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THE BANK SPECIFIC DETERMINANTS OF LOAN GROWTH AND STABILITY: EVIDENCE FROM INDONESIA

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ABSTRACT

Introduction/Main Objectives: This study aims to examine the specific determinants of loan growth and the consequences of excessive loan growth on bank stability. **Background Problems:** Bank loans play an important role in economic growth, but previous studies indicate that excessive loans lead to bank instability. **Novelty:** This study undertakes a comprehensive analysis, as it will discuss both the loan determinants and excessive loans simultaneously. **Research Methods:** This study covers more than 89% of the total loans of commercial banks (listed and non-listed banks) between 2002 and 2018 and it employs GMM in order to obtain robust estimations. **Finding/Results:** The growth of customers' deposits and gross NPL are the most important factors in explaining loan growth in Indonesia. Banks with excessive loans tend to have high levels of credit risk. **Conclusion:** Banks' liquidity and credit risk have important roles in explaining banks' loans. However, excessive loans could lead to bank instability, particularly for small banks.

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INTRODUCTION

The banking sector is deemed to be the most prominent, as well as the most vulnerable, sector in the economy. It is prominent because many businesses and economy activities rely on funding provided by the banks. The banking sector has an important role in stimulating the country's economic growth and prosperity (Kaufmann and Valderrama, 2008; Cecchetti and Kharroubi, 2012). On the other hand, this is a sector that persistently becomes the source of systemic risk, namely the Asian financial crisis in 1998 (Kaminsky and Reinhart, 1999) and the global financial crisis in 2008 respectively (Nijsken and Wagner, 2011; Feldkircher, 2014). Consequently, the banking sector is the most highly regulated sector in every country.

Since the global financial crisis in 2008, interest rates have reached their lowest points, particularly in the US, UK, and EU countries, in order to stimulate the economies of those countries (Williamson, 2017). As most countries are interconnected, many developing countries gain the benefits of low interest rates, as the cost of borrowing is cheap for borrowers. Data from the Bank for International Settlements (BIS) indicate that the average credit growth for the non-financial sector in the G20 countries was 6.3%, from 2008 to 2017 (Bank for International Settlements, 2019).

In Indonesia, the growth in loans by commercial banks reached an average of 15.2% annually since the 2008 crisis. However, further examination shows that the growth in loans in Indonesia tended to decrease during that period. The growth in loans from commercial banks had averaged 23.2% from 2010 to 2013, which dropped to 9.8% from 2014 to 2018 (Bank Indonesia, 2019).

The main reason behind this occurrence was the decision of the Federal Reserve (the Fed) to reduce the quantitative easing, as the US economy was healthy enough. However, it caused significant unrest in many of the financial and currency markets around the world, particularly in Brazil, India, Indonesia, South Africa and Turkey (Basri, 2017). It is known as the "taper tantrum." Moreover, the Fed ended low-level interest rates by increasing the rates by 0.25% in 2015, 0.25% in 2016, 0.75% in 2017, and another 0.75% in 2018. By the end of 2018, the interest rates had risen to between 2.25 to 2.50% (Federal Reserve, 2019).

As loan growth tends to follow economy cycles (procyclicality), most academics discuss loan growth from many perspectives in order to prevent, or at least reduce, the procyclicality of banks. Some studies (Thakor, 1996; Kashyap and Stein, 2000; Barraza et al., 2019) explain how monetary policy affects the fluctuations in the growth of loans. Guo and Stepanyan (2011) showed that macro-economic factors (domestic and foreign funding, inflation, exchange rates) are pivotal in explaining the loan growth in 38 emerging countries. Other studies also examined the roles of competition and concentration on the growth in bank loans (Carbo-Valverde et al., 2009; Olivero et al., 2011; Leroy and Lucotte, 2019).

After discussing the macroeconomic and industry factors, it is necessary to conduct a deeper examination into the growth in loans based on the banks' specific factors, because every bank makes certain policy choices with respect to its efficiency and stability (Louzis et al., 2012). From the policy makers' point of view, understanding the bank specific factors may be useful to make effective policies (Klomp and Haan, 2012; Ghosh, 2015). The examination includes liquidity factors (Ivashina and Scharfstein, 2010; Cornett et al., 2011; Khan et al., 2017), capital factors (Chu et al., 2019), ownership structure (Brei and Schclarek, 2013; Chen et al., 2016; Choi et al., 2016; Davydov,

2018), and publicly held banks (Duprey, 2015). Therefore, this study will try to examine those various factors in explaining the variations in loan growth.

Nevertheless, an excessive growth in loans leads to bank instability, namely a high credit risk. From the theoretical approach, Jimenez and Saurina (2006) argued the relationship between loan growth and credit risk can be explained through the agency problem, strong competition, herding behavior, lack of management quality, and the value of collateral. Empirically, Foos et al. (2010) showed that the increase in abnormal loan growth led to loan losses over the subsequent 2 to 4 years in 16 countries. Amador et al. (2013) indicated consistent empirical results, in which loan growth was positively associated with bank insolvency in Colombia. Cucinelli (2016) also found that the relation between credit growth and Non-Performing Loans (NPL) was positive, particularly during the recession in Italy. Soedarmono et al. (2017) showed a similar result in nine Asian countries between 1998 and 2012. Finally, recent studies (Laidroo and Mannasoo, 2017; Papadamou et al., 2018) indicated loan growth caused a greater loan loss provision and insolvency in EU countries. In other words, there is a persistence relationship between high levels of loan growth and bank stability in developing and developed countries.

Since the 1998 monetary crisis, the Government of Indonesia has been trying to improve the stability of the financial system, particularly the banking system, and accelerating economic growth at the same time. The government realizes that loan growth is one of the key components for economic growth, but excessive loan growth may negatively affect the stability of the banks. According to the arguments and previous empirical studies, there are two research problems that arise. Firstly, which bank specific factors determine the growth in bank loans in Indonesia? Secondly, does excessive loan growth cause instability in Indonesia's banking system? Previously, these questions have usually been discussed in different papers, rather than in one paper (title). By answering both questions under one paper (title), this study will provide a stronger case and have more benefits for the policy makers in Indonesia, as the research observation (period and banks) is the same for both analyses. To address those questions, this study will examine the specific factors that determine bank loan growth, which consists of the banks' liquidity, capitalization, credit risk, and other specific determinants, such as size, foreign ownership, and mergers and acquisitions (M&A). Moreover, further examination will discuss the impacts of excessive loan growth on bank stability.

This study has three novelties. The first one, with respect to the existing studies on the determinants of loan growth (Ivashina and Scharfstein, 2010; Cornett et al., 2011; Khan et al., 2017; Chu et al., 2019; Brei and Schclarek, 2013; Chen et al., 2016; Choi et al., 2016; Davydov, 2018; Duprey, 2015), is the use of various bank specific determinants in Indonesia, such as liquidity, capitalization, profitability, credit risk, listing status, foreign ownership, and M&A for examining the growth in loans. The second novelty is that this study will offer a profound analysis of Indonesia, because this study will cover all the possible banks, including the non-listed and regional banks. Previous studies (Olivero et al., 2011; Agca et al., 2013; Soedarmono et al., 2017) predominantly used Indonesia as an example of an emerging market or Asian country. By focusing only on Indonesia, the results may be more reliable for policy makers in Indonesia. The final novelty is that this study employs a more comprehensive and complete methodology than the existing

studies that used the Indonesian banking system (Rokhim and Susanto, 2013; Novellyni and Ulpah, 2017; Hamada, 2018) as their researches' observation. This study uses a large data set which covers the period from 2002 to 2018 and involves listed and non-listed banks. It enables the authors to investigate banks of different sizes and with other characteristics, with respect to different economic conditions (i.e. expansionary and contractionary periods). Moreover, this study uses Generalized Moment of Methods (GMM) estimations which result in more robust estimations than those of the existing previous studies in Indonesia.

This study is important for bank regulators, namely the Financial Services Authority (OJK), Indonesia Deposit Insurance Company (LPS), and Bank Indonesia (BI), which have the responsibility for issuing policies that can both promote economic growth as well as maintain stability in the banking sector in Indonesia. Through this study, the regulators are not only able to identify which factors influence loan growth, but they are also able to detect these factors and mitigate the risk of financial instability in the event of excessive loan growth.

The rest of this study is structured as follows. Section 2 discusses the literature review, which covers the condition of Indonesia's banking system, the importance of loan growth, the determinants of loan growth, and the relationship between loan growth and bank stability. Section 3 provides the methodology. Section 4 presents the empirical analysis. Finally, section 5 offers the conclusion and recommendations.

LITERATURE REVIEW

1. The Condition of Indonesian Banking System: An Overview

The Indonesia banking system has encountered restructuring in many forms. Before 1983, the reliance on government in providing funding was so pivotal, in which state banks are the main providers of loans. In 1983, government tried to promote the involvement of private banks in the economy. In 1988, the government issued a new policy, which is called Paket Kebijakan Oktober (PAKTO), by giving more freedom for private entities to establish new banks. Many of submitted applications were from large companies or conglomerates that had sought ways to enter banking industry. Bank Indonesia accepted 73 new commercial two years after PAKTO (Santoso, 2000).

Unfortunately, relaxing the requirements for establishing banks led to fragility in the banking industry, which could be identified in several ways. Firstly, there were problems with loans. The non-performing loans of Indonesian banks were between 5% and 20%, while the Return on Assets (ROA) of the banks was also in negative territory. Secondly, there were deficiencies in the banking regulations and the supervision from BI, because it was not independent. Thirdly, there was a significant increase in the total number of banks and in their operational complexity (i.e. derivatives), while the bank supervisor could not anticipate the changes in the industry quickly enough. In 1997, the fall of the rupiah exacerbated the problems of the weaker banks. The government revoked the licenses of 61 banks between 1997 and 1999 (Santoso, 2000).

Since the financial crisis that hit Indonesia in 1997/1998, the Indonesian banking system has undergone a major overhaul. As the rupiah declined against major currencies, many domestic banks faced difficulties in meeting the liquidity requirements, which led to the closure of many banks. Consequently, people lost confidence in the Indonesian banking system. Previous studies (Enoch, 2003; Williams, 2014) argued that the collapse of the Indonesian

banking system was predominantly due to poor regulatory governance.

Since then, the government of Indonesia has conducted a few reforms in order to rebuild the trust of the people and investors. According to Nasution (2015), the restructuring of the Indonesian banking system can be divided into several components. Firstly, the establishment of the Indonesia Deposit Insurance Corporation (LPS); aimed at restoring public confidence in the banking system in Indonesia in 2004. The LPS was established to insure deposited funds and to promote stability in Indonesia's financial system (Lembaga Penjamin Simpanan, 2019).

Secondly, the government decided to recapitalize, liquidate, consolidate, and temporarily nationalize some banks. As a result, the number of banks in Indonesia decreased significantly from 237 in 1997 to 149 in 2001. This strategy also included modernizing the payment system into a Real Time Gross Settlement (RTGS) system in 2000. Thirdly, banks were required to do effective internal evaluations on their own risk management systems, in accordance with the Basel II accord. Moreover, BI tried to introduce regulations that promoted lending by relaxing the Loan to Deposit Ratio (LDR), requiring that the loan-to-value ratio be applied to property and automobile loans. BI also required commercial banks to lend at least 20% of their total loans to SMEs.

Lastly, there was an attempt to align the standards and regulations for the Indonesian banking system with the risk-based Basel standards, in order to allow for the effective monitoring of the stability of the banking system. This included making BI an autonomous and independent institution and to partly transfer its supervisory role over the banks to the newly established Financial Services Authority (Otoritas Jasa Keuangan, 2019). BI, OJK, and LPS, along with the Ministry of Finance, are the components of the Financial System Stability Committee (KKSK).

One of the primary functions of the KKSK is to maintain the financial stability of Indonesia's financial system, which includes its banking system, non-banking financial institutions, and capital market (Bank Indonesia, 2019). The effectiveness of its regulations and policies can be seen in several ways. Firstly, the capital to asset ratio and the non-performing loans of Indonesian banks during the period from 2014 to 2018 kept increasing and were stable below 4%, respectively (World Bank, 2019). Secondly, there has only been one high figure commercial bank, namely Bank Century, which collapsed and required a bailout since the global crisis in 2008. It infers that the Indonesian banking system is relatively stable against internal, and particularly, external shocks. Thirdly, in terms of the stability of the exchange rate, it is true that that rupiah has lost about 40 to 50% of its value due to the Federal Reserve Tapering in 2013 (Federal Reserve, 2019). However, the volatility of the rupiah has been relatively less than that of its counterparts, such as the South African rand, the Brazilian real, Turkish lira, and South Korean won in 2016 and 2017 (Bank Indonesia, 2018). Finally, the stability in the banking and financial system are reflected by key economic indicators. Indonesia's economic growth had remained stable, and greater than 5%, while lower inflation and unemployment rates have also been seen for the last five years (Figure 1). It is consistent with the notion that a strong financial system is associated with robust economic growth (Barseghyan, 2010). In short, the stability of the banking sector has been well maintained by LPS, OJK, and BI.

However, there are still weaknesses in the current regulatory banking framework. According to Triggs et al. (2019), the Financial System Stability Committee (KKSK) may undermine the

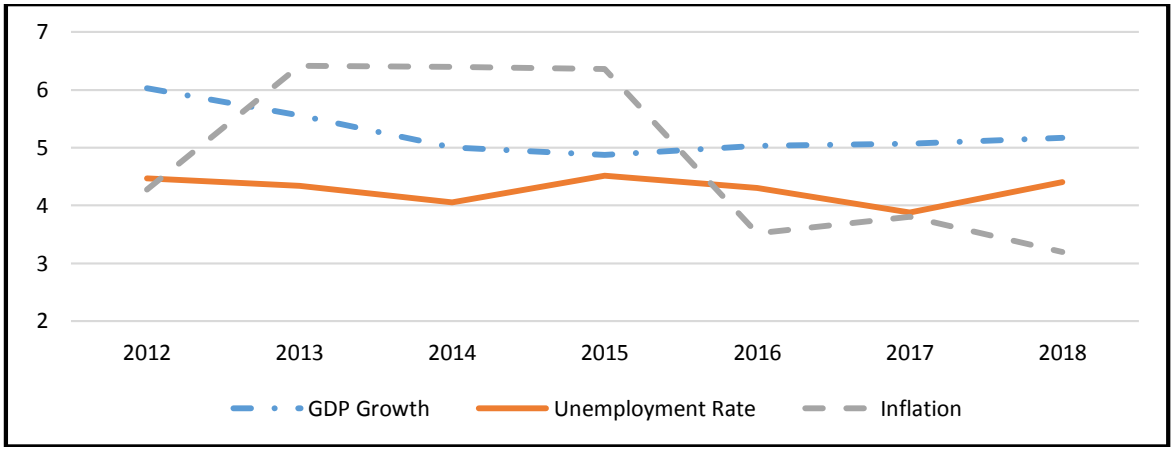
independence of BI, OJK, and LPS. In the event of an illiquid or insolvent bank, BI, which is deemed the lender of last resort, has to discuss (or even to seek approval) with its counterparts in the KKSK whether to bail the bank out or not. This bureaucratic process may alarm the market and depositors, as the value of the bank's assets could decline significantly.

Moreover, Allmen and Kang (2018) point out that the structure of the financial and banking system in Indonesia is complex. Although there are regulations about financial conglomeration (POJK No. 18/POJK.03/2014), it is argued that there are no clear and effective regulations to control the activities of financial conglomerates within a company (bank) group. As most conglomerates have a horizontal structure, the holdings tend not to be properly monitored because the regulations of BI and OJK are only applicable to financial institutions, typically banks.

2. Financial Development: The Importance of Loan Growth

Financial development, which is proxied by loan (credit) growth, plays an important role in the country's prosperity (macro-level) and bank sustainability (micro-level). At the macro-level, Joseph Schumpeter, one of the more influential economists of the 20th century (Kay, 2007), argued the importance of financial intermediaries for economic growth (Rajan and Zingales, 1998; Beck et al., 2000; Cetorelli and Gambera, 2001), via either government directed credit (Stiglitz, 1993) or a source for small businesses (Berger and Udell, 1998).

Nevertheless, as the 2007 to 2008 global economic crisis occurred, policy makers and academia were casting doubt on the linear relationship between loan expansion and economic growth. Arcand et al. (2015) showed that the debt negatively influenced economic growth when credit for the private sectors was close to 100% of GDP in over 100 developed and developing countries. Similarly, Law and Singh (2014) showed that the threshold for domestic credit was 99% of GDP, which meant the increase in debt would increase economic growth if domestic credit was lower than 99% of GDP. Beck et al. (2014) supported previous studies, in which a credit expansion of greater than 109% does not influence economic growth. They argued that this condition may occur due to financial cycles, non-intermediation activities, the misallocation of talent, excessive deregulation, and an overemphasis on consumption lending.



Source: World Bank (2019)

Figure 1. Key Indicators of Indonesia's Economy between 2012 - 2018

In terms of bank sustainability, loans are the main source of earnings for banks. Ideally, the more loan applications that are granted by banks, the more they earn. If banks provide more loans, they will earn more via the interest from the loans. From the market's perspective, Kracaw and Zenner (1996) and Mosebach (1999) showed that the market reacts positively when banks are involved in high-leveraged transactions and granting lines of credit greater than US$ 1 billion.

However, this condition does not always happen. Jimenez and Saurina (2006) showed that the positive association between excessive loan growth and credit risk exists. They argue that there are a few reasons to explain it. Firstly, there is the classical agency problem. Once the bank managers meet a reasonable Return on Equity (ROE) for their shareholders, they can engage in activities that satisfy their interests. For example, by increasing the number or size of the loans they can enlarge the presence of their bank in the industry. Secondly, the strong competition. The more banks that compete, the lower are the profit margins that can be obtained, which will lead to a further grow in loans. Thirdly, herding behavior (Rajan, 1994). Bank managers tend to follow their peers and increase bank profitability by predominantly lending more funds. In other words, they tend to put more emphasis on short term profits. Fourthly, the institutional memory hypothesis. Bankers become less able to properly lend the funds they control, which is possibly the result of a lack of management quality (Berger and Udell, 2004). Finally, the value of collateral. As the prices of assets (i.e. land, houses) increase, banks are more willingly to lend money.

Moreover, Baron and Xiong (2017) found that the rapid expansion of bank credit is positively associated with the crash risk in the bank equity indexes of 20 developed economies from 1920 to 2012. Likewise, Fahlenbrach et al. (2018) showed that banks with the top quartile of loan growth in the US tended to underperform, proxied by their stock returns, over a three year period. Both studies argue that this condition is due to excessive risk-taking behavior by the bank managers, which may be the result of misaligned incentives from their shareholders.

Thus, the growth of loans is similar to a "double-edge sword." On one side, it is a way to maximize the shareholders' wealth and to boost economic growth, while on the other side it may be the source of risks (i.e. bankruptcy, non-performing loans). In short, the future performance and sustainability of a bank can be explained by its loan growth (Foos et al., 2010; Zemel, 2018).

3. The Bank Specific Determinants of Loan Growth

Some studies discussed the bank specific factors that influence the growth in loans. Theoretically, customers' deposits are the main source of funds (Kashyap et al., 2002). Empirically, several studies (Barajas and Steiner, 2002; Guo and Stepanyan, 2011; Bouvatier and Lepetit, 2012; Bowman et al., 2015) have shown the importance of deposit growth in explaining loan growth, in emerging and developed countries.

Moreover, customers' deposits are also the source of liquidity. The more people save their money in the banks, the more liquid they are and the more funds are available for loans (Ivashina and Scharfstein, 2010; Cornett et al., 2011; Khan et al., 2017). Ivashina and Scharfstein (2010) indicated the importance of access to deposit financing during the financial crisis of 2008, which was measured by the deposit to asset ratio. Similarly, Cornett et al. (2011) stated that banks that depend heavily on their core deposits continued to lend more, relative to other banks,

during the crisis. Khan et al. (2017) have shown that banks tend to lend aggressively in response to having higher deposits.

Banks' capital ratios influence loan growth via the regulation channels (i.e. central bank regulations) and the market channels (i.e. access to the capital market). Via the regulation channels, higher capital levels allow a bank to provide more loans as the bank's capital is greater than the required capital buffer (Berger and Udell, 1994; Thakor, 1996). Via the market channels, more capital means a lower cost of borrowing (Flannery and Rangan, 2008) and lower liquidity costs (Allen and Gale, 2004). However, some banks with high levels of capital may reduce their loans to prevent capital structure fragility (Diamond and Rajan, 2000). Higher required capital levels will crowd-out demand deposits, which leads to a lower credit supply (Gorton and Winton, 2017). This is known as the fragility-crowding out hypothesis (Chu et al., 2019)

The credit risk, which is proxied by the loan loss provision, is another important factor in explaining loan growth (Laeven and Majnoni; 2003; Bouvatier and Lepetit, 2008; Beatty and Liao, 2011; Bouvatier and Lepetit, 2012). Banks with large loan problems tend to increase the cyclicality of their lending. It means banks tend to provide loans excessively in a boom period when the loan loss provisions are low. In contrast, they take a more negative stance during economic downturns if their loan loss provisions are high. A recent study (Alihodzic and Eksi, 2018) indicates that there is a reverse relationship between the loan loss provision and loan growth rate in the Western Balkan countries.

The ownership structure also has significant effects on loan growth. Previous studies (Brei and Schclarek, 2013; Chen et al., 2016) showed that government-owned banks in numerous countries tended to provide more loans during the global crisis of 2008 to 2010. Consistently, similar results were found in China (Zhang et al., 2018) and Russia (Davydov, 2018). Moreover, publicly held banks tended to lend more in the crisis, while they lend less in normal times. Duprey (2015) showed that publicly held banks in 86 countries tended to lend more either in expansionary or contractionary periods.

Foreign banks play an important role in loan growth. Foreign banks are associated with risk-taking because of several reasons. Firstly, foreign banks can better diversify the risk than domestic banks can. Secondly, foreign banks are deemed more efficient and have better access to the international capital market than domestic banks. Thirdly, foreign banks have a better competitive advantage in terms of technology for accessing and collecting financial information (Berger et al., 2005; Lassoued et al., 2016; Mulyaningsih et al., 2015). However, foreign banks reduced their lending in a significant way compared to private domestic banks during the crisis (Choi et al., 2016).

The other factors such as bank size, bank age, and mergers and acquisitions (M&A) may influence loan growth. Bank size influences loan growth in two ways. From the perspective of "too big to fail," large banks can lend more as they are not allowed to collapse by the government. However, small banks have more incentive to lend more than large banks, because small banks have more limited activities than their larger counterparts, in terms of their portfolio and investment diversification. Kim and Sohn (2017) indicated that small banks tend to provide more loans.

The age of a bank is associated with the establishment of the bank. Newly listed banks tend to be more efficient and profitable (Jemric and Vujcic, 2002; Lin and Zhang, 2009). Finally, banks may benefit from M&A by having more assets, a larger market share, and the transfer of

knowledge and technology. M&A can improve efficiency in the combined entity of banks in six emerging countries, including Indonesia (Du and Sim, 2016).

4. Loan Growth and Bank Stability

Many academics (Chang et al., 2008; Fang et al., 2014; Goetz, 2018; Abdelbadie and Salama, 2019) measure a bank's stability by using the number of non-performing loans (NPL). It is also known as "loan loss rate," "bad loans," "delinquencies," and "stressed assets" (Dhar and Bakshi, 2014). In Indonesia, Bank Indonesia (BI) defines NPL as the loans that are classified as sub-standard, doubtful, and loss. BI does not determine a certain threshold to distinguish between good and bad loans, but rather proposes a set of broad categories (Bank Indonesia, 2019).

According to Keeton (1999), the arguments of whether a bank loan may or may not lead to greater loan losses is determined by whether the loan has caused the loan supply or loan demand to shift. He argued that greater loan growth leads to greater loan losses when loan growth is caused by a shift in the loan supply. This refers to the willingness of banks to increase their lending, which can be done by either lowering interest rates or their credit standards (i.e. acceptance of lower collateral, weaker credit histories) for new loans. On the other hand, the increase in loan losses is less likely to occur when the loan growth is caused by something other than a shift in the loan supply, for instance by shifts in the loan demand and productivity. These changes will not affect the loan losses because they do not decrease the borrowers' credit worthiness.

Empirically, Foos et al. (2010) found that the loan loss provision increases as loan growth increases, which is proxied by abnormal loan growth, with a lag of 2 to 4 years. Similar evidence was found in 28 EU countries (Laidroo and Mannasoo, 2017). Papadamou et al. (2018) showed a consistent result for Swedish financial institutions, in which an abnormal credit growth is positively associated with greater credit loss (NPL) and insolvency (Z-score).

Amador et al. (2013) showed that a 1.1% increase in abnormal loans will lead to a 1.6% increase in NPL in Colombia. In China, which has experienced a rapid growth in its banking system, the relation between credit growth and bank risk has a similar result (Baradwaj et al., 2014). Soedarmono et al. (2017) showed that the abnormal credit growth increased bank systemic risk one year later in 9 Asian countries

Moreover, some studies show that the relationship of loan growth and NPL is time varying. Vithessonthi (2016) found that the relation between credit growth and NPL is time varying, which was positively correlated prior to the global financial crisis, and *vice versa*. Similarly, Cucinelli (2016) found that the relation between credit growth and NPL exists and is more significant when a country is hit by recession.

The other determinants of NPL include bank ownership, bank profitability, and bank size. According to Macit (2012), public banks and foreign banks significantly increase the NPL ratio. Rajan (1994) argued that bank lending is influenced by the motivation of bank agents (managers) to generate more earnings (profitability). Finally, large banks may excessively grant loans to businesses as they will be bailed out by the government if there are problems, as they come under the "too big to fail" criterion (Stern and Feldman, 2004). Consequently, some of these aspects will be included in the analysis.

HYPOTHESIS DEVELOPMENT

This study will examine the determinants of loan growth and its effect on bank stability. In terms of the determinants of loan growth, this study

will try to analyze deposit growth, liquidity, capitalization, and other specific determinants, such as bank size, foreign ownership, and mergers and acquisitions on loan growth. Barajas and Steiner (2002) showed that a slowdown in loans was related to low bank deposits in eight South American countries. Similarly, credit growth is effected by the level of domestic funding (i.e. demand deposits and saving deposits) in emerging countries (Guo and Stepanyan, 2011). Bouvatier and Lepetit (2012) indicated the importance of deposit growth on loan growth in the developed countries. Finally, Bowman et al. (2015) showed that liquidity (deposit growth) was more effective for increasing loan growth during a period of quantitative easing in Japan. Therefore, the first hypothesis is:

H_1: Deposit growth positively influences loan growth

The other important liquidity ratio is the deposit to asset ratio. Ivashina and Scharfstein (2010) indicated that the deposit to asset ratio significantly influenced bank lending during the 2008 financial crisis. Cornett et al. (2011) stated that the banks that depend heavily on core deposits continued to lend more, relative to other banks, during the crisis. Khan et al. (2017) have shown that banks tend to lend aggressively, in response to higher deposits. Therefore, the second hypothesis is:

H_2: The deposit to asset ratio positively influences loan growth

Capitalization may bring positive consequences. Banks with better capitalization are able to provide more loans because their capital is greater than the required minimum capital (Berger and Udell, 1994; Thakor, 1996; Flannery and Rangan, 2008; Allen and Gale, 2004). Moreover, well capitalized banks will result in lower costs of funding (Flannery and Rangan, 2008) and costs of liquidity, which leads to more bank lending. Therefore, the third hypothesis is:

H_3: The equity to asset ratio positively influences loan growth

This study also examines the credit risk of banks, as those banks with a high level of loan provision loss may try to reduce their loans in order to maintain stability (Laeven and Majnoni; 2003; Bouvatier and Lepetit, 2008; Beatty and Liao, 2011; Bouvatier and Lepetit, 2012). Banks with large loan problems tend to increase the cyclicality of their lending. It means banks tend to provide loans excessively in a boom period, when the loan loss provision is low. In contrast, they take a more negative stance during an economic downturn if the loan loss provision is high. This study will use gross NPL as the proxy of banks' credit risks. Therefore, the fourth hypothesis is:

H_4: Gross NPL negatively influences loan growth

Nevertheless, excessive loan growth is highly correlated to bank instability. Keeton (1999) argues that the instability occurs when the loan is driven by shifts in the supply of loans rather than shifts in the demand for loans. Empirically, Foos et al. (2010) found that the credit risk increases, which is proxied by NPL, the Z-score, and it is relative to interest income, as banks provide loans excessively. According to Vithessonthi (2016) and Cucinelli (2016), the relation between credit growth and NPL may depend on the macroeconomic conditions, as the relation is stronger during a crisis. In other words, excessive loan growth results in bank instability. This study will use three proxies for financial stability to ensure the robustness of our estimations. They are gross NPL, the Z-score, and *relative on interest income*. Therefore, the next hypotheses are:

H_5: A high level of loan growth positively influences the gross NPL

H6: A high level of loan growth negatively influences the Z-score

H7: A high level of loan growth negatively influences relative on interest income

RESEARCH METHODOLOGY

1. Sample and Data

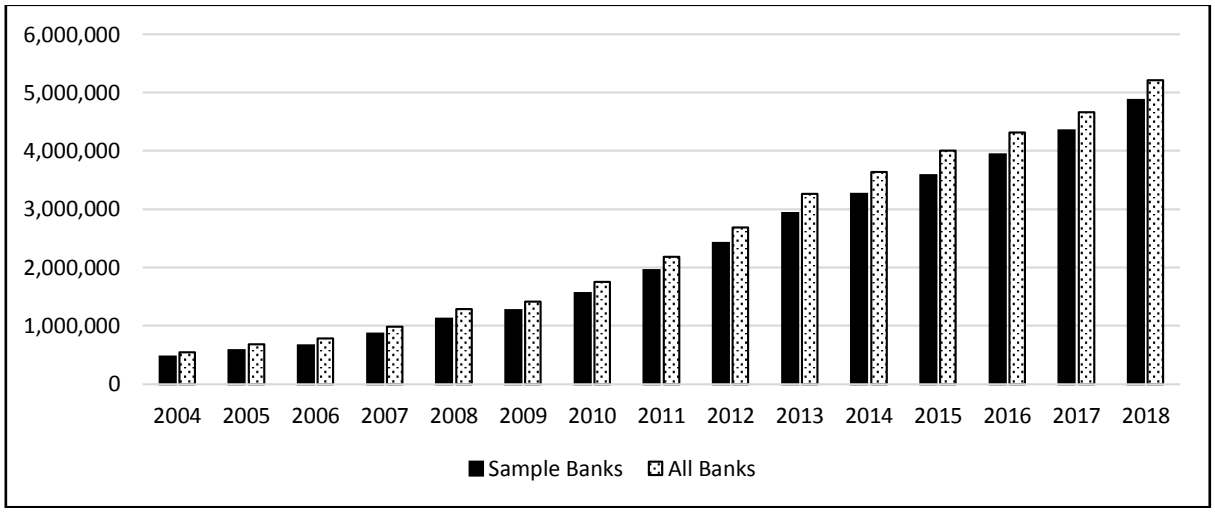
This study's focus was on commercial banks in Indonesia. This study used 86 commercial banks, which included state-owned banks, regional banks, publicly held banks, private banks, and foreign banks, for the period from 2002 to 2018. This study excluded investment banks and Sharia banks due to their unique characteristics. Figure 2 illustrates that the research sample covered almost all the loans provided by commercial banks in Indonesia. On average, the research sample represented 89% of the total given loans.

The data for each bank was obtained from several resources, such as the Indonesia Stock Exchange (IDX), the Financial Services Authority (OJK), Bank Indonesia (BI) and the banks' financial reports. The data are predominantly bank-specific data in the banks' annual reports, such as loans, deposits, equity, interest revenue, net income, NPL, etc.

2. Regression Models and Variables

In order to examine the two main objectives, a few models were employed in this study. The first model aimed to examine the determinants of loan growth. This model used loan growth as a dependent variable, while the independent variables were a proxy of liquidity (dpktoasset), growth in deposits (dpkgrowth), capitalization (equitytoasset), profitability (roe), credit risk (NPLGross), and control variables (lnasset, listed, foreign, agebank, merger). The general form of model 1 will be as follows:Loan

$$Growth_{i,t} = \beta_0 + \beta_1 dpktoasset_{i,t} + \beta_2\ dpkgrowth_{i,t} + \beta_3 equitytoasset_{i,t} + \beta_4\ roe_{i,t} + \beta_5 NPLGross_{i,t} + \beta_6 lnasset_{i,t} + \beta_7 listed_{i,t} + \beta_8 foreign_{i,t} + \beta_9 agebank_{i,t} + \beta_{10} Merger_{i,t} + \varepsilon_{i,t} \quad ....(1)$$



Source: Processed data

Figure 2. The Comparison of Given Loans between Sample Banks and All Banks in Indonesia (Billion Rp.)[2]

[2] Excluding rural banks (BPR)

To examine the second objective, which was to investigate the role of abnormal loan growth on bank stability, this study employed three models. This study follows previous studies (Foos et al., 2010; Vithessonthi, 2016). The second, third, and fourth models used gross NPL (NPLGross), the Z-score (zscore), and relative on interest income (rii) as dependent variables, respectively. The focused variable was abnormal loan growth, which had different annotations within the models. Abnormal loan growth in model 2 was annotated with alg1, alg2, alg3, and alg4. Model 3 and model 4 used avgalg4a and alg to proxy abnormal loan growth, respectively. The control variables were bank size (lnasset), bank capitalization (equitytoasset), bank profitability (roe), publicly owned banks (listed), and foreign ownership (foreign). The general form of the models was as follows:

$$NPLGross_{i,t} = \beta_0 + \beta_1 alg_{i,t-1} + \beta_2 alg_{i,t-2} + \beta_3 alg_{i,t-3} + \beta_4 alg_{i,t-4} + \beta_5 lnasset_{i,t} + \beta_6 equitytoasset_{i,t} + \beta_7 roe_{i,t} + \beta_8 listed_{i,t} + \beta_9 foreign_{i,t} + \varepsilon_{i,t} \quad (2$$

$$zscore_{i,t} = \beta_0 + \beta_1 avgalg4a_{i,t} + \beta_2 lnasset_{i,t} + \beta_3 equitytoasset_{i,t} + \beta_4 roe_{i,t} + \beta_5 listed_{i,t} + \beta_6 foreign_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$rii_{i,t} = \beta_0 + \beta_1 alg_{i,t} + \beta_2 lnasset_{i,t} + \beta_3 equitytoasset_{i,t} + \beta_4 roe_{i,t} + \beta_5 listed_{i,t} + \beta_6 foreign_{i,t} + \varepsilon_{i,t} \quad (4)$$

All the models were estimated using the generalized method of moments (GMM) to address any endogeneity problems that may have arisen (Brei and Schclarek, 2013; Khan et al., 2017; Foos et al., 2010; Soedarmono et al., 2017). The use of the GMM estimation resulted in better findings than are provided by the fixed effects estimation (Ghosh, 2015). Moreover, Vithessonthi (2016) indicated that the results of the GMM estimation would yield more consistent results than those from OLS estimations. Thus, the GMM estimations provided more robust estimations than the estimations of the fixed effects and OLS. As a result, the above models were modified. The lag of the dependent variable was added as one of the independent variables. The GMM models were as follows:

$$\text{Loan Growth}_{i,t} = \beta_0 + \beta_1 \text{ Loan Growth}_{i,t-1} + \beta_2 dpktoasset_{i,t} + \beta_3 \text{ dpkgrowth}_{i,t} + \beta_4 equitytoasset_{i,t} + \beta_5 roe_{i,t} + \beta_6 NPLGross_{,t} + \beta_7 lnasset_{i,t} + \beta_8 listed_{i,t} + \beta_9 foreign_{i,t} + \beta_{10} agebank_{i,t} + \beta_{11} Merger_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$NPLGross_{i,t} = \beta_0 + \beta_1 NPLGross_{i,t-1} + \beta_2 alg_{i,t-1} + \beta_3 alg_{i,t-2} + \beta_4 alg_{i,t-3} + \beta_5 alg_{i,t-4} + \beta_6 lnasset_{i,t} + \beta_7 equitytoasset_{i,t} + \beta_8 roe_{i,t} + \beta_9 listed_{i,t} + \beta_{10} foreign_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$zscore_{i,t} = \beta_0 + \beta_1 zscore_{i,t-1} + \beta_2 avgalg4a_{i,t} + \beta_3 lnasset_{i,t} + \beta_4 equitytoasset_{i,t} + \beta_5 roe_{i,t} + \beta_6 listed_{i,t} + \beta_7 foreign_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$rii_{i,t} = \beta_0 + \beta_1 rii_{i,t-1} + \beta_2 lag_{i,t} + \beta_3 lnasset_{i,t} + \beta_4 equitytoasset_{i,t} + \beta_5 roe_{i,t} + \beta_6 listed_{i,t} + \beta_7 foreign_{i,t} + \varepsilon_{i,t} \quad (4)$$

The research variables of both analyses can be seen in Table 1. In the first analysis for the determinants of loan growth, loan growth was used as the dependent variable along with various independent variables (i.e. deposit growth, gross NPL, equity to asset ratio, ROE, bank size, listed bank, foreign bank, age bank, and mergers). In the second analysis for excessive loan growth on bank stability, three dependent variables were used, namely gross NPL, the Z-score, and the relative income ratio, while the focused independent variables were abnormal loan growth and average abnormal loan growth over four years. This approach was similar to the one employed by Foos et al. (2010). By doing this, this study could control the macroeconomic environment via the growth in total loans. Moreover, abnormal loan growth will be in the form of lagged 1, 2, 3 and 4 years. In addition, gross NPL had two roles in the analyses, which were as an independent variable and a dependent variable in the first (loan growth) analysis and second (bank stability) analysis, respectively.

Table 1. Research Variables and Definitions

Variables	Notation	Definitions
Panel A. Dependent Variables		
Loan growth	Loangrowth	The difference between bank loans in year t and bank loans in year t-1 divided by Bank loans in year t-1
NPL Gross	NPLGross	Gross non-performing loans
Z-score	Zscore	The total of the equity to asset ratio and return on asset (ROA), divided by the standard deviation of the banks ROA in five years
Relative Income Ratio	Rii	Interest revenue divided by total loans
Panel B. Independent Variables		
Loan to deposit ratio	LDR	Total loans divided by total customer deposits
Deposit to total assets	Dpktoasset	Total customer deposits divided by total assets
Customer deposit growth	Dpkgrowth	The difference between customer deposits in year t and customer deposits in year t-1 divided by customer deposits in year t-1
Equity to total assets	Equitytoasset	Total equity divided by total assets
Gross NPL	NPLGross	Gross non-performing loans
Return on equity	Roe	Net income divided by total equity
Bank size	ln_asset	The natural logarithm of total assets of bank.
Listed	Listed	A dummy variable that is equal to 1 if the bank is listed, equal to 0 if something else
Foreign	Foreign	A dummy variable that is equal to 1 if the majority shareholder is a foreign entity, equal to 0 if not
Bank age	Agebank	The difference between the bank's establishment date and the observation year.
Merger	Merger	A dummy variable that is equal to 1 if banks are involved in mergers and acquisitions during the observation period
Average abnormal loan growth in 4 years	Avgalg4a	The average of bank abnormal loan growth for the period of four years.
Abnormal loan growth	Alg	The difference between the loan growth of the bank i and the loan growth of all the commercial banks

Source: Processed data

RESULT AND DISCUSSION

1. Descriptive Analysis

Table 2 shows the descriptive statistics of the dependent and independent variables. It can be seen that total assets in the sample were Rp. 39.9 trillion on average, which were funded by a third party by as much as 74%, while 15% came from the banks' own capital. Distributed loans, which were mainly funded by the third party funds, grew as much as 24% on average. The biggest loan growth contributor was the foreign banks, which was about 24%.

Interest income earned by the banks was 10% of total assets (rii) on average, and returns on capital (roe) produced as much as 12%. Regional banks have the highest rii with an average of 12. The banks' credit difference over the total industry's loan disbursed (alg) was 5%, in which foreign banks tended to have excessive loan growth, on average 7%.

The number of observations (N) was relatively large, at around 1,382 to 1,387 observations, as this study covered the listed banks (Panel B), regional banks (Panel C) and foreign banks (Panel D) during the period from 2002 to 2018. Moreover, there was a tendency for foreign banks to provide more loans than the listed banks and regional banks.

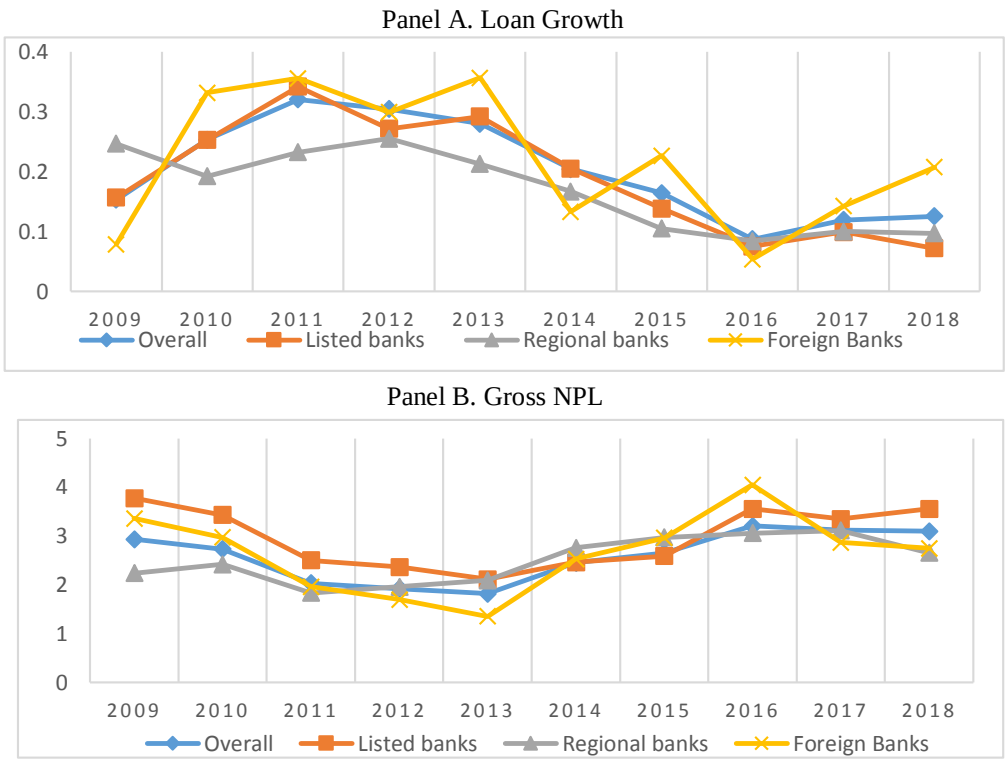
Of the total loans disbursed by the industry, the credit default was 2.92%, which was within tolerance according to the Financial Services Authority (OJK) regulations. The default ratio was below the OJK provisions; however the largest default ratio was experienced by listed banks in the exchange by 3.4%, and foreign banks by 3.18%.

Table 2. Descriptive Statistics.

Stats	N	mean	Median	Std. Deviation	Q1	Q3
Panel A. Overall Banks						
Loangrowth	1385	0.24	0.19	0.33	0.07	0.31
NPLGross (%)	1382	2.92	2.26	2.74	1.16	3.66
Zscore	1384	47.94	33.81	46.71	18.14	61.42
Rii	1383	0.10	0.10	0.03	0.08	0.12
Alg	1385	0.05	0.00	0.31	-0.09	0.11
Dpktoasset	1385	0.74	0.78	0.14	0.70	0.83
Dpkgrowth	1383	0.20	0.13	0.35	0.03	0.26
Total asset (Rp Trillion)	1387	39.90	5.87	121.00	1.86	20.20
Equitytoasset	1387	0.15	0.12	0.09	0.09	0.17
Roe	1387	0.12	0.11	0.12	0.05	0.19
Panel B. Listed Banks						
Loangrowth	498	0.21	0.18	0.27	0.07	0.29
NPLGross (%)	498	3.44	2.66	3.00	1.69	4.15
Zscore	495	46.99	33.65	48.37	15.92	60.30
Rii	498	0.10	0.09	0.03	0.08	0.11
Alg	498	0.03	0.00	0.25	-0.08	0.10
Panel C. Regional Banks						
Loangrowth	411	0.23	0.21	0.17	0.11	0.31
NPLGross (%)	410	2.49	1.81	2.27	0.97	3.30
Zscore	411	40.47	29.83	33.79	18.12	51.91
Rii	411	0.12	0.11	0.03	0.10	0.13
Alg	411	0.05	0.02	0.16	-0.05	0.10
Panel C. Foreign Banks						
Loangrowth	291	0.24	0.15	0.44	0.03	0.31
NPLGross (%)	291	3.18	2.49	2.94	1.34	3.89
Zscore	290	47.94	37.37	42.54	19.37	62.53
Rii	292	0.08	0.08	0.03	0.06	0.10
Alg	291	0.07	0.00	0.39	-0.12	0.12

Notes: Loangrowth is the growth in loans between year t and year t-1. NPLGross is the proxy of credit risk, which is defined as gross non-performing loans (loan loss provision). Zscore is the Z-score which is the equity to asset ratio plus the return on assets (ROA), divided by the standard deviation of ROA. Relative interest income (rii) is the ratio between interest revenue and total loans. Abnormal loan growth (alg) is the difference between the loan growth of a bank and the loan growth of all the commercial banks. The proxy of liquidity (dpktoasset), is measured by the ratio between customers' deposits and total assets. The growth of customers' deposits (dpkgrowth) is between year t and year t-1. Total assets are the sum of current assets and fixed assets of banks. The proxy of bank capitalization is equitytoasset, which is the ratio between total equity and total assets. Return on equity (roe) is measured by the ratio of total equity and net income. Panel A, Panel B, Panel C, and Panel D show the descriptive statistics of overall banks, listed banks, regional banks, and foreign banks, respectively. Loangrowth, NPLGross dpktoasset, dpkgrowth, total assets, equitytoasset and ROE are winsorized at the 1% and 99% levels.

Source: Processed data



Source: Processed data

Figure 3. Loan Growth and NPL between 2009-2018

Before carrying out the empirical analysis, the correlation between the independent and dependent variables was checked, as shown in Table 3. This analysis appeared to support the hypothesis that each independent variable had its own specific information value and the ability to explain bank lending. Among the independent variables, lnasset (total assets) tended to be positively correlated to listed banks, which suggested large banks tended to be listed on the stock market. Table 3 also shows that collinearity problems were less likely to occur in the regression analysis.

2. Determinants of Loan Growth

Table 4 indicates the estimation results for the determinants of loan growth. The models were estimated using the GMM. Two important statistics are shown in the table which are AR(2) and Hansen-J. AR(2) indicated serial correlation in the residuals. The P-value of AR(2) was greater than 10%, which meant there was no serial correlation in the residuals. Hansen–J indicated over-identification restrictions of the instruments. It had a null hypothesis that the instruments were exogenous. The P-value of Hansen-J was greater than 10%, which meant the instruments were valid and robust.

Model 1 (all periods) showed the estimations of the overall observations. Two factors that had important roles in explaining the loan growth were the growth in customers' deposits (dpkgrowth) and gross non-performing loans (NPLGross). When the growth in customers' deposits increased, the loan growth (Loangrowth) should go in the same direction. Whereas, the estimation of NPLGross was negative, which meant the banks should decrease their lending when the NPL increased. Other factors, i.e. dpktoasset (liquidity), equitytoasset (capitalization), roe (profitability), did not seem to significantly influence loan growth.

Table 3. Correlation Matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Loangrowth (1)	1												
NPLGross (2)	-0.23	1											
zscore (3)	-0.04	-0.2	1										
rii (4)	-0.15	0.01	-0.17	1									
alg (5)	0.97	-0.23	0	-0.18	1								
dpktoasset (6)	0.01	0.03	-0.04	0.25	-0.03	1							
dpkgrowth (7)	0.62	-0.14	-0.02	-0.17	0.62	0.1	1						
lnasset (8)	-0.12	-0.01	0.02	-0.24	-0.07	-0.01	-0.06	1					
equitytoasset (9)	0.04	-0.1	0.26	-0.1	0.07	-0.54	-0.02	-0.31	1				
roe (10)	0.03	-0.24	-0.1	0.28	-0.01	0.09	0.01	0.15	-0.28	1			
listed (11)	-0.07	0.14	-0.01	-0.12	-0.05	0.17	-0.01	0.5	-0.18	-0.19	1		
govt_bank (12)	-0.02	-0.03	-0.13	0.27	-0.03	0.03	-0.03	0.15	-0.25	0.55	-0.31	1	
agebank (13)	-0.06	-0.11	0.03	0.04	-0.02	-0.03	-0.05	0.38	-0.04	0.23	0.07	0.36	1

Notes: Loangrowth is the growth in loans between year t and year t-1. NPLGross is the proxy of credit risk, which is defined as gross non-performing loans (loan loss provision). Zscore is the Z-score which is the equity to asset ratio plus the return on assets (ROA), divided by the standard deviation of ROA. Relative interest income (rii) is the ratio between interest revenue and total loan. Abnormal loan growth (alg) is the difference between the loan growth of a bank and the loan growth of all the commercial banks. The proxy of liquidity (dpktoasset) is measured by the ratio between customers' deposits and total assets. The growth of customers' deposits (dpkgrowth) is between year t and year t-1. lnasset is the natural logarithm of total assets. is The ratio between total equity and total assets is equitytoasset. The return on equity (roe) is measured by the ratio of total equity and net income. Listed is a dummy variable, it is equal to 1 if banks are listed, equal to 0 if not. Foreign is a dummy variable, it is equal to 1 if the majority shareholder is a foreign entity, or 0 if not. The difference between the bank's establishment date and the year of observation is agebank.

Source: Processed data

This study classified the observation period into two sub-samples, which are the expansion period (2008 to 2013) and the contraction period (2014 to 2018), in order to analyze the macro-economic impact on the banks. The expansion and contraction periods were based on the activities of the Federal Reserve System (the Fed), the central bank for the US, such as quantitative easing and the federal funds rate. Ever since the 2008 global crisis, the Fed had been trying to conduct an expansionist monetary policy. The Fed started to end this policy in 2013, which caused unrest in many financial markets, including in Indonesia.

Model 2 (period 2008 to 2013) showed the estimations during the expansion period (2008 to 2013). The estimations were relatively consistent with model 1, in which dpkgrowth and NPLGross remained important for explaining the growth in loans. The significance of deposit growth was consistent with previous studies (Barajas and Steiner, 2002; Guo and Stepanyan, 2011; Bouvatier and Lepetit, 2012; Bowman et al., 2015), while NPLGross was consistent with Laeven and Majnoni (2003), Bouvatier and Lepetit (2008), Beatty and Liao (2011), Bouvatier and Lepetit (2012). However, the significance of NPLGross in model 2 was lower, as it was only at the 10% level. Consistently, model 3 (period 2014 to 2018) showed that dpkgrowth and NPL gross were statistically significant in explaining loan growth during the contraction period. This study analyzed the size effects on loan growth, which was based on banks' assets.

Table 4. The Determinants of Loan Growth.

Dependent Variable = Loangrowth	Model 1 All periods	Model 2 Period 2008-2013	Model 3 Period 2014-2018
$Loangrowth_{t-1}$	0.184***	0.132*	0.042
	(0.063)	(0.069)	(0.068)
Dpktoasset	-0.531	-0.426	-0.622
	(0.838)	(0.852)	(0.383)
Dpkgrowth	0.476***	0.514***	0.409***
	(0.062)	(0.120)	(0.084)
Lnasset	0.092	0.338	0.130
	(0.159)	(0.245)	(0.160)
Equitytoasset	-0.403	0.968	0.371
	(1.408)	(1.360)	(0.830)
Roe	-0.184	-0.228	-0.272
	(0.483)	(0.662)	(0.377)
NPLGross	-0.024***	-0.011	-0.036**
	(0.009)	(0.018)	(0.018)
Listed	0.210	-0.245	0.332
	(0.276)	(0.198)	(0.343)
Foreign	-0.005	-0.550	-0.395
	(0.419)	(0.534)	(0.262)
Agebank	-0.030	-0.094*	-0.022
	(0.034)	(0.056)	(0.023)
Merger	0.058	0.073	0.023
	(0.333)	(0.665)	(0.194)
Observations	1,190	514	338
Number of banks	86	86	85
AR2 (p-value)	0.688	0.891	0.542
Hansen-J (p-value)	0.332	0.102	0.101

Notes: The dependent variable is Loan growth in t ($Loangrowth_t$). Independent variables are, besides the lagged dependent variable ($Loangrowth_{t-1}$), dpktoasset which is the ratio between customers deposits and total assets; dpkgrowth is the growth in customers' deposits between year t and year t-1; lnasset is the natural logarithm of total assets; equitytoasset is the ratio between total equity and total assets; roe is return on equity which is measured by the ratio of total equity and net income; NPLGross is gross non-performing loans (loan provision loss); Listed is a dummy variable, it is equal to 1 if banks are listed, or 0 if not; foreign is a dummy variable, it is equal to 1 if the majority shareholder is a foreign entity, or 0 if not; agebank is the difference between the bank's establishment date and the year of observation; Merger is a dummy variable, it is 1 if the banks were involved in M&A, or 0 if not. Model 1 is for all the observation periods, while model 2 and model 3 are for the period 2008 to 2013 and 2014 to 2018, respectively. Standard errors are reported in parentheses, and ***, **, * coefficients are statistically significant at 1%, 5%, and 10%, respectively.

Source: Processed data

Table 5 shows that dpkgrowth was the most important variable for small and large banks. But its significance was less for large banks. In other words, there was a tendency for large banks to become less reliant on dpkgrowth as they have greater access to other sources of funding, such as the capital market.

3. Loan Growth and Bank Stability

His section discusses the effect of high levels of loan growth on banks' stability. In this case, there were three dependent variables to proxy bank stability, namely gross non-performing loans (NPL), the Z-score, and relative income interest (RII). Table 6 shows the estimations for each dependent variable. Model 1 showed that none of the focused variables, lagged abnormal loan growth (ALG1, ALG2, ALG3, ALG4), significantly influenced the gross NPL. However, model 2 indicated that the average abnormal loan growth for the last four years (avgalg4a) negatively and significantly affected

the Z-score. Similarly, abnormal loan growth (alg) was negatively associated with relative interest income in the model. Thus, there was sufficient evidence that excessive loan growth caused bank instability. The findings are consistent with previous studies (Foos et al., 2010; Amador et al., 2013; Vithessonthi, 2016; Cucinelli, 2016).

Table 5. Size Effects on the Determinants of Loan Growth.

Dependent Variable = Loangrowth	Model 1 Small Banks	Model 2 Large Banks
$Loan\_growth_{t-1}$	0.187**	0.123
	(0.073)	(0.102)
Dpktoasset	-1.948	0.842
	(1.529)	(1.105)
Dpkgrowth	0.600***	0.290**
	(0.093)	(0.128)
Equitytoasset	-1.881	0.833
	(1.421)	(3.128)
NPL Gross	-0.052	-0.067
	(0.054)	(0.042)
Roe	-1.872	1.927
	(1.323)	(1.694)
Listed	-0.209	-0.351
	(0.311)	(0.586)
Foreign	1.317*	0.572
	(0.746)	(1.174)
Agebank	-0.023	0.018
	(0.021)	(0.018)
Merger	-0.597	-0.886
	(0.745)	(1.215)
Observations	606	584
Number of banks	44	42
AR2 (p-value)	0.998	0.150
Hansen-J (p-value)	0.218	0.165

Notes: The dependent variable is Loan growth in t ($Loangrowth_t$). Independent variables are, besides the lagged dependent variable ($Loangrowth_{t-1}$), dpktoasset which is the ratio between customers deposits and total assets; dpkgrowth is the growth in customers' deposits between year t and year t-1; equitytoasset is the ratio between total equity and total assets; roe is return on equity which is measured by the ratio of total equity and net income; NPLGross is gross non-performing loans (loan provision loss); Listed is a dummy variable, it is equal to 1 if banks are listed, or 0 if not; foreign is a dummy variable, it is equal to 1 if the majority shareholder is a foreign entity, or 0 if not; agebank is the difference between the bank's establishment date and the year of observation. Merger is a dummy variable, it is 1 if the banks were involved in M&A, or 0 if not. Model 1 and model 2 are the estimations for small banks and large banks, which are based on the assets of the banks, respectively. Standard errors are reported in parentheses, and ***, **, * coefficients are statistically significant at 1%, 5%, and 10%, respectively.

Source: Processed data

Table 6. The Effects of Loan Growth of Bank Stability

Dependent Variables	Model 1 NPL Gross	Model 2 zscore	Model 3 rii
$NPLGross_{t-1}$	0.521***		
	(0.138)		
$zscore_{t-1}$		0.497***	
		(0.102)	
rii_{t-1}			0.313***
			(0.067)
alg1	-0.099		
	(0.339)		
alg2	-0.027		
	(0.130)		
alg3	-0.002		
	(0.115)		
alg4	0.017		
	(0.072)		
avgalg4a		-15.834*	
		(8.846)	
Alg			-0.112**
			(0.049)
Lnasset	2.936	12.348	-0.312
	(2.756)	(24.800)	(0.367)
equitytoasset	6.449	342.164**	0.815
	(17.792)	(146.005)	(1.837)
Roe	-19.090***	-149.658	0.206
	(5.740)	(91.496)	(0.645)
Listed	-7.142*	-6.765	-0.478
	(4.210)	(48.425)	(0.413)
Foreign	-2.815	-65.576	0.535
	(6.500)	(105.498)	(0.926)
Observations	949	1,035	1,204
Number of banks	87	87	87
ar2p	0.478	0.577	0.192
Hansenp	0.262	0.628	0.864

Notes: The dependent variables are NPLGross, Zscore, and rii for model 1, model 2, and model 3 respectively. Each model adds the lagged dependent variables as independent variables. NPLGross is gross non-performing loans (loan loss provisioning); Zscore is the Z-score, which is measured by the total of the equity to asset ratio and ROA, divided by the standard deviation of ROA; rii is relative interest income, which is the ratio between interest revenue and total loans; alg is abnormal loan growth, which is measured by the difference between the loan growth of the banks and the loan growth of all the commercial banks; alg1, alg2, alg3, and alg4 mean the lagged t-1, t-2, t-3, t-4 of abnormal loan growth, respectively. Avgalg4a is the average of abnormal loan growth for four years; lnasset is the natural logarithm of total assets; equitytoasset is the ratio between total equity and total assets; roe is return on equity which is measured by the ratio of total equity and net income. Listed is a dummy variable, it is equal to 1 if banks are listed, or 0 if not; foreign is a dummy variable, it is equal to 1 if the majority shareholder is a foreign entity, or 0 if not. Standard errors are reported in parentheses, and ***, **, * coefficients are statistically significant at 1%, 5%, and 10%, respectively.

Source: Processed data

Further examination was related to the size of the banks. Table 7 and Table 8 show the estimations for small banks and large banks respectively. Both tables consistently fail to report a significant relationship between gross NPL and abnormal loan growth. This suggested that NPL may not be an appropriate measure, due to the regulations on NPL. Nevertheless, the relation between abnormal loan growth and dependent variables, namely z-score (Model 2) and rii (Model 3), tended to be stronger in the small banks rather than in the large banks.

Table 7. The Effects of Loan Growth of Bank Stability for small banks.

Dependent Variables	Model 1 NPL Gross	Model 2 Zscore	Model 3 Rii
$NPLGross_{t-1}$	0.535***		
	(0.153)		
$zscore_{t-1}$		0.750***	
		(0.076)	
rii_{t-1}			0.505***
			(0.058)
alg1	0.010		
	(0.165)		
alg2	0.115		
	(0.100)		
alg3	-0.096		
	(0.074)		
alg4	0.053		
	(0.044)		
avgalg4a		-12.914***	
		(3.093)	
Alg			-0.095**
			(0.047)
equitytoasset	-0.058	71.241	0.527*
	(2.202)	(52.567)	(0.282)
Roe	-1.726	12.786	0.604
	(8.143)	(53.687)	(0.687)
Listed	-0.171	58.451***	-0.260
	(1.824)	(16.301)	(0.265)
Foreign	1.158	-15.082	0.055
	(2.430)	(92.733)	(0.353)
Observations	480	524	606
Number of banks	44	44	44
ar2p	0.770	0.166	0.232
Hansenp	0.877	0.808	0.930

Notes: The dependent variables are NPLGross, Zscore, and rii for model 1, model 2, and model 3 respectively. Each model adds the lagged dependent variables as independent variables. NPLGross is gross non-performing loans (loan loss provisioning); Zscore is the Z-score, which is measured by the total of the equity to asset ratio and ROA, divided by the standard deviation of ROA; rii is relative interest income, which is the ratio between interest revenue and total loans; alg is abnormal loan growth, which is measured by the difference between the loan growth of the banks and the loan growth of all the commercial banks; alg1, alg2, alg3, and alg4 mean the lagged t-1, t-2, t-3, t-4 of abnormal loan growth, respectively. Avgalg4a is the average of abnormal loan growth for four years; lnasset is the natural logarithm of total asset; equitytoasset is the ratio between total equity and total assets; roe is return on equity which is measured by the ratio of total equity and net income. Listed is a dummy variable, it is equal to 1 if banks are listed, or 0 if not; foreign is a dummy variable, it is equal to 1 if the majority shareholder is a foreign entity, or 0 if not. Standard errors are reported in parentheses, and ***, **, * coefficients are statistically significant at 1%, 5%, and 10%, respectively.

Source: Processed data

Table 8. The Effects of Loan Growth of Bank Stability for Large Banks.

Dependent Variables	Model 1 NPL Gross	Model 2 Zscore	Model 3 rii
$NPLGross_{t-1}$	0.659***		
	(0.123)		
$zscore_{t-1}$		0.238	
		(0.153)	
rii_{t-1}			0.219***
			(0.059)
alg1	-0.605		
	(0.811)		
alg2	-0.458		
	(0.599)		
alg3	-0.005		
	(0.327)		
alg4	0.024		
	(0.290)		
avgalg4a		-12.351	
		(36.350)	
Alg			-0.034***
			(0.011)
equitytoasset	0.128	115.097	-0.123
	(2.963)	(145.671)	(0.135)
Roe	-7.148	7.151	0.003
	(5.037)	(79.703)	(0.094)
Listed	-6.620	-165.749**	0.015
	(7.846)	(76.210)	(0.082)
Foreign	-2.716	3.495	0.148
	(4.555)	(33.361)	(0.097)
Observations	469	511	598
Number of banks	43	43	43
ar2p	0.458	0.406	0.247
Hansenp	0.814	0.456	0.776

Notes: The dependent variables are NPLGross, Zscore, and rii for model 1, model 2, and model 3 respectively. Each model adds the lagged dependent variables as independent variables. NPLGross is gross non-performing loans (loan loss provisioning); Zscore is the Z-score, which is measured by the total of the equity to asset ratio and ROA, divided by the standard deviation of ROA; rii is relative interest income, which is the ratio between interest revenue and total loans; alg is abnormal loan growth, which is measured by the difference between the loan growth of the banks and the loan growth of all the commercial banks; alg1, alg2, alg3, and alg4 mean the lagged t-1, t-2, t-3, t-4 of abnormal loan growth, respectively. Avgalg4a is the average of abnormal loan growth for four years; lnasset is the natural logarithm of total assets; equitytoasset is the ratio between total equity and total assets; roe is the return on equity which is measured by the ratio of total equity and net income. Listed is a dummy variable, it is equal to 1 if banks are listed, or 0 if not; foreign is a dummy variable, it is equal to 1 if the majority shareholder is a foreign entity, or 0 if not. Standard errors are reported in parentheses, and ***, **, * coefficients are statistically significant at 1%, 5%, and 10%, respectively.

Source: Processed data

4. Robustness Test: 2008 Financial Crisis

A robustness check of the 2008 global financial crisis was necessary in order to ensure that all the significant variables were robust. Table 8 shows the robustness check for the determinants of loan growth. The focused variables were deposit growth and NPLGross. Consequently, both variables interacted with the dummy year 2008 (year08). The estimation indicated that dpkgrowthXyear08 was significantly negative in model 1 (all banks) and model 2 (small banks).

It meant that the effect (magnitude) of deposit growth on loan growth was reduced during the financial crisis, but the significance of deposit growth was relatively the same. In contrast, the estimation of NPLGrossXyear08 was not statistically significant. The findings suggest that deposit growth and NPLGross had a consistently important role after controlling for the dummy year 2008.

The next robustness check was to examine whether the relationship between excessive bank loans and bank stability changed during the 2008 financial crisis. The abnormal loan growth, which was a focused variable, interacted with the dummy variable year08. The estimations of model 1, model 2, and model 3 in Table 10 indicated that none of the interaction variables were statistically significant. This meant the results in the previous analysis were robust with respect to the 2008 financial crisis.

Table 9. Robustness Check for the Determinants of Loan Growth.

Dependent Variable = Loangrowth	Model 1 All Banks	Model 2 Small Banks	Model 3 Large Banks
$Loan\_growth_{t-1}$	0.096	0.184**	0.131
	(0.062)	(0.072)	(0.156)
dpkgrowthXyear08	-0.853*	-0.469*	-0.083
	(0.466)	(0.243)	(0.384)
Dpkgrowth	0.627***	0.581***	0.325
	(0.090)	(0.071)	(0.204)
NPLGrossXyear08	-0.002	-0.009	-0.013
	(0.048)	(0.016)	(0.028)
NPL Gross	-0.030***	-0.016	-0.011
	(0.011)	(0.012)	(0.018)
year08	0.146	0.034	0.096
	(0.158)	(0.071)	(0.156)
dpktoasset	-1.492	-0.836	0.493
	(0.997)	(0.979)	(1.052)
Lnasset	-0.019		
	(0.143)		
equitytoasset	-1.042	-0.795	-0.688
	(1.288)	(1.276)	(1.759)
Roe	-0.084	-0.400	-0.005
	(0.328)	(0.482)	(0.263)
Listed	0.412	-0.353	-0.632
	(0.356)	(0.356)	(0.578)
Foreign	0.179	-0.015	-0.272
	(0.322)	(0.326)	(0.336)
Agebank	-0.021	-0.006	0.004
	(0.032)	(0.012)	(0.009)
Merger	-0.077	-0.075	0.116
	(0.304)	(0.265)	(0.229)
Observations	1,190	606	584
Number of banks	86	44	42
ar2p	0.510	0.883	0.800
Hansenp	0.502	0.884	0.575

Notes: The dependent variable is Loan growth in t ($Loangrowth_t$). Independent variables are, besides the lagged dependent variable ($Loangrowth_{t-1}$), dpkgrowthXyear08 is the interaction variable between dpkgrowth and year08; dpkgrowth is the growth in customers' deposits between year t and year t-1. NPLGrossXyear08 is the interaction variable between NPLGross and year08. Year08 is a dummy variable, it is equal to 1 if the year=2008, or 0 if not; dpktoasset is the ratio between customers deposits and total assets. lnasset is the natural logarithm of total assets; equitytoasset is the ratio between total equity and total assets; roe is the return on equity which is measured by the ratio of total equity and net income. NPLGross is gross non-performing loans (loan provision loss). Listed is a dummy variable, it is equal to 1 if banks are listed, or 0 if not; foreign is a dummy variable, it is equal to 1 if the majority shareholder is a foreign entity, or 0 if not; agebank is the difference between the bank's establishment date and the year of the observation. Merger is a dummy variable, it is 1 if banks involved in M&A, or 0 if not. Model 1 is for all the observation periods, while model 2 and model 3 are for the periods from 2008 to 2013 and 2014 to 2018, respectively. Standard errors are reported in parentheses, and ***, **, * coefficients are statistically significant at 1%, 5%, and 10%, respectively.

Source: Processed data

Table 10. The Effects of Loan Growth of Bank Stability.

Dependent Variables	Model 1 NPL Gross	Model 2 Zscore	Model 3 rii
$NPLGross_{t-1}$	0.611***		
	(0.127)		
$zscore_{t-1}$		0.460***	
		(0.123)	
rii_{t-1}			0.287***
			(0.064)
alg1Xyear08	11.018		
	(11.671)		
alg2Xyear08	-6.804		
	(5.189)		
alg3Xyear08	-3.144		
	(8.589)		
alg3Xyear08	0.000		
	(0.000)		
alg1	-0.245		
	(0.391)		
alg2	0.481		
	(0.470)		
alg3	-0.233		
	(0.301)		
alg4	-0.101		
	(0.322)		
avgalg4aXyear08		-12.395	
		(21.185)	
avgalg4a		-16.457*	
		(9.441)	
algXyear08			-0.066
			(0.150)
Alg			-0.101*
			(0.057)
year08	4.246	-1.925	-0.353
	(4.354)	(9.299)	(0.532)
lnasset	3.295	6.060	-0.304
	(2.531)	(26.732)	(0.391)

Dependent Variables	Model 1 NPL Gross	Model 2 Zscore	Model 3 rii
equitytoasset	10.170	354.010**	0.903
	(18.333)	(137.941)	(1.903)
Roe	-18.733***	-156.381	0.281
	(4.610)	(98.630)	(0.571)
listed	-2.262	-4.846	-0.374
	(5.873)	(49.459)	(0.573)
foreign	-5.991	-82.001	0.772
	(6.114)	(115.229)	(1.160)
Observations	949	1,035	1,204
Number of banks	87	87	87
ar2p	0.509	0.566	0.205
hansenp	0.089	0.590	0.929

Notes: The dependent variables are NPLGross, Zscore, and rii for model 1, model 2, and model 3 respectively. Each model adds the lagged dependent variables as independent variables. NPLGross is gross non-performing loans (loan loss provisioning); Zscore is the Z-score, which is measured by total of the equity to asset ratio and ROA, divided by the standard deviation of ROA; rii is relative interest income, which is the ratio between interest revenue and total loans; alg is abnormal loan growth, which is measured by the difference between the loan growth of the banks and the loan growth of all the commercial banks; alg1, alg2, alg3, and alg4 mean the lagged t-1, t-2, t-3, t-4 of abnormal loan growth, respectively. Avgalg4a is the average of abnormal loan growth for four years; alg1Xyear08 is the interaction variable between alg 1 and year08, alg2Xyear08 is the interaction variable between alg 2 and year08, alg3Xyear08 is the interaction variable between alg 3 and year08, alg4Xyear08 is the interaction variable between alg 4 and year08, avgalg4aXyear08 is the interaction variable between avgalg4a and year08, algXyear08 is the interaction variable between alg and year08, Year08 is dummy variable, it is equal to 1 if the year=2008, or 0 if not. lnasset is the natural logarithm of total assets; equitytoasset is the ratio between total equity and total assets; roe is the return on equity which is measured by the ratio of total equity and net income. Listed is a dummy variable, it is equal to 1 if banks are listed, or 0 if not; foreign is a dummy variable, it is equal to 1 if the majority shareholder is a foreign entity, or 0 if not. Standard errors are reported in parentheses, and ***, **, * coefficients are statistically significant at 1%, 5%, and 10%, respectively.

Source: Processed data

5. Research Discussion

This study used several important variables in determining loan growth, namely deposit growth, liquidity, capitalization, and risk. The regression estimations indicated that deposit growth was the most important explanatory variable and it was robust after controlling for the observation period (contraction and expansionary periods) and bank size (small and large banks). This finding is consistent with previous studies (Barajas and Steiner, 2002; Guo and Stepanyan, 2011; Bouvatier and Lepetit, 2012; Bowman et al., 2015). The second most important variable is gross NPL, which was significant in influencing loan growth in the expansion and contraction periods.

There are several interpretations regarding the results in Table 4 and Table 5. Firstly, banks were too dependent on customers' deposits, which suggested that the banks may encounter problems in trying to attract more deposits. The customers of the banks are becoming smarter at managing their money. Recent data has shown there is a significant increase in the number of investors on the Indonesia Stock Exchange (Simamora, 2018). This means that more Indonesians are becoming aware of the benefits of investing their money in the capital market, rather that putting their money in banks. Banks must offer attractive programs and returns to attract and keep the deposits from their customers.

Secondly, gross NPL was the main concern for banks in Indonesia when lending money. Banks with large gross NPL tend not to lend money either in the expansion or contraction periods. This finding is consistent with previous studies (Laeven and Majnoni; 2003; Bouvatier and Lepetit, 2008; Beatty and Liao, 2011; Bouvatier and Lepetit, 2012). Thirdly, the

liquidity ratio was more important than the capitalization, which is consistent with a study by Kim and Sohn (2017). Consequently, if the regulators try to increase bank lending, they should focus on the liquidity aspect rather than the capitalization of banks.

This study used various control variables, namely the deposit to asset ratio, equity to asset ratio, ROE, bank size, listed bank, foreign bank, age of the bank, and mergers. The results indicated that only some of the variables were statistically significant in influencing loan growth, such as bank age and foreign bank. Banks that were established earlier (old banks) tended to have lower loan growth during the expansionary period (2008 to 2013). Old banks may not be as aggressive as young banks in increasing their loan growth after the financial crisis, which is consistent with previous studies (Jemric and Vujcic, 2002; Lin and Zhang, 2009). Moreover, foreign banks tended have a higher loan growth than domestic banks' loan growth, which is consistent with a previous study in Indonesia (Mulyaningsih et al., 2015). The insignificance of the control variables may be due to the specific characteristics of Indonesia. Previous studies tended to use multiple countries in the analysis, while this study only used Indonesia as the research observation.

The second part of the empirical evidence shows that there was a tendency that the high level of loan growth could create bank instability. Even though the relation between abnormal loan growth and gross NPL was not statistically significant, which may be caused by the thresholds set by the regulator, there was an early sign that excessive loan growth affected the credit risk and profitability, proxied by the Z-score and relative interest income (RII), respectively. These findings are consistent with previous studies (Foos et al., 2010; Amador et al., 2013; Vithessonthi, 2016; Cucinelli, 2016), in which loan growth caused bank instability.

Instability remains prevalent in small banks. One possible explanation is the reliance of small banks on providing loans to generate revenue for the bank, while large banks have more alternative methods of doing so (Kim and Sohn, 2017). Small banks might be relaxing the requirements (standards) of the loan applications in order to improve (maintain) bank performance, which might lead to bank instability in the future. The other reason is related to the resources of small banks which are less than those of the large banks. According to Berger and Udell (2002), the main difference between small banks and large banks is in their lending technologies. Large banks tend to use transaction-based lending (i.e. financial statement lending, asset-based lending, credit scoring) while small banks use relationship lending (i.e. soft information). In small banks, the loan officer has more authority to approve loans. This condition will likely create or exacerbate the agency problem such as illegal kickbacks (i.e. bribery for bank managers after the approval of a loan application). Moreover, they can hide the borrowers' worsening condition through their personal relationship. This argument may be a reason why small banks are more prone to instability when providing more loans.

RESEARCH CONCLUSIONS AND SUGGESTIONS

The objectives of this study were to examine the determinants of loan growth and to investigate the impacts of a high level of loan growth on banks' stability. Using a large dataset of Indonesian banks and comprehensive estimation methods, this study is deemed robust. The findings are as follows. Firstly, the growth in customers' deposits is the most important

variable for explaining the growth in loans, in both expansionary and contractionary periods. The significance of the growth in deposits remains strong after controlling for bank size. Gross NPL is another factor that is important in explaining loan growth, particularly during the contractionary period. However, there is insufficient evidence that the relationship between gross NPL and loan growth is affected by bank size. For that reason, deposit growth is more pivotal than gross NPL. Secondly, this study shows excessive loan growth is detrimental to bank stability as the banks' Z-scores and relative interest income are lower. This finding is more prevalent for small banks than for large banks. Both findings are robust after controlling for the 2008 financial crisis.

This study has shown that certain bank-specific factors may significantly influence one type of bank while they do not for another type. For instance, liquidity matters for both small and large banks, but it has a more significant effect on small banks. The current regulations for boosting loan growth i.e. the loan to deposit ratio (LDR), tend to follow the notion of "one size fits all." This policy will be less likely to have effective results on loan growth. Moreover, as small banks are more prone to instability, the regulators must pay more attention to those banks. Lastly, the regulators should not only rely on one aspect, namely NPL, to assess the stability of banks.

Several specific determinants have not been included in the models, such as board characteristics (i.e. board size, board independence, board diversity) and ownership structure. These variables can be added in future studies. Moreover, as bank regulators are trying to consolidate the number of banks, it is interesting to investigate the effect of mergers and acquisitions in the banking sector on banks' loan growth and stability in detail.

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