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Monetary Shock, Banking Risk and Bank Lending Channel: Evidence from Indonesian Banking Industry

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ABSTRACT

This study examines the existence of a bank lending channel in the Indonesian banking system and tests whether monetary policy shock is transmitted via bank risk in bank lending activity. We use banking micro-data from 2007 to 2016. Using static and dynamic panel data, we find some contrary results from the US banking evidence, in which less-liquid banks and smaller banks and not highly liquid and larger banks are able to insulate their credit supply against the monetary shock. These types of the banks could raise funds from their business group, loyal depositors, and strong lending relationships to shield their loan portfolio from risk. Additionally, well-capitalized banks face minimal problems raising uninsured funding. Therefore, they can provide more loan supply. Moreover, riskier banks suffer more in their lending supply against monetary policy shock. Even stable banks (characterized by higher Z score) are unable to protect their capacity to channel their loans when interest rates increase. It should be suspected that larger banks convert their loanable funds into short-term investments and also focus on generating income from high-risk non-traditional bank products during the contracting period. Hence, they suffer more with their loan portfolios. This provides a signal for Financial Services Authority (OJK) to scrutiny the behavior of larger banks that might take on riskier businesses. To anticipate this activity, the banking regulator must also refine the minimum loan-to-deposit ratio for different sizes of banks so that they can increase their participation in spurring economic growth.

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INTRODUCTION

The bank lending channel (BLC) and monetary transmission received widespread attention among scholars after Bernanke and Blinder (1988) established the theoretical model of aggregate demand, which provides roles for both money and bank loans. Several articles state that BLC is defined as a credit view of the mechanism, in which changes in monetary policy or monetary shock tighten the reserve in the central bank. This leads to a shrinking credit supply if the bank faces the problem of rising uninsured funds instead of the decrease in the loanable funds. Thus, the existence of bank lending channel is shown by the response of banking credit supply due to movement in monetary policy. The effectiveness of the central bank in managing its monetary policy could be measured through the sensitivity of the bank's credit supply (Ramos-Talada, 2015). The more sensitive the bank's lending supply, the more effective the central bank is in managing monetary policy, and accordingly, this BLC becomes an important tool to stabilize the country's economic condition.

Growth in credit availability in the banking system is jointly determined by supply and demand. Bernanke and Gertler (1995) proposed the credit channel or balance sheet channel theory of monetary transmission. This channel emphasizes the adverse impact of the monetary policy movement on the debtors' financial reporting, including their net worth, cash flow, and liquid assets. Contracting monetary policy may weaken the credit worthiness of debtors; it results in the debtor's decreased ability to raise cheaper funds from the banks or other sources. Consequently, this practice reduces the demand for the credit market in the banking system. On the other hand, lowering the interest rate increases the value of borrowers' assets, net worth, and collateral. Thus, with an increase in the quality and the quantity of their assets, the borrowers get better access to cheaper interest rates for credit facilities. Credit demand increases even higher for riskier borrowers, because their value of net worth and collateral assets are better under these circumstances (Gertler and Gilchrist, 1994).

Various bank lending channel studies have been established by previous researchers through theoretical analysis, such as Bernanke and Blinder (1988) and Bernanke et al. (1999) within the empirical and policy setting; furthermore, Kashyap and Stein (2000), Kishan and Opiela (2006), and Kishan and Opiela (2000) analyzed the existence of BLC in US banking. Altunbas et al. (2010) examined the European zone, and Borio and Gambacorta (2017) studied larger international banks data. Furthermore, data from emerging markets are explored by Chen et al. (2017), Ramos-Talada (2015) use data from Brazil, and Yang and Shao (2016) provided evidence from China. The results of the studies are still debatable; these inconclusive findings might derive from using the aggregate macro data, as applied by Bernanke and Blinder (1988). Thus, it is not easy to determine whether the growth of loan portfolios is propelled by the supply of and demand for loans. Moreover, the use of bank-level data can be applied from some omitted unobserved variables or identification problem (Kashyap and Stein, 2000, Jimenez et al., 2012). Therefore, this study combines the impact of macroeconomic data and bank-level data to obtain the more accurate and precise estimation of changes in lending against monetary shock.

Our study separates the impact of monetary policy changes on loan supply using the change of short-term interest rate (central bank rate, here BI-rate) and loan demand by applying the GDP growth and inflation rate as measurements of economic activity. Supply of loans could decrease, due to the increase in the bank cost of capital as a consequence of increases in BI-rate, but demand for the loan may fall because of the deterioration of firms' financial condition in response to a change in interest rate. Demand for the loan might remain constant because economic activities are still high. Additionally, the panel data approach is used. Thus, heterogeneity of bank-level data can be accommodated, such as bank liquidity position, bank capitalization, and size of the bank. Those variables are the measurement of the ability of the bank to transfer their liquidity to provide loans for debtors. If those variables hold a weaker position, it can impact the price of the bank's loanable funds, or the bank is charged a premium for its external funding (Bernanke and Gertler, 1995). Subsequently, the bank having a higher cost of external funding has a higher sensitivity of monetary movement on its lending supply.

Bank liquidity variables (liquidity ratio, capital, and size) are not sufficient to accurately evaluate the bank's ability to provide additional loans in response to monetary shock. The risk perception of banks also plays an important role in raising the insured funds (Altunbas et al., 2010). Tightening monetary policy can weaken the financial position of the firm as well as the bank as a supplier of the loan. As interest rates

increase, the firm has difficulty to earn more returns from its investments and impact its ability to pay off the loan. Banks will face a problem in its quality of assets when more loans are not performing well. Consequently, the increasing market perception on bank risk influences its capability to raise funds, as the market charges higher premium, leading to a higher cost of capital and then lowering profitability. This condition forces the bank to restructure its availability of credit in the market. Our study uses non-performing loan (NPL) as the ex-ante credit risk and alternative measurement of risk, while included herein is the bank solvency risk Z-score.

The purpose of this current study is to examine whether bank lending channels operate in the Indonesian banking system, and we also test whether bank lending channels exist via bank risk. We are motivated to undertake this BLC topic for two reasons: firstly, the literature exhibits inconclusive findings regarding the monetary shock on loan growth around the US banking system, Eurozone, and emerging markets. The Indonesian banking system is the main source of financing for firms. Thus, changes in monetary policy are predicted to impact the banking and real business sectors through BLC. Secondly, limited articles have been published that discuss the determinants of loan growth in Indonesian banking (see Lahuddin and Viverita, 2017); however, the authors do not analyze the bank lending channel. Meanwhile, Indonesian banking is part of the study by Chen et al. (2017), who studied bank risk-taking and monetary policy in emerging economies. They do not analyze specifically BLC for Indonesian banking.

Our findings show that less liquid banks and smaller-sized banks are better able to insulate their lending activities against monetary shock. This is in contrast to the conclusion of some US bank studies (Kashyap and Stein, 1995, Kishan and Opiela, 2000). Additionally, riskier banks suffer more in their lending supply when contracting monetary policy. It should be suspected that larger banks convert their loanable funds into short-term investments and also focus on generating income from high-risk non-traditional bank products during the contracting period, and hence they suffer more in their loan portfolio

Our paper contributes to the existing Indonesian bank lending channel literature and its relationship with monetary policy and bank risk. Firstly, we distinguish the determinant factor of loan growth, whether from monetary policy (BI-rate) that impacts the loan supply, or from economic activity (GDP rate). Additionally, the heterogeneity of bank characteristics involves overcoming identification problems. Thus, the monetary authority could use these results to fine tune its policy to promote economic growth and stability. Secondly, slow growth was observed in the aggregate loan for the last three years (10.4 percent, 7.9 percent and 8.2 percent for the years 2015, 2016, and 2017, respectively). Additionally, NPL increased to 2.6%, but the bank is still a dominant player in providing loans (www.ojk.id). This implying that bank credit risk magnifying by contraction monetary policy might impact loan growth negatively. Thus, prompting action by authorities need to be taken if there is higher sensitivity of BLC.

The rest of this article is structured as follows: Section 2 discusses the literature review on the bank lending channel and risk-taking. Data collection, operational variables, and the empirical model are described in Section 3. Section 4 provides the analysis of findings, and lastly, Section 5 concludes this article.

LITERATURE REVIEW

Central banks manage monetary stability to support countries' economic growth. This monetary policy must be examined to determine whether it is issued at the right time and has a positive impact on the economy (Mishkin, 1995). Additionally, the author described the several transmission channels of monetary policy that affect the economy, such as interest rate channel, exchange rate channel, credit channel, and asset-prices channels. Credit channels are divided into two channels, namely bank lending channel (BLC) and balance-sheet channel (BSC). Those channels emerge from the agency problem in the credit market because of asymmetric information and the high cost of the contract.

The Old Keynesian model on interest rate channel suggested that contraction of the monetary policy increases the interest rate, which leads to increased cost of capital for both firms and banks. This decreases firms' investments as well as consumers' spending on durable goods. Consequently, a decrease in economic growth emerges as a whole. If banks do not have a problem with their source of deposits and margins, their loan portfolios are not affected. Additionally, when the loan demand falls because of weaker demand for loans

only, thus this relates to the interest rate channel (Kishan and Opiela, 2000), and in this particular condition, banks do not have the role in monetary transmission.

Bernanke and Blinder (1988) proposed a new view of monetary transmission; they explained how monetary policy impacts the real economy via the intermediation process. This theory implies that alterations to monetary policy lead to a decrease in credit supply and increase costs for bank-dependent borrowers. Firstly, when the central bank applies to contract monetary policy in the financial system through market operation, it reduces the deposit funds available for loan because it must hold more as a reserve in the central bank. Asymmetric information between bank and depositors increases risk perception of the bank, forcing the bank to sell highly cost uninsured deposit, however some banks unable to replace the fund held in central bank's reserve. Consequently, then the supply of credit drains in the banking system (Kashyap and Stein, 1995, Sentero-Saiz et al., 2014). Secondly, the tight monetary policy is likely to increase the interest rate and return for depositors, the speed of price adjustment among asset is different, thus encouraging the household depositors to hold them. In another word, tightening policy increases the cost of deposits which force bank gathers expensive cost of funding, ultimately shrinking the supply of loans (Disyatat, 2011, Sentero-Saiz et al, 2014).

An alternative view of the bank lending channel proposed by Bernanke (2007) and Disyatat (2011) relies on the availability of capital market as the source of bank funding. Contraction monetary policy forced restrictive banks to raise the external fund premium from the capital market, and then pass this cost to the borrowers. However, Disyatat (2011) suggested that well-capitalized bank under a liberalized capital market does not have a problem raising funds from the market. Thus, through this mechanism, we can see that monetary policy not only impacts the bank's traditional deposit but also funding from the capital market. Sentero-Saiz et al. (2014) studied the link between sovereign risk and loan supply through the change of monetary policy. The new phenomenon of the transmission of negative deposit rate policy to the bank lending supply in European Banks that have not been explained by Bernanke (2007) explored by Heider et al. (2019). They found this action taken by European Central bank unfavorably impact the growth of lending and lead to more risk-taking. Moreover, lower interest rate regime negatively impairs US's bank performance and its net interest margin, which in turn may increase the overall bank risk (Bikker and Verveliet, 2018).

In addition to the bank lending channel, Bernanke and Gertler (1995) also suggested balance sheet channel (BSC) as a possible nexus between monetary policy taken by the central bank and its impact on the external finance premium in the loan market. The stronger financial position of the borrower, the lower the finance premium charged by lenders is. Additionally, this channel focuses on how monetary policy shock impacts the debtors' balance sheet, income statement, and other parts of the financial conditions, such as net worth, cash flow, and its liquid assets. Changes in central bank' policy impact the interest rate that affects the financial position of borrowers. Tightening of the monetary policy increases the interest expense of borrower's floating rate loan, thus lowering the income as well as the cash flows. Similarly, an increase in interest rate decreases the value of borrower investment and indirectly lowers the value of collateral and borrowers' net worth. Worsening the borrowers' financial position reduces their ability to spend on investment. Subsequently, this could decrease the demand on the bank loan, lower the value of banks' portfolios, and deteriorate the bank capital (Kishan and Opiela, 2006).

Some researchers have previously focused on examining the link between monetary policy and the credit channel. Kashyap and Stein (2000), using a big set of data from all banks in the US from 1976 to 1993, proved the existence of a bank lending channel in the country. The banking system reduced its supply of loans when the cost of a deposit could not be substituted by other lower costs of external sources when the monetary policy was tight. The impact of this condition is more pronounced for small and less liquid banks than larger and liquid banks. Similarly, Kishan and Opiela (2000) also explore US banking data and test the impact of monetary policy on BLC, and they find that fewer capital banks adjust their supply of credit under the monetary policy shock. Different empirical results emerge in Euro-zone; Altunbas et al. (2010) find weak evidence for the bank lending channel. Studies in the emerging market using data banking in Brazil show that the short-term market interest rate negatively affects bank lending supply. However, the money market rate does not significantly impact the lending growth (Talada, 2015). Stronger competition in the Chinese banking market diminishes the impact of the monetary shock on the bank lending channel, especially for highly liquid and well-capitalized banks (Yan and Shao, 2016); this is in accordance with the findings by Leroy (2014). A Study in Malaysian banking by Caporale et al. (2019) shows that the lending growth of Islamic banking is less

responsive than do of commercial banking to the change of interest rate. However, credit portfolios increase more in the low growth period.

As discussed by Bernanke and Gertler (1995), there is a close relationship between borrower net worth and a bank's net worth. A higher-pressure bank balance sheet will be reflected in its default risk. A weaker net worth impacts the bank's ability to tap funds either from big depositors or the capital market, because of the increased bank perceived risk. Thus, the bank's ability to supply credit will decrease. Additionally, Rajan (2005) suggests that financial deregulation and innovation have already changed the banking structure of financing. Market-based pricing and financing are now essential; this hypothetically increases the relationship between monetary policy and financial stability. Increasing securitization and off-balance sheet activities can protect the bank loan supply against monetary shock (Gambacorta and Marquez-Ibanez, 2011; Parera et al., 2014). Altunbas et al. (2010) explored data from a European bank that moved its originating banking traditional business away in order to sell and securitize its loan portfolios. The researchers found that lower risk bank offers a greater supply of credit, despite shock from the monetary policy. The authors argued that those banks could insulate their loan supply because they do not have a problem accessing uninsured funds in the capital market. However, a non-performing loan as measured by ex-ante credit risk by Ramos-Talada (2015) for a Brazilian bank does not show a significant impact on loan growth when monetary policy changes.

Market structure and bank competition have also influenced the effectiveness of transmission monetary shock on loan growth. Olivero et al. (2011) recorded that higher competition in the Latin American banking system weakens the monetary policy transmission on lending growth. This finding is in line with the Monti-Klein analytical model used by Freixas and Rochet (1997). Additionally, similar results also found in the Chinese banking system especially for city-commercial, highly liquid, and well-capitalized banks (Yang and Shao, 2016). Meanwhile, some scholars also studied the association between bank ownership and bank lending channel. Foreign banks in developing countries have less influence on its lending activities through monetary transmission (Wu et al., 2011). When central banks contract the monetary policy, their loan growth decreases, and interest loan rate increases less than that of domestic banks. The foreign bank could buffer its portfolio from the host monetary shock, because it has easy access to the overseas parent or international capital market (Gambacorta, 2005).

RESEARCH METHODOLOGY

Set of Data and operational variables

Indonesian banking data, which are used in this study, are available from each bank's website, The Indonesian Capital Market (IDX) website, and the website of Bank Indonesia and The Indonesian Financial Authority (OJK). The data sample covers 77 commercial banks, including 35 public listed banks, state-owned banks, non-public commercial banks, and foreign-owned banks. Sariah Banks are excluded from our data, because they apply different regulations and playing fields from the commercial bank. World Bank categorizes a bank as a foreign bank when the proportion of foreign ownership is more than 50 percent (Bustaman et al., 2016). Our data sample ranges from 2007 to 2016. The series of monetary policy data, including the Indonesian benchmark interest rate and the aggregate money supply, are captured from the Bank Indonesia's website; meanwhile, macroeconomics data are available from the Indonesian Central Statistics Biro (BPS) website.

The dependent variable is measured using the percentage change of aggregate loans of every bank each year. The main independent variables used by many studies to measure monetary transmission shock (MP) is the benchmark central bank interest rate, and the alternative measure of monetary policy changes in the aggregate money supply. Additionally, to capture the impact of individual bank risk in granting the loan, this study uses the ratio of the percentage of the gross non-performing loan to total loans (NPL). The higher the bank NPL, the higher the banks' risk perception is, which could lead to higher cost of deposits and consequently impact the growth of the bank loan negatively. This study also uses the measure of the whole of individual bank risk or solvency risk Z score as an alternative measurement of bank risk. This time-variance of individual risk-taking is used in most literature related to the banking stability, such as Bustaman et al. (2017), Berger, Klapper, and Turk-Ariss (2009), and Lepetit and Strobel (2013). It is formalized as follows:

$$Z_{i,t} = \frac{ROA_{i,t} + TE/TA_{i,t}}{\overline{\sigma_{ROA}}} \quad (1)$$

$ROA_{i,t}$ and $TE/TA_{i,t}$ are the current period of bank profit and the bank equity consecutively, and $\overline{\sigma_{ROA}}$ is the average of standard deviation of the bank profit over the full sample. The value of the Z score can be interpreted as the inverse probability of bank failure, thus the higher the score, the lowest the risk of bankruptcy or the more stable the bank. On the other hand, the lower the score, the higher the exposure to insolvency risk.

Banks' specific factors are then used as additional explanatory variables in the literature of monetary transmission and lending growth. Those variables, such as size, capital, and liquidity, are not homogeneous among banks. Thus, the heterogeneity across banks determines the response of each individual bank in providing a signal to the market of their capacity and ability in order to supply credit to the market. Furthermore, these bank-specific factors explained in Kashyap and Stein (1995) and Kashyap and Stein (2000) could overcome the identification problem of whether the bank-lending channel is induced by supply or demand in the loan market. Previous studies found that small-sized banks, those with less capital, and banks with less liquid assets are adversely affected by tightening the monetary policy (see for example Kashyap and Stein (2000), Kishan and Opiela (2000, 2006) and Altunbas et al. (2010).

Other individual bank characteristics, such as ownership, also play important roles in providing the loan from the liquid assets or its ability to overcome liquidity restraint (Ramos-Talada, 2015). This study distinguishes ownership of a foreign bank and the local bank as well as between state-owned banks and private banks by using dummy variables. Additionally, we also include macroeconomics variables, namely GDP and inflation rates, as our control variables for homogenous demand for the loan of each bank (Kashyap and Stein, 1995; Ramos-Talada, 2015).

Empirical Methodology

This study applies a regression of the static and dynamic data panel approach using Generalized Moment of Method (GMM). The empirical model assumes that the loan growth or explained variables of this period are mainly impacted by the lack of one period of explanatory variables. Thus, all independent variables are presented in one period lag, except for ownership, with those lag variables we expect the endogeneity problem to reduce. The GMM methods from Arrelano and Bover (1995) and Blundell and Bond (1998) is used in this estimation model to control for the unobservable of the heterogeneity problem from the bank-specific effect. Lagged levels and lagged differences were used as instruments to minimize the endogeneity of the explanatory variable. The Sargan test is used to access the validity of all instruments used in the model and serial correlation of order two (Arellano and Bond, 1991).

We use the change of aggregate money supply as an alternative measure of monetary policy; the main measurement is the sort term benchmark of central bank interest rates. Risk measures that are used in this model are the ratio of non-performing loan (NPL), the ex-ante risk of bank credit portfolios, and alternative measurement of bank risk, which is the degree of solvency risk Z score. We also introduce into the model the existence of drivers in amplifying bank lending channel by joining the impact of bank risk and monetary policy variables as well as monetary policy and bank-specific variables. We adopt the model by Altunbas et al. (2010) and Ramos-Talada (2015), and thus our empirical dynamic panel data model is stated in equation (2).

$$\begin{aligned} Loangr_{it} =& \propto + \gamma_1 \Delta Loangr_{i,t-1} + \gamma_2 MP_{i,t-1} + \gamma_3 Risk_{i,t-1} + \gamma_4 MP_{i,t-1} * Risk_{i,t-1} \\ &+ \sum_{1}^{l} \beta_{1,l} MP_{i,t-1} * BS_{i,t-1} + \sum_{1}^{n} \beta_{1,n} BS_{i,t-1} + \sum_{1}^{m} \beta_{1,m} ME_{i,t-1} + D + \varepsilon_t \end{aligned} \quad (2)$$

Δloangr is the change in loan supply, Risk is bank risk, MP is Monetary Policies, BS is the vector of Bank Specific factors, and ME is the vector of macroeconomics variables. Lag one period of loan growth is also included as an independent variable, and because of the inertia problem, we assume that this lag loan growth variable impacts the loan growth significantly.

RESULTS

Descriptive Statistics

Table 1 shows the descriptive statistics of our set data; the average loan growth (LOANGR) in Indonesian banking industry is 17.79 percent. Central bank rate (BI_RATE) moves from 5 percent to 9 percent during the period under examination, with an average rate of 7.11 percent. Risk measures are represented by NPL and ZSCORE, average non-performing loan is 2.33, and the mean of insolvency risk is ZSCORE 6.26, with the maximum value at 17.70.

Table 1 Descriptive Statistics

	Mean	Maximum	Minimum	Std. Dev.
LOANGR	0.1779	1.0400	-0.8000	0.2140
BI_RATE	0.0711	0.0900	0.0500	0.0120
NPL	0.0233	0.3800	0.0000	0.0267
ZSCORE	6.2462	17.7000	-12.4200	2.5966
EQUITY	0.1373	0.3500	-0.2700	0.0592
LIQUIDITY	0.3237	3.0300	0.0900	0.1630
SIZE	30.1932	34.5800	25.2200	1.7567
PROFIT	0.0174	0.1600	-0.1800	0.0220
FOREIGN	0.3983	1.0000	0.0000	0.4899
GDP	0.0467	0.0600	0.0300	0.0082
INFLATION	0.0567	0.1100	0.0300	0.0275
PUBLIC	0.4242	1.0000	0.0000	0.4946

Results Analysis

The results of the estimated regressions model, in which loan growth is the dependent variable, is presented in Tables 2 and 3. Static data panel estimations are obtainable in Table 2, and the results of dynamic panel regressions are shown in Table 3. There are six columns of estimation in Table 2; column 1 and column 2 present the estimation regression results only for monetary policy (MP) variables and GDP as explanatory on the loan growth. Columns 1, 3, and 4 use BI rate as the MP measurement; on the other hand, changes in the aggregate money supply are in columns 2 and 5. Moreover, NPL is applied as a bank risk measure in columns 3 and 5; meanwhile, the Z score is a risk dimension exhibited in columns 4 and 6. The results of estimation using dynamic panel data are presented in Table 3. This table is divided into 4 columns; columns 1 and 2 show the regression results when we use BI-rate as an MP variable, and money supply as an MP variable is shown in columns 3 and 4. Meanwhile, NPL appears as a risk measurement in columns 1 and 3, and then the Z score is put in columns 2 and 4.

Regression results show that the interest rate negatively impacts the loan growth in almost all tables, whether indicating long-term equilibrium (static panel) as well as short-term equilibrium (dynamic panel). In other words, the central bank monetary policy, which changes the interest rate benchmark, effectively impacts the equilibrium of the loan. Other factors being equal, the availability and growth of the money supply parallel with the interest rate impact the loan supply positively. Oversupply of money credit leads to the credit boom. A study by Liu and Kool (2017) in European zone banking also finds that the supply of money and credit growth moves in the same direction. An increase in economic activity (change in GDP growth) positively impacts the loan demand. This finding is in accordance with the studies by Kashyap and Stein (1995) and Altunbas et al. (2010). Loan demand is also effectively impacted by the inflation rate, as a higher inflation rate reduces the loan demand in the banking system

The interaction variable between interest rate and GDP rate has a negative sign of the coefficient, and it seems that the change in interest rate has a more dominant impact than the GDP rate on influencing bank loan portfolios. However, the joint impact between money supply and interest rate do not affect the lending supply significantly in the long term, but in the short run (dynamic panel), it shows an oversupply of money and better economic condition results in credit overhang.

Bank credit risk as measured by NPL negatively impacts the capacity of the bank to distribute the loan. A higher non-performing loan reduces bank income, leads to reduced bank capital, and results in a decreased capacity of the bank providing the loan to debtors. Additionally, NPL represents the perception of risk in channeling the credit, and higher risk banks may be punished by the market to ensure higher cost on deposits

or other sources of financing (Altunbas et al., 2010). Thus, it impacts negatively the cost of lending and then ultimately the lending growth. Similarly, the more distance the bank has to insolvency, as measured by a higher Z score, the more power the bank has to increase its loan portfolio. We also analyze the impact of monetary policy on lending via bank risk by compounding the MP variable and risk variable. The joint variable between BI-rate and NPL has a negative sign, thus riskier banks suffer more it their lending supply against monetary policy shock. Stable banks (characterized by higher Z score) are neither unable to protect their capacity to channel their loans when interest rate increases. However, when the supply of money is higher, riskier banks are better able to insulate their loan supply.

Bank characteristics show that the size of the bank consistently has a negative impact on loan growth (Tables 2 and 3). This implies that small-sized banks do not suffer more than larger banks do from informational frictions. Moreover, only one bank collapse occurred in Indonesia within this period, and the deposit insurance scheme provides better confidence for small banks as well as the lending relationship between small banks and small debtors; thus, smaller bank can keep growing their loans. This finding is in line with the study on European banking (Altunbas et al., 2010; Ehrmann et al., 2003) and in China (Yang and Shao, 2016). On the other hand, bigger banks tend to increase their business by not spurring their lending growth. This might be because bigger banks have the ability to expand their business and income through non-interest product diversification (Bustaman et al., 2017).

Table 3 shows that equity has a positive relationship with loan growth. In the short run, well-capitalized banks have greater capacity to provide loans than less-capitalized banks do. However, in the long run, a poorly capitalized bank might use its network group arrangement to increase its portfolio, it is reflected in the negative sign of liquidity coefficient with the loan growth in Table 2. Another bank-specific ratio is liquidity, and as expected, highly liquid banks impact loan growth positively, as evident in both tables, and the liquid bank has more opportunity to convert its liquid asset to the loan portfolio. This is the same result as from previous findings (Kashyap and Stein, 1995; Jimenez et al., 2012).

Interaction bank-specific variables between liquidity, size, and monetary policy shock consistently have a negative sign in both Table 2 and Table 3. It seems that less-liquid banks and smaller-sized banks are better able to insulate their credit supply against the monetary shock than highly liquid and larger-sized banks face. Larger banks in Indonesia probably suffer more from asymmetric information; hence, they face difficulty raising uninsured funds from the market to tighten monetary policy, resulting in decreased lending supply (Kashyap and Stein, 1995). Another possibility is that larger banks invest some of their loanable funds in more safe short-term investments instead of providing credit to riskier debtors in the time monetary contract. Meanwhile, less-liquid banks might have funds from their business groups and loyal depositors to shield their loan portfolio. Additionally, well-capitalized banks in the long run do not have a problem raising uninsured non-deposit funding, therefore they can increase their loan to supply the credit market.

We also include the impact of ownership on a bank's capacity to provide the loan. Foreign and public banks have a positive link with the dependent variable loan growth. This implies that foreign and public banks do not have difficulty providing more loans to their debtors, as reflected in the positive sign of their coefficients. However, foreign banks also impact their portfolio negatively when central banks in a host country contract the monetary policy. In contrast to foreign banks, Indonesian public-listed banks seem to easily raise uninsured funding to support their loan portfolio against tight monetary policy conditions.

Table 2 Regression of static panel data loan growth as a dependent variable

MP measured by	BI Rate		Money Supply		BI Rate				Money Supply			
Risk measured by					NPL		ZSCORE		NPL		ZSCORE	
	1		2		3		4		5		6	
C	0.179	***	-0.067	***	2.396	***	2.261	***	-0.623		-0.643	
	(0.000)		(0.001)		(0.000)		(0.000)		(0.282)		(0.355)	
MP(-1)	-0.154	***	1.840	***	0.529		-0.255	***	6.400	**	6.297	***
	(0.001)		(0.000)		(0.361)		(0.000)		(0.038)		(0.094)	
DGDP(-1)	0.087	***	0.029	*	-0.037		-0.033		-0.347		-0.310	
	(0.001)		(0.097)		(0.247)		(0.320)		(0.539)		(0.592)	
MP*GDP(-1)					-1.214	***	-1.215	***	1.905		1.654	
					(0.000)		(0.000)		(0.598)		(0.655)	
RISK(-1)					-1.220	***	0.039	***	-3.139	**	0.025	
					(0.003)		(0.002)		(0.017)		(0.339)	
MP*RISK(-1)					-5.257	***	-0.097	*	22.377	**	-0.191	
					(0.000)		(0.064)		(0.024)		(0.380)	
MP*EQU(-1)					0.936		5.632	**	7.441	**	12.919	
					(0.154)		(0.020)		(0.018)		(0.224)	
MP*LIQ(-1)					-0.588	*	-0.551	*	0.908		0.639	
					(0.053)		(0.079)		(0.569)		(0.688)	
MP*SIZE(-1)					-0.014		0.009		-0.193	**	-0.156	
					(0.432)		(0.671)		(0.030)		(0.166)	
EQUITY(-1)					-0.493	**	-1.852	***	-0.933	**	-1.624	
					(0.022)		(0.001)		(0.045)		(0.206)	
LIQUIDITY(-1)					0.470	***	0.492	***	0.236		0.262	
					(0.000)		(0.000)		(0.328)		(0.280)	
SIZE(-1)					-0.076	***	-0.074	***	0.020		0.016	
					(0.000)		(0.000)		(0.231)		(0.436)	
INFLATION(-1)					-0.510	*	-0.605	**	-1.365	***	-1.342	***
					(0.086)		(0.043)		(0.000)		(0.000)	
FOREIGN					0.067		0.080	*	0.035		0.045	
					(0.115)		(0.068)		(0.415)		(0.327)	
PUBLIC					0.055	***	0.052	***	0.042		0.045	
					(0.005)		(0.010)		(0.211)		(0.196)	
MP*FOREIGN(-1)					-0.201	***	-0.190	***	0.585	***	0.667	***
					(0.001)		(0.003)		(0.006)		(0.006)	
MP*PUBLIC(-1)					-0.012		-0.088		0.293		0.229	
					(0.829)		(0.190)		(0.191)		(0.344)	
Adjusted R-squared					0.420		0.417		0.530		0.529	

Source: Data processed, value in parenthesis ( ) t prob, * significance level at 10%, ** significance level at 5%, and *** significance level at 1%.

Table 3 Regression of dynamic panel data loan growth as dependent variable

MP measured by	BI Rate				Money Supply			
Risk measured by	NPL		ZSCORE		NPL		ZSCORE	
	1		2		3		4	
LOANGR(-1)	-0.172	***	0.245	***	-0.129	***	0.115	**
	(0.000)		(0.000)		(0.008)		(0.037)	
MP(-1)	-5.941	***	-2.552	*	38.767	**	17.268	
	(0.000)		(0.052)		(0.017)		(0.262)	
DGDP(-1)	1.498	*	-0.692		126.316	***	10.853	
	(0.084)		(0.337)		(0.004)		(0.384)	
MP*GDP(-1)	-10.837	**	-8.487	*	-817.743	***	-63.951	
	(0.032)		(0.064)		(0.005)		(0.420)	
RISK(-1)	-0.588	*	-0.005		-3.874	**	0.316	*
	(0.079)		(0.988)		(0.020)		(0.091)	
MP*RISK(-1)	0.380		0.785		23.179	*	2.310	*
	(0.429)		(0.385)		(0.099)		(0.091)	
MP*EQU(-1)	1.130		0.988		6.650		-93.332	
	(0.103)		(0.326)		(0.511)		(0.145)	
MP*LIQ(-1)	0.159		-0.366		-10.286	*	-13.650	***
	(0.536)		(0.180)		(0.052)		(0.006)	
MP*SIZE(-1)	-0.003		-0.042		-0.198		-0.845	**
	(0.867)		(0.175)		(0.388)		(0.013)	
EQUITY(-1)	0.729	***	0.706		-0.095		13.185	
	(0.002)		(0.289)		(0.948)		(0.136)	
LIQUIDITY(-1)	1.288	***	2.279	***	2.691	***	2.975	***
	(0.000)		(0.000)		(0.000)		(0.000)	
SIZE(-1)	-0.238	***	-0.067		-0.173	***	0.018	
	(0.000)		(0.347)		(0.001)		(0.757)	
INFLATION(-1)	-59.778	***	-8.001		-68.450	**	3.561	
	(0.000)		(0.550)		(0.017)		(0.697)	
FOREIGN	-0.135		-0.375	*	-0.146		-0.099	
	(0.270)		(0.069)		(0.292)		(0.578)	
PUBLIC	0.280	***	0.379	***	0.366	***	0.200	***
	(0.000)		(0.001)		(0.000)		(0.007)	
MP*FOREIGN(-1)	-0.246	***	-0.282	***	1.062		1.369	**
	(0.001)		(0.001)		(0.212)		(0.052)	
MP*PUBLIC(-1)	-0.046		0.009		2.016	**	0.409	
	(0.568)		(0.919)		(0.024)		(0.617)	
J-statistic	34.392		30.441		32.700		31.809	
Prob(J-statistic)	0.155		0.250		0.207		0.200	
AR(1)	0.029		0.000		0.099		0.000	
AR(2)	0.236		0.253		0.181		0.939	

Source: Data processed, value in parenthesis ( ) t prob, * significance level at 10%, ** significance level at 5%, and *** significance level at 1%.

CONCLUSION

A bank-lending channel (BLC) is a tool that can be used by the monetary authority to stabilize the country's economic condition. The existence of a BLC is determined by the response of the bank to provide a loan against the monetary shock. Thus, the sensitive supply of bank loans as a result of changes in monetary policy is a yardstick of monetary policy effectiveness taken by the authority. Additionally, if the BLC is not active, the authority loses an important tool in managing inflation. However, very sensitive BLC could result in an overheating economy that ultimately shocks countries' economies as a whole (Ramos-Talada, 2015).

The purpose of our study is to examine whether BLCs are active in the Indonesian banking system and whether monetary policy shock is transmitted via bank risk on bank lending activity. Our findings show contrary results with the findings in the US but similar to those of the European and China banks in some respects. Less-liquid banks and smaller-sized banks are better able to insulate their credit supply against the monetary shock than highly liquid and larger-sized banks are. Larger banks in Indonesia probably suffer more from asymmetric information; hence, they face difficulty raising uninsured funds from the market to tighten monetary policy, thus decreasing their lending supply (Kashyap and Stein, 1995). Meanwhile, less-liquid banks might obtain funds from their business group and loyal depositors to shield their loan portfolio. Additionally, well-capitalized banks do not have a problem raising uninsured funding; therefore, they can provide a greater loan supply.

Banks with higher credit risk negatively impact the bank capacity to channel the loan. Additionally, the greater distance a bank has to insolvency, as measured by higher Z score, the more power the bank has to increase its loan portfolio. Joint variables between BI rate and NPL have a negative sign; thus riskier banks suffer more in terms of their lending supply against monetary policy shock. Stable banks (characterized by higher Z score) are also unable to protect their capacity to channel their loan when interest rates increase. However, when the supply of money is higher, riskier banks are better able to insulate their loan supply through monetary shock.

It seems that larger banks decrease their loan supply more as an impact of the tightening monetary policy. This can possibly be explained by their business strategy not to focus on increasing their portfolios during the short-term contraction period. These banks might convert their loanable funds into short-term investments and also focus to generate income from high-risk non-traditional bank products. These activities must be scrutinized by the financial service authority, and bank regulators also need to refine the minimum loan-to-deposit ratio for different-sized bank so that they can increase their participation in increasing economic growth.

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