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Banking Industry Specific and Macroeconomic Determinant of Credit Risk

Hazimi Bimaruci Hazrati Havidz, William Obeng-Amponsah

School of Management, Wuhan University of Technology, P.R. China

Abstract—*This study analyzes the determinants of bank's credit risk from macroeconomic and bank-specific perspective in Indonesia. The analysis use panel data analysis by employing fixed effect, different GMM and system GMM approach to accommodate lagged determinant variable used in the model. The use of lagged variable in the study is used to analyze the delayed response of bank's credit risk to its determinant because of the persistence nature in bank's credit risk. The result shows that bank-specific variable have stronger influence to credit risk compare to macroeconomic variable. Additionally, the study found that banks in this study maintain a prudent management in managing its credit risk thus further explain why bank-specific variable have higher significant compare to macroeconomic variable resulting to bank have more resistance to macroeconomics changes.*

Keywords—***Credit risk, Non-performing loans, Macroeconomic factor, bank-specific factor, panel data***

I. INTRODUCTION

It is a well-known and common understanding that the banking system plays important role in the dynamic of economic activities since banks function as an entity that allocates capital from fund sufficient party to fund deficient party. Banks function to allocate capital follows by inherent risk which is credit risk thus a bank should have a proper criteria and procedure in allocating fund. A well manage risk is a vital instrument that could increase bank's profitability (Öker, 2007). When credit risk is not manages well, event such as financial crisis in 2008 might occur. Financial crisis that happen in 2008 have made many financial institution suffered from bad debt. Cause of the financial crisis was due to bad mortgages that cannot repay their loans that brought credit risk to be higher and since the structure of banking system have change that financial activity could be connected internationally the financial crisis that originate in the US also affected other emerging and advanced economic countries. According to Kuzucu and Kuzucu (2019)the financial crisis had cause a massive increase of bank's credit risk in emerging and advance country. World Bank data indicate that the increase of credit risk is higher comparatively higher than emerging countries.

Rise of credit risk during the financial crisis raise some concern regarding what could build-up credit risk and cause disturbance in the economy. Furthermore, this phenomenon has been confirmed that the crisis originated in the US could spread to other countries since almost all countries are affected. Because of how an increase in credit risk could affect the financial system and economy, it is interesting to understand how credit risk would response to the changes in the economy and variable that originates from bank's activity itself. According to Radivojević et al. (2019) there have been studies that attempt to figure out how credit risk affected by its macro and micro determinants, however there are some contradiction resulted from the study in term of direction and significant of credit risk determinant. To some extent, the difference might be because the differences in the studies data and method applied to analyze credit risk determinants.

According to (Committee, 1999), credit risk is a major source of financial instability in the banking sector. Bank for International Settlement express that bank should manage their credit system properly by establishing an appropriate mechanism to measure, control and monitor the soundness of credit risk. Banks that are struggling with liquidity or insolvency problem by non-performing loan should be concern about their credit risk level as it might bring crisis to the bank.

As described above, banks are highly exposed to credit risk originated from loans bank issue in which loan debtor could not fulfill their obligations to repay the principal and interest charged on time (Altıntaş, 2012). Credit risks are commonly exposed to two kinds of risk which is systematic risk and unsystematic credit risk. Systematic credit risks are risk that essentially comes from the unexpected changes from economics, politics, financial market and other factors that are not in the control of a firm. On the other hand, unsystematic credit risks are risk

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that originated from the management of a firm or the condition of the industry the firm is in (Yurdakul, 2014).

Systematic credit risk of banks could be affected by several variables such as GDP growth, interest rate, inflation, and exchange rate. The capability of these macroeconomic factors to explain the changes of credit risk might differ from one country to another as well from one industry to the other. The unfavorable changes of macroeconomic condition such as GDP, inflation, interest rate and exchange rate might lead to banking crisis (Louzis et al., 2012). Most of the time, bank crisis are caused by bad loans which is why it is necessary to understand the bank's credit risk problem in the form of non-performing loans (NPL) before examining other probable cause of a bank's crisis (Castro, 2013).

Other than macroeconomics condition that could affect bank's credit risk, banks that are not well-managed, might suffer from unsystematic risk. Some bank-specific variable such as credit growth, profitability, and bank size have influence on how banks are manage, thus affect the volatility of credit risk (Ghosh, 2015), (Ahmad and Ariff, 2007). (Ghosh, 2015), in his study argued that the growth of credit risk will increase non-performing loan.

The aim of this study is to examine and obtain an understanding of how Indonesia bank's credit risk responses to changes in macroeconomic variables and bank-specific variables nowadays after the financial crisis have passed. Most of previous studies build a model of how bank's credit risk correlate with the current condition of macroeconomic and bank-specific variables. However since according to Ghosh (2015) and (Kjosevski and Petkovski, 2017) credit risk might have a delayed responses to its determinants thus this study would add lagged variable of credit risk determinants to the model that would be built in this study.

II. LITERATURE REVIEW

There are a number of studies that analyze and explain how some macroeconomic factor and bank-specific factor influence the changes of credit risk in the banking sector. By definition, credit risk is a risk of a default loan, either partially or totally, that probably will not be paid back to the Bank. The analysis of credit risk is important because it can provide a warning in case the banking sector becomes more exposed to crisis (Castro, 2013).

The literature of bank's credit risk determinant are generally divided into two which is systematic credit risk that are usually represented by macroeconomics determinant and unsystematic credit risk that are usually represented by bank-specific determinant.

Macroeconomics factors are usually used to describe how well one country condition is performing. Economic condition in one country could significantly influence how credit risk changes (Kraft and Jankov, 2005). Most literature agrees that changes of GDP growth have influence on bank's credit risk. When the economy is declining, GDP decreases and bank's credit risk rise (Tanasković and Jandrić, 2015). GDP growth theoretically means that people's income are getting better which could improves borrower's capability to pay their loans, thus banks would be exposed to fewer credit risk. The negative correlation between GDP growth and credit risk explain that credit risk will decrease because the borrowers capacity to repay their loans will be better along with the development of the economy (Kuzucu and Kuzucu, 2019). Kuzucu and Kuzucu (2019)in their research to analyze the influence of macroeconomic variable that drive bank's non-performing loan in emerging economy country and advance economy country found that GDP have significant influence to bank's non-performing loan before the financial crisis in 2007 and after the financial crisis after 2008. Similarly to Kuzucu and Kuzucu (2019), Klein (2013) also found that GDP have significant negative relation to bank's credit risk.

Inflation is expected to have a positive influence to bank's credit risk (Tanasković and Jandrić, 2015). However, inflation correlation to bank's credit risk is ambiguous according to some researcher. Higher inflation could reduce real value of outstanding loan, thus ease borrower to pay off their loan, or reduce the real value of their earning, thus borrower will have more difficulty to pay off their loan (Castro, 2013 , Ghosh, 2015 , Kuzucu and Kuzucu, 2019). Kuzucu and Kuzucu (2019) in his research proved that inflation could have positive relation to bank's credit risk in advance economy country and negative relation to bank's credit risk in emerging economy country. Škarica (2014) analyze the determinant of non-performing loan in selected European emerging market (Bulgaria, Croatia, Czech Republic, Hungary, Latvia, Romania and Slovakia) by means of fixed effect estimator and find that an increase of inflation would be followed by an increase of non-performing loan. Contrary with studies that have significant result, Radivojević et al. (2019) in his study of non-performing loans determinants by employing one-step GMM estimator found that inflation does not have significant influence to non-performing loan.

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Table 1 Variable Description

Variable	Definition	Expected Sign
Non-performing loans	Non-performing loans/Gross Loans	
Loan Loss Provision	Loan Loss Provision/Gross Loans	-
Capital Adequacy Ratio	Capital to Asset Ratio	-/+
Return on Asset	Net Income/Total Asset	-
Earning Power	Earning Before Interest and Taxes (EBIT)/Total Asset	-
Credit Growth	Percentage change in Gross Loans	+
Inflation	Inflation rate	-/+
GDP Growth	Percentage change of GDP	-
Lending Interest Rate	Rate on loans for working capital	+
Exchange Rate	Currency exchange rate	-/+

According to Castro (2013) and Nkusu (2011)exchange rate could have positive or negative impact depending the nature of economic activity in the country. A positive correlation could happen when an appreciation in exchange rate weaken export oriented firms because they could not pay their debt and a negative relation is possible when a loans was made in foreign currency thus a currency appreciation improve borrower ability to service their debt.

Other than macroeconomics condition that impact bank's credit risk systematically, some researches also bring their attention to study bank's management and operation to understand unsystematic factor that might affect bank's credit risk. Under bad management hypothesis, bank's low cost efficiency could signals poor management practices that cause poor loan underwriting, monitoring, and control which in turn would likely increase bank's credit risk. However, under skimping hypothesis, banks with high cost efficiency might imply there are limited resources allocated to monitor lending risk thus result in higher bank's credit risk(Berger and DeYoung, 1997). These hypotheses was support by Podpiera and Weill (2008) that extend Granger-causality model by applying GMM panel estimator and Williams (2004) that agree to bad management hypothesis while Rossi et al. (2005) support the skimping hypothesis. Study by Ghosh (2015) shows the importance of bank-specific factors to be considered when assessing the impact of these factors to bank's credit risk. ¬By applying

fixed effect and dynamic estimation model, the study proved that 'too big to fail' and bad management hypothesis to be true along with other factor such as credit growth to have positive relation to credit risk. However, moral hazard hypothesis is rejected in this study since loan loss provision has positive relation to bank's credit risk. The result of bad management hypothesis is also found to be in line with Kjosevski and Petkovski (2017) that found bank's profitability have negative and significant influence to bank's credit risk.

The implications of bank-specific factor on credit risk are also explored by Rachman et al. (2018) by employing fixed-effect panel regression found that higher profitability and credit growth would lower bank's credit risk as the bank could afford better management practices and credit management system. Klein (2013) found similar result regarding bank's profitability influence to bank's credit risk. However, contrary to Rachman et al. (2018), Klein (2013) study shows that higher credit growth contribute to higher bank's credit risk. These results is also supported by Vouldis and Louzis (2018) research that employ the quasi-AIM approach that shows profitability and inefficiency are good predictor for bank's credit risk.

III. DATA AND METHODOLOGY

3.1. Data

This study uses an unbalanced panel data of 40 banks in Indonesia. The macroeconomics and bank-specific data that obtained are based on quarterly frequency from the first quarter of 2014 to the first quarter of 2019. Bank-specific data are obtained from Bankscope database of Bureau van Dijk. The financial information was derived from balance sheets and income statement from quarterly financial report. The Bank-specific data that are used in this study are loan loss provision, capital adequacy ratio, net interest margin, return on asset, earning power and loan growth. Macroeconomic data that consist of inflation, GDP, lending interest rate, and exchange rate were obtained from the world development indicators database. In this study, the dependent variable that is used to measure bank's credit risk is non-performing loans to gross loans. Description of all variable used in this study as well as its expected sign to bank's credit risk is detailed in Table 1.

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Table 2 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
NPL	537	3.983	6.950	0.003	96.806
LLP	540	2.486	2.107	0.063	22.493
CAR	538	20.979	7.623	8.010	76.420
NIM	550	5.505	2.270	-5.398	18.425
ROA	550	0.792	2.477	-30.631	3.825
EP	550	2.144	1.878	-8.098	6.019
CG	518	0.018	0.049	-0.157	0.290
INFL	800	0.046	0.017	0.030	0.080
GDPG	800	5.033	0.133	4.752	5.251
LIR	800	11.753	0.861	10.430	12.817
EXRT	800	13351.650	868.573	11404.000	14929.000

Source: Author's calculation

Table 2 presents summary descriptive statistics for variables used in this study. There were some missing observation data for bank-specific data variable due to unreported figures in some bank's quarterly financial report. Bank's credit risk level has a mean of 3.98% with lowest and highest value is 0.3% and 96.8% respectively. This shows that there are bank that maintain their credit risk very prudently and there are banks that have problems with loans that they have distributed to borrowers. Several bank-specific variable values such as net interest margin, ROA, earning power, and credit growth show negative value which means at some point in time banks might have suffer a loss from their activity

3.2. Methodology

This study will adopt panel data analysis to analyze the determinant of bank's credit risk, which in this case is expressed as non-performing loans/gross loans. Panel data analysis is used because it offers better efficiency forecast individual outcomes in the model. Capture and measure that are undetectable in cross-section time-series (Hsiao, 2014). This study will attempt three different estimation methods. First, fixed effect model will be utilized to control unobserved heterogeneity between different banks. The fixed effect model to be estimated will be:

$$CredRisk_{i,t} = \alpha_i + \beta B_{i,t} + \beta M_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where $CredRisk_{i,t}$ denotes the value of non-performing loans/gross loans, $B_{i,t}$ denotes bank-specific,variables, $M_{i,t}$ denotes macroeconomic variable, and $\varepsilon_{i,t}$ is the error term. However, fixed effect approach is quite intuitive, simple and as becomes more consistent with larger thus might raise the possibility of dynamic panel bias. Furthermore, bank's credit risk is expected to persist over time for two reasons. First, bank's credit risk could have delayed time before it responses to macroeconomics changes (Klein, 2013). Second, bank'snon-performing loans that denote credit risk is expected to stay in bank's balance sheet for some time because it cannot be immediately written off thus bank's credit risk could be influence by its previous value. To address this problem this study would try to add laggedvalue of bank's credit risk into the right hand side of the equation as follows:

$$CredRisk_{i,t} = \beta_0 CredRisk_{i,t} + \beta_i B_{i,t} + \beta_i M_{i,t} + \varepsilon_{i,t} \quad (2)$$

However, (2) could create other problem which makes the lagged dependent variable correlate to the fixed effect error term. To address this situation, applying difference GMM would be a valid solution. Difference GMM application could fix fixed effect problem by transforming the first order difference and use lagged dependent variable at the right hand side equation model as instruments(Arellano and Bond, 1991). Next, the application of difference causing parameter bias because the lagged dependent variable still correlates with observed specific error.

Second problem that arise from (2) is endogenity problem from independent variables with the error term. By applying different GMM endogenous variable is predetermined to solve the correlation problem with the error term. Current variable values as well as its lagged value are valid instrument even for weak predetermined and exogenous variable(Louzis et al., 2012). However, variables that is close to random walk causes a problem for lagged variable because it could be poor instrument for the first difference(Arellano and Bond, 1991). Furthermore different GMM could magnify gap in unbalance data set that it is possible that a data could disappear in the first difference (Roodman, 2009). Data set with persistence could have lower precision estimation because it causes the lagged level to be less correlated with its following changes thus it becomes weak instruments (Blundell and Bond, 1998).

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To obtain better estimation from the different GMM, system GMM will also be applied by using forward orthogonal deviations propose by Arellano and Bover (1995) because it propose an assumption concerning non-correlation of fixed effect and first difference in instruments variables. The use of system GMM could improve efficiency and transform the instrument variable to be uncorrelated with fixed effect. Lastly, it is assumed that credit risk is closely related to its previous value because previous credit risk value could be carried over to the current credit risk since it cannot be immediately be write off from the balance sheet and might remain for several periods in the Bank's balance sheet(Dimitrios et al., 2016 , Kjosevski and Petkovski, 2017). These imply that credit risk is typically persistent over time which could be interpreted that credit risk might have a delay to response to the changes of its determinants(Klein, 2013). As a consequence of credit risk persistence, the lagged value of bank's credit risk determinant (in this study second lagged value will be used) will be included as an independent variable on the right hand side of the model equation. Therefore, the equation of the model will be express as follow:

$$CredRisk_{i,t} = \beta_0 CredRisk_{i,t-2} + \beta_i B_{i,t-2} + \beta_i M_{i,t-2} + \varepsilon_{i,t} \quad (3)$$

IV. EMPIRICAL RESULTS

The result presented in table 3 report the estimation result of (1) , (2) and (3) in Indonesia banking industry from 2014 to 2018 by employing fixed effect regression, difference GMM, and system GMM panel estimator. The result confirms that macroeconomic and bank-specific factors play a role in influencing bank's credit risk. Even though some bank-specific factor does not significantly affect bank's credit risk, most of bank-specific factor does have significant influence to bank's credit risk. The model shows that the estimators are efficient and consistent given that the residual did not show serial correlation of second order even though negative first order autocorrelation is found. However, the negative first order autocorrelation does not mean that the model were inconsistent because inconsistency would be implied if second order autocorrelation is found(Arellano and Bond, 1991), which in this research is rejected by the test result of AR(2) errors.

The first lag of nonperforming loan is proven to have statistical significances in one-step difference and system GMM estimator model. However, the second lagnonperforming loans shows weaker significance level in one-step difference GMM estimator. Loan loss reserve is shown to have a positively strong significant influence to credit risk. This means the moral hazard theory is not accepted in this study because loan loss provision is used as a tool to anticipate loan losses for banks' loans. The positive significant influence also suggest that Banks in Indonesia practice prudent loan loss provisioning policy by adjusting their loan loss provision according to their credit risk.

The estimation of net interest margin variable shows mix relation to credit risk. Net interest margin have significantly positive relation on credit risk at time t that indicate higher risky loan with bigger margin is expected to compensate with higher risk of default. However, the lagged value of net interest margin at t-2 shows negative relation. This could be interprets in two ways depending on Bank's management during the observed period. Fist, Banks are performing better compare to their previous operation because it could improve its loans quality while increasing its interest margin. Second, banks are performing worse compare to their previous operation because its loan quality becomes poorer by indicating higher credit risk while having lower net interest margin.Bank's profitability which represent by earning power variable have expected significant negative correlation at time *t*. However, Bank's lagged earning power has positive significant correlation. The negative correlation of Bank's earning power explains that an increase of Bank's profitability will lower Bank's credit risk. It is assumed that Banks are engage in a more prudent lending according to the result of positive relation of Bank's loan loss provision to credit risk thus entail that Banks with stronger profitability is less likely to conduct risky activities and able to lower their credit risk. The reason

Table 3 Fixed effect and GMM estimation

Variable	FE	System GMM		Diff GMM	
NPLR (-1)		0.137**		0.145***	
		(0.367)		(0.448)	
NPLR L(-2)			0.037		0.042*
			0.053		0.071
LLP	0.189***	8.723		11.824	
	0.679	(8.909)		(6.936)	

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LLP(-2)			2.062		1.961
			(1.83)		(1.426)
CAR	0.058	1.571		3.855	
	(0.048)	(0.759)		0.016	
CAR (-2)			0.872		1.06
			(1.018)		(0.655)
NIM	0.567	6.385**		5.589	
	0.051	14.554		8.053	
NIM (-2)			4.619		2.457**
			(5.442)		(5.867)
ROA	0.183	1.476		2.771	
	(0.117)	(1.029)		(1.492)	
ROA (-2)			2.343		2.516
			(2.025)		(2.47)
EP	0.413***	4.815***		6.343*	
	(1.565)	(12.991)		(12.168)	
EP (-2)			3.13**		2.626***
			6.793		8.57
CG	4.885*	53.751*		59.12	
	(8.551)	(105.649)		(74.364)	
CG(-2)			39.837*		39.019
			69.677		60.421
INFL	17.37	235.337		204.514	
	(5.64)	(272.715)		(245.647)	
INFL (-2)			36.307		37.383
			(18.665)		(1.803)
GDPG	2.2	23.175		9.563*	
	0.272	(30.647)		(18.653)	
GDPG (-2)			5.046		6.207
			(0.745)		3.43
LIR	0.63	12.2612*		9.833*	
	(0.24)	(20.692)		(18.043)	
LIR (-2)			3.644*		3.728
			(6.455)		(4.233)
EXRT	0.001	0.003		0.004	
	(0.001)	(0.004)		(0.005)	
EXRT (-2)			0.003**		0.003*
			(0.006)		(0.005)
R-Square	0.3496				
AR(1)		0.059	0.067	0.131	0.056
AR(2)		0.308	0.604	0.375	0.871
Hansen		0.332	0.839	0.247	0.946

Note: ***, **, *, indicate significance on 1%, 5%, 10% respectively.

why lagged earning power shows opposite relation to credit risk could be because Bank's earning power at time t is comparatively better to lagged Bank's earning power. In other word, Bank's profitability performs better than its previous performance and could lower Bank's credit risk.

Unexpectedly, unlike most previous research, credit growths have significant and negative influence to credit risk at time t which means an increase of credit growth will not increase credit risk and able to minimize risk taken by Banks when creating new loans. This proves that Banks do not lower their credit standard by taking more risk when issuing more credit and maintain their credit

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issuing in a prudent manner even though they increase their credit. The lagged credit growth shows significant and positive impact to Banks credit risk. It explain that previous credit loans created by Banks was riskier compare to time t credit loans thus higher lagged credit growths could potentially contribute to higher loans default.

The result on macroeconomic level shows that all variable have significant impact to Bank's credit risk except for inflation. GDP variable shows low negative significant level on model 4 only. This result is in line with most previous research which argue an increase in GDP indicate better macroeconomics development and improve borrowers capability to service their debt thus lowering credit risk. Interestingly, Interest Rate shows opposite result with most previous studies that because interest rates have negative and significant influence on credit risk that shows on model 2, 3, and 4. The opposite result in this study is probably because the interest rate used in this study is lending interest rate. Higher lending interest rate means Banks are applying higher standard in granting loans for borrowers. Borrowers which are given loans would be those who have less probability to default thus lowering Bank's credit risk. Exchange rate variable have negative relation to Bank's credit risk, a decrease in exchange rate will increase Bank's credit risk. This result shows that the economic activity is influenced by exchange rate which in turn affect borrowers to service their debt.

V. CONCLUSION

This study uses three different approaches to examine the determinants of bank's credit risk from 40 banks in Indonesia. Fixed effect was employed to control the unobserved heterogeneity across different banks but since this effect might lead to dynamic panel bias because of becomes more persistent with larger t in the model, different GMM and system GMM is utilized. The use of GMM method allows the use of lagged dependent variable on the right hand side of the model equation since bank's credit risk which proxy with NPL does not immediately written off in the next period of bank's balance sheet. Additional to the use lagged dependent variable, the use of GMM enable to use of lagged determinants variable to examine whether delayed response of credit risk to its determinants exist.

According to the result of the study, half of the determinants of credit risk have significant influence to credit risk across fixed effect, different GMM, and system GMM method. Those determinants are GDP growth, lending interest rate, and exchange rate for macroeconomic variable and loan loss provision, net interest margin, earning power, and credit growth for bank-specific variable. The result shows that bank-specific determinant have higher significance compare to macroeconomics determinants because most of bank-specific determinants have one percent level of significance while most of macroeconomic determinants have ten percent level of significance. The result also shows that bank's credit risk is persistence to its previous value since lagged value of credit risk show significant level to its current value. However, it could be assumed that the correlation of credit risk lagged value will be weaker as time goes.

All macroeconomic variables except inflation are proven to influence the changes of bank's credit risk. GDP growth shows negative influence to credit risk that translates better economic condition will lower bank's credit risk.. Unexpectedly, interest rate shows opposite result compare to most previous studies. The explanation for this result is that because the interest rate used in this study is lending interest rate for capital lending and higher interest rate means debtor will have difficulty to apply for loans since the bank have higher standard to approve their loans. Exchange rate variable also shows negative correlation to bank's credit risk which means an appreciation in currency value improve debtor ability to pay loans. The significant of macroeconomic lagged value to credit risk only shown from lending interest rate and exchange rate which means it could be concluded that bank's credit risk have delayed response to these two variables.

Overall, the result of bank-specific variable shows that banks in Indonesia manage their loans in a prudent manner and reject theory such as moral hazard theory. The prudent risk management of credit risk could be indicated from the positive and negative correlation of loan loss provision and earning power respectively to bank's credit risk. Bank's earning power also proved to have a delayed influence to bank's credit risk. Net interest margin variable however shows mix result between its current value and lagged value. The interpretation could be that bank's loans quality are better comparatively to its previous value while having higher interest margin and vice versa. The result on credit growth also shows that bank in Indonesia always maintain prudent manner in managing their risk.

REFERENCES

[1] Ahmad N H, Ariff M 2007. Multi-country study of bank credit risk determinants. International Journal of Banking and Finance [J], 5: 135-152.

[2] Altıntaş M A 2012. Kredi kayıplarının makroekonomik değişkenlere dayalı olarak tahmini ve stres testleri: Türk bankacılık sektörü için ekonometrik bir yaklaşım [M]. Türkiye Bankalar Birliği.
[3] Arellano M, Bond S 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The review of economic studies [J], 58: 277-297.
[4] Arellano M, Bover O 1995. Another look at the instrumental variable estimation of error-components models. Journal of econometrics [J], 68: 29-51.
[5] Berger A N, Deyoung R 1997. Problem loans and cost efficiency in commercial banks. Journal of Banking & Finance [J], 21: 849-870.
[6] Blundell R, Bond S 1998. Initial conditions and moment restrictions in dynamic panel data models. Journal of econometrics [J], 87: 115-143.
[7] Castro V 2013. Macroeconomic determinants of the credit risk in the banking system: The case of the GIPSI. Economic Modelling [J], 31: 672-683.
[8] Committee B 1999. Principles for the management of credit risk. Basel Committee on Banking Supervision, July [J].
[9] Dimitrios A, Helen L, Mike T 2016. Determinants of non-performing loans: Evidence from Euro-area countries. Finance Research Letters [J], 18: 116-119.
[10] Ghosh A 2015. Banking-industry specific and regional economic determinants of non-performing loans: Evidence from US states. Journal of Financial Stability [J], 20: 93-104.
[11] Hsiao C 2014. Analysis of panel data [M]. Cambridge university press.
[12] Kjosevski J, Petkovski M 2017. Non-performing loans in Baltic States: determinants and macroeconomic effects. Baltic Journal of Economics [J], 17: 25-44.
[13] Klein N 2013. Non-Performing Loans in CESEE: Determinants and Macroeconomic Performance IMF Working Paper. WP13/72 [J].
[14] Kraft E, Jankov L 2005. Does speed kill? Lending booms and their consequences in Croatia. Journal of Banking & Finance [J], 29: 105-121.
[15] Kuzucu N, Kuzucu S 2019. What Drives Non-Performing Loans? Evidence from Emerging and Advanced Economies during Pre-and Post-Global Financial Crisis. Emerging Markets Finance and Trade [J]: 1-15.
[16] Louzis D P, Vouldis A T, Metaxas V L 2012. Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. Journal of Banking & Finance [J], 36: 1012-1027.
[17] Nkusu M M 2011. Nonperforming loans and macrofinancial vulnerabilities in advanced economies [M]. International Monetary Fund.
[18] Öker A 2007. Ticari bankalarda kredi ve kredi riski yönetimi-bir uygulama. Marmara Üniversitesi Sosyal Bilimler Enstitüsü Yayınlanmamış Doktora Tezi, İstanbul [J].
[19] Podpiera J, Weill L 2008. Bad luck or bad management? Emerging banking market experience. Journal of Financial Stability [J], 4: 135-148.
[20] Rachman R A, Kadarusman Y B, Anggriono K, et al. 2018. Bank-specific Factors Affecting Non-performing Loans in Developing Countries: Case Study of Indonesia. The Journal of Asian Finance, Economics and Business [J], 5: 35-42.
[21] Radivojević N, Cvijanović D, Sekulic D, et al. 2019. Econometric model of non-performing loans determinants. Physica A: Statistical Mechanics and its Applications [J], 520: 481-488.
[22] Roodman D 2009. How to do xtabond2: An introduction to difference and system GMM in Stata. The stata journal [J], 9: 86-136.
[23] Rossi S P, Schwaiger M, Winkler G 2005. Managerial Behaviour and Cost/Profit Efficiency in the Banking Sectors of Central and Eastern European Countries. Working Paper No. 96, Austrian National bank [J].
[24] Škarica B 2014. Determinants of non-performing loans in Central and Eastern European countries. Financial theory and practice [J], 38: 37-59.
[25] Tanasković S, Jandrić M 2015. Macroeconomic and institutional determinants of non-performing loans. Journal of Central Banking Theory and Practice [J], 4: 47-62.
[26] Vouldis A T, Louzis D P 2018. Leading indicators of non-performing loans in Greece: the information content of macro-, micro- and bank-specific variables. Empirical Economics [J], 54: 1187-1214.
[27] Williams J 2004. Determining management behaviour in European banking. Journal of Banking & Finance [J], 28: 2427-2460.
[28] Yurdakul F 2014. Macroeconomic modelling of credit risk for banks. Procedia-Social and behavioral sciences [J], 109: 784-793.