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What Drives Credit Risk?

Empirical Evidence from Southeast Europe

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Abstract

Bank stability is an important aspect of financial stability, especially in bank-centric systems such as those in Southeast Europe. The financial crisis has shown that there is a particular need to monitor credit and other similar risks. Hence, it is important to analyse risks affecting the stability of both the banking sector and the financial system as a whole. To that end, central banks have developed macroprudential policies aiming to safeguard financial stability. However, little is known about the drivers of some financial risks. In that context, this study analyses the determinants of credit risk, which is the most prominent risk in the banking sectors of three selected Southeast European economies – Montenegro, Kosovo* and Bosnia and Herzegovina. Dynamic panel data techniques were applied to 48 banks, which represent almost the entire banking sectors in the respective countries. The empirical evidence has shown that both macroeconomic and bank-specific determinants represent influential factors driving credit risk in Southeast Europe. Particularly important macroeconomic factors affecting credit risk are business cycle and sovereign debt. On the other hand, bank size, capital levels, credit activity and profitability are the most prominent factors influencing credit risk in the region.

Keywords: Credit Risk, Financial Stability, Southeast Europe, Banking

JEL classification: G21, E37

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1. Introduction

A high level of non-performing loans (NPLs) slows down economic activity (usually when it is most required), jeopardises liquidity in the real economy, worsens market confidence and contributes to savers and investors withdrawing deposits, slowing the speed of recovery and economic growth. Bad loans represent a burden for both banks and debtors. The consequences of high levels of NPLs are usually not seen as an immediate destabilising factor, but after a while they represent a barrier to the rapid recovery of an economy and a vulnerability of the system that may be present for a long period of time.

Also, a high level of NPLs can lead to a significant deterioration of a bank's solvency, which can ultimately lead to its failure. This can create additional contagion effects and seriously jeopardise a country's financial stability. Today there are many arguments in favour of the hypothesis that it is financial instability rather than inflation that is much more dangerous for central banks, provided it is not hyperinflation (Fabris, 2018). This was also demonstrated during the global financial crisis, when many banks did not have sufficient capital to cover bad loans, leading to massive bank failures at the time.

The almost unimaginable pace of technical and technological progress and the dramatic acceleration of change in all spheres of life have amplified the complexity of modern business (Luburić, 2019) and the likelihood of a crisis. Crises have often been the trigger for the growth of bad credit – a high level of NPLs is a common feature of banking crises. On a sample of 88 banking crises, Ari et al. (2019) found that the average level of NPLs during a banking crisis was 22%. A large number of studies have shown that a banking crisis is followed by a significant loss of GDP growth. Cerra & Saxena (2008) found that the cumulative loss over the 10-year period following a banking crisis was 7.5% of GDP. They also found that the difference in real GDP levels in countries that experienced NPL growth during the crisis was 2.6% in the first year after the crisis and continued to expand, reaching 9.1% in the sixth year following the onset of the crisis. According to Reinhart & Rogoff (2009), the peak through output decline is on average 9% after a crisis.

The process of reducing NPLs is very complex and expensive. In a study conducted before the global financial crisis, Dages (2004) estimated that there had been 117 systemic banking crises in 93 countries and 51 minor banking crises in 45 countries since the late 1970s, and that all banking crises had led to significant fiscal losses, which averaged about 19% of GDP. According to Caprio & Honohan (2001), the fiscal costs of banking crises in developing countries alone exceeded USD 1 trillion during the 1980s and 1990s.

The global financial crisis led to a large increase in NPLs in the Southeast Europe (SEE) region. Even a decade later bad loans and credit risk are still topical issues. The crisis has also led to a rapid deterioration in the quality of assets, significant losses of capital and write-offs of large numbers of bad debt. Its consequences are not only visible in the banking system but are also reflected in significant GDP losses, rising unemployment and worsening fiscal imbalances, especially in the context of the rapid growth of public debt.

Considering the devastating effects of banking crises and the growth in NPLs, this paper aims to analyse the factors affecting credit risk in the SEE region. Following the COVID 19 crisis and the energy and supply chain crisis, induced by the war in Ukraine, a large number of companies face serious business difficulties, which in turn may have an impact on credit risk growth. This obliges us to exercise extra caution in analysing credit risk in emerging macroeconomic circumstances. Our analysis is based on two groups of factors: macro-specific and bank-specific. The following three countries were selected as the subject of this analysis: Bosnia and Herzegovina, Kosovo* and Montenegro.

All three countries share some similarities: they all belong to the region of Southeast Europe, they formed part of the former Yugoslavia, they share a common history, and they are all small and highly open economies. Their banking systems are dominated by foreign banks, mainly from the EU. Due to the nature of their monetary regimes (Montenegro and Kosovo* are euroised and Bosnia and Herzegovina has the currency board arrangement in place), they have limited monetary policy options and are unable to manipulate the exchange rate. In all three countries their central banks are in the process of developing macroprudential policies, so credit risk is one of the key issues. Also, they have very similar definitions of NPLs, a problem that has been tackled in many other studies. The selection of these three countries was also influenced by the availability of data, as we used the NPL data of individual banks that were not publicly available.

Our paper contributes to the literature on the causes and the management of credit risk based on several factors. First, it covers three countries during a period not previously analysed in the literature. Second, most studies dealing with similar issues base their analysis on country-level data because bank-level data are most often treated as confidential and are therefore not generally available, and/or because their analysis is at best based on a smaller number of major banks.[1] Granular bank or loan-level data are essential for understanding the causes of NPLs and credit risk. In our study our analysis is based on individual banking data that are related to the almost complete banking systems in the three observed cases. Third, our study gives rise to some very relevant policy implications and policy recommendations, especially during the pandemic period, which brought about weaker growth in all economies in the world. Due to the lower liquidity of the real economy, credit risk may come again into focus in the region as well as in other countries.

The paper consists of five sections. The first section provides a theoretical analysis of the factors potentially affecting credit risk, which are divided into macroeconomic determinants and bank-specific determinants of credit risk. The third and fourth sections explain the data used and the methodology applied. Section five presents the results of their significance. In the final section we present our conclusions and the policy implications.

[1] The authors would like to use this opportunity to thank the monetary authorities from the three countries for providing bank-level data and information.

2. Determinants of credit risk – theory and empirical evidence

There are various factors that could inflict or attenuate the level of credit risk, the most important financial risk in the SEE region, which is characterised as being highly bank-centric. The determinants of credit risk can be divided into two groups: macro-specific and bank-specific. The examination of macroeconomic factors is important, as credit risk is often closely intertwined with business and economic cycles (Salas & Saurina, 2002). Growth of GDP, inflation, unemployment rates, wages and sovereign debt represent some of the macroeconomic factors recognised in the theory as important drivers of credit risk. Bank-level factors, on the other hand, are inherent to a bank or the banking industry itself and could be characterised by credit growth, bank size, the level of bank capitalisation, bank profitability and the level of bank competition. These factors will be elaborated separately.

2.1. MACROECONOMIC DETERMINANTS

Macroeconomic determinants are an important factor influencing the movement of credit risk levels. Poor macroeconomic performance can often signal the growth of bad loans, as it strongly affects the economic position of debtors and their debt repayment capacity (Ari et al., 2019; Bernanke et al., 1998; Žugić & Fabris, 2014). However, a high rate of credit growth and GDP may reflect credit expansion, which is a consequence of relaxed credit standards and can thus lead to an increase in NPLs.

Economic growth is the most significant macroeconomic factor driving NPLs (Carey, 1998). A country's business cycle affects the quality of banks' portfolios. A period of economic prosperity leaves individuals and companies with more income and revenue to service their debts (Ghosh, 2015; Louzis et al., 2012). Ari et al. (2019) find that countries with higher levels of GDP per capita are less likely to experience an NPL increase. However, excessive credit growth can lead to unfavourable effects. This is because excessive growth – or an economic boom – is followed by excessive credit emissions. Bankers may be under the wrong impression that a positive economic swing is long-lasting and adopt loose credit policies. Without the ability to anticipate an economic bust, which is usually preceded by excessive economic growth, banks have a false perception of economic actors' continued ability to finance further credit expansion. This vicious circle of an economic boom fuelling a credit boom continues until the boom becomes unsustainable and is followed by bust, bringing with it restrictive credit policies.

The economic downturn is coupled with higher credit risks too. In sum, economic booms are accompanied by looser credit standards and better credit portfolios, while economic busts, in contrast, are coupled with more stringent credit policies and worse credit portfolios (Ruckes, 2004). Besides the economic cycle supporting a credit cycle, the reverse is true as well. Hence looser credit policies stimulate the economy, but rigid policies can restrict economic development. Overall, the empirical evidence is very consistent with the theoretical expectations. The negative effects of economic growth on NPLs were found in the US (Ghosh, 2015), in Greece, particularly on non-performing business loans (as opposed to mortgage loans) (Louzis et al., 2012), in France and Germany (Chiabi & Ftiti, 2015) as

well as in the euro area (Anastasiou et al., 2016). However, there is no empirical evidence available for the Balkan region.

Another important macroeconomic determinant that has been receiving greater attention recently is sovereign debt. According to Reinhart & Rogoff (2011), 'banking crises most often either precede or coincide with sovereign debt crises'. There are two mechanisms through which a sovereign debt crisis can cause a banking crisis. First, the deterioration of a country's public finances affects banks' credibility (the credit rating of an individual bank does not supersede the credit rating of the country in which it operates). This squeezes the borrowing potential of banks, leaving them with more expensive sources of finance. A consequential urge to better maintain liquidity may lower banks' credit potential (Reinhart & Roggoff, 2011). Second, public debt growth can lead to negative fiscal measures that mainly affect social allowances and the wage component of government spending. These fiscal measures affect citizens' debt servicing directly (due to reduced income) as well as the servicing of corporate loans (due to reduced demand) (Ghosh, 2015; Perotti, 1996). Thus, increased fiscal risks as a result of high public debt can lead to higher credit risk. Empirical evidence confirms this relationship. Louzis et al. (2012) found sovereign debt to be an influential factor for NPLs in Greece from 2003 to 2009. By contrary, Anastasiou et al. (2016) discovered no significant effects of government debt on NPLs in the euro area between 1990 and 2015. The evidence regarding the effects from rising public debt is missing for the SEE region as a whole.

Inflation, another important determinant, has an ambiguous effect on credit risk. Inflation reduces the real value of debt, allowing for quicker debt servicing, which lowers credit risk. However, in the event of rising inflation a bank can increase its active nominal and real interest rates, making borrowing costly. In addition, high inflation may be linked to macroeconomic instability, which could lead to further NPL growth. Since wages do not adjust so quickly to rising inflation (a phenomena known as 'sticky wages'), debt servicing can become more challenging owing to the reduced value of income on the one hand (Louzis et al., 2012; Nkusu, 2011; Skarica, 2014) and the higher cost of borrowing on the other. Furthermore, low inflation is also associated with high unemployment, as suggested by the Phillips curve, indicating an (indirect) positive relation with credit risk. As expected, the evidence is diverse. Anastasiou et al. (2016) found no significant effects of inflation on NPLs in the euro area between 1990 and 2015, while Ghosh (2015) discovered negative effects of inflation on NPLs in the US between 1984 and 2013. Again, the SEE region has not been subject to empirical tests.

A surge in unemployment rates reduces the consumption of goods and services directly, jeopardising the profitability of companies and, inevitably, their creditworthiness (Chiabi & Ftiti, 2015). Therefore, a rise in unemployment rates should exert a positive effect on credit risk. Empirical evidence confirms a positive relationship between unemployment and credit risk in the US (Ghosh, 2015) as well as in Greece during 2003-2009 (Louzis et al., 2012), France and Germany (Chiabi & Ftiti, 2015) and in the entire euro area (Anastasiou et al., 2016). Likewise, low-income borrowers carry a higher default risk. Income has not been found to be an important factor in explaining credit risk in the euro area (Anastasiou et al., 2016), but this variable lowered NPL levels in the US significantly (Ghosh, 2015). However, no evidence exists on countries that suffer from structural unemployment levels, such as the economies of the SEE region.

2.2. BANK-SPECIFIC DETERMINANTS

In addition to macroeconomic factors, various factors inherent to banks and the banking sector as a whole can affect credit risk, including banks' credit activity, the level of bank capitalisation, bank size, profitability and market competition prevailing in the banking industry.

Banks adopting expansionary credit policies tend to have lower interest rates and lower credit standards. In a period of credit boom companies are encouraged to borrow more and invest in higher-risk projects. Thus, according to some authors, credit expansion may lead to higher credit risk. Salas & Saurina (2002) found no evidence of a significant relationship between the growth of loans and the quality of loans among Spanish commercial banks during 1985-1997. Conversely, Vithessonthi (2016) found that credit growth led to higher NPL rates prior to the financial crisis in Japan, taking a negative turn after the outbreak of the crisis there. However, these studies refer to the period before the global financial crisis. After that crisis many banks in the region under review imposed stricter credit policies and monitored their clients' creditworthiness more closely, which calls for further research.

Bank size is also an influential factor. Big banks can be less risk averse, which is in line with the 'too big to fail' hypothesis (Louzis et al., 2012). Bigger banks can count on their government for financial protection in case of insufficient capital to combat credit risk. This is because big banks with significant market shares are important actors in any national financial system (Stern & Feldman, 2004). Hence, we expect that bigger banks could be exposed to greater credit risks. Chiabi & Ftiti (2015) found support for this hypothesis in France and Germany during the 2005-2011 period. Louzis et al. (2012) also found higher NPL levels among the bigger banks between 2003 and 2009, holding at least 30% of the market share in the Greek banking sector.

The moral hazard hypothesis argues that banks with relatively low levels of capital become more prone to moral hazard by increasing the riskiness of their loan portfolio (Berger & Young, 1997; Ghosh, 2015; Keeton & Morris, 1987; Louzis et al., 2012; Salas & Saurina, 2002). On the other hand, well capitalised banks could follow looser credit policies, counting on higher capital levels to compensate for their credit losses. Thus, in addition to large banks, the notion 'too big to fail' also applies to well capitalised banks. Overall, both negative and positive relations can be observed between the level of banks' capital and NPLs. Ghosh (2015) found that better capitalised banks across the US had increased levels of credit risk, lending support to the 'too big to fail' hypothesis. However, Makri, Tsagkanos and Bellas (2014) found that among the better capitalised banks in the euro area the level of NPLs was lower during the pre-crisis period, calling for further research on this aspect of credit risk.

Unlike the determinants listed above, which are bank-specific, competition in the banking industry is an external factor for a bank. A bank assesses its competitors (other banks), in addition to its potential clients, when deciding on extending its loan portfolio. If the assessment is negative, the bank is less likely to issue a loan to a debtor with low creditworthiness. However, a favourable assessment by competing banks increases the client's chances of a favourable assessment, and consequently riskier lending (Ruckes, 2004). Many authors agree that banks are more prone to risky behaviour against the backdrop of increased competition, also with respect to lending (Keeley, 1990; Salas & Saurina, 2003; Repullo, 2004). Fungacova & Weill (2013) studied the effects of bank competition on the failure of banks in Russia. They found that increased competition led to bank failure, supporting the 'traditional' view of the negative effects of competition on a bank's risks. However, Martinez-Miera & Repullo (2010)

identified two opposing effects influencing credit risk in the context of increased competition. Greater competition may result in lower interest rates, which reduces the probability of loan default, and hence the risk of bank failure (Boyd & De Nicolo, 2005). According to the first hypothesis, it can be implied that increased competition lowers credit risk – a situation known as the risk-shifting effect. However, competition could imply reduced interest payments or lower profits from loans. This can indirectly reduce banks' buffer against non-performing loans, proposing that greater competition may cause bank failure – a situation known as the margin effect. The two opposing effects form an inverted-U relationship between credit risk and competition. Gomez & Ponce (2014) confirmed this relationship and found that there is a level of competition above which banks' loan quality starts to deteriorate. Overall, the effects of bank competition on credit risk are ambiguous and require further research.

A number of studies have confirmed the link between NPL growth and a negative impact from bank profitability due to increased provisioning, write-offs of doubtful receivables or their sale at discounted prices (Cetin, 2019; Espinoza & Prassad, 2010; Jolevski, 2017; Michael, 2018; Mwinlaaru et al., 2016). However, a much smaller number of studies have addressed the inverse relationship (impact of profitability on the NPL level) that is the subject of this research. At issue is the so-called 'bad management' hypothesis, indicating that better managed banks have a better asset quality. An IMF study (2019) found that high profitability may help banks to absorb capital losses associated with NPL recognition, thus facilitating NPL resolution. Carletti (2008) found that high profitability influences lower levels of NPLs because high profitability reduces risk-taking incentives. A study by Klein (2013) of the Central, East and Southeast Europe group for the period 1998-2011 confirmed the hypothesis that high profitability impacts a lower level of NPL, that is, he found that banks with high profitability are better managed and thus have a better quality of assets.

3. Data

The empirical analysis includes 48 banks, corresponding to almost the entire number of banks (in Q4 2018) in Montenegro, Kosovo* and Bosnia and Herzegovina[2] over the post-financial crisis period (2008-2018). The majority of the sampled banks are based in Bosnia and Hercegovina (53%), while 29% and 17.7% of banks operate in Montenegro and Kosovo*, respectively.

We employ the ex-post measure of credit risk – non-performing loans – as the dependent variable. A non-performing loan is a loan that is close to default, while repayment (of the principal and interest) is late by 90 days or more. Independent variables include a set of macroeconomic and bank-specific variables as previously described. Macroeconomic explanatory variables include the level of GDP, inflation, the unemployment level, gross wages and the sovereign debt level (which should measure the impact of sovereign debt on credit risk). In addition, we include dummy variables controlling for country-specific effects influencing credit risk as well as year dummies to control for macroeconomic shocks.

Bank factors potentially influencing NPL levels are the size of a bank, bank capitalisation, lending activity and bank profitability. The list of variables used in the model is presented in Table 1 below.

Table 1 / Definition of macro and bank-specific determinants

Dependent variables	Definition
Credit risk	Non-performing loans
Macro variables	
Economic growth	Gross domestic product in current prices
Unemployment levels	Unemployment levels
Inflation	Annual consumer price index
Wage	Net earnings
Sovereign debt	Levels of sovereign debt
Bank-specific variables	
Credit activity	Loans
Bank size	Share of bank's assets into total assets within a banking sector
Capitalisation levels	Solvency ratio
Profitability	Return on assets – ROA
Market competition	Herfindahl-Hirschman index (HHI) – the sum of the squared market share (as measured by assets) of each bank in the banking sector of an economy

The summary of the variables (Table 1) across the studied period for the three countries is presented in Table 2.

[2] To be exact, the sample corresponds to 98.9%, 92% and 100%, respectively, of the total assets in the banking sector of Kosovo*, Montenegro, and Bosnia and Hercegovina.

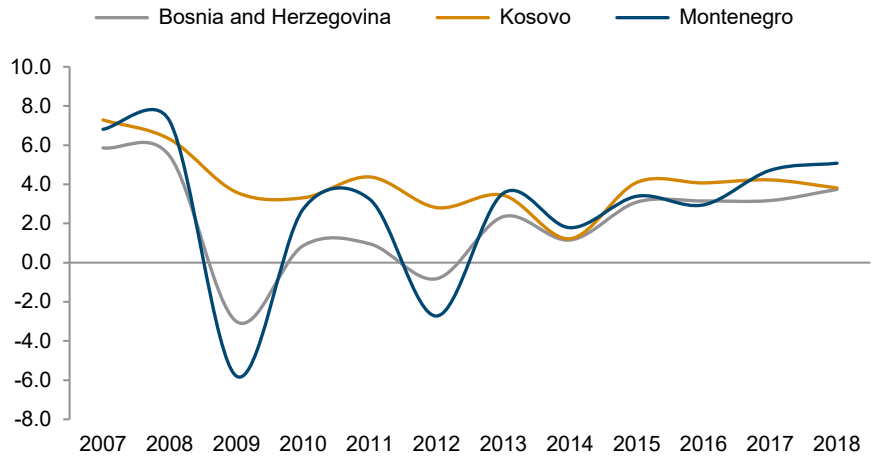
Table 2 / Summary statistics of macro and bank variables, averaged across three countries

	mean	stdev	min	max
NPL	10.9%	12.2	0.2%	98.0%
Unemployment	33.1%	12.1	10.7%	45.4%
Net earnings	421.8	64.9	199.3	515.0
CPI index	101.5	2.1	98.8	107.7
Sovereign debt	105302751.5	258586433.8	4784.7	1093052414.8
GDP	1984572675.4	1450836255.3	412128.3	3448723501.6
HHI	1278.3	480.1	844.6	2601.2
Bank size	6.7	7.3	0.1	45.9
Loans	37240594.8	109906305.8	1433.0	615102820.7
ROA	-0.1	2.1	-23.2	5.2
Solvency ratio	28,7	6.4	2.11	949.5

*Source: authors' own calculations. All the variables are used in logarithmic form for the model calibration. HHI – Herfindahl-Hirshman index. Net earnings are deflated and converted into euros for Bosnia and Herzegovina.

The macroeconomic situation is relatively similar in the three countries surveyed, with the most significant deviation being observed in the unemployment rate. GDPs showed similar trends in all three countries, and since 2013 they have been recording very similar GDP growth rates. All three countries experienced negative macroeconomic shocks in 2009 as a result of the global financial crisis (Figure 1).

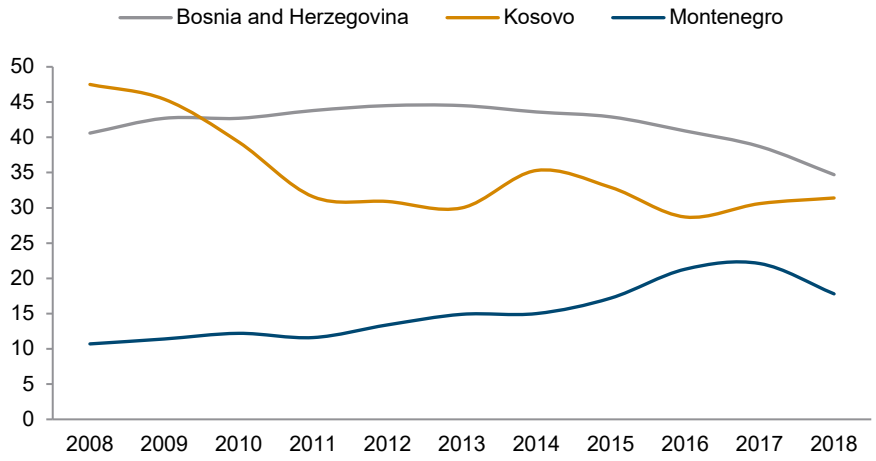
Figure 1 / GDP growth rates: Bosnia and Herzegovina, Kosovo* and Montenegro (in %)



Source: World Bank.

The key macroeconomic difference relates to the movement of the unemployment rate. The unemployment levels were quite high in Kosovo* and in Bosnia and Hercegovina over the studied period. On average, in the post-crisis period unemployment levels were 42.5% and 33.6% for Bosnia and Herzegovina and Kosovo*, respectively, and about 15.7% for Montenegro.

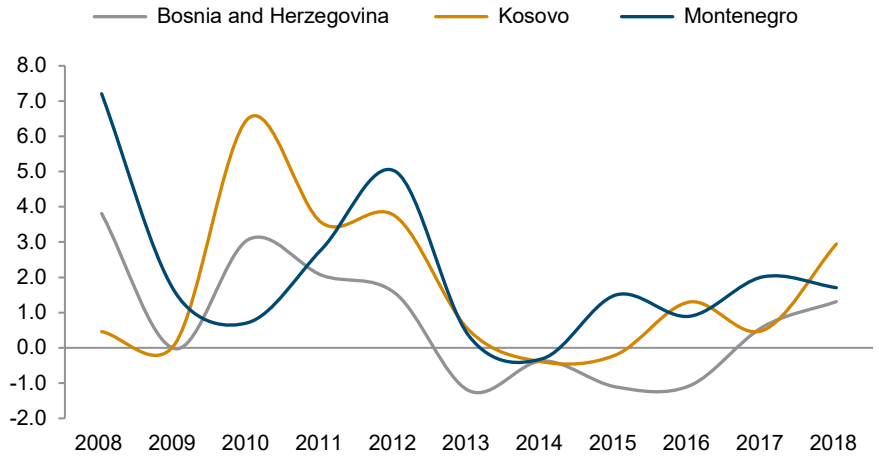
Figure 2 / Unemployment rate in Bosnia and Herzegovina, Kosovo* and Montenegro (in %)



Source: Statistical offices of the three countries.

There were some differences in inflation in the first half of the observed period (the period of demand overheating and the global financial crisis), while in the second half of the observed period inflation moved within a similar range (Figure 3).

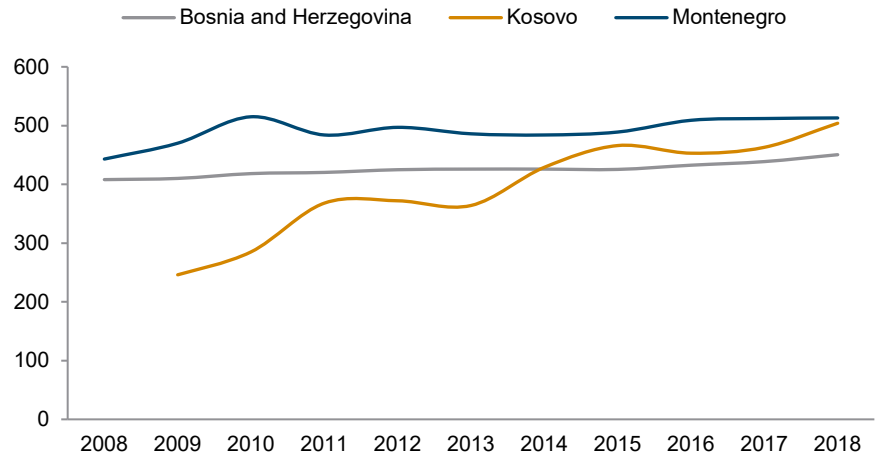
Figure 3 / Inflation in Bosnia and Herzegovina, Kosovo* and Montenegro (in %)



Source: World Bank.

The level of net earnings was roughly similar across the three countries, ranging from EUR 395 (Kosovo*) to EUR 436 (Montenegro). Although Montenegro and Kosovo* recorded the steepest rise in net earnings over the studied period, the earnings were pretty steady in Bosnia and Herzegovina.

Figure 4 / Net earnings in Bosnia and Herzegovina, Kosovo* and Montenegro (in EUR)



Source: Statistical offices of the three countries. Earnings for Bosnia and Hercegovina have been converted into euros.

There is a higher variability of bank-level NPLs in Montenegro and Bosnia and Hercegovina than in Kosovo*. The competition is measured with the Herfindahl-Hirschman index (HHI), which is the sum of the squared market shares of each bank within a country. This is a widely accepted measure of market competition (concentration) and was also employed by Fungacova and Weill (2013). The HHI shows increasing competition in all three countries in the post-crisis period. Bosnia and Hercegovina is characterised by a competitive market, with HHI fluctuating at around 1,000 over the period under review. It is important to note that during this period the changing levels of competition in Bosnia and Hercegovina were affected by bank insolvencies (in 2010, 2012, 2013, 2014, 2016) as well as by two bank mergers (in 2016). As for Montenegro, although the competition levels have tended to decrease from 2017 onwards, the overall competition level was on an upward trend during the post-crisis period, and from 2010 onwards it has been highly competitive. Kosovo* has more concentrated market competition in the banking industry, ranging from highly concentrated to moderately concentrated over the period under review.

The average bank solvency ratio was 28.7 over this period and was ranging from 22.4 (Bosnia and Hercegovina) to 44.3 (Kosovo*). Banks are on average larger in Kosovo* (11.1% of asset share) as opposed to Montenegro and Bosnia and Hercegovina (6.7% and 3.7% of asset share).

4. Methodology

We apply the Generalised Method of Moments (GMM) system by Arellano & Bover (1995) and Blundell & Bond (1998) to the following equation (1):

$$npl_{it} = \alpha_{it} + \delta npl_{it-1} + \beta * macro_{it} + \gamma * bank_{it} + Year_t + country + \mu_i + \varepsilon_{it} \quad (1)$$

npl_{it} is the dependent variable representing the share of NPLs in total loans of bank *i*, in year *t*. Its lagged term is included as explanatory variable npl_{it-1}, to account for the dynamics in credit risk, while δ is its corresponding estimator; *macro* denotes the vector of macroeconomic variables included (see Table 1) while β is the vector of corresponding estimators; *bank* denotes the vector of bank-specific variables (see Table 1) and its corresponding estimators are within vector γ; $Year_t$ represent year dummies while $country$ is the vector of country controls (Montenegro being the base category); α is the intercept term while μ are the bank-specific fixed effects that do not vary over time (for example, country institutional framework). The remaining error term ε_{it} is independent and identically distributed ($\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2)$). All the variables are in logarithmic form (except HHI and ROA). GDP is temporarily lagged to account for the fact that the business cycle may take time to spill over into the banking sector. This way a possible reverse causality between business cycle and credit cycle is attenuated too.

GMM consists of two equations, one in differenced form and another in level form, and is recommendable for the data that are highly persistent. GMM is a dynamic panel econometric technique that accounts for the dynamics of credit risk as well as the endogeneity concerns caused by the inclusion of lagged dependent variable npl_{it-1}. This is because the bank-specific invariant component μ_i is part of each period's error term and is thus part of npl_{it-1}. System GMM instruments the endogenous variable npl_{it-1} using the instruments within the system itself (lagged differenced and levels of NPL for the level and differenced equation, respectively). The instrument number is controlled for and the instrument's validity is properly tested with Sargan-Hansen test as well as first- and second-order autocorrelation tests. GMM also allows the inclusion of time invariant variables, such as country dummies. The results of the model are presented in the next section.

5. Results

The results from estimating equation (1) with GMM are presented in Table 3. The diagnostics tests confirm the model validity through the presence of the first-order autocorrelation and the absence of the second-order autocorrelation. The Sargan-Hansen test of over-identifying restriction confirms the instruments' validity. The difference in the Sargan-Hansen test confirms that the steady-state assumption-lagged NPL is uncorrelated with current unexplained changes in the NPL.

Table 3 / Credit risk determinants in selected SEE economies, system GMM

NPL (%)	Coefficient estimates	Robust se	P>|t|	95% confidence interval	
NPL_{t-1}	0.787***	0.098	0.000	0.595	0.979
Country controls					
Bosnia and Hercegovina	22.920**	9.751	0.019	3.808	42.032
Kosovo*	11.621*	6.147	0.059	-.427	23.669
Macro- level determinants					
GDP_{t-1}	-2.026**	0.953	0.033	-3.894	-0.158
Government debt	0.881**	0.431	0.041	0.036	1.727
Inflation	1.553	3.263	0.634	-4.843	7.949
Wage	-0.432	0.759	0.569	-1.920	1.056
Unemployment level	0.113	0.303	0.710	-0.482	0.707
Bank-level determinants					
Bank size	0.259***	0.091	0.004	0.081	0.437
Level of capitalization	-0.385***	0.064	0.000	-0.511	-0.259
Credit activity	-.290***	0.093	0.002	-0.473	-0.108
Profitability	-0.092***	0.015	0.000	-0.123	-0.062
Level of bank concentration	1.359	1.158	0.240	-0.910	3.629
Constant	-6.091	3811.2	0.999	-7475.9	7463.8
N (observations)	447		Diagnostics test (p-values)		
Number of groups (banks)	48		Arrellano-Bond AR (1)		0.000
Period studied	2009-2018		Arrellano-Bond AR (2)		0.258
			Sargan-Hansen test		0.298
			Difference-in-Sargan		0.459

Note: Year controls are excluded from the estimation.

The results reveal that bank-specific factors seem to be playing a greater role in the determination of NPL levels than macroeconomic factors. In fact, only GDP and government debt levels have a significant effect. Credit risk is highly contingent on its previous levels. There is a positive effect of the past NPL levels on the current levels of NPL, as the current level of credit risk is contingent on its past levels.

Judging by the size of the coefficient, GDP is the most important (macroeconomic) factor driving credit risk. If GDP increases by 1%, NPLs decrease by about 2%, suggesting that a country's creditworthiness is largely affected by its business cycle. This is in line with the previously explained theoretical expectations as well as empirical evidence from different European countries (Louzis et al., 2012; Chiabi & Ftiti, 2015; Anastasious et al., 2016). It is obvious that with growing GDP the financial position of both

the real economy and the household sector is improving, which results in a more regular settlement of their liabilities. This, in turn, results in a decrease in the level of credit risk.

Government debt has a positive effect as well, and a 1% increase in government debt increases NPL levels by almost 1%. This is an expected result, and it confirms the theory suggesting that a sovereign debt crisis can spill over into the banking sectors of the three selected countries. In the observed cases, in the absence of a sufficient number of profitable projects, banks turned to country financing, which is considered less risky and entails allocating a smaller amount of regulatory reserves. This is a less examined aspect of credit risk that is important for policymakers, particularly in Montenegro, where banks' exposure to the government has intensified, but at the same time public debt growth is recognised as the main source of systemic risk (Central Bank of Montenegro, 2020).

The results reveal that inflation in Southeast Europe is not a significant driver of credit risk. They may also indicate that the two opposing effects (positive and negative effects of inflation) could be at work, leading to overall insignificant effects. More probably, the results could reflect that all three countries are economies with stable inflation, considering that Montenegro and Kosovo* are euroised, while Bosnia and Hercegovina has adopted the currency board regime. Just as in the euro area (Anastasiou et al., 2016), price levels do not affect credit risk in the economics of the three countries. Also, one should not disregard the fact that in the period under observation inflation was low on the global level, including countries with both high and low levels of NPL.

Similarly, unemployment levels appear not to have affected credit risk in the three countries, which is not in line with the theoretical expectations. The reason could be that high unemployment in Kosovo* and Bosnia and Hercegovina was structural in nature and constant over the observed period, while it remained stable in Montenegro save for some oscillations that were not economic in nature.[3]

Wages did not have a significant effect on credit risk in the three economies, even though they were on an upward trend. This can be explained by the fact that they are relatively low in the observed region and their nominal growth rate was small, so they could not significantly influence the mitigation of credit risk.

The model results imply a negative impact of credit activity on the level of NPLs in the three economies, suggesting that credit expansion may on average reduce credit risk in these economies. The explanation for this result probably lies in the fact that since the global financial crisis banks have tightened their credit standards and/or improved their credit risk management significantly. This is a lesson learned after the outbreak of the crisis, because the high rates of NPL growth were the result of overly relaxed credit standards in the pre-crisis period, so most of the NPLs today have their origins in loans approved before the crisis. Also, credit expansion rates have been significantly lower in the post-crisis period.

The level of bank profitability in the region decreases the local NPL levels. It is apparent that a higher level of profitability indicates that banks are better managed and thus have a better asset quality. Also, banks with a high level of profitability are less prone to finance riskier projects and thus record lower NPL levels.

[3] In Montenegro, after the adoption of the so-called Mothers' Law in 2015, which provided for a lifetime allowance for mothers with three or more children, a large number of mothers left the labour market and stopped working. This led to an upsurge in unemployment, which, following the repeal of the law in 2017, has gradually started to return to its previous level.

Moreover, the level of capitalisation decreases the level of NPLs. This is the expected result that confirms the moral hazard hypothesis in the region as well.

Larger banks tend to have higher NPL levels. Hence, they have a greater appetite when it comes to bearing credit risk, possibly because they are 'too big to fail', as suggested by the theory. It is obvious that these banks apply the strategy of taking as much market share as possible through accepting clients with lower credit ratings. This link was particularly pronounced in the case of banks that had experienced rapid growth in their market share. Therefore, this is a clear indication to the supervisory authorities that rapid bank growth leads to a lower quality of banks' credit portfolios.

However, the level of market concentration has no significant effect on the credit levels. This is not surprising, since the literature review is not conclusive. The conclusions of studies vary, and it is evident that this factor can affect credit risk in both directions.

5.1. ROBUSTNESS CHECK

The authors tested whether the inclusion of potentially endogenous variables influenced the results. As the theory suggests, government debt could trigger new fiscal measures that would reduce public spending, such as wages in the public sector. Hence, equation (1) was augmented first by excluding the wage variable and then by excluding the variable referring to government debt. The results remain robust (Table A1, Appendix)

Considering that the GMM method is designed for larger dataset with a shorter time span (large N/banks and small T/year), static econometric techniques were also employed. We used two sets of fixed effect and random effect models – one that includes lagged NPLs (in line with the GMM model) and another one that does not. This is because static panel techniques face endogeneity issues caused by the inclusion of the lagged dependent variable. Even though the Hausman test shows preferences towards the fixed effect model (Table A3, Appendix), the random effect model is also applied. Applying fixed effect and random effect panel data methods showed that the results are robust in sign, although few variables lose their significance levels marginally (Table A2, Appendix).

6. Conclusion and policy implications

The financial crisis outbreak brought about the materialisation of credit risk in Southeast Europe's banking systems, generating a slowdown in lending activity and lower investment activity and ultimately resulting in a deceleration of GDP growth. Although on a downtrend, credit risk levels expressed as the level of NPLs remained prominent.

Therefore, for the purposes of the study, we conducted an econometric testing of the impact of different variables on the level of credit risk, which has been recognised as the most prominent risk in Southeast Europe. The three countries we tested were Bosnia and Herzegovina, Kosovo* and Montenegro, which share numerous characteristics.

All the variables included in our tests were divided into two groups. The first group included macro-specific variables, while the second group considered variables specific to the banking system. The impact of GDP, public debt, employment, wages and inflation were tested within the macroeconomic variables. Testing of bank-specific determinants included the influence of bank size, bank capitalisation level, lending activity, profitability and the bank's competitiveness.

With regard to macro-specific variables, two out of five variables proved to be statistically important for trends in NPLs. Economic growth turned out to be a significant factor, suggesting that the ability to pay off debt is largely affected by the business cycle. In addition to economic growth, sovereign debt is also important, as it affects a country's credit rating as well as the likelihood of a public debt crisis spilling over to the financial sector. It is indisputable that the COVID-19 pandemic and the sanctions against Russia have altogether negatively affected these economies (wiiw, 2022), and there is a real possibility that credit cycle will be affected too. Smaller economies, such as those analysed in this study, have a smaller set of monetary policy instruments at their disposal. They will therefore need to rely more on fiscal policies and public spending to remedy the economic impact of these crisis. Therefore, it can be expected that public finances will be the focus of these countries in the coming period, which suggests that further careful monitoring of credit risk will be required. Also, due to the deteriorating macroeconomic environment it is certain that a significant number of companies will face serious financial difficulties, which will also have an adverse effect on the level of non-performing loans.

The study clearly shows that bank-specific factors seem to play a more prominent role in the level of credit risk and that four out of the five variables have proved to be statistically important. The model results suggest a negative impact of credit activity on the level of NPLs. This is because of the lessons banks have learned from the global financial crisis, as a result of which they have significantly improved their credit risk management, credit expansion rates are now much lower now, and loans are only granted to viable clients. The level of profitability in the region decreases the levels of NPLs, clearly indicating that more profitable banks are less likely to take risks. Also, the 'moral hazard' hypothesis is confirmed, which argues that banks with relatively small levels of capital are prone to moral hazard because they tend to increase the riskiness of their credit portfolios. Larger banks tend to have higher

NPL levels because they have obviously relied on the 'too big to fail' assumption when increasing their market share.

This brings us to the conclusion that both macroeconomic and bank-specific determinants affect the level of NPLs, but with a stronger influence of bank-specific determinants.

The policy implications of this study indicate that the growth of non-performing loans has a destructive effect on the economy. Therefore, the belated implementation of the Basel III standard in the observed region is of great importance, especially in terms of the formation of capital and liquidity buffers. It is very important to strengthen supervision as a preventive factor to act against the accumulation of imbalances, primarily in the form of rapid credit growth, undercapitalisation and inadequate credit risk management. All forms of policy incentives that aim to accelerate the restructuring of the banking system and the cleaning up of banks' balance sheets are also of great importance. From the point of view of economic policy and in order to mitigate credit risk the creation of high fiscal deficits should be avoided, because they lower the credit rating of countries and thus make external sources of financing for the banking system more expensive. There is also a risk that a public debt crisis could spread to the banking system, and for countries with a high burden of public debt it will be more difficult to provide additional funding should it be needed to restructure the banking system in the event of a systemic crisis.

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Appendix

Table A1 / Robustness check, different GMM specifications

	Excluding wage Variable	Excluding debt Variable
LAGGED DEPENDENT VARIABLE		
Log(NPL_{t-1})	0.773***	0.736***
	(0.0948)	(0.0920)
COUNTRY CONTROLS		
Kosovo	10.75*	6.555
	(6.199)	(5.763)
Bosnia and Herzegovina	20.88**	5.823
	(9.769)	(6.122)
MACRO VARIABLE		
Log(unemployment)	0.218	0.149
	(0.257)	(0.301)
Log(cpi)	1.940	1.901
	(2.965)	(3.187)
Sovereign debt	0.838**	
	(0.416)	
Log (GDPt-1)	-1.726*	-0.501
	(0.962)	(0.731)
Log (wage)		0.204
		(0.728)
COMPETITION		
Log (HHI)	2.173**	1.293
	(1.028)	(1.130)
BANK VARIABLE		
Log (solvency Ratio)	-0.421***	-0.413***
	(0.0710)	(0.0703)
Log (bank size)	0.511***	0.521***
	(0.178)	(0.178)
RAO	-0.0885***	-0.0884***
	(0.0150)	(0.0148)
Log (credits)	-0.500***	-0.511***
	(0.170)	(0.170)
TIME DUMMIES		
2005	-9.573	-7.836
	(20.33)	(24.60)
2006	-9.290	-7.877
	(20.21)	(24.47)
2007	-7.889	-6.745
	(20.31)	(24.60)
2008	-7.609	-6.515
	(20.37)	(24.69)
2009	-7.274	-6.199
	(20.20)	(24.48)
2010	-7.491	-6.294
	(20.19)	(24.47)
2011	-7.429	-6.217
	(20.19)	(24.45)
2012	-7.501	-6.182
	(20.18)	(24.43)
2013	-7.295	-5.962
	(20.11)	(24.32)
2014	-7.399	-6.042
	(20.12)	(24.33)
2015	-7.559	-6.152
	(20.14)	(24.35)
2016	-7.660	-6.228
	(20.15)	(24.36)
2017	-7.668	-6.282
	(20.18)	(24.39)
2018	-7.640	-6.228
	(20.20)	(24.40)
_cons	0	0
	(.)	(.)
No. Observations	447	447

Note: Standard errors in parentheses; * p<.10, ** p<.05, *** p<.01

Table A2 / Robustness check, Random effects and fixed effect specification

	Fixed effects	Random effects	Fixed effects	Random effects
	With lagged NPL		Without lagged NPL	
LAGGED NPL				
Log(NPL_{t-1})	0.474***	0.637***		
	(0.0357)	(0.0302)		
MACRO VARIABLES				
Sovereign debt	0.585	0.671*	0.204	0.144
	(0.366)	(0.397)	(0.449)	(0.488)
Log (GDPt-1)	-1.227	-1.380	-0.0276	0.0861
	(0.804)	(0.872)	(0.988)	(1.075)
Log(unemployment)	0.0746	0.165	-0.393	0.00825
	(0.276)	(0.296)	(0.340)	(0.367)
Log (wage)	-0.399	-0.459	-0.0644	-0.0192
	(0.682)	(0.741)	(0.836)	(0.910)
Log(cpi)	-2.266	-0.896	-7.842**	-7.597**
	(2.831)	(3.053)	(3.440)	(3.739)
COUNTRY DUMMIES				
Kosovo	0	7.488	0	1.350
	(.)	(5.824)	(.)	(7.195)
Bosnia and Herzegovina	0	16.29*	0	2.450
	(.)	(8.864)	(.)	(10.93)
COMPETITION				
Log (HHI)	1.667	1.748	2.384*	2.860**
	(1.040)	(1.128)	(1.283)	(1.394)
BANK VARIABLE				
Log (solvency Ratio)	-0.270***	-0.387***	-0.245***	-0.414***
	(0.0727)	(0.0546)	(0.0875)	(0.0827)
Log (sizet-1)	0.643***	0.231***	1.175***	0.726***
	(0.108)	(0.0735)	(0.124)	(0.105)
ROA	-0.0953***	-0.0820***	-0.0920***	-0.0988***
	(0.0133)	(0.0128)	(0.0139)	(0.0146)
Log (loans)	-0.432***	-0.271***	-1.125***	-0.724***
	(0.108)	(0.0735)	(0.116)	(0.101)
TIME DUMMIES				
2006	0.256	0.0910	0.892**	0.670
	(0.327)	(0.348)	(0.400)	(0.431)
2007	1.558***	1.375***	2.446***	1.915***
	(0.476)	(0.498)	(0.580)	(0.618)
2008	1.995***	1.742***	2.937***	2.295***
	(0.512)	(0.533)	(0.621)	(0.661)
2009	2.123***	1.921***	2.982***	2.480***
	(0.500)	(0.526)	(0.611)	(0.653)
2010	2.205***	1.853***	3.601***	3.107***
	(0.522)	(0.544)	(0.632)	(0.674)
2011	2.321***	1.939***	3.877***	3.398***
	(0.534)	(0.557)	(0.646)	(0.689)
2012	2.361***	1.914***	4.150***	3.647***
	(0.541)	(0.560)	(0.650)	(0.692)
2013	2.463***	2.031***	4.234***	3.754***
	(0.564)	(0.587)	(0.680)	(0.725)
2014	2.443***	1.975***	4.332***	3.856***
	(0.568)	(0.590)	(0.683)	(0.729)
2015	2.283***	1.813***	4.183***	3.693***
	(0.555)	(0.575)	(0.666)	(0.710)
2016	2.215***	1.728***	4.174***	3.606***
	(0.548)	(0.564)	(0.656)	(0.697)
2017	2.184***	1.689***	4.141***	3.568***
	(0.563)	(0.579)	(0.674)	(0.717)
2018	2.133***	1.641***	3.878***	3.255***
	(0.597)	(0.620)	(0.720)	(0.769)
_cons	22.00	5.652	31.54	18.80
	(24.96)	(24.50)	(30.72)	(30.22)
No of observations	447	447	452	452

Note: Standard errors in parentheses; * p<.10, ** p<.05, *** p<.01

Table A3 / Housman test

	Coefficients			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fe	re	Difference	S.E.
log (NPLt-1)	.4739737	.6366441	-.1626705	.0189846
log(unemploy)	-.0746074	.1652212	-.2398286	.
log(wage)	-.3994424	-.4587684	.0593259	.
log(cpi)	-2.265865	-.8956338	-1.370231	.
Debt	.5849345	.6708884	-.0859539	.
Log (GDPt-1)	-1.227126	-1.379741	.1526151	.
Log (HHI)	1.667024	1.74791	-.0808866	.
Log(solvency Ratio)	-.2702851	-.3873671	.1170821	.0479913
log (sizet-1)	.6425731	.2312095	.4113635	.0790735
ROA	-.0952626	-.0819674	-.0132952	.0032978
Log (size)	-.4318755	-.2707375	-.161138	.0791273
Year dummies				
2006	.2560409	.0909858	.165055	.
2007	1.558402	1.37471	.1836919	.
2008	1.995197	1.742014	.2531823	.
2009	2.12296	1.920727	.202233	.
2010	2.204696	1.852782	.3519135	.
2011	2.321128	1.938842	.3822864	.
2012	2.360832	1.913502	.4473302	.
2013	2.463347	2.031181	.4321656	.
2014	2.443354	1.974516	.4688374	.
2015	2.283412	1.813201	.4702114	.
2016	2.214814	1.727509	.4873048	.
2017	2.183665	1.68912	.4945444	.
2018	2.133281	1.641236	.4920443	.

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic
chi2(24) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 202.84
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

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