Macroeconomic, Structural, and Bank-specific Determinants of Non-performing Loans in Central and Eastern Europe

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Abstract

The study of credit risk has gained significant importance in the aftermath of the global financial crisis of 2007 – 2008. Estimating the determinants of non-performing loans (NPLs), as an important indicator of credit risk in the banking sector, is essential for financial stability policies. The main goal of this research is to examine the determinants of NPLs in Central and Eastern European countries (CEE). This paper analyzes macroeconomic, structural, and bank-specific determinants of NPLs for 17 CEE countries for the period 2006 – 2017 by utilizing panel data and the fixed effects model. Although the literature on NPLs is quite extensive, this is the first empirical research with such a large number of countries from the CEE region using country-level data. The baseline analysis suggests that the unemployment rate, inflation rate, credit growth, crisis, bank concentration, and regulatory quality have a significant impact on NPLs. Unexpectedly, the law enforcement of creditor rights, proxied by various indicators, is not a statistically significant determinant of NPLs. The result of the study contributes to the literature on banking regulation and supervision, especially in the context of the CEE region.

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Introduction

The high-level of NPLs is becoming a growing concern given that earlier financial crises have shown that it takes long-term and well-designed policies to recover the financial sector. NPLs create uncertainty and harm banks' willingness and ability to lend, affecting the activity in the real sector. The 2007 – 2008 global financial crisis (GFC), which emanated from advanced economies, caused a considerable deterioration in the bank asset quality in the CEE countries when the global economy was hit by the subsequent economic crisis. For example, in 2006, the average NPL ratio in the CEE was 3.83%, rising to 18.1%in 2013 (Tanasković and Jandrić, 2015).

The CEE region has seen significant economic development in recent years, with an average real GDP growth rate of more than 3% per year over the previous five years. In 2019, the average real GDP growth was 3.4%, down from 4.0% in 2018. The highest growth rates were achieved in Hungary (4.9%), Estonia (4.3%), and Serbia (4.2%) in 2019. Increased domestic demand, supported by favorable consumer prices across Europe and strengthening labor market conditions, drove growth. In 2019, the unemployment rate fell by 0.9 percentage points on average, from 8.8 to 7.9%. Kosovo had the highest rate of unemployment in the region in 2019 (25.7%). Due to the economic shock and uncertainty brought on by the coronavirus pandemic, the unemployment rate and inflation have already risen in the majority of countries in 2020 Q3 (Deloitte, 2022).

In 2019, the five largest banking organizations controlled 33% of all assets in CEE, indicating that the CEE banking market remained relatively concentrated. Prior years saw a significant improvement in asset quality, which persisted into 2019. The economic expansion and the banks' ongoing portfolio cleaning efforts, which were also supported by the regulatory bodies, were two of the primary factors contributing to the declining NPL volumes. The average total NPL ratio was 7.2% in 2019, 0.75% lower than in 2018. The NPL ratio in Croatia was 8.9%, followed by Albania at 8.1%. Kosovo (2.0%) reported the lowest total NPL ratio in the region (Deloitte, 2022).

The study on NPL is very important. As mentioned by Huljak et al. (2020), the high level of NPLs on banks' balance sheets can adversely affect the soundness of the banking system and its ability to lend to the real economy through three main channels. First, high NPLs reduce bank profits. They do so because they require higher provisions. Second, NPLs feature higher risk weights, leading to higher capital needs. Finally, the management of large NPL stocks can divert important managerial resources away from the core and more profitable activities.

In most of the CEE countries, banks apply the traditional business model of taking deposits and lending, which means that credit risk is a key to financial

stability. NPLs are one of the most important measures of a bank's credit risk. During periods of financial stability, it is widely acknowledged that financial markets, in general, and banking institutions, in particular, extend more credit. Furthermore, more financially reliant businesses are more likely to have lending connections with banks, expanding their access to external capital and, as a result, boosting economic growth. The growth of NPLs in many CEE countries puts pressure on banks' balance sheets, with potential negative effects on bank lending (Klein, 2013). The reasons for the increase in NPLs are many. In many cases, the combination of a weak macroeconomic environment, inefficient debt recovery frameworks, and bank-specific factors affects the level of NPLs.

Since the GFC, financial stability has been at the center of economic analysis and policymaking. Relevant national and international authorities have advanced the risk monitoring systems for monitoring as well as developed other regulatory measures to improve the financial sector's resilience. Following the GFC, the growth rate of NPLs in CEE countries was much higher compared to the EU as a whole or compared to high-income countries (Škarica, 2014). Therefore, the context of this investigation is of particular importance.

The main purpose of this study is to analyze the determinants of NPLs using data for macroeconomic, structural, and bank-specific variables for the period 2006 – 2017 for 17 CEE countries that include: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Estonia, Kosovo, Latvia, Lithuania, Montenegro, Poland, Republic of North Macedonia, Romania, Serbia, Slovakia, and Slovenia. Our study contributes to the enrichment of the existing literature by investigating the factors that determine NPLs for a larger number of CEE countries. Although the literature on NPLs is quite extensive, this is the first empirical study employing aggregate, country-level data on NPLs, covering a relatively long time period. Another novelty in this paper is that, in addition to the common variables used in the literature, various indicators that proxy for the legal environment are included. Particular attention was paid to the impact of the GFC on NPLs.

The rest of the paper is organized as follows. The next section provides a summary of the relevant literature that discusses the determinants of NPLs. Section two describes the data and methodology, followed by a discussion of the results. Conclusions and recommendations are presented in the final section.

1. Literature Review

The literature on the determinants of NPLs is quite extensive. Therefore, we focus on the research conducted mainly in the context of CEE countries. For example, Festiæ and Beko (2008) studied the NPLs in five CEE countries for the

period 1995 – 2007. They concluded that GDP growth, foreign direct investment growth, real interest rates, and credit growth are significant macroeconomic determinants of NPLs. According to their research, the dynamics of NPLs have been proven to be pro-cyclical to concerning GDP growth, while rising inflation makes borrowing more expensive and causes a significant drop in loan portfolio quality. The authors argue that increased levels of loans to the private sector had a positive impact on the NPL ratio in all the CEE countries, caused by inadequate credit risk management, suggesting a need to strengthen bank supervision by the regulator.

Nkusu (2011) studied the determinants of NPLs and examined their interactions with macroeconomic variables for 26 developed countries between 1998 and 2009. As pointed out by the author, competitive pressure and optimism about the macroeconomic prospects lead to a relaxing of lending criteria and rapid credit expansion, thus leading to an increase in NPLs. On the other hand, when the macroeconomic prospects are negative, the higher-than-expected NPL ratios, combined with a decrease in the value of collateral, cause lenders to be more cautious, resulting in a tightening of credit, which has a negative effect on domestic demand. According to Klein (2013), high levels of NPLs in the CEE area are a legacy of the GFC, and because the economic recovery was relatively weak, NPLs will continue to be a problem. The upward trend of NPL reflects the contraction of economic growth and rising unemployment throughout the region, which, together with the devaluation of some currencies and the tightening of financial conditions, weakened the repayment capacity of borrowers. The author found that rates of unemployment, inflation, currency depreciation, loan-to-assets ratio, and lagged lending growth had a positive impact on NPLs, while equity-to-assets ratio, GDP growth, the change in credit to GDP ratio, and return on equity had a negative impact.

An empirical analysis conducted by Bykova and Pindyuk (2019) regarding NPLs in CEE countries for a period of time from 2007 – 2019, it shows that GDP growth, inflation, and loan growth have a statistically significant impact on NPLs. The special feature of this paper is the research on the effects of macroeconomic downturns on different types of loans (corporate and household credit). According to the authors, after the financial crisis, the asset quality of corporate loans deteriorated more strongly than that of household loans on average for countries examined, such as Bosnia and Herzegovina, Croatia, Montenegro, Serbia, and Slovenia. As the author mentions, in the Western Balkans, migration is high and remittance inflows are large, so the amounts involved are smaller, and can often be serviced in times of difficulty by friends or relatives. When compared to household loans, loans to non-financial firms appear to be more sensitive to economic cycles: they

react more strongly to changes in GDP growth, monetary tightening/easing, and unemployment changes.

In all the above studies, the main focus has been the study of the relationship between NPLs and macroeconomic variables. Regarding the variable of GDP, the general explanation is that the growth in real GDP, usually implying better economic activity, improves the possibility of debt repayment for the borrowers and lowers NPLs. Almost all authors studying the determinants of NPLs use GDP growth as a macroeconomic variable (Klein, 2013; Škarica, 2014; Anastasiou et al., 2019). For CEE countries, GDP growth had a significantly negative relationship with the NPL, as reported by other authors (Jakubík and Reininger, 2013; Klein, 2013; Škarica, 2014; Çifter, 2015; and Semia, 2019). Based on these studies, it can be expected that real GDP growth will be negatively associated with NPLs.

According to various authors, the relationship between inflation and NPLs is ambiguous (Klein, 2013; Škarica, 2014). A high inflation rate can make debt servicing easier, but it can also reduce borrowers' real income when wages are sticky. Higher inflation can lead to higher lending rates as a result of monetary policy initiatives to control inflation (Nkusu, 2011). There are many studies that show both the negative and positive impacts of inflation on NPLs. Klein (2013) and Škarica (2014), for example, find a positive relationship between these two variables in CEE countries. Meanwhile, Szarowska (2018) indicates in her study for CEE countries that inflation has a negative impact on NPLs.

Rising unemployment rates increase the household debt burden and reduce output as a result of declining effective demand. An increase in unemployment makes borrowers unable to meet their debt obligations. Therefore, the relationship between the unemployment rate and NPLs is positive and significant; an increase in the unemployment rate would reflect an increase in NPLs (Szarowska, 2018). Klein (2013), Makri et al. (2014), Škarica (2014), Çifter (2015), and Tatarici et al. (2020) find a significant and positive relationship between unemployment and NPL in CEE countries. Therefore, we expect a positive relationship between the unemployment variable and NPLs. The following table provides a summary of other studies that deal with the impact of macroeconomic variables on NPLs.

Studies also analyze bank-specific determinants of NPLs. The loan-to-deposit ratio represents the usage of deposits by the banks to finance lending (Çifter, 2015). The loan-to-deposit ratio is an important indicator, as it represents the bank's liquidity by measuring the funds that a bank has used in loans from accumulated deposits (Dimitrios et al., 2016). This variable was found to be positive and significant by Dimitrios et al. (2016) and Tatarici et al. (2020) for CEE countries, whereas it was negative and significant by Çifter (2015).

T a b l e 1

A Literature Review on the Effect of Macroeconomic Variables on Non-performing Loans

Author (s)	Countries	Period	Variables	Methods/data	Results
Szarowska (2018)	11 CEE countries	1999 – 2015	Unemployment, economic growth, inflation, the nominal effective exchange rate, general government debt, and, as a dummy variable, the GFC.	A panel dataset using ordinary least squares and including fixed effects.	The results show that unemployment is one of the most important determinants. The impact of the crisis on NPLs is significant and statistically significant.
Tanasković & Jandrić (2015)	11 CEE countries	2006 – 2013	GDP, the ratio of foreign currency loans to total loans, the exchange rate level, the average lending rate for new loans, and annual inflation, the financial market level of development.	Panel data/ Fixed-Effects/ OLS.	The results show that NPLs have a negative relationship with economic growth and financial development, but a positive and statistically significant relationship with foreign currency loans and the level of the exchange rate. This reinforces the prediction that countries with a high level of euroisation will face more problems with NPLs, which will be exacerbated during periods of domestic currency depreciation.
Beck et al. (2013)	75 countries	2000 – 2010	GDP growth, share price, the exchange rate, and lending interest rate.	Panel data/ Fixed-Effects/ OLS.	They showed that changes in the NPL ratio are affected by real GDP growth, share prices, the exchange rate, and lending interest rates. The authors conclude that the greatest significant risk to bank asset quality is a reduction in global economic activity. Also, exchange rate depreciation, in particular, could contribute to a rise in NPLs in countries where unhedged borrowers are lent in foreign currencies.
Jakubík & Reininger (2013)	9 CEE countries	Quarterly data 1993 – 2012	Real GDP, private sector credit-to-GDP ratio, national stock index, exchange rate.	The generalized method of moments (GMM)/ Panel data techniques.	According to the authors, when credit growth is high in comparison to GDP growth, the NPL ratio is initially lower, but eventually rises after the period of high credit growth has ended.
Škarica (2014)	7 CEE countries	2007 – 2012	The real GDP growth, unemployment rate, nominal effective exchange rate (NEER), harmonized index of consumer prices (HICP), share price index, and the 3-month money market interest rate.	Panel data techniques. The estimation technique used is a fixed effect model OLS.	The results show that economic growth had a negative impact on the NPL, whereas unemployment and inflation had a positive impact.
Beck et al. (2006)	69 countries	1980 – 1997	Real Gross Domestic Product, Nominal Effective Exchange Rate (NEER), Lending Interest Rate, Share Prices, International Claims (ICL), Stock Market Capitalization.	Generalized method of moments (GMM)/ Panel Data/Fixed effects estimations.	The results show that concentration has a negative and significant coefficient. Their results showed that banking systems where regulations restrict banks from engaging in non-lending activities and countries with more developed institutions that foster competition are less likely to experience systemic banking crises. Their results also suggest that concentration might be an insufficient measure of the competitiveness of the banking system.
De Bock & Demyanets (2012)	25 countries	1996 – 2010	Growth rate of real GDP, growth rate in ratio of private credit to GDP, foreign portfolio and bank flows (% GDP), net capital flows (% GDP), foreign direct investment (% GDP) growth U.S. Dollars per national currency, growth in the real exchange rate, growth in terms of trade (goods).	Panel data/simple OLS and country-specific fixed effects.	The private credit to GDP ratio shows no significant impact in the overall sample, but it is significant with a negative sign in the sub-sample for 2004 – 2010. A decline in the real GDP, a depreciating exchange rate, weaker terms of trade, and a fall in debt-creating capital inflows led to a higher aggregate NPL ratio in the banking sector.

Source: Authors.

Kraft (2007) claims that rapid credit growth has been identified as the most important determinant in banking and currency crises around the world. During economic growth, many banks are involved in fierce competition for their market share. Therefore, the easiest way to gain market share is to lend to borrowers of lower credit quality. A positive and significant relationship between credit growth and NPL was also found by Demirgüç-Kunt et al. (2005). The growth of domestic credit is associated with higher levels of NPLs; therefore, the credit growth variable in relation to NPLs should be positive (Škarica, 2014). If more credit was available in the economy, more risk-taking behavior was likely to occur, resulting in increased NPLs. However, if it leads to increased prudence, NPLs are likely to fall. Also, as indicated by some studies, this variable may have an ambiguous sign (Dimitrios et al., 2016; Anastasiou et al., 2019).

Regulatory quality is one of six governance indicators that demonstrate the government's capacity to establish and implement sound policies and regulations that encourage and facilitate private sector growth (Kaufmann et al., 2006). The variable of regulatory quality has resulted in a statistically significant with a negative sign, implying that higher levels of this governance indicator signify a lower level of NPLs (Semia, 2019). According to Anastasiou et al. (2019), this means that these countries have reinforced the rules that strengthen the ability of the financial system to reduce NPLs; for example, the rules that enforce borrowers to repay their debts.

Lee et al. (2020), in a sample of banks of European Union countries for the period 2007 – 2016, investigated the effect of a country's governance through several indicators (corruption control, government effectiveness, and regulatory quality) in mitigating the negative effects of macroeconomic cycles on NPLs. The authors individually tested each indicator of a country's governance and found them all to have a negative relationship with NPLs.

Mustafa and Toçi (2018) provide empirical evidence on the impact of competitive behaviour of banks on risk-taking by using panel data of banks for 15 Central and South-Eastern European countries during the period 1999 – 2009. They explore the impact of competition on EU and non-EU countries in the CESEE region. While the relationship between banking sector competitiveness and risk-taking remains negative for EU countries, it is positive for non-EU countries, implying that an increase in competition in these countries may be detrimental to the stability of the banking sector. As mentioned by the authors, this finding could reflect unobserved deficits in non-EU countries, such as the quality of financial institutions' licensing processes and the quality of staff available to banks, which could have altered the relationship between competition and risk-taking in these countries' banking sectors.

Çifter (2015) examines the effect of banks' concentration on NPLs in 11 CEE countries for the period between 2000 and 2009 and shows that the relationship between these two variables is unclear. The empirical analysis demonstrates that bank concentration is an insignificant determinant of NPLs for the panel data set. Individual results reveal that bank concentration reduces NPLs in some countries and increases NPLs in others. According to this evidence, bank concentration does not reduce credit risk for all of the CEE countries. On the one hand, a bank's concentration can minimize NPLs by enhancing market power and bank profits, which can act as a "buffer" against negative shocks. A more concentrated banking system, on the other hand, may result in less credit rationing.

Karadima and Louri (2020) focused on the impact of bank competition (as measured by the Lerner index) and bank concentration (as measured by the CR5 and HHI indexes) on NPLs for the period 2005 – 2017 in the 19 member countries of the euro area. They found that post-crisis consolidation facilitated the reduction of NPLs, while competition discourages the growth of new NPLs. The contradictory results of competition and concentration on NPLs, which support the argument that more concentration does not always imply less competition, suggest that competition appears to support stability when it comes to increases in NPLs but that concentration enhances faster NPL reduction.

One of the reasons for the recent rise in NPLs was the GFC. For many CEE countries, their economies plunged into recession after the financial crisis, so the value of NPLs was very high, for instance, over 20% in Albania, Montenegro, Romania, and Serbia (Aiyar et al., 2017). This variable is found to be positive and significant by Dimitrios et al. (2016) and Karadima and Louri (2020), showing a clear change in NPLs starting from 2008. Similar results on the impact of the crisis on NPLs were also found by Kjosevski and Petkovski (2017). Based on aggregate annual panel data, Szarowska (2018) studies the determinants of NPLs in 11 CEE countries for the period 1999 – 2015. The impact of the crisis (as measured by the dummy variable) on NPLs is significant and statistically significant.

However, experience has shown that lessons learned from the current financial turmoil suggest the following principles as the foundation of the regulatory architecture of the future: universal application of similar rules; increased transparency to regulators; regulatory consolidation; assurance of efficacy; burden minimization, countercyclicality; market conduct and prudential supervision; and implementation. Also, the legislators who give supervisors their mandate should make sure the goals of the surveillance are clear. Supervisors must make the rules clear and transparent. The majority of governments implemented various fiscal programs that gave the impression of being expansionary but had little effect on the economy (Ludwig, 2008).

Several countries, most notably Bosnia and Herzegovina and Serbia, have seen a significant decline in trust in their banking systems. People still have quite recent memories of periods of hyperinflation. Reforms have significantly slowed down because governments have been too preoccupied with crisis management. There has been far more uniformity in reaction when it comes to reserve requirements. In an effort to reduce liquidity and encourage banks to continue lending or at least reduce lending by a smaller amount, the majority of countries dropped the mandatory reserve requirement at some point in 2008 and 2009 (Sanfey, 2011).

As pointed out by Sanfey (2011), we learned from the crisis's primary lessons five things. First, market-oriented reforms have become deeply embedded in the region. Second, the region will need to adjust to experiencing slower growth during the coming years. Third, more attention must be placed on creating the framework for credible, long-term fiscal policy planning. Fourth, the crisis has amply illustrated the advantages of international collaboration, not just between government representatives and non-governmental organizations but also with the private sector. Fifth, the crisis has shown the inadequacies of the economics profession in making future predictions.

In the literature, we also encounter studies that explore the importance of legal reform for the functioning of financial markets. A study with other variables that were not investigated in previous studies was conducted by Djankov et al. (2007). They studied the cross-country determinants of private credit in 129 countries. They found that contract enforcement and creditor rights are positive and significant determinants of private credit in rich countries. The statistical significance of these variables, on the other hand, disappears for poorer countries. The number of days it takes to execute a simple debt contract is used by Djankov et al. (2007) to measure the enforcement of creditors' rights.

Pistor et al. (2000) use the Rule of Law Index and the EBRD law effectiveness scores related to commercial laws. Both studies fail to provide strong evidence that these indicators matter in credit market development. Toçi and Hashi (2013) used the enforcement of bankruptcy laws from EBRD's 2003 and 2004 surveys, the number of days required to enforce a contract, the rule of law index, and the Legal Indicator Survey. Unlike previous studies, the authors used a variety of law enforcement measures to provide new evidence on the role of legal institutions in transition economies for many aspects of financial development. The study provides a critical examination of current studies' law enforcement indicators, demonstrating that some proxies for law enforcement in the credit market may not be adequate. The evidence presented shows that creditor rights enforcement, rather than the quality of the law itself, has an impact on financial

development and that enforcement of collateral laws, rather than bankruptcy laws, is the main channel through which the law contributes to the financial development of transition economies. The authors criticize the RLI (Rule of Law) and CED (the number of days required to enforce a contract), because if they do not accurately measure what they represent, then they cannot be used for policy purposes.

For several OECD countries, Consolo et al. (2018) tested the relationship between the aggregate insolvency framework index (IFI) and NPLs for the period from 2003 to 2016. The results show that OCDE countries with a better IFI adjust their NPL levels faster, as well as better insolvency frameworks affect NPL reduction more quickly. The strength of the legal rights index will help to determine whether or not increased legal protection for borrowers and lenders reduces NPLs (Ahmad, 2013). The stronger the protection provided by collateral and bankruptcy laws for borrowers and lenders, the higher the credit quality in that country.

2. Estimation Methodology

2.1. Data and Model

For this study, we have used a panel data set covering 17 CEE countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Estonia, Kosovo, Latvia, Lithuania, Montenegro, Poland, Republic of North Macedonia, Romania, Serbia, Slovakia, and Slovenia, for the period 2006 – 2017. Data on the macroeconomic variables are collected from the World Bank (World Development Indicators). The dimensions of a country's governance data are gathered from World Governance Indicators (WGI); the indicators for enforcing contracts and getting credit are collected from Doing Business Data. The estimation technique used is the fixed effects model, as determined through the Hausman test, which allows controlling for omitted country-specific characteristics and unobservable differences among countries.

The basic specification (eq.1) includes macroeconomic variables (GDP growth, inflation rate, unemployment), bank-specific variables such as loans-to-deposit ratio, credit growth, bank concentration, country governance dimensions (regulatory quality), and the Global Financial Crisis (GFC) expressed through the dummy variable:

$$NPL_{i,t} = \beta_0 + \beta_1 GDPgr_{i,t} + \beta_2 INF_{i,t} + \beta_3 UNEM_{i,t} + \beta_4 LTD_{i,t} + \beta_5 CRgr_{i,t} + $$
$$+ \beta_6 REG_{i,t} + \beta_7 BANKCON_{i,t} + \beta_8 GFC_{i,t} + \varepsilon \qquad \text{(eq.1)}$$

where

$NPL_{i,t}$	– non-performing loans in total loans,
$GDPgr_{i,t}$	– GDP growth,
$INF_{i,t}$	– the inflation rate,
$UNEM_{i,t}$	– the unemployment rate,
$LTD_{i,t}$	– the loan to deposit ratio,
$CRgr_{i,t}$	– for credit growth,
$REG_{i,t}$	– an abbreviation for regulatory quality,
$BANKCON_{i,t}$	– bank concentration,
$GFC_{i,t}$	– crisis,
i	– denotes the country,
t	– denotes the time period.

In the following three specifications (2 – 4, Table 2) we test individually each of the variables obtained from Doing Business Indicators (DOI): TD-Time (days), CC-Cost (percent of claim), and SRLI – Strength of legal rights index.

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Variable Definitions

Variables	Definition	Exp. sign	Source
Dependent variable			
Non-performing loans (NPL)	Bank non-performing loans to total gross loans (%)		WBD
Independent variables			
GDP growth (GDPgr)	The annual percentage growth rate of GDP	–	WBD
Inflation rate (INF)	Inflation (annual %)	(+)/(–)	WBD
Unemployment rate (UNEM)	Total (% of the total labor force)	+	WBD
Loans to deposit ratio (LTD)	Total loans to deposits	+	WBD
Credit Growth (CRgr)	Ral growth of domestic credit	+	WBD
Crisis (GFC)	Dummy variable equal to 1 for the period 2008 – 2009, 0 otherwise	+	
Concentration (BANKCON)	Percentage of assets held by the three largest banks	+	
Regulatory quality (REG)	Regulatory quality index	+	WB, WGI
Strength of legal rights index (SLRI)	Analyzes the legal protection and rights offered to lenders and borrowers in relation to bankruptcy and collateral in order to facilitate financing.	–	WB, DB
Time (days) (TD)	The number of days to resolve a payment dispute through court	(–)/(?)	WB, DB
Cost (% of claim) (CC)	Is expressed as a percentage of the claim value	(–)/(?)	WB, DB

Source: Authors.

Time is measured in calendar days, beginning with the seller's decision to file the lawsuit in court and ending with payment. Cost, percent of claim is expressed as a percentage of the claim value, which is assumed to be 200 percent of per

capita income or 5,000 USD, whichever is greater. The strength of the legal rights index analyzes the legal protection and rights offered to lenders and borrowers in relation to bankruptcy and collateral in order to facilitate financing (World Bank, 2010). Table 2 describes the variables, expected signs, and their sources.

3. Empirical Results and Discussion

Table 3 shows the empirical results of our regressions. Model 1 presents the results for the baseline model. Models 2 to 4 display results for the other variables tested (strength of legal rights index, time, and cost (% of claim)).

We will discuss the results produced by the baseline model because the variables included in this model have not changed their signs or their significance when tested for robustness in the other three model specifications.

T a b l e 3

Determinants of NPLs for CEE Countries

Variables	Fixed Effects Estimation – Dependent Variable NPL			
	(1)	(2)	(3)	(4)
GDP growth (GDPgr)	0.000200 (0.000599)	0.000230 (0.000609)	0.000214 (0.000597)	0.000200 (0.000601)
Inflation (INF)	−0.355*** (0.102)	−0.352*** (0.103)	−0.342*** (0.102)	−0.357*** (0.107)
Unemployment rate (UNEM)	0.845*** (0.0853)	0.841*** (0.0863)	0.840*** (0.0851)	0.846*** (0.0864)
LnCredit-to-deposit (LTD)	−3.286 (3.148)	−3.327 (3.159)	−3.624 (3.147)	−3.266 (3.172)
LnCreditGrowth (CGgr)	6.460** (3.074)	6.461** (3.082)	7.068** (3.094)	6.429** (3.120)
Regulatory Quality (REG)	−5.150** (2.115)	−5.170** (2.122)	−5.375** (2.114)	−5.133** (2.137)
Concentration (BANKCONS)	−0.0730* (0.0401)	−0.0752* (0.0408)	−0.0827** (0.0406)	−0.0729* (0.0403)
Crisis (GFC)	3.896*** (0.718)	3.919*** (0.724)	3.742*** (0.724)	3.904*** (0.732)
Strength of legal rights index (SLRI)		−0.0944 (0.303)		
Time (days) (TD)			0.00571 (0.00402)	
Cost (% of claim) (CC)				−0.00850 (0.130)
Constant	−6.641 (7.721)	−5.625 (8.400)	−10.01 (8.056)	−6.431 (8.380)
Observations	188	188	188	188
R-squared	0.595	0.595	0.600	0.595

Notes: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; NPLs – Non-performing loans in total loans, GDPgr – GDP growth, INF – Inflation rate, UNEM – Unemployment rate, LTD – LN of Loans to Deposit Ratio, CRgr – Ln of Credit Growth, GFC – Crisis, BANKCONS – Bank Concentration, REG – Regulatory quality. TD – Time (days), CC-Cost (percent of claim), and SRLI – Strength of legal rights index.

Source: Author's calculations.

Our results show that GDP growth has a positive sign but unexpectedly appears statistically insignificant. Beck et al. (2013) found a positive and statistically significant impact of GDP growth on NPL. As they state, this result backs up the theory that bank asset quality deteriorates with a lag in response to positive growth due to loosening credit standards in the boom years. Such a theory is also pointed out by other authors. Excessive loan growth during boom times can also be interpreted as a proxy for banks' lowering lending standards and underwriting criteria in the pursuit of market share (Jakubík and Reininger, 2013).

The coefficient of the inflation variable is negative and statistically significant, consistent with the results of Klein (2013), Dimitrios et al. (2016), and Szarowska (2018). This negative impact of inflation on the NPLs can be explained by the fact that higher inflation rates can lower the real value of outstanding loans, making it easier for borrowers to service their debts.

Our estimations also confirm a negative and statistically significant coefficient for the unemployment rate, which means that an increase in the unemployment rate will lead to a higher NPL ratio. Increased unemployment rates imply that borrowers face greater difficulties in repaying their debt. Our findings provide support to the findings of previous studies, such as Makri et al. (2014), Škarica (2014), Szarowska (2018); Bykova and Pindyuk (2019).

The loan-to-deposit ratio is used as a proxy for liquidity. If this rate is very high, it means that banks may not have enough liquidity. Our results do not show a statistically significant impact of the loan to deposit ratio on the NPL ratio. This result is in line with the results of Makri et al. (2014) and Çifter (2015).

The coefficient of credit growth appears positive and statistically significant. In line with Klein (2013), Kjosevski and Petkovski (2017), our results suggest that faster credit growth leads to a higher NPL ratio. During periods of faster credit growth, banks may ease lending standards, thus leading to a deterioration in the quality of the loan portfolio.

The legal and institutional environments play a key role in reducing NPLs. This can be achieved by ensuring better enforcement of regulations, better control of corruption, a sound regulatory environment, and accountability (Lee et al., 2020). Boudriga et al. (2010) argue that good regulatory quality plays a significant role in reducing NPL.

All these theories have been confirmed by the negative and statistically significant coefficient of regulatory quality (RQ), which means that an increase in regulatory quality will decrease the level of NPLs. The results are in line with Boudriga et al. (2010), Semia (2019), and Lee et al. (2020). This negative effect can be explained by the fact that improving the quality of supervision has a significant impact on NPLs.

The relationship between bank concentration and NPLs appears negative and statistically significant, which means that an increase in the degree of market concentration decreases the level of NPLs. This result is in line with the findings of Boudriga et al. (2009) and Çifter (2015). According to Çifter (2015), the "competition-fragility" view observes that more concentrated banking systems have larger banks that hold more diversified portfolios than smaller banks, thus resulting in better quality loan portfolios.

We include a dummy variable that is equal to 1 for the period 2008 – 2009 and 0 otherwise. The global financial crisis, expressed by the dummy variable, has a positive sign and is statistically significant, meaning that the financial crisis resulted in an increase in the level of NPLs. Similar results were found by Çifter (2015), Szarowska (2018), Anastasiou et al. (2019a), Karadima and Louri (2020).

Unlike other studies, we also tested variables obtained from Doing Business Indicators. Even though for the countries in the CEE region, the quality of law enforcement is expected to be important for the determination of the NPL ratio, our results show that its impact is not statistically significant. Perhaps such a result can be explained by Djankov et al. (2007), which emphasize that the protection of creditors through the legal system is more important in rich countries. Also, as pointed out by Toçi and Hashi (2013), the results seem to be highly dependent on the choice of indicators that measure law enforcement, and not all of them can be a good proxy.

Table 4 reports the summary of the descriptive statistics (in the appendix). Also, Table 5 reports the Pearson correlation coefficients. The NPL is positively correlated with the unemployment rate (UNEM), time-days (TD), cost-percent of the claim (CC), and the global financial crisis (GFC). NPL is negatively correlated with GDP growth (GDP), the inflation rate (INF), the loan to deposit ratio (LTD), credit growth (CGgr), bank concentration, regulatory quality, and the strength of the legal rights index (SRLI). However, the correlations are sufficiently low to be concerned about multi-collinearity (see appendix). Our results demonstrated robustness to different econometric specifications.

Conclusions and Recommendations

This paper investigates the impact of bank-specific variables, macroeconomic variables, and other indicators on NPLs in 17 CEE countries from the period 2006 – 2017. The special feature of this study is the inclusion of a large number of CEE countries, which have not been included in previous studies, such as Kosovo, Serbia, Montenegro, Albania, etc. In this study, in addition to the impact of key macroeconomic variables, the impact of other highly specific variables

such as financial crisis, market concentration, regulatory quality, legal rights index, time (day), and cost (% of claim) was also investigated. Another novelty of this study is the critique of legal environment indices generally used in these studies. This research framework can be used in future studies, especially in the context of the impact of COVID-19 on the increase in NPLs.

Our results for all the variables are mostly consistent with the previous research on the determinants of NPLs. It is not surprising that the inflation and unemployment coefficients are statistically significant for the CEE countries, given their levels in these countries. Credit growth has also been found to be a significant variable in determining NPLs. This is very important for policy implications. Supervisors should pay much more attention to the possibility that credit risk can also increase during upturns in the economy. Regulatory quality is one of the variables with the highest impact on NPLs in the CEE countries. Specifically, reforms in the judicial systems lead to a significant, large, and persistent reduction of NPL stocks. Likewise, the empirical analysis shows that bank concentration is a significant variable in determining the level of NPLs. GDP growth, loan to deposit ratio, the strength of legal rights index, time (days), and cost (% of claim) have not been found to have a statistically significant impact on the level of NPLs.

This study is of particular importance to the banks themselves, the regulatory authorities, and other financial institutions in CEE countries. The findings imply that national supervisors need to strengthen the microprudential supervision of banks in their countries to maintain low levels of NPLs. The results of this study also show that supervisors should consider some of the most important variables, such as credit growth and regulatory quality, in order to indirectly influence the level of NPLs. Finally, other relevant institutions that deal with the compilation of various indicators should be careful in measuring them because if they do not show what they represent, they cannot be used for policy implications.

This suggests that policy measures should be taken by all stakeholders, such as banks, central banks, and relevant government institutions simultaneously to address the problem effectively, even if some of the solutions do not have the power to reduce the existing level of NPLs, but at least they may be effective in reducing the occurrence of new NPLs. In addition to the necessity of economic growth, the solution to the NPL problem requires a proactive and cooperative approach between all parties. This should be especially emphasized for countries with weak institutions and corrupt business environments where regulatory equipment does not exert an impact on NPLs. Engagement of the CEE countries in various international initiatives to promote the cross-border regulatory framework and mechanisms for resolving NPLs is also necessary.

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A p p e n d i x

T a b l e 4

Summary Statistics

Variables	N	Mean	SD	MIN	MAX
	(1)	(2)	(3)	(4)	(5)
NPL	194	8.878	6.078	0.200	24
GDPgr	208	2.830	3.999	−14.84	11.99
INF	206	2.934	3.124	−4.300	16.12
UNEM	206	13.18	7.519	2.890	37.25
LTD	203	2.013	0.141	1.390	2.410
CGgr	208	0.520	0.161	0.150	1
BANKCONS	208	60.16	14.95	34.32	98.87
REG	208	0.627	0.501	−0.580	1.700
TD	208	605.6	227.1	210	1,440
SLRI	208	1.911	0.258	1.100	2.300
CC	208	24.60	7.769	12.30	40.80
GFC	208	0.769	0.422	0	1

Source: Authors' calculations.

T a b l e 5

Cross-correlations between Variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NPL	1.000											
GDPgr	–0.314	1.000										
INF	–0.185	0.121	1.000									
UNEM	0.398	–0.084	–0.101	1.000								
LTD	–0.092	–0.194	0.323	–0.049	1.000							
CGgr	–0.092	–0.328	0.107	–0.089	0.741	1.000						
BANKCONS	–0.273	0.094	–0.107	–0.043	–0.022	0.099	1.000					
REG	–0.531	0.034	0.004	–0.667	0.280	0.276	0.345	1.000				
TD	0.020	–0.177	–0.165	–0.059	–0.046	0.044	–0.336	–0.087	1.000			
SLRI	–0.065	0.117	0.168	–0.175	–0.134	–0.211	–0.171	0.106	–0.462	1.000		
CC	0.185	0.075	–0.144	0.469	–0.457	–0.410	0.114	–0.417	–0.209	0.092	1.000	
GFC	0.419	–0.534	–0.226	0.020	0.118	0.219	–0.071	–0.002	0.107	–0.029	0.056	1.000

Source: Authors' calculations.

T a b l e 6

Robustness Tests

Variables	Model 1	Model 2	Model 3	Model 4
Robust	(1)	(2)	(3)	(4)
GDP	0.000200 (0.000301)	0.000230 (0.000307)	0.000214 (0.000304)	0.000200 (0.000302)
Inflation	–0.355*** (0.120)	–0.352** (0.123)	–0.342** (0.130)	–0.357*** (0.109)
Unemployment	0.845*** (0.130)	0.841*** (0.130)	0.840*** (0.124)	0.846*** (0.131)
LnCredit-deposit	–3.286 (3.914)	–3.327 (3.984)	–3.624 (3.796)	–3.266 (3.701)
LnCreditGrowth	6.460* (3.637)	6.461* (3.663)	7.068* (3.601)	6.429* (3.435)
Dummy_cr	3.896*** (0.835)	3.919*** (0.868)	3.742*** (0.820)	3.904*** (0.822)
Concentration	–0.0730 (0.0590)	–0.0752 (0.0609)	–0.0827 (0.0660)	–0.0729 (0.0588)
Regulatory Quality	–5.150* (2.671)	–5.170* (2.707)	–5.375* (2.994)	–5.133* (2.555)
Strength of legal rights index		–0.0944 (0.313)		
Time (days)			0.00571 (0.00573)	
Cost (% of claim)				–0.00850 (0.306)
Constant	–6.641 (9.011)	–5.625 (10.34)	–10.01 (9.076)	–6.431 (13.94)
Observations	188	188	188	188
R-squared	0.595	0.595	0.600	0.595
Number of ind_cnty	16	16	16	16

Note: Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Authors' calculations.