibly due to targeted mandates or niche market positioning, while others maintain minimal exposure, likely due to perceived risks, regulatory preferences, or business models prioritizing corporate or consumer lending. The wide variation in MSME loan composition may also reflect banks' differing responses to external factors such as macroeconomic conditions, government support programs, and shifts in credit demand from the MSME sector—particularly during and after the COVID-19 pandemic. Furthermore, banks' credit risk appetite, availability of collateral, and internal risk management frameworks could also influence the extent to which they allocate capital to MSME lending.

Table 2. Descriptive Statistics Summary

Variables	Observation	Mean	Std. Dev.	Min	Max
NPL	1,536	0.0322	0.0217	0.0000	0.2227
Z-score	1,536	8.3572	4.9421	-0.0792	42.4521
MSME Loan Composition	1,536	0.2032	0.1864	0.0001	0.9995
Income Diversification	1,536	0.2246	0.1289	0.0072	0.5000
Market Concentration	1,536	0.0778	0.0025	0.0734	0.0820
Asset	1,536	17.0986	1.4255	13.4283	21.2834
Capital Adequacy Ratio	1,536	0.2952	0.2825	0.0802	5.3801

Notes: *The dataset consists of 1,536 observations, covering 96 banks over 16 quarters (from Q1 2019 to Q4 2022). All variables are interval scale, except for the Z-score (ratio). A higher non-performing loan (NPL) ratio indicates greater credit risk faced by the bank. A lower Z-score reflects a higher level of risk and reduced bank stability. MSME loan composition is measured as the ratio of MSME lending to total lending. A higher value indicates a greater proportion of loans directed to MSMEs. Income diversification reflects the extent to which a bank generates revenue from various sources; higher values indicate better diversification. A higher market concentration ratio implies a less competitive environment, with a few banks dominating the market. Larger asset values indicate greater bank size. A higher Capital Adequacy Ratio (CAR) signifies a bank's stronger ability to absorb potential losses and maintain stability. Several banks reported Capital Adequacy Ratios (CAR) exceeding 100% during certain periods, far surpassing the regulatory minimum threshold.*

Source: Financial Services Authority (OJK)/Bank Quarterly Report.

When categorized by ownership, as illustrated in Tables 3 and 4, government-owned banks (including state-owned and regional development banks) report lower non-performing loan (NPL) ratios on average compared to their non-government-owned counterparts. This finding suggests that government-owned banks tend to maintain better credit quality and exhibit more effective credit risk management. However, when bank stability is assessed using the Z-score as a proxy, the results indicate that non-government-owned banks demonstrate higher average Z-scores compared to government-owned banks. This implies that, overall, non-government-owned banks tend to be more stable, likely due to stronger capital buffers, more diversified income streams, and more market-driven operational models that incentivize prudent risk-taking and efficiency.

In terms of MSME loan composition, the average share of MSME loans is higher in non-government-owned banks. This indicates a more aggressive approach among private banks in penetrating the MSME sector, potentially driven by the desire to capture new growth markets and diversify lending portfolios. Notably, there is at least one private bank in the sample with an MSME loan composition exceeding 90%, indicating a strategic focus on the micro and ultra-micro segments. This suggests that some private banks are highly specialized in MSME lending, positioning themselves as niche players in financial inclusion. Interestingly, despite having a lower average, the variation in MSME loan composition is greater among government-owned banks. This reflects heterogeneity in lending strategies within the group, where some banks may aggressively support MSME lending due to government mandates or development missions, while others remain more conservative due to concerns over repayment risks or institutional limitations. The contrast between ownership types highlights the diverse institutional motivations and risk appetites that shape MSME lending behavior in Indonesia's banking sector.

These patterns highlight that while government-owned banks may benefit from better control over NPLs, non-government banks may achieve superior overall financial stability and stronger outreach to the MSME sector. The divergence also underscores the complexity of balancing financial stability, risk management, and financial inclusion goals across different types of bank ownership.

Table 3. Descriptive Statistics Summary (Government-owned Banks)

Variables	Observation	Mean	Std. Dev.	Min	Max
NPL	496	0.0296	0.0232	0.0029	0.2227
Z-score	496	6.6718	1.5536	1.9227	13.6811
MSME Loan Composition	496	0.1826	0.1759	0.0022	0.9464
Income Diversification	496	0.1929	0.0945	0.0616	0.5000
Market Concentration	496	0.0778	0.0025	0.0734	0.0820
Asset	496	17.3434	1.4447	15.4902	21.2834
Capital Adequacy Ratio	496	0.2259	0.0475	0.0802	0.4963

Notes: *The dataset comprises 496 observations, covering 31 government-owned banks (both state-owned banks and regional development banks) for 16 quarters (from Q1 2019 to Q4 2022). All variables are measured on an interval scale, except for the Z-score, which is presented as a ratio. The highest Capital Adequacy Ratio (CAR) among regional banks was recorded in Q3 2020, primarily due to an increase in Non-Performing Loans (NPL).*
Source: Financial Services Authority (OJK)/Bank Quarterly Report.

Table 4. Descriptive Statistics Summary (Non Government-owned Banks)

Variables	Observation	Mean	Std. Dev.	Min	Max
NPL	1,040	0.0335	0.0208	0.0000	0.1673
Z-score	1,040	9.1610	5.7386	-0.0792	42.4521
MSME Loan Composition	1,040	0.2129	0.1906	0.0001	0.9995
Income Diversification	1,040	0.2397	0.1399	0.0072	0.5000
Market Concentration	1,040	0.0778	0.0025	0.0734	0.0820
Asset	1,040	16.9819	1.4019	13.4283	20.9728
Capital Adequacy Ratio	1,040	0.3282	0.3369	0.0983	5.3801

Notes: *The dataset comprises 1,040 observations, covering 65 private banks over 16 quarters (from Q1 2019 to Q4 2022). All variables are measured on an interval scale, except for the Z-score, which is presented as a ratio. One bank reported an MSME loan portfolio composition exceeding 99%, reflecting its strategic focus on the micro and ultra-micro segments. Additionally, the most notable case related to capital adequacy occurred in Q1 2021, when a bank that had transitioned into a digital bank in 2020 recorded an exceptionally high Capital Adequacy Ratio (CAR) of 538%. This unusually high CAR was primarily driven by a substantial capital injection that significantly increased the bank's capital base, while its risk-weighted assets remained relatively low. Such conditions are typical among newly established or transitioning digital banks, which often receive significant investor funding but have yet to develop a large-scale lending portfolio.*

Source: Financial Services Authority (OJK)/Bank Quarterly Report.

The results in Table 5 show that the relationships between the variables are generally weak. MSME loan composition has a small positive link with NPL (7.3%), meaning that lending more to MSMEs could slightly raise credit risk. On the other hand, bank assets and CAR have negative links with NPL (-10.62% and -6.76%), suggesting that larger banks with strong capital are better at managing credit risk and handling potential losses.

Table 5. Correlation Between Variables (Stability Proxy: NPL)

	NPL	MSME Loan Composition	Income Diversification	Market Concentration	Asset	Capital Adequacy Ratio
NPL	1.0000					
MSME Loan Composition	0.0730*	1.0000				
Income Diversification	0.0102	-0.2388*	1.0000			
Market Concentration	0.0180	-0.0307	0.0265	1.0000		
Asset	-0.1062*	-0.1441*	0.3752*	0.0338	1.0000	
Capital Adequacy Ratio	-0.0676*	0.0963*	-0.1252*	0.0732*	-0.2842*	1.0000

Notes: ** Significance level at 5%. A score close to 1 indicates a strong positive correlation, while a score near 0 indicates a weak correlation. A positive sign shows a linear relationship, while a negative sign indicates an inverse relationship.*

Source: Financial Services Authority (OJK)/Bank Quarterly Report.

Table 6 shows how the Z-score relates to other variables. It has a negative correlation of -9.81% with income diversification, meaning more diverse income doesn't always

lead to higher stability. On the other hand, the Z-score has a strong positive correlation (9.45%) with CAR, suggesting that banks with stronger capital tend to be more stable.

Table 6. Correlation Between Variables (Stability Proxy: Z-Score)

	Z-Score	MSME Loan Composition	Income Diversification	Market Concentration	Asset	Capital Adequacy Ratio
Z-Score	1.0000					
MSME Loan Composition	0.0125	1.0000				
Income Diversification	-0.0981*	-0.2388*	1.0000			
Market Concentration	0.0129	-0.0307	0.0265	1.0000		
Asset	-0.0468	-0.1441*	0.3752*	0.0338	1.0000	
Capital Adequacy Ratio	0.0945*	0.0963*	-0.1252*	0.0732*	-0.2842*	1.0000

Notes: ** Significance level at 5%. A score close to 1 indicates a strong positive correlation, while a score near 0 indicates a weak correlation. A positive sign shows a linear relationship, while a negative sign indicates an inverse relationship.*

Source: Financial Services Authority (OJK)/Bank Quarterly Report.

Increase of MSME Lending Composition

Based on the results obtained in Tables 8, the conclusions are as follows:

An increase in the composition of MSME loans negatively affects bank stability, as evidenced by both the NPL and Z-score proxies. For the NPL proxy, a higher MSME loan composition is associated with higher non-performing loans, indicating deteriorating credit quality and lower bank stability. Similarly, for the Z-score proxy, a higher composition of MSME loans corresponds to lower Z-scores, which also signifies increased risk and reduced stability. These findings are consistent across models, including those with government ownership as a moderating variable.

However, these results contrast with the findings of Morgan & Pontines (2018) and Brei et al. (2020), who generally reported that MSME lending contributes positively to bank stability. The divergence can be attributed to key contextual differences. First, this study focuses on Indonesia, while Morgan & Pontines (2018) and Brei et al. (2020) analyzed cross-country data from several Asian economies. The Indonesian banking system, MSME credit landscape, and regulatory environment may exhibit characteristics that differ significantly from those in other emerging markets. Secondly, this study also covers during the post- COVID 19 period, a time when MSMEs in Indonesia faced heightened vulnerability, cash flow disruptions, and repayment challenges. These unique economic shocks may have deteriorated the performance of MSME loans, thereby weakening bank stability.

In addition, the negative relationship may also be explained by the quality of MSME credit portfolios in Indonesia. The findings suggest that many banks are exposed to MSMEs with poor collectibility and high default risks. As Ghosh et al. (2000) noted, even in developing countries where lenders are geographically close to borrowers, moral hazard and default risks can still persist. Moreover, Berger & Udell (1992) emphasized the significant role of asymmetric information in MSME lending, which often results in ad-

verse selection and moral hazard. These problems are especially pronounced in the MSME segment due to the lack of financial records, informal business operations, and limited credit histories.

The negative impact of increased MSME loan composition on bank stability can be attributed to the high level of asymmetric information inherent in the MSME sector. Asymmetric information, where banks have less information about the creditworthiness of MSME borrowers compared to larger, more established firms, leads to adverse selection and moral hazard issues. This information gap makes it difficult for banks to accurately assess the risk of MSME loans, resulting in higher default rates and non-performing loans. Consequently, despite the socio-economic benefits of supporting MSMEs, the inherent risks associated with asymmetric information can undermine bank stability, particularly in environments where credit risk management practices are less rigorous. In conclusion, hypothesis 1 has not been met due to the negative effect from the increase of the composition of MSME loans on bank stability.

Moderating Effect of Government Ownership

The moderating effect of government ownership reveals that the direct relationship between the increase in the composition of MSME loans and bank stability remains negative, consistent with the results observed in the model without moderation (models 3.1 and 3.3). This means that, in general, a higher share of MSME loans is still associated with a decline in bank stability, probably due to the higher credit risk and repayment uncertainty often found in the MSME segment.

The result from the moderation model (models 3.2 and 3.4) shows that although the increase in MSME loan composition generally has a negative effect on bank stability (as also shown in the model without moderation), government ownership moderates this relationship and turns the impact into a positive one. In other words, for government-owned banks, a higher share of MSME loans may actually contribute to stronger bank stability. The descriptive data from this study show that government-owned banks have lower NPL ratios than private banks, even though they may have significant MSME loan exposure.

This finding can be explained by several theories and previous literature:

1. Social and Political Priorities (La Porta et al., 2002): Government-owned banks are often encouraged to finance projects with high social and political value, including MSME development. Although these projects may not always promise high financial returns, they often receive government support in the form of guarantees, subsidies, or special programs. This support can reduce credit risk and enhance overall stability. This is supported by the descriptive findings in the study, which show that government-owned banks have lower NPLs than private banks.
2. Different Risk Management Approaches (Boulanouar et al., 2021; Demirgüç-Kunt & Detragiache, 2002): Government banks often adopt a more cautious and policy-driven approach to risk management. With a mandate to promote financial inclusion and system stability, they may implement stricter credit control mechanisms even when expanding their MSME loan portfolios. This helps them maintain asset quality and mitigate the risks usually associated with MSME lending.

3. Lack of Focus on Profitability (Sapienza, 2004): Unlike private banks that are profit-maximizing entities, government-owned banks can afford to balance social goals with financial sustainability. Government support mechanisms, such as credit guarantees and subsidized interest rates, can buffer the risk associated with MSME loans. As a result, although profitability may be lower, the portfolio quality can remain stable or even improve, especially when the MSME segment is actively managed and supported.

Although both moderation models (3.2 and 3.4) indicate a positive relationship between MSME loan composition and bank stability, only the NPL-based model yields statistically significant results, whereas the Z-score model does not. This finding aligns with the results of the nested Wald test in Table 7, which shows that MSME Loan Composition and its interaction with Government-owned Banks have a significant joint effect on bank stability when measured by the NPL ratio. However, this joint effect is not statistically significant when bank stability is proxied by the Z-score. This difference can be explained by the nature of the two stability indicators. NPL is a direct measure of credit risk and reflects short-term changes in loan quality. It is highly sensitive to shifts in lending, especially to higher-risk sectors like MSMEs. In contrast, the Z-score is a broader, long-term measure of bank stability that includes profitability, leverage, and earnings volatility. Because of this, changes in MSME lending may quickly impact NPLs, but take more time or be influenced by other factors before significantly affecting the Z-score.

The findings of this study, particularly the moderating role of government ownership in mitigating the negative impact of MSME loan composition on bank stability, align with Indonesia's unique regulatory and institutional context. The Indonesian government has historically played an active role in promoting financial inclusion through MSME financing, as reflected in several key policies, such as Bank Indonesia Regulation No. 17/12/PBI/2015, which mandated banks to gradually increase their MSME loan share to 20% by 2018, and the more recent Member of Board of Governors Regulation (PADG) No. 24/6/PADG/2022, which encourages annual increases in inclusive financing ratios (RPIM) up to 30%. These regulations have positioned government-owned banks at the forefront of MSME credit expansion, supported by policy tools such as subsidized interest rates, credit guarantees, and capital injections, especially during the COVID-19 pandemic through the National Economic Recovery (PEN) program. This institutional support enables government banks to maintain asset quality despite higher exposure to the inherently riskier MSME segment, which helps explain why their higher MSME loan share correlates with lower NPLs and, in turn, better credit risk performance. Thus, the Indonesian context not only reinforces the empirical findings but also illustrates how institutional frameworks and ownership structures can shape the risk-return dynamics of MSME lending in emerging economies.

According to the agency theory, government ownership introduces potential agency conflicts due to differing objectives between government stakeholders and bank managers. Government-owned banks are often expected to fulfill social and political objectives, such as expanding MSME lending, regardless of financial returns. This can lead to agency problems if managers prioritize these public mandates over risk management and profitability. However, the results from the moderation model suggest a more nuanced picture. While the direct effect of increased MSME loan composition is negative

for bank stability (as seen in the model without moderation), government ownership moderates this relationship and shifts the impact into a positive one. This implies that in government-owned banks, especially in Indonesia, MSME lending may actually contribute to improved stability, possibly due to stronger oversight, risk-sharing mechanisms, or policy support that helps mitigate the risks typically associated with MSME lending. Consequently, Hypothesis 2 is not supported, as government ownership moderates the relationship in a way that enhances, rather than diminishes, bank stability.

Table 7. Wald Test for Moderating Effect

Variables MSME Loan Composition x Government-Owned Banks	NPL		Z-score	
	(1) Sys-GMM Model	(2) Sys-GMM Model	(3) Sys-GMM Model	(4) Sys-GMM Model
chi2		7.32		0.05
Prob > chi2		0.0257*		0.9745

Notes: ****, **, and * denote significance levels at 1%, 5%, and 10%, respectively. Column (1) reports the results of Model 3.1, Column (2) for Model 3.2, Column (3) for Model 3.3, and Column (4) for Model 3.4. The variable MSME Loan Composition and its interaction term MSME Loan Composition × Government-Owned Banks have a significant joint effect on bank stability, as proxied by the NPL ratio. However, this effect is not statistically significant when using the Z-score as the stability proxy.*

Source: Financial Services Authority (OJK)/Bank Quarterly Report.

Table 8. Summary of Analysis

Variables	NPL		Z-score	
	(1) Sys-GMM Model	(2) Sys-GMM Model	(3) Sys-GMM Model	(4) Sys-GMM Model
NPL_{t-1}	0.7420***	0.7421***		
$Z\text{-score}_{t-1}$			0.6108***	0.6108***
MSME Loan Composition	0.0179***	0.0216***	-5.3115***	-7.9219***
MSME Loan Composition x Government-Owned Banks		-0.0104***		3.6839
Income Diversification	-0.0109***	-0.0110***	-17.6278***	-16.9381***
Market Concentration	0.0705***	0.0821***	22.2019*	20.4155*
Asset	-0.0045***	-0.0041***	-24.0643***	-24.0470***
Capital Adequacy Ratio	-0.0068***	-0.0068***	20.6153***	20.7320***
COVID	0.0026***	0.0025***	-2.6483***	-2.6558***
Cons	0.0788***	0.0717***	431.0557***	430.7246***
Validity Test (Sargan)	Valid	Valid	Valid	Valid
Consistency Test	Consistent	Consistent	Consistent	Consistent
Unbiasedness Test	Unbiased	Unbiased	Unbiased	Unbiased
N	1,440	1,440	1,440	1,440

Notes: ****, **, and * denote significance levels at 1%, 5%, and 10%, respectively. The reduction in observations from 1,536 to 1,440 is due to the use of lagged variables in the GMM estimation, which necessitates dropping*

the first time period for each bank to construct valid instruments. Given 96 banks over 16 quarters, this results in 96 × 15 = 1,440 usable observations. Column (1) reports the results of Model 3.1, Column (2) for Model 3.2, Column (3) for Model 3.3, and Column (4) for Model 3.4. All models have passed both the validity test (Sargan test) and the consistency test (Arellano-Bond), confirming that the models are statistically reliable. The system GMM (SYS-GMM) estimator is used to address potential endogeneity and ensure unbiasedness. The choice of SYS-GMM is supported by the constant term falling between the coefficients estimated from the common effect model (CEM) and the fixed effect model (FEM), indicating its suitability.

Source: Financial Services Authority (OJK)/Bank Quarterly Report.

For control variables, the capital adequacy ratio shows a positive effect on bank stability (Köhler, 2014; Adem, 2023), while COVID-19 shows a negative effect on stability (Duan et al., 2021; Elnahass et al., 2021). Other control variables such as income diversification, market concentration, and assets have different results depending on the stability proxies used.

Income diversification positively impacts bank stability when measured using the NPL proxy (Adesina, 2021). However, this result reverses to negative when tested with the z-score proxy in the robustness test (Wu et al., 2020). Similarly, market concentration shows a positive impact on bank stability when measured with the NPL proxy (Boot & Thakor, 2012), but this result also turns negative with the z-score proxy (Berger et al., 2010). Furthermore, asset size positively impacts bank stability when measured with the NPL proxy (Mishkin, 1999), yet it reverses to a negative impact when tested with the z-score proxy in the robustness test (Fu et al., 2014). These findings highlight the sensitivity of bank stability measures to different proxies and suggest that the choice of proxy can significantly influence the observed impact of various factors on stability.

Conclusion

The study shows that a higher share of MSME loans in a bank's portfolio is generally linked to lower stability. This is likely due to challenges in assessing MSME creditworthiness, such as limited financial records, lack of collateral, and weak documentation. These conditions lead to higher non-performing loans (NPLs) and greater default risks. This supports Berger & Udell (1992) view that asymmetric information increases lending risks.

MSMEs also tend to operate in unstable markets and are more vulnerable during economic downturns (Beck & Torre, 2007), which adds to credit risk. This was especially true in Indonesia after the COVID-19 pandemic. These findings differ from some cross-country studies (e.g., Morgan & Pontines, 2018, and Brei et al., 2020), which found that MSME lending can enhance stability. The difference likely reflects unique national factors, such as regulations, banking structures, and the pace of post-pandemic recovery.

However, the study also finds that government ownership can reduce the risks of MSME lending. In banks with higher government ownership, the negative link between MSME lending and stability becomes positive. This suggests government-owned banks are better equipped to handle MSME-related risks.

There are several reasons for this. Government banks often have development-focused missions and are not pressured to pursue short-term profits (Sapienza, 2004). They receive policy support, apply different risk strategies (Demirgüç-Kunt & Detragiache, 2002; Boulanouar et al., 2021), and may benefit from targeted programs. The study also found that government banks have lower NPLs, which supports this explanation.

While agency the theory argues that government ownership can lead to conflicting goals, such as favoring social programs over financial soundness, this study shows that good oversight and institutional experience help government banks manage these risks effectively. Although both the NPL and Z-score models show positive moderation effects, only the NPL model results are statistically significant, likely because NPLs reflect short-term loan quality more directly.

While MSME lending carries more risk, it can support bank stability if managed well, especially in government-owned banks that operate under development mandates and benefit from stronger oversight and policy tools. This highlights the need for balanced policies that promote MSME growth while ensuring sound risk practices. Government support, institutional capacity, and ownership structures all play important roles in determining outcomes.

Based on the findings, the implications of this study can inform both regulatory and banking practices. For regulators, promoting sustainable MSME financing requires complementing policies such as PADG No. 24/6/PADG/2022 with stronger risk management standards, including more robust credit profiling, stress testing, and segmentation of MSME loan portfolios. The development of a centralized database on MSME credit behavior would also help reduce information asymmetry and improve lending decisions. For banks, especially private institutions, managers should enhance MSME-specific risk management systems by adopting advanced credit scoring models, improving loan monitoring, and utilizing digital tools for early risk detection. Collaborating with government programs may also help distribute risk more effectively and improve overall portfolio quality.

In terms of academic contribution, this study adds to the literature by focusing on a single-country, post-pandemic context, specifically Indonesia, differentiating it from previous studies such as Morgan & Pontines (2018) and Brei et al. (2020), which relied on cross-country data under more stable macroeconomic conditions. By capturing the unique institutional, regulatory, and economic environment in Indonesia, especially during and after COVID-19, this study offers a more nuanced understanding of how MSME lending affects bank stability. Furthermore, this moderating effect aligns with theoretical perspectives suggesting that government-owned banks, driven by social and political mandates (La Porta et al., 2002), supported by policy tools, and applying different risk management strategies (Boulanouar et al., 2021; Demirgüç-Kunt & Detragiache, 2002), are better equipped to manage MSME-related risks. Their lower emphasis on profitability (Sapienza, 2004) also enables them to serve high-risk segments like MSMEs more sustainably.

Limitations

This study acknowledges several limitations that may affect both its internal and external validity. The findings are based on a specific period and the unique institutional and regulatory context of Indonesian banks, which may limit their generalizability to other countries or timeframes. Future research is encouraged to refine and expand upon these results to deepen the understanding of the MSME bank stability relationship:

1. Limited availability of MSME-related loan data: The analysis primarily uses the composition of MSME loans as a proxy to represent banks' MSME expo-

sure. Other potentially influential variables, such as MSME-specific loan interest rates, collateral coverage, or credit guarantee programs, are not included due to a lack of publicly available bank-level data.

2. Government ownership proxy: Government ownership is measured as the percentage of government shares in each bank. While this provides a more nuanced view than a simple dummy variable, the study does not capture whether MSME lending is strategically prioritized within each bank, as strategic priorities are not disclosed in public reports.
3. Bank stability measures: This study uses NPL ratios and Z-scores as proxies for bank stability. However, MSME-specific NPL data are not used due to its absence in previous literature and limited public access. This may dilute the precision of the stability measure for banks with high MSME loan exposure. Additionally, the difference in significance between NPL and Z-score results may reflect the nature of these indicators. NPLs are short-term and highly sensitive to loan quality changes, whereas Z-scores are broader, long-term indicators that incorporate profitability, capital adequacy, and earnings volatility. These differences in proxy sensitivity may explain why the moderating effect of government ownership appears significant for NPLs but not for Z-scores.
4. Limited existing literature: Research specifically examining the relationship between MSME loan composition and bank stability remains limited, especially in emerging markets. This study contributes to filling this gap, but further empirical research across different countries and regulatory contexts is needed to validate and extend these findings.

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Appendix

Data

Bank Cluster	List of Banks After Cleansing Data
State-owned Banks	Bank BRI, Bank Mandiri, Bank BNI, Bank BTN.
Regional Development Banks	Bank BJB, Bank Sumut, Bank NTT, Bank DKI, Bank Bengkulu, Bank Maluku Malut, Bank Sulteng, Bank Jateng, Bank DIY, Bank Jatim, Bank Jambi, Bank Riau Kepri, Bank Nagari, Bank Sumsel Babel, Bank Lampung, Bank Aceh, Bank Kalsel, Bank Kalbar, Bank Kalteng, Bank Kaltimtara, Bank Sulselbar, Bank Sulutgo, Bank Sultra, Bank Banten, Bank Bali, Bank Papua dan Bank NTB Syariah.
National Private Banks	Bank Danamon, Bank BCA, Bank Maybank, Bank Permata, Bank Panin, Bank CIMB Niaga, Bank UOB, Bank OCBC NISP, Bank Artha Graha, Bank HSBC, Bank Bumi Arta, Bank Jtrust, Bank Mayapada, Bank of India, Bank Mestika, Bank Shinhan, Bank Sinarmas, Bank Maspion, Bank Ganesha, Bank ICBC, Bank QNB, Bank Woori Saudara, Bank Mega, Bank KB Bukopin, Bank KEB Hana, Bank Raya, Bank SBI,Bank Index, Bank MNC, Bank Hi, Bank CCB,Bank DBS, Bank Resona, Bank Capital, Bank ANZ, Bank IBK, Bank CTBC, Bank Commonwealth, Bank BPTN, Bank Krom, Bank Jasa Jakarta, Bank Neocommerce, Bank Nationalnobu, Bank Ina, Bank Sampoerna, Bank OK, Bank Amar, Bank Seabank, Bank Jago, Bank Multiarta, Bank Superbank, Bank Mandiri Taspen, Bank Victoria, Bank Muamalat, Bank BTPN Syariah, Bank Panin Dubai Syariah, Bank BCA Syariah, Bank Mega Syariah, Bank BJB Syariah, Bank KB Bukopin Syariah, Bank Victoria Syariah, Bank Aladin Syariah Bank Syariah Indonesia.
Foreign Banks	Bank Citibank, Bank Standard Chartered, Bank Deutsche.
Total	**96**

Stata Output

```
System dynamic panel-data estimation          Number of obs      =      1,440
Group variable: count                         Number of groups   =         96
Time variable: qdate

                                              Obs per group:
                                                           min =         15
                                                           avg =         15
                                                           max =         15

Number of instruments =    126                Wald chi2(7)       =  568001.06
                                              Prob > chi2        =     0.0000
Two-step results
```

StabilityNPL	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
StabilityNPL						
L1.	.7420789	.0021565	344.12	0.000	.7378523	.7463055
MSMELoanCompositionC_MSME	.0179019	.0006573	27.23	0.000	.0166136	.0191903
IncomeDiversificationIDV	-.01093	.0003296	-33.17	0.000	-.0115759	-.010284
MarketConcentrationMKC	.0705489	.0112439	6.27	0.000	.0485112	.0925866
LnAssetAsset	-.0045259	.000164	-27.60	0.000	-.0048473	-.0042045
CapitalAdequacyRatioCAR	-.0068962	.0000753	-91.63	0.000	-.0070437	-.0067487
CovidPeriodCVD	.0026417	.000096	27.51	0.000	.0024535	.00283
_cons	.0788185	.0032797	24.03	0.000	.0723904	.0852466

Variable	fem	fdgmm	sygmm	cem
StabilityNPL				
L1.	.59342913***	.6655399***	.74207893***	.85892299***
MSMELoanCo~E	.01042725*	.01565473***	.01790194***	.00243412
IncomeDive~V	-.01466458***	-.01189421***	-.01092995***	-.00180664
MarketConc~C	.00646401	-.0021808	.0705489***	.07649269
LnAssetAsset	-.0064624***	-.00843864***	-.00452586***	-.00020179
CapitalAde~R	-.00069117	-.00467624***	-.00689618***	-.00211295*
CovidPerio~D	.00178916*	.00324835***	.00264174***	-.00004543
_cons	.12300677***	.15334024***	.07881846***	.00237431
N	1440	1344	1440	1440

legend: * p<0.05; ** p<0.01; *** p<0.001

System dynamic panel-data estimation — Number of obs = 1,440
Group variable: count — Number of groups = 96
Time variable: qdate

Obs per group:
min = 15
avg = 15
max = 15

Number of instruments = 127 — Wald chi2(8) = 1.35e+06
Prob > chi2 = 0.0000

Two-step results

StabilityNPL	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
StabilityNPL						
L1.	.7421403	.0014971	495.72	0.000	.739206	.7450745
MSMELoanCompositionC_MSME	.0216332	.0003235	66.87	0.000	.0209991	.0222672
MSMELoanCompositionxGovernme	-.0104353	.0011651	-8.96	0.000	-.0127188	-.0081517
IncomeDiversificationIDV	-.0110335	.0003606	-30.60	0.000	-.0117402	-.0103268
MarketConcentrationMKC	.082135	.0121624	6.75	0.000	.0582973	.1059728
LnAssetAsset	-.0041677	.0001626	-25.63	0.000	-.0044864	-.0038489
CapitalAdequacyRatioCAR	-.0068809	.000084	-81.89	0.000	-.0070456	-.0067163
CovidPeriodCVD	.002539	.0001143	22.20	0.000	.0023149	.0027631
_cons	.0717442	.0033184	21.62	0.000	.0652403	.0782481

Variable	fem	fdgmm	sygmm	cem
StabilityNPL				
L1.	.59332***	.66565089***	.74214027***	.85827098***
MSMELoanCo~E	.0098271	.01864743***	.02163318***	.00301351
MSMELoanCo~e	.00162833	-.00707758***	-.01043529***	-.00256854
IncomeDive~V	-.01465502***	-.0117085***	-.01103349***	-.00220684
MarketConc~C	.00798727	-.00535464	.08213504***	.07477436
LnAssetAsset	-.00646361***	-.00820011***	-.00416767***	-.00016941
CapitalAde~R	-.00071845	-.00481848***	-.00688094***	-.00225809*
CovidPerio~D	.00177671	.00325073***	.00253902***	-.00002523
_cons	.1229642***	.14950201***	.07174422***	.00211023
N	1440	1344	1440	1440

legend: * p<0.05; ** p<0.01; *** p<0.001

System dynamic panel-data estimation — Number of obs = 1,440
Group variable: count — Number of groups = 96
Time variable: qdate

Obs per group:
min = 15
avg = 15
max = 15

Number of instruments = 126 — Wald chi2(7) = 4.02e+07
Prob > chi2 = 0.0000

Two-step results

StabilityZ_Score	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
StabilityZ_Score						
L1.	.6108412	.0001722	3546.55	0.000	.6105037	.6111788
MSMELoanCompositionC_MSME	-5.311504	.3790345	-14.01	0.000	-6.054398	-4.56861
IncomeDiversificationIDV	-17.62784	.4685228	-37.62	0.000	-18.54613	-16.70955
MarketConcentrationMKC	22.20197	9.064195	2.45	0.014	4.436472	39.96746
LnAssetAsset	-24.06439	.1529946	-157.29	0.000	-24.36426	-23.76453
CapitalAdequacyRatioCAR	20.61537	.230166	89.57	0.000	20.16425	21.06649
CovidPeriodCVD	-2.648364	.0971558	-27.26	0.000	-2.838786	-2.457943
_cons	431.0557	2.548224	169.16	0.000	426.0613	436.0502

Variable	fem	fdgmm	sygmm	cem
StabilityZ~e				
L1.	.61053774***	.33335891***	.61084124***	.82587934***
MSMELoanCo~E	2.121004	6.2780707***	-5.311504***	-4.1061293
IncomeDive~V	-18.710123	-22.218617***	-17.627839***	-11.490239
MarketConc~C	85.421596	573.66212***	22.201967*	168.7448
LnAssetAsset	-9.0385806*	-21.209988***	-24.064391***	-.64185561
CapitalAde~R	16.889815***	17.044705***	20.615369***	6.6466645*
CovidPerio~D	.62455012	-8.2154062***	-2.6483644***	-1.0869038
_cons	166.11064*	356.92581***	431.05574***	9.2541715
N	1440	1344	1440	1440

legend: * p<0.05; ** p<0.01; *** p<0.001

System dynamic panel-data estimation — Number of obs = 1,440
Group variable: count — Number of groups = 96
Time variable: qdate

Obs per group:
min = 15
avg = 15
max = 15

Number of instruments = 127 — Wald chi2(8) = 3.35e+07
Prob > chi2 = 0.0000

Two-step results

StabilityZ_Score	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
StabilityZ_Score						
L1.	.6108926	.0002145	2848.54	0.000	.6104722	.6113129
MSMELoanCompositionC_MSME	-7.921933	1.381417	-5.73	0.000	-10.62946	-5.214407
MSMELoanCompositionxGovernme	3.6839	2.330628	1.58	0.114	-.8840465	8.251847
IncomeDiversificationIDV	-16.93813	.560035	-30.24	0.000	-18.03578	-15.84048
MarketConcentrationMKC	20.41557	10.21488	2.00	0.046	.3947745	40.43637
LnAssetAsset	-24.04703	.146724	-163.89	0.000	-24.3346	-23.75946
CapitalAdequacyRatioCAR	20.73205	.3339175	62.09	0.000	20.07758	21.38652
CovidPeriodCVD	-2.655898	.0966047	-27.49	0.000	-2.845239	-2.466556
_cons	430.7247	2.687495	160.27	0.000	425.4573	435.9921

Variable	fem	fdgmm	sygmm	cem
StabilityZ~e				
L1.	.61052154***	.33289713***	.61089256***	.8247262***
MSMELoanCo~E	2.7733609	8.4686954***	-7.9219333***	-2.5612505
MSMELoanCo~e	-1.7729508	-5.4534837*	3.6839	-6.9220107
IncomeDive~V	-18.722018	-22.605559***	-16.93813***	-12.638406
MarketConc~C	83.736228	570.99609***	20.415573*	164.43707
LnAssetAsset	-9.0391688*	-21.07201***	-24.04703***	-.54959885
CapitalAde~R	16.919918***	17.108857***	20.732051***	6.2822754*
CovidPerio~D	.63869582	-8.1072237***	-2.6558977***	-1.0365536
_cons	166.19634*	353.50217***	430.72469***	8.4463316
N	1440	1344	1440	1440

legend: * p<0.05; ** p<0.01; *** p<0.001

System dynamic panel-data estimation — Number of obs = 1,440
Group variable: count — Number of groups = 96
Time variable: qdate

Obs per group:
min = 15
avg = 15
max = 15

Number of instruments = 127 — Wald chi2(7) = 34.49
Prob > chi2 = 0.0000

One-step results

StabilityNPL	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
StabilityNPL						
L1.	.3317747	.0825357	4.02	0.000	.1700076	.4935417
MSMELoanCompositionC_MSME	.0345646	.013802	2.50	0.012	.0075131	.061616
IncomeDiversificationIDV	-.0263592	.0093401	-2.82	0.005	-.0446654	-.0080529
MarketConcentrationMKC	.1468119	.2830485	0.52	0.604	-.407953	.7015767
LnAssetAsset	-.0058665	.0032991	-1.78	0.075	-.0123327	.0005997
CapitalAdequacyRatioCAR	-.0086208	.0045554	-1.89	0.058	-.0175491	.0003075
CovidPeriodCVD	.0007441	.0026017	0.29	0.775	-.0043551	.0058434
_cons	.1113327	.062017	1.80	0.073	-.0102184	.2328838

System dynamic panel-data estimation — Number of obs = 1,440
Group variable: count — Number of groups = 96
Time variable: qdate

Obs per group:
min = 15
avg = 15
max = 15

Number of instruments = 128 — Wald chi2(8) = 34.38
Prob > chi2 = 0.0000

One-step results

StabilityNPL	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
StabilityNPL						
L1.	.3326547	.0833852	3.99	0.000	.1692228	.4960867
MSMELoanCompositionC_MSME	.0379683	.0148272	2.56	0.010	.0089076	.067029
MSMELoanCompositionxGovernme	-.0109191	.0255193	-0.43	0.669	-.060936	.0390978
IncomeDiversificationIDV	-.0265967	.0093199	-2.85	0.004	-.0448633	-.00833
MarketConcentrationMKC	.1392402	.2772635	0.50	0.616	-.4041862	.6826666
LnAssetAsset	-.0056724	.0034269	-1.66	0.098	-.0123891	.0010442
CapitalAdequacyRatioCAR	-.0085294	.0045614	-1.87	0.061	-.0174695	.0004108
CovidPeriodCVD	.000788	.0025605	0.31	0.758	-.0042305	.0058065
_cons	.1084489	.0648947	1.67	0.095	-.0187424	.2356402

```
 ( 1)  MSMELoanCompositionC_MSME = 0
 ( 2)  MSMELoanCompositionxGovernme = 0

           chi2(  2) =    7.32
         Prob > chi2 =    0.0257
```

```
System dynamic panel-data estimation          Number of obs      =     1,440
Group variable: count                         Number of groups   =        96
Time variable: qdate
                                              Obs per group:
                                                           min =        15
                                                           avg =        15
                                                           max =        15

Number of instruments =    127                Wald chi2(7)       =    121.13
                                              Prob > chi2        =    0.0000
One-step results
```

StabilityZ_Score	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
StabilityZ_Score						
L1.	.4374173	.0678829	6.44	0.000	.3043693	.5704653
MSMELoanCompositionC_MSME	-.7021426	13.73304	-0.05	0.959	-27.61841	26.21412
IncomeDiversificationIDV	-15.10998	19.95421	-0.76	0.449	-54.21952	23.99956
MarketConcentrationMKC	92.73807	1121.88	0.08	0.934	-2106.106	2291.583
LnAssetAsset	-25.9648	8.008851	-3.24	0.001	-41.66186	-10.26774
CapitalAdequacyRatioCAR	13.87969	9.682365	1.43	0.152	-5.097397	32.85678
CovidPeriodCVD	-3.855099	8.445084	-0.46	0.648	-20.40716	12.69696
_cons	468.0488	178.4418	2.62	0.009	118.3092	817.7884

```
System dynamic panel-data estimation          Number of obs      =     1,440
Group variable: count                         Number of groups   =        96
Time variable: qdate
                                              Obs per group:
                                                           min =        15
                                                           avg =        15
                                                           max =        15

Number of instruments =    128                Wald chi2(8)       =    120.01
                                              Prob > chi2        =    0.0000
One-step results
```

StabilityZ_Score	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
StabilityZ_Score						
L1.	.4370796	.0676847	6.46	0.000	.3044199	.5697392
MSMELoanCompositionC_MSME	11.08791	51.64599	0.21	0.830	-90.13636	112.3122
MSMELoanCompositionxGovernme	-24.16384	106.5291	-0.23	0.821	-232.9571	184.6294
IncomeDiversificationIDV	-16.11452	17.16862	-0.94	0.348	-49.76439	17.53536
MarketConcentrationMKC	89.62634	1129.642	0.08	0.937	-2124.431	2303.683
LnAssetAsset	-25.70276	8.183877	-3.14	0.002	-41.74287	-9.662658
CapitalAdequacyRatioCAR	14.02539	9.516082	1.47	0.141	-4.625785	32.67657
CovidPeriodCVD	-3.727707	8.821343	-0.42	0.673	-21.01722	13.56181
_cons	462.7853	174.2294	2.66	0.008	121.302	804.2686

```
 ( 1)  MSMELoanCompositionC_MSME = 0
 ( 2)  MSMELoanCompositionxGovernme = 0

           chi2(  2) =    0.05
         Prob > chi2 =    0.9745
```