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How Do Bank-Specific Factors Impact Non-Performing Loans: Evidence from G20 Countries

Abstract: Banking is important for the stability and success of the economy. The success of the banking system on financial intermediation in developing countries is directly affected by non-performing loans (NPLs). Many factors can be treated as NPL determinants. Accordingly, the factors that explain NPLs contain very important information for banks. To this end, the study is an attempt to examine various banking factors that affect NPLs with respect to developing economies. In this study, the bank-specific and macroeconomic factors affecting the NPL rates were analysed through the dynamic panel data analysis. Analyses were made using described G20 countries between 1998 and 2017. The results indicate that the lagged value of NPLs, return on equity, credit growth and credit costs have a significant positive relationship with NPLs, while capital adequacy and GDP have a negative association with NPLs. The results confirm that if the bank-specific conditions change, the credit quality and bank management of banks are affected. It was concluded that the performance of banks is responsive to an effective loan monitoring policy. The findings of the study have implications for policymakers and regulators in the banking sector.

Keywords: Commercial Bank, Credit Risk, Dynamic Panel Data Analysis, Two-Step GMM, G20 Countries

JEL Classification: G32, G01, G21, C23, F62

1. Introduction

The financial system contributes to economic development by affecting the decisions of saving and investment, risk reduction, mobilization of savings, efficient allocation of funds, and transaction facilitation (Petkovski and Kjosevski, 2014; Levine, 2005). The development of the financial sector has undoubtedly been the most significant impact on the achievement of any country's economy for many years. The incidents that occurred in the financial sector have affected not only the microeconomy but also the macroeconomy (Helhel, 2014). Hence, the decrease in the performance of the financial sector can affect the sectors. In countries with bank-based economic systems, the banking sector plays a crucial role in the sustainability of the financial system of each country (Moradi, Mirzaeenejad & Geraeenejad, 2016). Thus, the financial market has been mainly dominated by the banking sector, especially in emerging markets.

The companies having to compete in the national and international markets with globalization and advancing technology need an external source, i.e. a loan system to perform their operations and investments. The majority of those needs are satisfied by the banks under the title of "loan". However, management of the loans which have an important role in the performance of the banks is crucial. This is because one of the most important indicators of a bank's performance is the quality of its active structure. And, one of the most important indicators reflecting the quality of the bank's active structure is the NPLs rate (Kabatas and Karamustafa, 2019: 2). Therefore, banks try to collect the amounts for the credits which enhance their active quality while they create accounts for the loans which are one of their most important incomes (Yucememis and Sozer, 2011). In cases where loan risk analysis is not carried out accurately, an economic constriction or crisis in the country may cause the loans not to be collected. While the banks want to maximize profits in the credit process, they are exposed to the credit risk that some loans may become non-performing loans (Ikram, Su, Ijaz & Fiaz, 2016). NPLs can be defined as the credit risk that is taken by the banks (Yurttadur, Celiktas & Celiktas, 2019). Loans that cannot be collected when they fall due and for which the legal proceedings are started at the end of the legal process become NPLs. NPLs are the most important indicator to measure credit risk as it directly affects the banking system and exhibits the loss probability (Koju, Koju & Wang, 2018: 112; Kola, Gjipali & Sula, 2019). The size of NPLs plays a key role in the stability of the banking sector of a country (Khan, Siddique & Sarwar, 2020). When NPLs continue permanently, they have an impact on the funds that are enclosed in unprofitable fields (Messai and Jouini, 2013: 852). It is accepted that the more NPLs the bank has, the less the relevant bank is successful. It affects the performance of the banks adversely and increases the problem of NPLs (Hou and Dickinson,

2007: 5). The level of asymmetric information in the market where the operations are carried out affects the NPL rates. An increase in NPLs may cause banks to increase their lending interest rates to compensate for their decreasing profit levels. In this case, the NPL rates of banks which make their loan conditions more difficult decreases; however, it can adversely affect the sectors needing funds.

Technological advancements in the financial sector have created an opportunity for increases in the ranges of products and customers. Increasing loan demands and banks' wish to meet those demands by taking high risks increase the potential of loans to become NPLs. And it may cause banks to have some problems to carrying out their operations consistently (Genc and Sasmaz, 2016: 120). As a result, increases in NPLs may threaten the future and consistency of the banking system directly and the real economy indirectly. Accordingly, the minimization of NPLs is an essential condition for improving financial markets as well as economic growth. Therefore, it is necessary to carry out a good credit risk analysis in order to decrease losses during the loan-providing process. However, credit risks are exclusive to the banking sector and are quite a complex issue due to the non-systematic risks. Therefore, the NPLs are not only the subject of the bank system itself as a measure of performance and profitability also it is the central attention of the policymakers as well as the bank's management (Reinhart and Rogoff, 2010). Many researchers have emphasized that examining the factors of NPLs is of substantial importance to policymakers. They emphasized that NPLs can be an indicator of the beginning of a banking crisis because it seriously ruins economic growth and decreases economic efficiency (Souza and Feijó, 2011; Louzis, Vouldis and Metaxas, 2012; Nkusu, 2011; Ivanović, 2016). Accordingly, NPLs are a threat to sustainable development for countries, especially in emerging countries (Zheng, Bhowmik and Sarker, 2019).

When taking into consideration the importance of the banks for the financial system and the national economy, and the fact that the loan risk is the greatest risk the banks face, it is obvious why? the causes of the NPLs have become the subjects of research conducted in this field. Even though several factors cause a loan to become NPLs, the leading causes are instabilities caused by the macroeconomic policies and loss of trust between the parties in the market. Banks may have an opportunity to diminish credit risk by performing good risk management. Taking several measures in order not to be affected by credit risk is an important issue in terms of the cost of NPLs for the banking sector and the national economy. Also, the performance of banking sectors in emerging markets was marked by extensive NPLs. To this end, the purpose of this study is to determine the bank-specific and macroeconomic determinants affecting NPLs of commercial banks in emerging markets. From this point of view, determining the bank-specific fac-

tors causing the loans to become NPLs and providing policy recommendations for them form a motivation for this study. Thus, this paper mainly aims to shed light on bank-specific factors that affect NPLs in emerging countries. The study contributes to the current literature on the empirical determinants of NPLs by using a unique data sample covering a large number of developing economies.

The research subject is generally explained in five parts. The first section includes an introduction, Section 2 provides a brief literature review on bank-specific and macroeconomic determinants of NPLs. Section 3 describes variables, data, and the methodology to investigate the credit risk of commercial banks in emerging markets. Section 4 outlines empirical findings of the study. The final section concludes and gives policy recommendations on the results as well as suggestions for future research.

2. Literature review

In recent years, the literature on the determinants of NPLs of banks has occupied the interest not only of bank management but also policymakers and researchers. The empirical studies explaining the NPLs in a cross-country context concluded that macroeconomic and bank-specific conditions have an important impact on NPLs (Berger and DeYoung 1997; Quagliarello, 2007; Vogiazas and Nikolaidou, 2011; Louzis et al., 2012; Zeng, 2012; Klein, 2013; Makri, Tsagkanos and Bellas, 2014; Abid, Ouertani and Zouari-Ghorbel, 2014; Dimitrios, Helen and Mike, 2016; Memdani, 2017; Waqas, Fatima, Khan and Arif, 2017). González-Hermosillo, Pazarbasioğlu and Billings (1997) employs a combination of macroeconomic and microeconomic variables in explaining the banking fragility in Mexico. They concluded that the main causes underlying banking failure in Mexico were the outcomes of macro factors and bank-specific factors, which led to problematic loans. Some studies have shown that there is a negative relationship between bank size and NPLs (Saunders, Strock and Travlos, 1990; Salas and Saurina, 2002; Rajan and Dhal, 2003; Hu, Li and Chiu, 2004; Konishi and Yasuda, 2004; Ćurak, Pepur and Poposki, 2013; Belke, Ulrich and Ralph, 2016; Gulati, Goswami and Kumar, 2019).

Ahmad and Ariff (2007) investigated the relationship between regulatory capital and credit risk in the states of Japan, Malaysia, and Mexico. The results of the study show that regulatory capital has a positive effect on credit risk in these countries. The findings also suggest that management quality as a bank-specific factor played a substantial role in the based credit banks in developing countries. Boudriga, Taktak and Jellouli (2009) investigated the factors affecting NPL rates in 59 countries. The findings revealed that NPLs are affected mainly by bank-

specific factors such as capital adequacy, provisions, and bank ownership. Espinoza and Prasad (2010) analysed the effect of macroeconomic and bank-specific factors on the NPLs ratio in the Gulf Cooperation Council. They found that the NPLs were related to capital adequacy ratio, measures of efficiency, bank size, net interest margin, and rate of non-performing loans of the previous year. Macit and Keceli (2012) conducted Turkish participation banks to investigate the micro-macro factors of NPLs ratio. The results suggested that the ratio of NPLs is lower in banks with a high ratio of loans to total assets and the asset size has a negative effect on NPLs. Besides, the decline in GDP growth both in the same period and with a delayed increase in the ratio of NPLs. Swamy (2012) examined the determinants of non-performing assets of banks in India. The study found that savings growth rate, bank assets, credit deposit ratio, cost of funds, priority sector loans to total loans had a negative impact on NPLs while the loan to deposit ratio and return on assets had a positive impact on NPLs. Ćurak et al. (2013) evaluated the bank-specific determinants of the NPLs in Southeastern European countries. They revealed that NPLs are affected by bank size, performance, solvency and the lower economic growth was effective on the level of NPLs. Vatansever and Hepsen (2013) examined the association between macroeconomic, bank-specific variables and NPLs ratio in Turkey. The authors indicated that ROE and capital adequacy ratio positively affect the NPLs ratio; the inefficiency ratio of all banks negatively affects the NPLs ratio. Prasanna (2014) used data from 31 banks in the Indian banking system and stated that an increase in savings and GDP leads to lower NPLs. Makri et al. (2014) analysed the bank-specific and macroeconomic factors affecting the NPLs for the euro area's banking sector. They concluded that capital adequacy ratio, lagged NPL value and return on equity are strongly correlated. Ghosh (2015) examined the relationship between economic and bank-specific variables and NPLs in the banks of 50 U.S. states. The results indicated that operating inefficiency, loans-to-asset, loan loss provisioning and lagged values of NPLs had a positive impact on the NPLs while economic growth and return on assets had a negative impact on NPLs. Baselga-Pascual, Ponce-Trujillo and Riportella-Cardone (2015) explored the association between bank-specific and macroeconomic variables and NPLs in the euro area and expressed that capitalization, profitability efficiency and liquidity lead to lower NPLs. Yagcilar and Demir (2015) analysed the factors of NPLs in commercial banks in Turkey. They found that loan-to-deposit ratio, liquidity and profitability have negative effects on NPLs, and the capital adequacy ratio and foreign ownership have positive effects on NPLs. Dhar and Bakshi (2015) examined the association between the bank-specific factors? and the level of gross non-performing advances in India and stated that net interest margin and capital adequacy ratio have a negative significant effect on gross non-performing advances. Abdioglu and Aytekin (2016) evaluated the impact of the bank-specific factors on NPLs in the Turkish

banking system and affirmed that the NPL rate in the previous period, net interest margin, capital adequacy, and payment power had a negative impact on the NPLs. Isik and Bolat (2016) conducted a research on deposit banks in Turkey and found that greater capital and loan loss provisions significantly increase the NPLs rate while economic growth has a negative effect on NPLs. Belke et al. (2016) studied the causes of NPLs. They revealed that NPLs vary negatively with the loan-to-deposit ratio and liquidity risk and positively with the size of the bank, capital adequacy, non-effectiveness of the bank, economic growth. Rachman, Kadarusman, Anggriono and Setiadi (2018) analysed the bank-specific determinants of NPLs by focusing on the data of 36 commercial banks on the Indonesia Stock Exchange. They found that the rise in the size of NPLs has a significant negative impact on the banks' profitability and credit growth. Koju et al. (2018) studied the bank-specific and macroeconomic factors of NPLs by using the data of 30 Nepalese banks. The results suggested that the inefficiency and asset size increase NPLs, whereas interest rate and growth rate of GDP and capital adequacy decrease NPLs. Danisman (2018) studied determinants of NPLs in Turkey and stated that profitability, capital adequacy and bank size affect adversely credit quality. Kjosevski, Petkovski and Naumovska (2019) focused on examining the effect of determinants of NPLs in North Macedonia. The findings revealed that banks' solvency made the credit quality worse whereas the growth of GDP improved the credit quality. Zheng et al. (2019) focused on exploring whether changes in the bank-specific and macroeconomic factors affected? NPLs in Bangladesh. They concluded that bank loan growth, net operating profit, and deposit rates negatively impacted on NPLs while bank liquidity and lending rates had a significant positive affiliation with NPLs. Bayar (2019) evaluated the impacts of the macroeconomic, institutional, and bank-specific factors on NPLs in emerging markets. The author found that economic growth, return on assets and equity regulatory capital to risk-weighted assets, and noninterest income to total income decrease NPLs while credit growth, lagged values of NPLs and cost to income ratio increase NPLs. Cetinkaya (2019) used panel data from the banking sector in Turkey and noted that asset profitability, bank size, net interest margin, fiscal deficit and return on equity were statistically significant. Gulati et al. (2019) expressed that NPLs can be explained mainly by bank-specific factors for public sector banks while macroeconomic and bank-specific variables are important factors in explaining credit risk for private and foreign banks. Kozarić and Žunić-Dželihodžić (2020) researched the association between macroeconomic variables, non-performing loans and financial stability by employing regression analysis over the period of 2006 to 2017. As a result of the study, they concluded that there is a correlation between macroeconomic conditions, non-performing loans, and financial stability. The authors concluded that improvement in macroeconomic conditions causes improvement in credit quality. Misman and Bhatti

(2020) researched ASEAN and GCC countries to explain the level of NPLs and concluded that financing quality and credit risk are positively correlated. Khan et al. (2020) explored factors of NPLs by observing a case of in the banking sector in Pakistan and found that operating efficiency and profitability have a negative association with NPLs. Zegiraj, Mrasori, Iskenderoglu and Sohag (2021) aimed to investigate whether banking performance impacts financial stability in South-eastern European countries by using the GMM approach over the period of 2000 to 2015. The authors indicate that the return on assets/equity as a measurement of banking performance is positively associated with financial stability. Abbas and Younas (2021) aim to investigate the influence of bank capital, risk-based capital and bank capital buffers on the behaviour of bank risk-taking by using GMM over the period of 2002 to 2018. As a result of the study, they concluded that there is a positive relationship between bank capital and total risk, while there is a negative relationship between risk-based capital and capital buffer and total risk.

3. Data, model, and research methodology

This study analyses NPLs as a measurement of credit risk of commercial banks in the G20 countries. Analyses of the study are conducted through commercial banks listed on the stock markets in developing economies. The data belonging to banks from the period 1998-2017 were obtained from the World Bank database and Fred economic data database. The dataset was formed of financial variables and control variables representing macroeconomic factors.

Factors affecting the NPL rate in the banking sector are generally explained in two different groups in the literature. The first of them is the external factors involving macroeconomic conditions, and the second is the bank-specific internal factors. Research models were developed by analysing the studies in the literature addressing the relationships of NPLs with the macroeconomic and bank-specific factors. Analysing whether bank-specific internal factors affect NPLs was the motivation of this study. Therefore, the bank-specific internal factors focus on the research models. Besides, the growth of real gross domestic product (GDP) factor was included in the study to take into consideration macroeconomic effects in the country where the banks carry out their operations. The dependent variable is NPLs. The independent variables in the research model are lagged value of NPLs, non-interest income ratio (NII), return of equity (ROE), net interest margin (NIM), capital adequacy ratio, operating expenses (COST), bank credit to bank deposits (CRE/DEP), and growth of real gross domestic products (GDP). The model is presented below;

$$NPLs_{i,t} = \alpha_0 + \beta_1(NPLs)_{i,t-1} + \beta_2(NII)_{i,t} + \beta_3(ROE)_{i,t} + \beta_4(NIM)_{i,t} + \beta_5(CAP)_{i,t} + \beta_6(COST)_{i,t} + \beta_7(CRE/DEP)_{i,t} + \beta_8(GDP)_{i,t} + \varepsilon_{it}$$

In the equation; *i* indicates countries (i=1,…, N) and *t* indicates the analysis period (t=1,…,T). In the model; α_0 indicates constant term and ε_{it} indicates error term. NPLs are calculated as the ratio of NPLs to total loans. It means that a ratio that compares bad credit to total disbursed loans so it is also called bad debt. The high value of NPLs will enlarge costs and cause bank losses. The NPLs ratio as the proxy for success in banks' credit management and active quality. A high-quality loan portfolio of a bank is necessary for liquidity and profitability of the relevant bank. Liquidity is crucial for due liabilities to be performed/serviced?. Besides, it also helps decrease the re-funding costs. Within this frame; decreased quality of the loan portfolio of the bank, i.e. increased NPLs rate is an indicator of the financial problems for the bank. Banks have two fundamental functions: providing financial intermediation services and providing financial products and services. The capacity of banks to provide loans is a criterion for their financial intermediation performances. As a criterion for providing products and services, the non-interest income to total revenues rate was applied. Non-interest income consists of incomes from the banking services, fees received from the loans and commissions, and other non-interest incomes. Return on equity is used as an indicator of the return earned from the investment of the company owner. The net interest margin is measured as the ratio of a bank's net interest income to the value of its total investing assets. The net interest margin provides information on the profitability structure of the bank and it is expressed as a performance metric for banks so it is also used to measure the bank's management capability. The capital adequacy ratio indicates the solvency of banks. The capital adequacy ratio is calculated using a ratio of capital and reserves to total assets. Capital adequacy ratio represents the adequacy of capital owned by banks to support assets. It reflects the amount of the total assets of banks that contain the risk and the capital adequacy and durability of the bank against the risks. Achievements in creating competitive advantage and providing banking products and services are important for banks. The cost-to-income ratio, which is the key financial measure, is a metric that is used in a bank to evaluate its efficiency of the operation. This ratio measures the relation of the bank's operating expense as a percentage of operating income. Here, the indicator of cost is operating expenses and it is assumed that bad managers cannot control these expenses. Basically, the lower the cost to income ratio, the higher the profitability and bank's performance. The ratio of bank credit to bank deposits is used to measure a bank's liquidity by dividing the bank's total loans disbursed by the total deposits received. It shows whether the bank has stable funding. GDP growth rate is the annual percentage growth rate

of real GDP. The growth on the level of real GDP over the years was calculated and applied in the analysis. Descriptions of the variables can be found in Table 1.

Table 1: Description of variables

NPLs	Nonperforming loans to total loans
NII	Non-interest related activities as a percentage of total income
ROE	Ratio of net income to average of total equity capital
NIM	Ratio of tax-adjusted income to average earning assets.
CAP	Ratio of bank capital and reserves to total assets.
COST	Operating expenses of a bank as a share of sum of net-interest revenue and other operating income.
CRE/DEP	Ratio of bank credit to bank deposits
GDP	Growth of real gross domestic product

The main objective of the study is to determine the relationship between NPLs, bank-specific and the macroeconomic variables. The variables were chosen based on the review of the previous literature where the most cited variables that affect level of the NPLs were used.

4. Analysis method

The regression analyses were carried out in two different ways in the study. First, the bank-specific and macroeconomic factors affecting the NPLs were estimated through the static panel models. The endogeneity problem which can be caused by the bank-specific factors became prominent as an important factor during the analysis process. In this case, it is possible to obtain deviant and inconsistent findings if the static panel method is applied (Baltagi, 2005). Accordingly, using linear dynamic estimation methods is suggested in case there are internal factors in the panel data model. Additionally, it is possible to face important problems in case lagged dependent variables are applied in the static panel models since the lagged dependent variables are correlated with the error term (Greene, 2000). By considering the results obtained through the static regression estimation methods, it is suggested to apply an instrumental variable instead of lagged dependent variable (Cameron and Trivedi, 2005).

Unlike static panel data models, dynamic panel data models include delayed values of dependent or independent variables within the model. Among the dynamic panel data models, models in which the delayed state of the dependent variable is included in the independent variables are called autoregressive panel data models (Tatoglu, 2018). The dynamic panel data model is created by having

a lagged value of the dependent variable as an independent variable on the right side of the equation (Arellano, 2010). In these models, the delayed state of the dependent variable included in the independent variables is correlated with the error term, so it does not comply with the externality assumption. The lagged state of the dependent variable in the model will cause a correlation with unobservable effects (Baltagi, 2005). Due to the endogeneity problem, the estimators of such models obtained by the pooled least squares method (OLS) method will be biased and inconsistent. The fact that the error term is correlated with the lagged state of the dependent variable neglects an important assumption of the random effects model. Therefore, random-effects estimators will not be consistent and reliable.

To overcome this problem, the Generalized Method of Movements (GMM) was suggested by Arellano and Bond (1991) and based on the primary difference transformation. Through this method, it is possible to provide estimations resistant to heteroscedasticity and autocorrelation (Tatoglu, 2018). However, determining whether the model is valid is important in terms of validity and soundness of the findings. Various tests should be carried out to test deviations from hypothesis in panel data models to determine whether the data used are appropriate. What is meant by stubs from the hypothesis is the presence of autocorrelation, varying variance and correlation between units in the model. The first of these conditions is that there is no multicollinearity between the independent variables. The linear regression model assumes that there is no multicollinearity between independent determinants. From this point of view, the existence of multicollinearity was investigated by the variance inflation factor (VIF). It was determined that the obtained VIF values do not contain multicollinearity between the independent variables. Another important factor is the heteroscedasticity problem decreasing the significance by causing the standard errors of estimated coefficients not to be estimated accurately. For this reason, the existence of the heteroscedasticity problem in the research model was analysed through the Greene (2000) test and the existence of the autocorrelation problem in the research model was analysed through the Wooldridge (2002) and Drukker (2003) tests. As a result, the tests performed reveal that there is a heteroscedasticity and autocorrelation problem in the model.

In this study, dynamic panel data analysis with the two-step Generalized Moments Method (GMM) developed by Arellano and Bond (1991) for estimation of elasticity free of variance and autocorrelation was preferred. Estimations provided by the dynamic estimators are valid when the instrumental variables are applied completely and accurately and when the instrumental variables reflect the actual variables completely. For the determination of the validity of instrumental variables, the Sargan test statistics were used. For the heteroscedasticity problem, robust estimations were conducted. Besides, the relationship between

the specific effects and explanatory variables for the static panel models was determined through Hausmann test statistics (Hausman, 1978).

5. Empirical results

The findings were reported within three different frames in general. In order to analyse the factors affecting the NPL rate for the banks, the descriptive statistics of the variables included in the research model were calculated. Second, the correlation relationships between the variables were analysed. Finally, the factors affecting the NPL level were analysed by conducting two-step GMM regression estimations.

Table 1 presents descriptive statistics for the determinants involved in the GMM model. Within this frame, the mean, standard deviation, minimum, and maximum of the variables are calculated. The financial features of the banking sector operating in the countries subjected to the analysis were revealed. The descriptive statistics are presented in Table 2.

Table 2: Descriptive analysis of the variables

Variables	Obs.	Mean	Std. Dev.	Minimum	Maximum
NPLs	380	4.97463	5.705448	0.4	48.6
NII	380	39.25793	14.54192	7.96108	95.2632
ROE	380	8.69754	17.99367	-211.443	36.608
NIM	380	3.365884	2.294768	0.306504	19.9032
CAP	380	7.9062	3.014276	2.4	15.4164
COST	380	58.46887	13.3296	27.5016	139.468
CRE/DEP	380	108.561	51.0107	37.12	330.979
GDP	380	3.162344	3.567966	-13.12673	14.23086

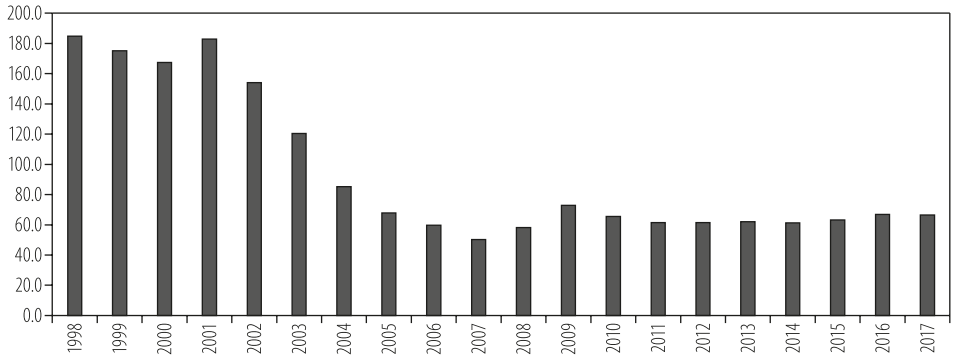
Source: The authors

As can be seen from Table 2, all variables have 380 observations for the period 1998-2017. The NPLs variable has a mean value of 4.97%, which ranges from 48.6% to 0.4%. The average value of NII, ROE, NIM, CAP, COST, CRE/DEP, and GDP are 39.25%, 8.69%, 3.36%, 7.90%, 58.4%, 108.56%, and 3.16%, respectively. Additionally, CRE/DEP for the same period is very high. It takes values from 37.12% to 330.97%. It can also be observed that the highest value of the standard deviation is CRE/DEP and the lowest value of standard deviation is NIM. The value of standard deviation shows that the value of NPLs in the G20 economies is very close. Accordingly, it is understood that the total of NPLs in these countries

is similar. The CRE/DEP variable has significant variations between the minimum and the maximum. Furthermore, from Table 2 we can see that ROE and GDP have negative and positive values. These results also confirm the fact that banks in the G20 economies were affected by the economic and financial crisis and marked negative growth. Different statements can be made in Table 2 for other variables.

The levels of NPLs by years for the G20 countries included in the analysis was presented in Graph 1.

Graph 1: The levels of NPLs for G20 countries from 1998 to 2017



Source: The authors

According to Graph 1, it can be observed that the evolution of the NPLs in the G20 countries from 1998- to 2017, monotonically exhibits a mixture of upward and downward. It was discovered that the year with the highest NPLs rate is 2001 in the period subjected to research. The rate trended to decrease in the period between 2003 and 2008. The global financial crisis had started in 2007 in the USA with the collapse of the mortgage market with high interest and it continued to affect the world until 2011 causing a major increase in the NPLs rates in the G20 countries. It can be observed that the NPLs rate trended to decrease in the period between 2003 and 2015. The financial crisis was one of the factors that affected the increase in non-performing loans. It can also be observed that the crisis in 2008 has a negative effect on the NPLs values of the banks. It was discovered that the return rates of the loans decreased and NPLs rates increased in this period. Due to the 2008/2009 global financial crisis, borrowers had more difficulties paying off their credits, therefore increasing the rate of NPLs and devastating effects on the entire economy. However, the value of the NPLs started to decrease after the end of 2009. It is understood that the national economies of the countries

have managed to recover rapidly. It was also discovered that the number of NPLs increased during the period of recession and it decreased during the period when the economies are invigorated, and the real economies grow.

The correlation between the dependent variable and its explanatory variables was analysed. Table 3 indicates the Pearson correlation analysis between NPLs and their explanatory variables.

Table 3: Pearson correlation analysis

	NPLs	$NPLs_{t-1}$	NII	ROE	NIM	CAP	COST	CRE/DEP	GDP
NPLs	1								
$NPLs_{t-1}$	0.908	1							
	(0.000)								
NII	-0.075	-0.090	1						
	(0.143)	(0.086)							
ROE	-0.323	-0.335	0.015	1					
	(0.000)	(0.000)	(0.759)						
NIM	0.068	0.112	-0.176	0.250	1				
	(0.185)	(0.032)	(0.000)	(0.000)					
CAP	-0.105	-0.063	0.061	0.351	0.577	1			
	(0.040)	(0.225)	(0.229)	(0.000)	(0.000)				
COST	0.171	0.100	0.495	-0.319	-0.162	-0.221	1		
	(0.000)	(0.057)	(0.000)	(0.000)	(0.001)	(0.000)			
CRE/DEP	-0.026	-0.089	-0.127	0.005	-0.280	-0.192	-0.262	1	
	(0.613)	(0.088)	(0.013)	(0.922)	(0.000)	(0.000)	(0.000)		
GDP	-0.109	0.132	-0.222	0.169	0.091	0.094	-0.295	0.171	1
	(0.032)	(0.012)	(0.000)	(0.000)	(0.07)	(0.064)	(0.000)	(0.000)	

Source: The authors' calculations

According to Table 3, in general, the correlations among the explanatory variables are found statistically significant. The correlation analysis indicates that correlation coefficients between the explanatory variables are low except for the relationship between the NPLs and the lagged NPLs. Accordingly, lagged NPLs has the highest correlation coefficient and the correlation between the other variables have a relatively low correlation coefficient. The lowest value of correlation exhibited among explanatory variables is 0.015 which was found in the case of ROE and NII. While NPLs were positively correlated with lagged NPLs, NIM and COST were negatively correlated with NII, ROE, CAP, CRE/DEP, and GDP. The correlation between the GDP and NPLs is broadly in line with economic theory: NPLs were negatively correlated with GDP growth. This may suggest that lagged NPLs, NIM

and COST increase the NPLs of the G20 economies. The comparison of the correlation coefficients between the variables and the variable except for lagged NPLs was not strong, suggesting that multicollinearity problems were not severe between variables. Appendix (1) gives the matrix of correlation coefficients between the dependent variable and the explanatory variables in the equation of our study.

Table 4: The results of the two-step GMM regression

Variables	(Model 1) NPLs	(Model 2) NPLs	(Model 3) NPLs	(Model 4) NPLs	(Model 5) NPLs	(Model 6) NPLs	(Model 7) NPLs
$NPLs_{(t-1)}$	0.838***	0.795***	0.798***	0.759***	0.751***	0.750***	0.855***
	(0.00565)	(0.00501)	(0.00394)	(0.00764)	(0.0356)	(0.0384)	(0.0622)
NII	-0.0559***	-0.0401***	-0.0473***	-0.0488***	-0.0364***	-0.0402***	-0.0143
	(0.00657)	(0.00719)	(0.00572)	(0.00758)	(0.00928)	(0.00879)	(0.0102)
ROE		-0.0271***	-0.0261***	-0.0208***	-0.0103***	-0.00212	-0.0137***
		(0.00276)	(0.00301)	(0.00433)	(0.00327)	(0.00500)	(0.00463)
NIM			-0.0510	-0.0710*	0.00613	0.0423	-0.101
			(0.0313)	(0.0412)	(0.0819)	(0.0958)	(0.146)
CAP				-0.403***	-0.326***	-0.343***	-0.275***
				(0.0752)	(0.0766)	(0.0796)	(0.0768)
COST					0.0725***	0.0855***	0.0520**
					(0.0148)	(0.0137)	(0.0247)
CRE/DEP						2.602*	4.757**
						(1.553)	(1.934)
GDP							-0.219***
							(0.0289)
Constant	2.662***	2.498***	2.906***	6.296***	0.702	-11.87	-21.25**
	(0.253)	(0.255)	(0.297)	(0.854)	(0.718)	(7.675)	(9.071)
Observations	342	342	342	342	342	342	342
Number of cno	19	19	19	19	19	19	19
Wald Testi	71497.38	105801.61	139920.43	15911.45	2272.37	2738.59	7774.60
P Değeri	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(1)	-1.306***	-1.330***	-1.330***	-1.332***	-1.504***	-1.538***	-1.418***
AR(2)	0.547	0.479	0.499	0.541	0.552	0.559	0.492
AR (2) (p)	0.584	0.631	0.617	0.588	0.580	0.575	0.622
Sargan test	17.625	16.174	16.545	16.083	13.757	14.977	8.365
Sargan test (p)	0.990	0.995	0.994	0.996	0.999	0.998	1.0000

Notes: Standard errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. VIF values were below the value of 2 (values ranged from 1.14 to 1.78 and the average value of VIF is 1.51 which indicates that multicollinearity was not an issue.

Source: The authors' calculations

The regression estimations were conducted through two-step GMM estimations in this study. The two-step GMM provides reliable estimation results for solving the endogeneity problem between the variables. Besides, it also enables the dynamic effects of dependent variables to be revealed. The regression analyses related to the factors affecting the NPLs rate are presented in Table 4.

The test statistics in Table 4 indicate that the findings obtained through the two-step estimation method are valid and reliable. The lagged value of NPLs was included in the models as a descriptive variable and we expect a positive sign of its coefficient. It was discovered that there is a statistically significant positive relationship between the NPLs levels of the banks from the previous period. The lagged NPLs indicate a positive significant correlation in all models and the NPLs follow an autoregressive process. Accordingly, a high level of NPLs from the previous period makes the NPLs from the future period to be high too. This result is corroborated by the literature, highlighting the dynamic persistence of NPLs during the observed period. The results are consistent with the studies in the literature by Makri et al. (2014), Ghosh (2015), Dimitrios et al. (2016), and Koju et al. (2018). There are different opinions in the literature regarding the effect of banks' profitability on NPLs. When the results of the two-step estimations are examined, it is seen that there is a statistically significant negative relationship between the ROE and NPLs. The correlation coefficient indicates that with increasing the ROE, the rate of NPLs decreases. The high NPLs ratio indicates that the credit quality of a bank and, therefore, profitability of the bank is lower. Accordingly, a negative relationship is expected between bank profitability and the level of NPLs. As banks lean towards risky loans, as the NPLs increase, their profitability especially returns on equity will decrease. Hence, a higher return on equity indicates better profit expectations and, therefore, it is associated with lower credit risk. Many studies have revealed that the ratio of NPLs is negatively related to bank capital. This situation shows that banks with high capital adequacy are more careful and selective in their lending processes. Since banks with low capital structure will be more flexible in lending, they may tend to take high credit risk. It is closely related to the moral hazard problem (Keeton and Morris, 1987). Capital adequacy also represents the level of guarantee against the risks for the banks in general. The literature presented evidence that capital adequacy ratio has a strong effect on NPLs (Sinkey and Greenawalt, 1991; Berger and DeYoung, 1997). In this study, it has been determined that there is a negative relationship between the capital ratio and the NPLs. The increasing capital ratio decreases the NPLs ratio. The results are consistent with the studies in the literature Berger and DeYoung, 1997, Sinkey and Greenwalt (1991), Kwan and Eisenbeis (1997) Boudriga et al. (2009). According to Berger and DeYoung (1997), the low level of cost effectiveness is a result of bad management, and this nega-

tively affects the credit management of bank managers. It is possible to say that when the high credit cost of the banks with higher NPLs is considered. The assumption that banks' high loan costs will lead to non-performing loans is related to the bad management hypothesis (Berger and DeYoung, 1997). In this study, it has been determined that there is a positive relationship between the operating expenses and the NPLs. An increasing level of operating expenses increases the NPLs rate. In the literature, the relationship between bank credit to bank deposits as credit growth and NPLs can work both positively and negatively. In this study, it was detected that there is a positive relationship between bank credit to bank deposits and NPLs. Banks' increase in loan amounts causes them to decrease interest rates and credit standards. This decrease in credit standards results in the borrowers being unable to repay their debts. Therefore, a positive relationship is expected between rapid loan growth and NPLs (Keeton, 1999). Most studies in the literature conclude that there is a negative relationship between NPLs and GDP growth. In this study, it was detected that there is an adverse relationship between the growth rate of GDP and NPLs, as predicted by theory. It indicates that the NPLs increase in periods of economic recession, and they decrease in the periods when the economy is invigorated, and the real economy grows. As GDP growth slows down, credit quality deteriorates, and defaults increase, thus reducing bank returns. The credit risk is affected by macroeconomic developments. The results are consistent with the studies of Salas and Saurina (2002), Fofack (2005), Espinoza and Prasad (2010), Warue (2012), Jakubik and Reininger (2013), Beck, Jakubik and Piloiu (2015), Viswanadham and Nahid (2015), Mpofu and Nikolaidou (2018), Kozarić and Žunić-Dželihodžić (2020). The statistically significant relationship between the non-interest income and NPLs was not obtained. Similarly, a significant finding between the net interest margin and NPLs was not obtained. When the results in the two-step GMM are evaluated together, it can be observed that banks should give interest to bank-specific factors when they offer loans to decrease the level of NPLs.

6. Conclusion and policy recommendations

The banking sector has a very important place in terms of financing economic growth and ensuring financial development. Especially in developing countries, the banking sector is the lifeblood of the financial system and encourages the development of other sectors. Therefore, there is a very close relationship between economic development and banking performance in these countries. A measurement of the profitability and performance of banks is the level of NPLs. Banks face the risk of non-repayment of loans in their lending processes, in other words, problematic loans. The increase in the level of NPLs in the banking sector has a

negative impact not only on the banking sector but also on the entire economy. Accordingly, the NPLs are a threat to the sustainable development of economies. The increase in NPL ratio negatively affects the balance sheets of banks and causes a decrease in their profitability and capital. This situation will cause banks to restrict the provision of new loans. If the NPLs problem is not resolved, it may cause serious financial problems and crises in the system. For these reasons, it is extremely important to understand NPLs, which is one of the most important obstacles to loan growth, and to develop solutions.

In this study, the factors affecting NPLs for the banks of developing countries were analysed. The findings revealed that the bank-specific factors and developments in the economy affect the NPLs rate. It was discovered that the current NPLs rates of the banks are affected by the NPLs rates of the previous period. In the case of the higher NPLs rates for the banks from the previous period, increases in the NPLs rates in the future periods are expected. It is determined that there is a statistically significant negative relationship between NPLs and returns on equity, capital adequacy, and GDP growth. Another important finding in the study is the existence of a positive relationship between NPLs and lagged NPLs operating expenses and bank credit to bank deposits. An adverse relationship between the growth rate of GDP and NPLs was obtained. NPLs were found to be affected by the economic structure operated. It was concluded that NPLs tend to decrease during the period when the economic conjuncture is good and that they increase when it is bad. This finding indicates that fluctuations in the economy are quickly transmitted to the problem loans of banks in developing countries. According to the results obtained, increasing the ratio of GDP, ROE, and CAP and decreasing the ratio of COST and CRE/DEP reduce the level of NPLs. The results of the study were found to be consistent with the relevant literature. Therefore, it is recommended that policymakers focus on bank-specific factors affecting the level of NPLs.

In this study, NPLs of the banks in G20 countries were examined in the context of bank-specific factors. There are lots of factors that may affect increases or decreases in the number of NPLs. Here, the analyses of the study were mainly conducted by focusing on the bank-specific factors. However, the proliferation of the Covid-19 pandemic process, which started in January 2020 in many countries, caused political, social, economic, and cultural changes. Countries have put into effect imperative new applications in many fields. Hence, it is recommended to consider the effects of the economic conjuncture and global crises such as the Covid-19 pandemic for the studies to be conducted and research their impact on the banking sector (Žunić, Kozarić and Žunić-Dželihodžić, 2021). Furthermore, new researches can be conducted to examine NPLs by changing the period and

using different econometric models in panel data analysis. Finally, the empirical findings of this study may also have implications for policymakers. The findings of this study could be useful for policymakers as it offers important data related to the performance of banking sector.

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Appendix 1

