"The impact of monetary policy and bank competition on banking industry risk: A default analysis"

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THE IMPACT OF MONETARY POLICY AND BANK COMPETITION ON BANKING INDUSTRY RISK: A DEFAULT ANALYSIS

Abstract

In the financial system and economy, the banking industry plays a crucial role. Default risk takes central stage in preserving financial stability and needs to be mitigated as it can trigger a crisis. The study examines the combined effects of monetary policy and bank competition on banking defaults. Using a sample of 95 commercial banks in Indonesia between 2009 and 2019, this study employs the Generalized Method of Moments, a two-step dynamic panel-data estimation system, to analyze it. Empirical estimation results show that monetary policy, through an increase in the benchmark interest rate, negatively affects probability of default. The extent of banking stability is also enhanced by monetary policy. Banking competition has a negative and significant effect on probability of default and has a positive effect on the banking distance to default. Furthermore, the combined impact of monetary policy and banking competition positively affects probability of default but has a negative impact on the distance of default. Building on this study, to promote a stable and more efficient banking system, policymakers should develop policies that foster complementary monetary and competition policies.

INTRODUCTION

Compared to other financial institutions such as insurance, pension funds, capital markets, and funding institutions, the banking industry plays a very strategic role in the financial system and economy. In a broader sense of banking, banks play intermediation positions interconnected in almost all economic activities (Ciobota, 2015). As a result, regulation and supervision are needed to ensure that financial stability is a condition that enables the national financial system to operate effectively and efficiently and also allows it to withstand vulnerabilities. The distribution of funding or financing will contribute to the economy's development and stability (Morgan & Pontines, 2014).

The financial crisis has attracted the attention of policymakers, and regulators have generally re-linked monetary policy with banking defaults. Low-interest rates have influenced how banks take risks in monetary policy regarding the behavior of risk-taking through the valuation of bank assets, income and cash flows. The negative impact of changes on banks is due to the intensive need for higher returns, where greater risk-taking is quickly realized through the provision of loans (Altunbas et al., 2010). Therefore, monetary transmission with low-interest rates causes financial imbalances. Furthermore, regarding size, banks in the middle and small positions tend to have the highest sensitivity of risk-taking behavior relative to changes in monetary policy (Rajan, 2005; Thai Ha & Quyen, 2018).

Gunji et al. (2009) prove that intense banking competition can weaken the impact of monetary transmission on credit growth. Thus, banking risk needs serious attention, since previous studies have produced a consensus that banking risk plays an important role in triggering financial crises in both developed and developing countries, as well as the crises that hit the Southeast Asian region in 1997, Mexico in 1994, Russia in 1998, and in the United States in 2008 (Barry et al., 2011). Since risk exposure continues to be a source of problems in financial institutions, banks must identify, measure, monitor and control risk to ensure they have adequate capital against default risk.

This study aims to explore how monetary policy affects the risk of banking stability by examining the path of the benchmark interest rate or the path of credit interest rates and analyzing the level of bank competition in relation to risks to the stability of the banking system.

1. LITERATURE REVIEW

1.1. Banking systemic risks

According to Furfine (2003), systemic risk occurs when financial shocks occur, causing financial markets to fail and to operat*ue* effectively at the same time. Due to financial relationships between institutions, the burden of institutional failure is passed on to others. According to Kahou and Lehar (2015), systemic risk is a risk in which an occurrence can cause economic losses and financial system instability, all of which have a negative impact on the real economy. Acharya (2009) stated that systemic risk is a risk of mutual loss resulting from the relationship between asset returns on the balance sheet and asset returns on the income statement.

The cost of resolving crises and recapitalization will be immense if the financial system is affected by bank failures. In macro terms, financial system collapse would jeopardize economic stability, obstruct the recovery process, and expand unemployment while reducing people's living standard, the cost of resolving crises and recapitalization will be immense if the financial system is affected by bank failures. In macro terms, financial system collapse would jeopardize economic stability, obstruct the recovery process, and expand unemployment while reducing people's living standards (Avgouleas & Goodhart, 2015). Also, failures in the banking sector have made monetary policy formulations ineffective as the set of quantitative targets and interest rate parameters tend to find it difficult to quickly respond to unhealthy banks and other financial institutions (Goodhart, 2015).

Thus, according to Adrian and Brunnermeier (2016), systemic risks are a possibility if banking institutions experience distress, since this may cause other institutions to experience distress as well, resulting in bank runs and the breakdown of the financial banking system. Roengpitya and Rungcharoenkitkul (2010) state that systemic risk is a type of liability in the event of bankruptcy of one banking institution. It can cause other institutions to fail as well. Systemic not only the problems of bank run and currency crises, but also a correlation breakdown between institutions, occurred in a short period due to liquidity withdrawals and widespread mistrust (Billio et al., 2010).

Kliestik et al. (2015) also published a paper that used a combination of KMV-Merton model to calculate the quantitative distance to default (1974). For a given time, the default distance reflects the gap between asset expectations and liabilities (debt). Since the size of credit risk is inextricably linked to default, the likelihood of a company default is an important topic in credit risk analysis (including credit interest). If the value of an asset falls below the value of its debt obligations, it is called a bank default.

In the micro scale, Harada et al. (2010) examined the distance to a default of eight major Japanese banks from 1986 to 1998. The results showed that the distance to default regression can be used to predict bank defaults. However, in the test process, several banks were unable to calculate the distance to default. Meanwhile, a quantitative measurement of the distance to default uses a combination of the Merton model. Measurement of the distance to default represents the distance between the expectations of assets and liabilities in a

particular time. The company default is an essential issue in credit and interest risk analysis as the size is inseparable by default (Kliestik et al., 2015).

1.2. Monetary policy and banking risk

Männasoo and Mayes (2009) conducted a study taking into account the factors of macroeconomic and specific conditions in explaining the occurrence of bank crises in 19 transition countries in Eastern Europe. They stated that the two interacting factors influence banking stability using of a discrete-time survival model. The fragility of a loan base with high exposure to market risk and macroeconomic disruptions is a typical precursor to banking pressure.

Purnomo (2018) analyzed the influence of monetary policy on the risk of default and its effect on the distance of banking defaults using a sample of 97 observation banks from 2010 to 2017. Monetary policy (via interest rate channels) can influence the likelihood of individual bank defaults. Research into how macroeconomics affects banking defaults has also expanded. Empirical evidence indicates that policies, such as economic development, benchmark interest rates, exchange rates, and inflation, affect bank default distances at the country level.

Debates also occur in determining the relationship between monetary policy and defaults, regarding the impact of bank competition on banking defaults. Several studies have shown that interest rate monetary policy shocks are transmitted to economic and banking players. This is in line with the argument that intense competition increases risk and becomes a channel of contagion effects that harm banking stability.

1.3. Banking competition and stability

The study of monetary policy and the risk associated with financial default is inseparable from the discussion of banking competition. This is because intense competition encourages the banking sector to implement strategies to achieve higher margins. Beck et al. (2004) stated that more concentrated structures in the banking market lead to high barriers. Conversely, based on samples in developed countries, Gunji et al. (2009) reported

that intense banking competition weakens the impact of monetary transmission on credit growth. Therefore, serious attention is needed on banking risk as it plays a vital role in triggering financial crises in both developed and developing countries.

In a less competitive market, the quiet life hypothesis states that businesses with greater market power would decrease their efforts to pursue cost efficiency, resulting in higher profits. Instead, from 1994 to 1999, Weill (2004) used panels to conduct tests in 12 EU countries, demonstrating empirical evidence that high bank competition makes banks inefficient.

2. DATA, METHODS AND HYPOTHESES

This study uses secondary data such as financial ratio metrics from financial statements and balance sheet statements of 119 banks from 2009 to 2019. Data is sourced and gathered from Financial Services Authority (FSA) of Indonesia reports, websites of financial services authorities, Bank Indonesia's websites, as well as from banks that have gone public and have not gone public. Macroeconomic data is gathered from a variety of sources, including World Development Indicators, World Bank Databases, Economic Data Indicators, etc.

The System of Generalized Method of Moments (GMM), an analytical testing method developed by Roodman (2009), is used in the data panel analysis. The use of the GMM System in this procedure would be beneficial because it can address heteroscedasticity disruption. Furthermore, the GMM Method can deliver a more accurate and effective estimated value than the first-difference GMM. If the p-values for AR (2) and Hansen-J tests are less than significant ($p < 0.01$; $p < 0.05$; and $p < 0.1$), the GMM system is valid. The following hypotheses will be raised based on the analysis of panel data using the Stata program:

H1: *Monetary policy has a positive and significant impact on the bank stability risk.*

H2: *Bank competition has a negative and significant impact on the bank stability risk.*

Equations (1) and (2) with banking risk dependent variables determined by *ZSCORE* indicators form the empirical model for testing Hypothesis 1 (*H1*). *REPO* or *RATE* are used as independent variables in monetary policy. To examine the effect of monetary policy on banking stability threats, the following equation is used:

$$
\begin{aligned}
ZSCORE_{it} = &\alpha + \beta_0 ZSCORE_{it-1} + \\
&+ \beta_1 REPO_{it} + \beta_2 SIZE_{it} + \beta_3 EQTA_{it} + \\
&+ \beta_4 CAR_{it} + \beta_5 LDR_{it} + \beta_6 NIM_t + \\
&+ \beta_7 INF_t + \beta_8 KURS_t + \beta_9 CA\_GDP_t + \\
&+ \beta_{10} GDP_t + e_{it},
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
ZSCORE_{it} = &\alpha + \beta_0 ZSCORE_{it-1} + \\
&+ \beta_1 RATE_{it} + \beta_2 SIZE_{it} + \beta_3 EQTA_{it} + \\
&+ \beta_4 CAR_{it} + \beta_5 LDR_{it} + \beta_6 NIM_t + \\
&+ \beta_7 INF_t + \beta_8 KURS_t + \beta_9 CA\_GDP_t + \\
&+ \beta_{10} GDP_t + e_{it},
\end{aligned}
\tag{2}
$$

ZSCORE indicators are used in empirical models to test Hypothesis 2 (*H2*) using equations (3) and (4) with banking risk dependent variables, although the competition bank HHI is an independent variable. The regression equation below is specifically designed to examine the impact of bank competition on banking stability risks:

$$
\begin{aligned}
ZSCORE_{it} = &\alpha + \beta_0 ZSCORE_{it-1} + \\
&+ \beta_1 HHI_{it} + \beta_2 SIZE_{it} + \beta_3 EQTA_{it} + \\
&+ \beta_4 CAR_{it} + \beta_5 LDR_{it} + \beta_6 NIM_t + \\
&+ \beta_7 INF_t + \beta_8 KURS_t + \beta_9 CA\_GDP_t + \\
&+ \beta_{10} GDP_t + e_{it},
\end{aligned}
\tag{3}
$$

$$
\begin{aligned}
ZSCORE_{it} = &\alpha + \beta_0 ZSCORE_{it-1} + \\
&+ \beta_1 PRH_{it} + \beta_2 SIZE_{it} + \beta_3 EQTA_{it} + \\
&+ \beta_4 CAR_{it} + \beta_5 LDR_{it} + \beta_6 NIM_t + \\
&+ \beta_7 INF_t + \beta_8 KURS_t + \beta_9 CA\_GDP_t + \\
&+ \beta_{10} GDP_t + e_{it},
\end{aligned}
\tag{4}
$$

$$
\begin{aligned}
NPL_{it} = &\alpha + \beta_0 NPL_{it-1} + \beta_1 HHI_t + \\
&+ \beta_2 SIZE_{it} + \beta_3 EQTA_{it} + \beta_4 CAR_{it} + \\
&+ \beta_5 LDR_{it} + \beta_6 NIM_t + \beta_7 INF_t + \\
&+ \beta_8 KURS_t + \beta_9 CA\_GDP_t + \beta_{10} GDP_t + e_{it}.
\end{aligned}
\tag{5}
$$

Research variables can be represented as shown in Table 1.

As stated in the previous section, this research aims to determine how monetary policy, as measured by the path of the benchmark interest rate or the path of credit interest rates, affects the risk of banking stability, and how bank competition levels affect the risk of banking stability. Before empirical estimation, the following stages will be performed on several research variables as an analysis unit for testing successive hypotheses:

1) State 1: Using profit and loss statements, calculate the value of market equity based on cash flow.

2) Stage 2: Using an iterative approach, calculate asset market value and volatility of bank assets.

3) Stage 3: Individual bank banking risk computing.

4) Stage 4: Estimating the H-Statistics index with regression using a fixed-effect model data panel.

5) Stage 5: A two-step GMM estimator and orthogonal deviation dynamic data panels are used in empirical model estimation. Empirical estimation is also performed using the fixed-effect model data panel as a contrast. Besides, STATA software applications were used to analyze the processing.

3. RESULTS

Before estimating empirical evidence, descriptive statistics for each variable used in this analysis should be examined. Table 2 shows descriptive statistics for variables used in the regression equation estimation. Furthermore, the variable goes through a screening process to ensure no data outliers in the variables used. First, the error data on bank financial output variables in Table 2 must be removed, since the value is most likely due to missing values at some observation points.

Second, the primary emphasis is excluded from

Table 1. Research variables

Variable	Description	Description
Dependent variables		
ZSCORE	Insolvency risk (stability index)	Banking risk level indicator that measures the probability of bank insolvency. Insolvency occurs when losses due to standard deviation of return on assets increase and decrease in capital ratio
NPL	Non-performing loans	As a proxy of asset quality in the loan portfolio and the level of risk of banking credit. Rising ratios may indicate a signal of a decline in the quality of bank assets
Independent variables		
REPO	Benchmark interest rates (BI-rate and BI-7DRR)	Monetary policy indicators. High interest rates, resulting in the ability of customers to pay mortgages, tend to increase the failure of banks
RATE	Credit interest rate	Credit interest rates can be used as a replacement measure
HHI	Herfindahl-Hirschman Index	An alternative method of calculating market mastery distribution (concentration) and inferring mastery in banking market share
PRH	Competition index Panzar-Rosse approach	Indicators to measure the level of competition in the banking market
SIZE	Total assets	As a bank measure associated with total assets. Calculated as the logarithm of an asset
EQTA	Ratio of equity to total bank assets	As an indicator of bank capitalization. Higher equity is used as a cushion from future losses
CAR	Capital adequacy ratio	As a substitute for resource sufficiency. A measure of a bank's ability to cover a drop-in asset due to losses
NIM	Net interest margin	Net interest income is generated by management's ability to control productive assets
LDR	Loans to deposit ratio	The percentage of deposit funds is connected to a loan portfolio, as well as calculating the risk of losing access to customer deposits
INF	Inflation	Indicators of macroeconomic activity. Customers' willingness to pay low credit is hampered by the high rate of inflation
KURS	Exchange rate	Indicators of macroeconomic activity. The greater the exchange rate fluctuations, the greater the instability, which may lead to the bank's failure
CA/GDP	Comparing the current account to GDP	Indicators of macroeconomic activity. The structure and composition of economic transactions and financial condition are seen in the balance of payments
GDP	Economic growth	As an indicator of the business cycle. Low economic growth can increase defaults resulting in bank failure. A crisis can occur if economic growth conditions are low

the variable EQTA (to measure the probability of insolvency bank), since the EQTA is the equity divided by the total market assets ratio, with the maximum ratio equal to one. Third, since the available data is in quarters, the national economic growth rate (GGDP) was interpolated between observation points to obtain monthly data. Fourth, the study excludes banks that do not send LBU, balance sheet statements, cashflows, or incomplete profit and loss statements. In this study, 95 banks (4 government banks, 51 private banks, 24 regional banks, 9 international banks, and 7 mixed banks) were observed and listed by capital (4 BUKU1 banks, 49 BUKU2 banks, 25 BUKU3 banks, and 5 BUKU4 banks). Between 2009 and 2019, a monthly research cycle was conducted.

The ZSCORE indicator calculates empirical models for evaluating hypothesis 1 using equations (1) and (2) with bank risk dependent variables. The equation is a regression equation that explores monetary policy and lending rates on banking risk. Tables 3 indicates empirical calculations that were used to evaluate the hypothesis. REPO and RATE are used once more to examine the impact of their respective interest rate policies through monetary policy or credit interest rate channels. As Table 3

shows, ZSCORE is used to measure bank insolvency risks to view banking risks.

Table 3 shows that REPO has a positive impact on ZSCORE, implying that monetary policy will improve banking stability. If the GMM System and effect model are used as predictions, this relationship is essential. However, when calculated in terms of credit interest rate (RATE), the strategy has a negative relationship with stability (ZSCORE). Because of the high credit interest rate (RATE), there would be volatility due to many debtors defaulting. As a result, while REPO affects banking stability, rising REPO will result in rising lending rates, and tight monetary policy (REPO) will result in lower lending rates (RATE).

When interest rates are low, empirical evidence indicates that banks can offer loans with higher credit risk. As a result, when interest rates are low, bank risk-taking increases, suggesting that monetary policy influences the composition of bank loans in the economy. Banks will relax lending conditions during a period of low-interest rates. In the short term, low-interest rates would minimize risky loan portfolios by reducing refinancing costs, lowering the risk credit of unpaid bank

Table 2. Descriptive statistics of variables

Variable	Definition	Mean	Std. dev	Min	Max
ZSCORE	Stability index	19.111	14.242	1.688	166.87
NPL	Non-performing loans	2.7083	2.8351	0	62.22
RATE	Credit interest rate	12.27	3.58	0	46.12
SIZE	Logarithm of market assets	16.26	1.69	11.41	20.78
EQTA	Ratio of equity and total assets	14.81	8.84	0.35	95.76
CAR	Capital adequacy ratio	23.66	14.39	−4.17	270.94
LDR	Loan deposit ratio	92.73	49.84	0	162.90
NIM	Net interest margin	5.19	2.17	−0.53	19.41
INF	Inflation rate	4.89	1.78	2.41	9.17
KURS	Exchange rate (IDR/USD)	11.573	2.061	8.500	15.227
CA_GDP	Ratio of trade account and GDP	−1.46	1.74	−4.26	2.47
GDP	Economic growth	5.375	0.575	4.136	6.89
Banks by ownership and capital					
Number of banks	95	BUKU 1	BUKU2	BUKU3	BUKU4
Government bank	4	–	–	1	3
Commercial bank	51	11	25	13	2
Local bank	24	5	16	3	–
Foreign bank	9	–	5	4	–
Mixed bank	7	–	3	4	–

loans. Banks are more enticed to lend to high-risk borrowers with fewer guarantees because they have more options.

According to Table 4, PRH and HHI have a good relationship with *ZSCORE*. When the GMM System is used as an estimation tool, this relationship is essential. This empirical finding supports the market-stability hypothesis, which notes that increased banking competition will potentially boost stability, the banking stability because banks would prefer to lower loan interest rates in a competitive market system. In this scenario, the borrower will obtain a lower credit interest rate and, of course, will be more vigilant when using credit.

Table 3. Effect of monetary policy/interest rate (*REPO* or *RATE*) on the risk of banking stability (*ZSCORE*)

Independent variables	GMM system			Fixed effects model		
	ZSCORE	ZSCORE	ZSCORE	ZSCORE	ZSCORE	ZSCORE
ZSCORE, L1	0.9048***	0.9037***	0.9128***	0.7988***	0.7996***	0.7988***
	(0.0108)	(0.0106)	(0.0081)	(0.0040)	(0.0040)	(0.0040)
REPO	0.3392***	0.3334***	–	0.0888**	0.0871**	–
	(0.0041)	(0.0039)	–	(0.0403)	(0.0403)	–
RATE	−0.0361***	–	−0.0264***	−0.0205**	–	**−0.0201****
	(0.0041)	–	(0.0051)	(0.0083)	–	(0.0083)
SIZE	0.3885***	0.4856***	0.3814***	−0.0733	−0.0684	−0.0793
	(0.0462)	(0.0438)	(0.0452)	(0.0556)	(0.0556)	(0.0555)
EQTA	0.2282***	0.2359***	0.2116***	0.1883***	0.1891***	0.1881***
	(0.0208)	(0.0214)	(0.0144)	(0.0051)	(0.0051)	(0.0051)
CAR	−0.0214***	−0.0200***	−0.0197***	0.0052**	0.0046**	0.0053***
	(0.0020)	(0.0025)	(0.0015)	(0.0020)	(0.0020)	(0.0020)
LDR	−0.0040***	−0.0030***	−0.0032***	−0.0004	−0.0003	−0.0004
	(0.0007)	(0.0006)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
NIM	0.0285***	0.0182***	0.0252***	0.0193	0.0117	0.0188
	(0.0037)	(0.0037)	(0.0034)	(0.0155)	(0.0152)	(0.0155)
INF	0.0347***	0.0337***	0.0753***	−0.0028	−0.0034	0.0076
	(0.0011)	(0.0010)	(0.0010)	(0.0156)	(0.0156)	(0.0148)
KURS	−0.0005***	−0.0005***	−0.0003***	−0.0001**	−0.0001**	−0.0001*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
CA_GDP	0.3193***	0.3148***	0.2705***	0.1375***	0.1355***	0.1259***
	(0.0051)	(0.0052)	(0.0031)	(0.0278)	(0.0278)	(0.0273)
GDP	0.0997***	0.1165***	0.1279***	0.0645	0.0679	0.0699
	(0.0051)	(0.0041)	(0.0052)	(0.0653)	(0.0653)	(0.0653)
C	0.0000	0.0000	−4.0551***	3.4167***	3.0998***	3.3817***
	(0.0000)	(0.0000)	(0.8943)	(1.1568)	(1.1499)	(1.1569)
Observations, *N*	11,875	11,875	11,875	11,875	11,875	11,875
R-squared	N/A	N/A	N/A	0.9269	0.9269	0.9269
Number of banks	95	95	95	95	95	95
F-stat.	N/A	N/A	N/A	0.0000	0.0000	0.0000
AR (1): p-val	0.000	0.000	0.000	N/A	N/A	N/A
AR (2): p-val	0.085	0.086	0.099	N/A	N/A	N/A
Hansen-J: p--val	1.000	1.000	1.000	N/A	N/A	N/A

Note: *** $p < 1\%$, ** $p < 5\%$, and * $p < 10\%$.

Table 4. Impact of bank competition (*PRH* or *HHI*) on the risk of banking stability (*ZSCORE*)

Independent variables	GMM system			Fixed effects model		
	ZSCORE	ZSCORE	ZSCORE	ZSCORE	ZSCORE	ZSCORE
ZSCORE, *L*1	0.9104*** (0.0085)	0.9062*** (0.0082)	0.9023*** (0.0165)	0.8012*** (0.0039)	0.7996*** (0.0040)	0.8011*** (0.0039)
PRH	1.5343*** (0.0631)	1.6316*** (0.0578)	– –	39.4100 (25.669)	9.7259 (25.551)	v –
HHI	0.0092*** (0.0001)	– –	0.0093*** (0.0002)	0.0081*** (0.0009)	– –	0.0079*** (0.0009)
SIZE	0.4196*** (0.0362)	0.4485*** (0.0359)	0.4852*** (0.0431)	−0.0656 (0.0553)	−0.0743 (0.0555)	−0.0593 (0.0552)
EQTA	0.2186*** (0.0158)	0.2273*** (0.0166)	0.2316*** (0.0312)	0.1874*** (0.0050)	0.1889*** (0.0051)	0.1877*** (0.0050)
CAR	−0.0161*** (0.0014)	−0.0195*** (0.0026)	−0.0175*** (0.0019)	0.0045** (0.0020)	0.0047** (0.0020)	0.0045** (0.0020)
LDR	−0.0019*** (0.0004)	−0.0024*** (0.0004)	−0.0025*** (0.0004)	−0.0005 (0.0005)	−0.0003 (0.0005)	−0.0005 (0.0005)
NIM	0.0166*** (0.0045)	0.0195*** (0.0039)	0.0248*** (0.0038)	0.0136 (0.0152)	0.0114 (0.0152)	0.0154 (0.0151)
INF	0.1363*** (0.0015)	0.0739*** (0.0011)	0.1474*** (0.0015)	0.0608*** (0.0159)	0.0067 (0.0148)	0.0616*** (0.0159)
KURS	−0.0004*** (0.0000)	−0.0003*** (0.0000)	−0.0004*** (0.0000)	−0.0002*** (0.0000)	−0.0001* (0.0000)	−0.0002*** (0.0000)
CA_GDP	0.2464*** (0.0036)	0.2668*** (0.0033)	0.2287*** (0.0039)	0.1066*** (0.0273)	0.1241*** (0.0273)	0.0925*** (0.0257)
GDP	−0.0182*** (0.0048)	0.1375*** (0.0037)	−0.1260*** (0.0024)	−0.0681 (0.0669)	0.0731 (0.0653)	0.0042 (0.0475)
C	−10.145*** (0.8079)	−5.776*** (0.7712)	−9.618*** (0.8111)	−24.099* (13.657)	−3.4005 (13.514)	−3.2033*** (1.1213)
Observations, *N*	11,875	11,875	11,875	11,875	11,875	11,875
R-squared	N/A	N/A	N/A	0.9274	0.9268	0.9273
Number of banks	95	95	95	95	95	95
F-stat.	N/A	N/A	N/A	0.0000	0.0000	0.0000
AR (1): p-val	0.000	0.000	0.000	N/A	N/A	N/A
AR (2): p-val	0.185	0.098	0.181	N/A	N/A	N/A
Hansen-J: p-val	1.000	1.000	1.000	N/A	N/A	N/A

Note: *** $p < 1\%$, ** $p < 5\%$, and * $p < 10\%$.

Table 5. Impact of bank competition (*PRH* or *HHI*) on credit risk (*NPL*)

Independent variables	GMM system			Fixed effects model		
	NPL	NPL	NPL	NPL	NPL	NPL
NPL, *L*1	0.9554*** (0.0014)	0.9601*** (0.0014)	0.9755*** (0.0011)	0.9153*** (0.0037)	0.9153*** (0.0037)	0.9157*** (0.0037)
PRH	−0.3094*** (0.0079)	−0.1543*** (0.0063)	– –	−0.3205*** (0.1050)	−0.1986** (0.0976)	– –
HHI	−0.0018*** (0.0000)	– –	−0.0007*** (0.0000)	−0.0015*** (0.0005)	– –	**−0.0009**** (0.0004)
SIZE	−0.0151 (0.0128)	−0.0201** (0.0093)	−0.0112 (0.0091)	−0.0005 (0.0292)	0.0018 (0.0292)	−0.0098 (0.0290)
EQTA	0.0048*** (0.0010)	0.0046*** (0.0009)	0.0063*** (0.0011)	0.0051** (0.0021)	0.0051** (0.0021)	0.0046** (0.0021)
CAR	−0.0025*** (0.0009)	−0.0041*** (0.0006)	−0.0023** (0.0010)	0.0003 (0.0011)	0.0003 (0.0011)	0.0004 (0.0011)
LDR	0.0002 (0.0002)	−0.0000 (0.0002)	−0.0002 (0.0002)	−0.0017*** (0.0003)	−0.0018*** (0.0003)	−0.0018*** (0.0003)
NIM	0.0019 (0.0017)	0.0057*** (0.0016)	0.0249*** (0.0015)	0.0031 (0.0080)	0.0038 (0.0080)	0.0076 (0.0078)
INF	0.0164*** (0.0004)	0.0294*** (0.0003)	0.0231*** (0.0003)	0.0213** (0.0084)	0.0313*** (0.0078)	0.0228*** (0.0084)
KURS	−0.0000*** (0.0000)	−0.0000*** (0.0000)	−0.0000*** (0.0000)	−0.0000* (0.0000)	−0.0001*** (0.0000)	−0.0000* (0.0000)
CA_GDP	0.0313*** (0.0007)	0.0245*** (0.0006)	0.0393*** (0.0008)	0.0030 (0.0136)	−0.0022 (0.0135)	0.0104 (0.0134)
GDP	−0.0612*** (0.0012)	−0.0770*** (0.0014)	−0.0796*** (0.0018)	−0.1058*** (0.0252)	−0.1220*** (0.0246)	−0.1310*** (0.0238)
C	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	2.4011*** (0.6002)	1.4334*** (0.5151)	2.0396*** (0.5886)
Observations, *N*	11,875	11,875	11,875	11,875	11,875	11,875
R-squared	N/A	N/A	N/A	0.8630	0.8629	0.8629
Number of banks	95	95	95	95	95	95
F-stat.	N/A	N/A	N/A	0.0000	0.0000	.0000
AR (1): p-val	0.012	0.012	0.012	N/A	N/A	N/A
AR (2): p-val	0.160	0.160	0.161	N/A	N/A	N/A
Hansen-J: p-val	1.000	1.000	1.000	N/A	N/A	N/A

Note: *** $p < 1\%$, ** $p < 5\%$, and * $p < 10\%$.

HHI's empirical calculations indicate that the number of banks affects competition; the more banks there are, the more competitive the market becomes. Defaults in Indonesian banks will lower stability if it becomes more competitive (*HHI* is lower). According to the competition index (*PRH*), the rise in banking competition positively affects financial stability. Consequently, competition plays an essential role in the economy in strengthening the intermediation function, reducing bank failure, and enhancing financial stability.

The relationship between banking competition and insolvency becomes negligible when the estimation approach's fixed effect is used. The findings obtained through the GMM System are clear enough to infer that the influence of competition would promote stability through reduced credit risk (*KKR* and *NPL*), as shown in Tables 4 and 5.

4. DISCUSSION

Beck et al. (2006) studied the events of 36 banking crises in 35 countries, using bank data. The research found that using variables such as macroeconomics, banking, and the real sector, including inflation, interest rates, and the rupiah exchange rate, empirical findings identify several significant variables in forecasting the Asian crisis.

Based on this research result, the first hypothesis (*H1*) was found, indicating that monetary policy has a positive and significant impact on the risk of bank stability. This result found that low interest rates would reduce the gap between credit and deposit interest rates in the short term, decreasing bank income. This study's findings are consistent with those of Andries et al. (2016), who studied the effect of monetary policy on bank risk-taking and how it influenced the financial crisis. Using a data set of 571 commercial banks from the Eurozone, the current study analyzed relationships from 1999 to2011, focusing on 2008–2011. The empirical findings indicate that lending rates and bank risk-taking have a negative relationship. Furthermore, the recession had negative consequences for interest rate relationships and risk-taking.

High interest rates would reduce loan rates, while low interest rates would boost credit growth. The

presence of loan networks is classified based on these results. Banks alter their lending strategies in response to monetary policy changes. When it comes to raising or lowering lending rates, government banks are more sensitive than private banks, international or mixed banks. Banks would have higher credit exposures during credit rate times, which could negatively affect their efficiency (Tabak et al., 2010).

This research also found that the second hypothesis (*H2*) indicates that bank competition has a negative and significant impact on the bank stability risk. Based on this result findings, the competition promotes stability by lowering credit risk. The result of this study in line with previous researched that conducted by S. Kasman and A. Kasman (2015) published a study in the field of banking, which examined the effect of competition on banking stability between 2002 and 2012. Bank rivalry is proxied by Boone's index and Lerner's efficiency-adjusted index. Meanwhile, banks depend on non-performing loans (NPLs) and Z-scores for stability.

The competition was found to be negatively related to NPL but positively related to Z-scores. Further findings indicate that higher market concentration positively affects the Z-score, whereas lower market concentration has a negative effect. S. Kasman and A. Kasman (2015) used the quadratic model coefficient of competition to capture the non-linear relationship between competition and stability. The quadratic coefficient relationships pattern always yields the same result: NPL is negative, and Z-score is positive.

Noman et al. (2017) found that competition for ASEAN commercial banks' stability from 1990 to 2014 yielded similar results. Noman et al. (2017) used the Panzar Rosse H-statistic approach, the Lerner index, and the Herfindahl-Hirschman index to assess the competition of banks. As indicators of financial stability, Z-Score, NPL, and equity ratio are used. Competition, as calculated by the H-statistic, is positively related to Z-Score and negatively related to equity and bad credit, according to GMM panel data analysis.

On the other hand, market powers are negatively related to Z-Score and equity ratios, while competition is positively related to NPL, as calculated

by Lerner. This performance bolsters the ASEAN banks' competitive-stability view. A quadratic rivalry model was also included in the analysis. Overall, this study's findings back up the "competition-stability" hypothesis, which states that increased competition will potentially improve banking stability (Noman et al., 2017).

Thus, according to Boyd et al. (2006), there must be more competition in the banking sector to support financial stability. According to this study's findings, banking strength in highly competitive markets necessitates more equity and allows banks to take overall risks in existing financial markets, thus enhancing financial stability. At a certain degree of competition, this ensures that banking stability can be channeled into high capitalization (ZSCORE).

According to Allen et al. (2011), rivalry encourages banks to raise their stock reserves. Since retained earnings create the bank's capital buffer, a higher return on bank equity would raise capital where the dividend payout ratio is relatively fixed, and the movement of equity ratios and financial stability is related.

CONCLUSION

This study investigated the impact of monetary policy and competition on the risk of banking default using a panel of commercial banks from 2009 to 2019. The measures used for monetary policy are implemented through the interest rate channel (REPO) and the credit interest rate channel (RATE). Meanwhile, the level of bank competition is determined through the Panzar-Rosse H-statistic model (PRH). The monetary policy through an increase in the benchmark interest rate (REPO) positively affects the risk of banking stability, while the monetary policy through an increase in the credit channel (RATE) has a negative and significant impact on the risk of banking stability.

The research also found that the effect of bank competition (PRH) on banking stability is substantial (ZSCORE). In terms of credit risk, the study shows that a more competitive banking market reduces credit risk (NPL). Meanwhile, competition is affected by the number of banks in the market (HHI is low), resulting in a decrease in banking stability (ZSCORE) and an increase in nonperforming loans (NPL). According to this study's findings, both Bank Indonesia and the Financial Services Authority should include more optimum levels of monetary policy and banking competition in stress testing to see how they affect banking risk.

AUTHOR CONTRIBUTIONS

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REFERENCES

1. Acharya, V. V. (2009). A theory of systemic risk and design of prudential bank regulation. *Journal of Financial Stability, 5*(3), 224-255. https://doi.org/10.1016/j.jfs.2009.02.001

2. Adrian, T., & Brunnermeier, M. K. (2016). CoVaR. *The American Economic Review, 106*(7), 1705-1741. Retrieved from https://scholar.princeton.edu/sites/default/files/markus/files/covar_0.pdf

3. Allen, F., Carletti, E., & Marquez, R. (2011). Credit market competition and capital regulation. *Review of Financial Studies, 24*(4), 983-1018. https://doi.org/10.1093/rfs/hhp089

4. Altunbas, Y., Gambacorta, L., & Marques-Ibanez, D. (2010). *Does Monetary Policy Affect Bank Risk-Taking* (Working Paper Series No. 1166). Germany.

5. Andries, A. M., Cocriş, V., & Pleşcău, I. (2016). Low Interest Rates and Bank Risk-Taking: Has the Crisis Changed Anything? Evidence from the Eurozone. *Review of Economic and Business Studies, 8*(1), 125-148. https://doi.org/10.1515/rebs-2016-0019

6. Avgouleas, E., & Goodhart, C. (2015). Critical reflections on bank bail-ins. *Journal of Financial Regulation, 1*(2), 3-29. https://doi.org/10.1093/jfr/fju009

7. Barry, T. A., Lepetit, L., & Tarazi, A. (2011). Ownership structure and risk in publicly held and privately owned banks. *Journal of Banking and Finance, 35*(5), 1327-1340. https://doi.org/10.1016/j.jbankfin.2010.10.004

8. Beck, T., Demirgüç-Kunt, A., & Levine, R. (2006). Bank concentration, competition, and crises: First results. *Journal of Banking and Finance, 30*(5), 1581-1603. https://doi.org/10.1016/j.jbankfin.2005.05.010

9. Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2004). Bank Competition and Access to Finance: International Evidence. *Journal of Money, Credit and Banking, 36*(3), 627-648. Retrieved from https://www.jstor.org/stable/3838958

10. Billio, M., Getmansky, M., Lo, A. W., & Pelizzon, L. (2010). *Measuring Systemic Risk in the Finance and Insurance Sectors* (MIT Sloan School Working Paper No. 4774-10). Retrieved from https://www.bis.org/bcbs/events/sfrworkshopprogramme/billio.pdf

11. Ciobota, G. (2015). The Strategic Positioning of the Financial Banking Companies – Key Factor for Achieving Competitive Advantages. *Knowledge Horizons – Economics, 7*(1), 103-106.

12. De Nicoló, G., Jalal, A. M., & Boyd, J. H. (2006). *Bank Risk-Taking and Competition Revisited: New Theory and New Evidence* (IMF Working Paper No. WP/06/297). https://doi.org/10.5089/9781451865578.001

13. Furfine, C. (2003). Interbank Exposures: Quantifying the Risk of Contagion. *Journal of Money, Credit, and Banking, 35*(1), 111-128. https://doi.org/10.1353/mcb.2003.0004

14. Goodhart, C. (2015). Why Monetary Policy has Been Comparatively Ineffective? *Manchester School, 83*(S1), 20-29. https://doi.org/10.1111/manc.12094

15. Gunji, H., Miura, K., & Yuan, Y. (2009). Bank competition and monetary policy. *Japan and the World Economy, 21*(1), 105-115. https://doi.org/10.1016/j.japwor.2007.11.001

16. Harada, K., Ito, T., & Takahashi, S. (2010). *Is the Distance to Default a Good Measure in Predicting Bank Failures? Case Studies* (NBER Working Paper Series No. 16182). National Bureau of Economic Research, Cambridge. Retrieved from http://www.nber.org/papers/w16182

17. Kahou, M. E., & Lehar, A. (2015). Macroprudential policy: A review. *SPP Research Paper, 8*(34). The School of Public Policy. Retrieved from https://www.policyschool.ca/wp-content/uploads/2016/03/macroprudential-policy-kahou-lehar.pdf

18. Kasman, S., & Kasman, A. (2015). Bank competition, concentration and financial stability in the Turkish banking industry. *Economic Systems, 39*(3), 502-517. https://doi.org/10.1016/j.ecosys.2014.12.003

19. Kliestik, T., Misankova, M., & Kocisova, K. (2015). Calculation of Distance to Default. *Procedia Economics and Finance, 23*, 238-243. https://doi.org/10.1016/s2212-5671(15)00481-5

20. Männasoo, K., & Mayes, D. G. (2009). Explaining bank distress in Eastern European transition economies. *Journal of Banking and Finance, 33*(2), 244-253. https://doi.org/10.1016/j.jbankfin.2008.07.016

21. Morgan, P., & Pontines, V. (2014). *Financial Stability and Financial Inclusion* (ADBI Working Paper No. 488). Tokyo. https://doi.org/10.2139/ssrn.2464018

22. Noman, A. H. M., Gee, C. S., & Isa, C. R. (2017). Does competition improve financial stability of the banking sector in ASEAN countries? An empirical analysis. *PLoS ONE, 12*(5), 1-27. https://doi.org/10.1371/journal.pone.0176546

23. Purnomo, S. (2018). *Determinan Faktor-faktor yang Mempengaruhi Distance to Default Perbankan di Indonesia*. Universitas Padjajaran.

24. Rajan, R. G. (2005). *Has Financial Development Made The World Riskier* (Working Paper Series No. 11728). Cambridge.

25. Roengpitya, R., & Rungcharoenkitkul, P. (2010). *Measuring Systemic Risk and Financial Linkages in the Thai Banking System* (Working Paper of Monetary Policy Group No. 2010-02). Monetary Policy Group, Bang-

kok. https://doi.org/10.2139/ssrn.1773208

26. Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal, 9*(1), 86-136. https://doi.org/10.1177/1536867x0900900106

27. Tabak, B. M., Laiz, M. T., & Cajueiro, D. O. (2010). *Financial Stability and Monetary Policy – The case of Brazil* (Working Paper No. 217). Banco Central do Brazil, Brazil. Retrieved from https://www.bcb.gov.br/pec/wps/ingl/wps217.pdf

28. Thai Ha, N. T., & Quyen, G. (2018). The Impact of Funding Liquidity on Risk-taking Behaviour of Vietnamese Banks: Approaching by Z-Score Measure. *International Journal of Economics and Financial Issues, 8*(3), 29-35. Retrieved from http://www.econjournals.com/index.php/ijefi/article/view/6265

29. Weill, L. (2004). Measuring cost efficiency in European banking: A comparison of frontier techniques. *Journal of Productivity Analysis, 21*(2), 133-152. https://doi.org/10.1023/B:PROD.0000016869.09423.0c