

Credit risk determinants in the Bulgarian banking system and the Greek twin crises

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Abstract

This paper aims to investigate the credit determinants in the Bulgarian banking sector by means of time series modelling approach. It is motivated by the hypothesis that macroeconomic - cyclical indicators, monetary aggregates, interest rates, financial markets' and bank-specific variables have a role to play on the non-performing loans in the Bulgarian banking system. Using monthly series that span from January 2001 to December 2010, we provide evidence based on data that covers both the booming period and the recent global financial turmoil. Given the significant penetration of the Greek banks in the Bulgarian financial system, the novelty of the paper is the introduction of data that proxy the Greek debt crisis and the ensuing Greek banks' financial distress. Thus, we investigate the impact of the global financial crisis and the subsequent Greek crisis on the Bulgarian non-performing loans. Findings indicate that the macroeconomic and financial markets' variables, specifically the unemployment rate, the construction index, the industrial production index and the real effective exchange rate jointly with the credit growth and the global financial crisis influence the quality of the Bulgarian banks' assets. Contrary to the expectations, there is no evidence supportive to the hypothesis of linking Greek-specific indicators to the quality of the Bulgarian loan portfolio.

Keywords: Macroeconomic credit risk, Non-Performing Loans, Bulgarian banking system, Greek fiscal crisis, Greek banking system

JEL classifications: C32, G18, G21

Introduction

The recent global financial crisis highlighted the importance of appreciating the stability of the financial sector and its capacity in managing credit risk. The key motivation for this paper is to improve our understanding of the credit risk determinants in the Bulgarian banking system while casting a vigilant eye on potential contagion effects from the debt-burdened neighbour. This is particularly important as the Bulgarian banking system is dominated by foreign-owned commercial banks. Among them, the Greek banks' subsidiaries have a substantial penetration as they represent around 32% of the credit wallet while their deposits account for 25% of the market. Therefore, any attempt of exploring the deterministic factors of the Bulgarian

banks' credit risk should not be limited solely on endogenous variables of the respective economy.

Using time series modelling techniques, this paper empirically investigates the determinants of ex-post credit risk. The latter is reflected on the non performing loans to total loans ratio in the Bulgarian banking system. Related to a growing body of literature, the purpose of the study is to offer an insight into the factors that determine the quality of the Bulgarian banks' assets. In this direction we utilize a broad dataset that spans from January 2001 to December 2010. The explanatory power of macroeconomic, monetary, interest rates, financial markets' and bank-related variables is investigated. The key contribution of the paper lies in the fact that it introduces proxies for the Greek debt crisis and the ensuing distress of the Greek banks. The aim is to examine the existence of a potential transmission channel to the Bulgarian banking system. As the twin Greek crises unfold, any repercussion for the neighbourhood is possibly the most important issue in the minds of policy makers, regulatory bodies and bankers. In this direction, the time series utilised attempt to capture include both the booming period and the slump following the financial crisis as well as the ensuing manifestation of Greece's structural weaknesses.

The paper is organized as follows. Section 2 presents an overview of the Bulgarian economy and banking system while Section 3 presents the empirical literature that attempts to delineate the determinants of loan portfolio quality. Section 4 briefly discusses the data, the methodological approach and the empirical findings while Section 5 concludes the paper.

Overview of the Bulgarian economy and banking system

The Bulgarian economy has evolved from a long history of high inflationary periods and banking crises. Similarly to all transition economies in the SEE region, bad loans¹ were a serious problem in Bulgaria partly due to the inherited legacies but also to continuing lending practices. Furthermore, the weak bank governance and poor regulation of the many small state owned commercial banks resulted in considerable asset stripping and insider lending (Bonin et al, 2008). Given that, the macroeconomic shock of the transition period during the mid-1990s was severe². It made the Bulgarian banking crises one of the most costly of all transition countries. Iskrov (2011) indicates that in 1996-97 one third of the banks went bankrupt, there was hyperinflation and the confidence in the national currency vanished. The introduction of a currency board in 1997 restored macroeconomic stability³ and the banking system was rationalized quickly thereafter. Since then the Bulgarian economy has been growing in an environment of practically non-existent exchange rate risk, with flexible labour markets, hard budget constraints and fiscal discipline. Benefited from being a prospect EU country, Bulgaria has been a major recipient of capital inflows in the SEE region during 2003 to 2008 and also

¹ The average ratio of non-performing loans to total loans for the four major SEE countries (Slovenia, Croatia, Romania and Bulgaria) in 1995 was 18.8% of the total loans on the books.

² In 1996, real GDP declined by 10%. Repeated rounds of recapitalization of banks resulted in a total cost to the government at 42% of 1998 GDP.

³ The establishment of the currency board set in train rapid disinflation to single digits and helped restore confidence in the banking system. Tight fiscal policy and debt management cut public debt in half relative to GDP and sustained a manageable external current account deficit (IMF, 2010).

experienced a significant increase in credit. This led to a surge in imports and a sharp increase of the current account deficit as domestic demand outgrew gross domestic product in the context of rising wages and the shift of resources toward non-tradable activities. In turn, the increase of wages led to a significant appreciation of the real exchange rate. Therefore, the growth was based upon both external and domestic demand. Rapid credit expansion led to a real estate and construction boom, while privatisation coupled with efficient marketing has made tourism a leading industry.

Duenwald et al (2005) argue that the rapid credit growth in Bulgaria has been driven by macroeconomic stabilization and capital inflows. However, the credit boom over the period 2001-2008 contributed importantly to widening macroeconomic imbalances. During 2004-06, the Bulgarian National Bank (BNB) introduced various policy measures to limit bank lending and mitigate the boom-bust cycle. In early 2005, the central bank introduced credit ceilings whereby banks were allowed to expand credit by up to 6% per quarter. Failing to comply, the banks faced a penalty in the form of marginal reserve requirements. Retrospectively, the measures proved to be insufficient as banks were able to freely borrow from abroad as they were keen to fight for their market share (IMF, 2010). Inevitably, the top priority of the newly privatized banks was to boost profitability and market share. With high capital adequacy ratios, banks managed to increase profitability by shifting the composition of their assets towards loans mainly directed to the non-government sector. Growth of real credit has been among the strongest in the SEE region during that period. This aggressive stance has been actively encouraged by the banks' foreign parents in both Bulgaria and Romania.

It becomes evident that the Bulgarian banking industry grew very rapidly since the turn of the century. Currently it consists of 30 banks and is dominated by subsidiaries of large foreign banks mainly engaged in traditional commercial banking. Major foreign banks are from other EU countries, most notably Greece, Italy and Austria. The five Greek banks together represent approximately 30% of the market (IMF, 2010).

An overview of the Bulgarian banking system is presented in Table 1.

Table 1: Bulgarian Banking System Overview as of 2009

Bank	Nationality	Total Assets (billion Leva)	Market Share Assets (%)	Loan to Deposit Ratio (%)
Largest banks				
Unicredit	Italy/Austria	11,5	16,3	147
DSK	Hungary	8,7	12,3	126
UBB	Greece	8,2	11,5	156
Raiffeisen	Austria	6,6	9,4	124
Eurobank	Greece	6	8,5	112
First Investment Bank	Bulgaria	4,1	5,8	97
Bank of Piraeus	Greece	3,6	5,1	261
Other Greek Banks				
Alpha Bank	Greece	2,2	3,2	235
Emporiki	Greece	0,5	0,7	319
Total Banking System		70,9		133

Source: IMF & Bulgarian National Bank

Some of these banks entered the Bulgarian market relatively recently and relied little on domestic deposits to fund their activities. The latter is witnessed by their high loan-to-deposit ratios (see Table 1).

South-eastern Europe is among the regions most severely affected by the current crisis. All countries in the region registered a sharp output decline reflected in the dramatic contraction in GDP, with the Romanian and Bulgarian economies being the most distressed. The crisis started to affect Bulgaria towards the end of 2008. Initially, exports and industrial output fell dramatically in parallel with a steep contraction in investments (EBRD, 2010). The banking system was affected by the crisis only when the real economy deteriorated and as a result the banks' clients found it harder to service their loans. Currently, the main risk encountered by the Bulgarian banks concerns the weakening of asset quality. The recession has caused the non-performing loan (NPL) ratio to reach 11.9% by December 2010. Publicly available data, point to a rather homogeneous increase in non-performing loans across various sectors.

A brief review of the literature

As the story unfolds, a survey of the relevant academic literature is presented. The survey covers mainly empirical findings on the relation between macroeconomic variables and credit risk⁴. Many studies investigate the factors that induce financial crises by examining potential links between bank-specific variables and macroeconomic factors. An increasingly popular method of assessing financial sector vulnerabilities is the macro stress-testing⁵ approach. Relevant studies examine the link between banks' loan losses, or non-performing loans and macroeconomic factors. The most common approach in similar studies involves estimating the sensitivity of banks' balance sheets to adverse changes in macro fundamentals based on historical data. Then the estimated coefficients can be used to simulate the impact on the financial system of possible stress scenarios in the future. The focus is on credit risk, which by large represents the most significant risk faced by banking systems worldwide.

Two main strands of the literature can be identified in this area, building on the seminal works of Wilson (1997) and Merton (1974). Merton's (1974) approach models initially the response of equity prices to macro fundamentals and then maps asset price movements into default probabilities. On the other hand, Wilson's (1997) framework allows the direct modelling of sensitivity of default probabilities in various industrial sectors to the evolution of a set of macroeconomic variables.

Studies analysing the macroeconomic determinants of banks' loan losses or non-performing loans include Pesola (2001) for the Nordic countries, Kalirai and Scheicher (2002) for Austria, and Delgado and Saurina (2004) for Spain. Typically, these studies find that loan loss provisions are negatively related to GDP growth and positively related

⁴ The framework for studying the impact of macroeconomic variables or the business cycle on credit risk is represented by two competitive theories. The first one stresses that credit risk is pro-cyclical whereas the second one defends the countercyclical view.

⁵ The term refers to a range of techniques used to assess the vulnerability of a financial system to 'exceptional but plausible' macroeconomic shocks.

to interest rates. Kalirai and Scheicher (2002) estimate a time series model of aggregate loan loss provisions in the Austrian banking system as a function of an extensive array of macroeconomic variables. Results indicate that a rise in short interest rates, a fall in business confidence, a decline in the stock market and a decline in industrial production have an impact on the loss loan provisions.

Several studies have used the VAR models to investigate the macro-fundamentals transmission mechanism in the United States and other countries⁶. These models include various macroeconomic factors, ranging in number from two to five variables depending on the country. In some cases variables more directly related to the creditworthiness of firms are added, such as measures of indebtedness; in other cases, market-based indicators of credit risk, such as equity prices and corporate bond spreads, are used⁷. Foglia's (2008) survey indicates that researchers increasingly adopt models that are more flexible and easier to use, such as VARs and other strictly statistical rather than structural models. The estimation process normally requires the selection of a set of macroeconomic and financial variables that, according to economic theory and empirical evidence, affect credit risk. In this regard, variables such as economic growth, unemployment, interest rates, equity prices and corporate bond spreads contribute to default risk (Foglia, 2008). Blaschke et al. (2001) propose applying the VAR methodology to investigate the impact of inflation, nominal interest rate, output (real GDP) and the changes in terms of trade to the ratio of NPLs to the total loans or total assets of the banking sector. The coefficients of the regressions provide an estimate of the sensitivity of loan performance to macroeconomic factors. Similarly, Hoggarth et al (2005) focus on the link between loan write-offs and the UK output gap, retail and house price inflation, nominal short-term interest rate and the real exchange rate. Delgado and Saurina (2004) apply cointegration techniques to study the short-term and long-term time series properties of the relationship between either loan loss provisions or nonperforming loans and a set of macroeconomic indicators such as GDP growth, unemployment, and interest rates. Gambera (2000) employs bivariate VAR models to investigate the impact of regional and national macroeconomic variables on the loan portfolio quality (NPLs and loan delinquencies) of a large sample of US banks. The explanatory variables include the unemployment rate, farming income, housing permits, state annual product, bankruptcy filings and car sales. With the exemption of car sales, all variables are found significant predictors of bank asset quality.

Baboucek and Jancar (2005) apply an unrestricted VAR⁸ model to investigate the effects of macroeconomic shocks on the loan quality of the Czech banking sector employing monthly series from 1993 to 2006. Using the NPL ratio⁹ as an indicator of loan quality, authors find robust causal relationships to exist with loan quality and a number of

⁶ These models are used in the studies developed at the Central Banks of the UK, Japan, Spain, the Netherlands, and at the European Central Bank.

⁷ Introducing market variables such as interest rates, foreign exchange rates, and equity and real estate price indices, into credit risk models is a way of explicitly integrating the analysis of market and credit risks.

⁸ The VAR model is based on transmission that includes the following nine endogenous variables: the real effective exchange rate, exports, monetary aggregate M2, imports, aggregate bank loans to clients, the unemployment rate, the consumer price index, the domestic real three-month interest rate and the share of non-performing loans in aggregate bank loans to clients.

⁹ Concerns were raised about the NPL ratio being a lag indicator of loan quality as its deterioration is usually evident at the point when problem emerges.

macroeconomic variables based on impulse response analysis. Unemployment, CPI inflation and credit risk shock were found to have negative influences on the NPL ratio, confirming theory and related empirical studies. However, other macroeconomic variables, such as the loan stock, real exchange rate and M1 used as a proxy for GDP failed to concur with economic theory as innovations in all variables except M1 improved loan quality. An accelerating NPL ratio, high unemployment and inflationary tendencies were cited as important early warning indicators of credit portfolio deterioration.

Several recent papers (Boss, 2002; Virolainen, 2004) analyse the impact of macro fundamentals on the credit quality of banks' debtors using the framework of Wilson (1997). Virolainen (2004) estimates a macroeconomic credit risk model for the Finnish corporate sector over the period 1986 to 2003¹⁰. The SUR model results suggest a significant relationship between corporate sector default rates and key macroeconomic factors including GDP, interest rates and corporate indebtedness. As in most studies, the estimated model is employed to analyse corporate credit risks conditional on current macroeconomic conditions, ie stress testing. The findings are in line with previous studies using observed bankruptcies for default rate measures.

Boss (2002) estimates a macroeconomic credit risk model for the aggregate corporate default rate to analyse stress scenarios for the Austrian banking sector. Findings suggest that industrial production, inflation, the stock index, the nominal short-term interest rate, and the oil price are the most important determinants of corporate default rates.

A leading role in the development of aggregate stress tests has been played by the IMF, in cooperation with the World Bank¹¹. In 2005 the IMF conducted for the first time in Greece a financial sector assessment program (Kalfaoglou, 2006). Similar to Boss (2002), Kalfaoglou (2006) emphasises that credit risk remains the most important risk in the Greek banking sector. Despite the satisfactory stress tests' results¹², author indicates that the cross-border expansion of banks increases their vulnerability to external shocks which, in turn, requires better and more intensive risk management practices.

The abovementioned studies, in general, corroborate theoretical postulates with respect to the macroeconomic influences on loan portfolio quality and, consequently, on banking sector stability. In effect, good economic conditions seem to be commensurate with good loan quality measured by either the non performing loans' ratio or loan loss provisions.

Data, methodology and empirical findings

It is evident from the body of literature reviewed that the main hypothesis under investigation is whether the credit risk is sensitive

¹⁰ A distinguishing feature of this study is the sample period used to estimate the model as it includes a severe recession and a banking crisis.

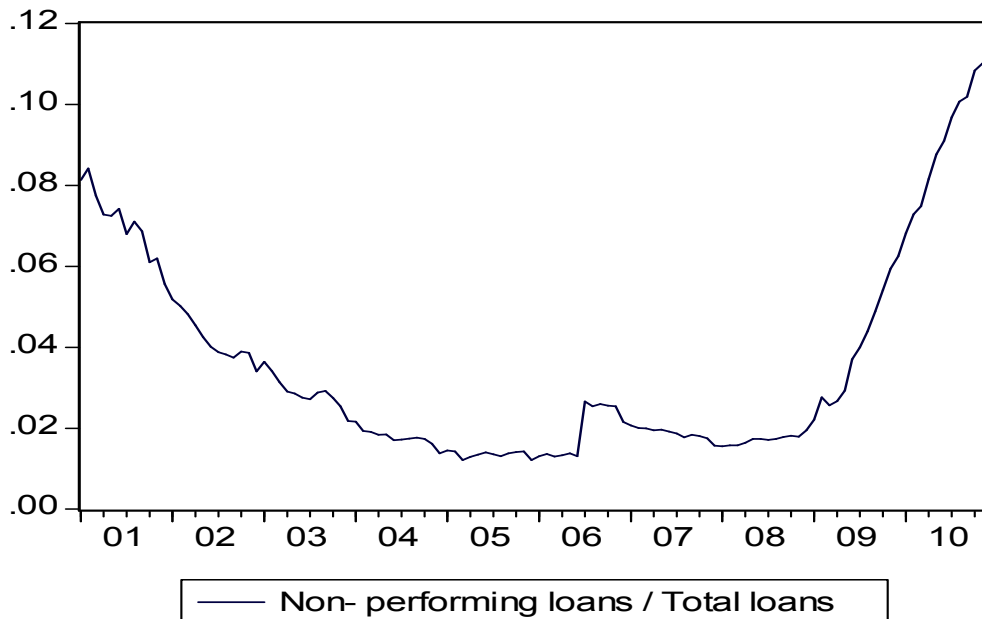
¹¹ These institutions started the Financial Stability Assessment Program (FSAP) in May 1999. By identifying weaknesses in a country's financial sector and suggesting remedial policies, the FSAP aims at reducing the incidence of crises.

¹² Results indicated that Greek banks stood well-provisioned and well-capitalised. However, findings correspond to the time period considered, indicating that the exercise should be repeated in a regular manner to ensure that results remain valid over time.

to macroeconomic - cyclical, financial markets and bank-related factors. The variables' identification for this study is based on related studies to ensure comparability of empirical results.

In this paper the dependent variable (credit risk) is defined as the ratio of loss and doubtful loans to total loans (NPL). Several studies employ non-performing loans, loan loss provisions or composite indices as the metrics to assess the vulnerability of the financial system over time. Figure 1 presents the evolution of the credit risk metric considered for the Bulgarian banking system. Clearly, by the end of 2008, NPLs follow an increasing trend, thus, signalling a steep deterioration in the quality of the Bulgarian credit portfolio.

Figure 1: Credit Risk in the Bulgarian Banking System



Source: Bulgarian National Bank & authors' calculations

The main macroeconomic indicators used are the GDP, the unemployment rate and the consumer price index. In addition we considered the construction and the building construction indices¹³, the foreign trade captured by the country's imports and exports and the current account. The latter is expected to play a significant role as in many SEE economies workers' inward remittances save the current account from becoming an unmanageable deficit. The 'bad habit' of debt growth is also included in the dataset as its dynamics may deteriorate the real economy and subsequently the credit risk.

The monetary policy on the dependent variable is investigated by means of the aggregates M1, M2 and M3. Other indicators used in this study are the average monthly wage (AMW), the oil imports proportionally to the GDP, the brent crude oil price per barrel and the industrial production index (IPI). The financial markets' potential effect on NPLs is explored by the Euribor and Sofibor rates, the long term Bulgarian government bond yield and the real effective exchange rate.

¹³ Real estate surveys indicate that the property market in Bulgaria has weakened considerably after the global financial crisis. A sharp contraction in the construction sector could ignite a major economic downward spiral with adverse consequences for banks' loan portfolios.

We also consider a number of Bulgarian bank-specific variables to study the potential impact of endogenous factors such as the credit growth on NPLs.

As highlighted previously, a substantial part of the Bulgarian banking system assets is owned by Greek banks. As their "parents" suffer funding shocks due to the Greek sovereign debt crisis, the local subsidiaries, albeit typically well capitalized (BNB, 2010) face considerable risk of coming under pressure. It cannot be disputed that the Greek banking system is negatively affected by the Greek fiscal crisis. And banking crises¹⁴ have historically been contagious as a crisis in one country can ignite a loss of confidence in neighbouring countries. The novelty introduced in this paper is the inclusion of indicators related to the Greek fiscal crisis, the Greek banking system and the Athens Stock Exchange Indices. The main reasons behind the selection of these variables are:

1. The unfolding of the Greek debt crisis is marked in the spread differential between the Greek and German long-term bonds yields
2. The deteriorating asset quality of the Greek banking system is reflected in the Greek NPLs whereas the strained liquidity is marked by the over-reliance in funding facilities provided by the European Central Bank
3. The Greek banks offer(ed) investors a promising emerging markets' vehicle. Consequently, their SEE prospects are reflected in their shares performance in the Athens Stock Exchange

De Haas and Van Lelyveld (2006) study of foreign banks in Eastern Europe indicates a significant negative relationship between home country economic growth and host country credit. Thus, the hypothesis under investigation is whether the Greek crisis and banking system dynamics matter for the Bulgarian non-performing loans.

The estimation process requires the selection of a set of variables that, according to economic theory and empirical evidence, affect the Bulgarian credit risk. Broadly, the empirical section consists of three steps:

- a. Unit root tests
- b. Univariate regressions to identify the indicators with explanatory power on the Bulgarian credit risk
- c. Estimation, specification and diagnostic checking of a multivariate model on the basis of variables and theory consistency

Initially the time series were tested for unit roots by the Augmented Dickey Fuller tests. When a series was found to be integrated of order one (I(1)) or two (I(2)), the first or the second difference of the variable was taken to obtain time series stationarity.

Following an analogous approach to Kalirai & Scheicher (2002) and Boss (2002) approaches, initially OLS univariate regressions are performed to identify the potential macroeconomic, monetary, financial and bank-specific indicators with explanatory power on the NPL ratio of the Bulgarian banking system. The univariate regressions¹⁵ are expected to provide fertile soil for identifying the factors that may have an impact on the dependent variable. In the following stage, these

¹⁴ We refer to Type II banking crises as defined by Reinhart and Rogoff (2009). That is a milder banking crisis also known as financial distress where there are no runs, closure or large-scale government assistance of an important institution that marks the start of a string of similar outcomes for other financial institutions.

¹⁵ The results of the bivariate estimations are omitted due to space limitations.

factors are used as a starting point for the multivariate modelling approach.

The NPL ratio is regressed against each indicator at time t but also at all lags up to two years. The rationale behind this extensive approach is to capture any potential lagged effect of any explanatory variable on credit risk. A positive (negative) sign means that theory confirmed by empirical evidence suggests that the respective factor x_t (or x_{t-s} , where $s=1, \dots, 24$) is expected to present a positive (negative) influence on the changes in the NPL ratio.

Building upon the significant factors identified in the bivariate regressions, we estimate a multivariate credit risk model following a general-to-specific methodology. The criteria to arrive at a parsimonious final model formulation are:

- a. The indicators in the final specification of the multivariate model should bear the correct sign
- b. Ideally, at least one significant indicator from each category should be included in the model
- c. The model should be logically plausible and simple. Such models are easier interpreted and communicated
- d. All variables included in the multifactor model should be significant both separately and jointly, at least at the 10% level of significance and last but not least
- e. The standard battery of residuals' tests should indicate no pathological issues

Following the described methodology while satisfying the criteria set previously, the time series model estimated by OLS is presented in Table 4. The diagnostic checks indicate no signs of first and second-order serial correlation on the basis of the Breusch-Godfrey test. As there are heteroscedasticity issues in the residuals, the results presented in Table 4 have been adjusted on the basis of the White heteroskedasticity consistent estimators¹⁶. Furthermore, the intercorrelations among the explanatory variables are at reasonable levels suggesting no serious multicollinearity issues.

16 The White consistent covariance estimates do not change the point estimates of the parameters, only the estimated standard errors.

Table 4: Regression output of the final multifactor model

Dependent Variable: NPL				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010761	0.011130	0.966807	0.3359
IPI	-0.004417	0.002268	-1.947032	0.0542
CONSTRUCTION INDEX(-6)	-0.004038	0.002146	-1.881700	0.0627
UNEMPLOYMENT	0.065055	0.024905	2.612083	0.0103
REEL(-3)	-0.008064	0.003298	-2.445309	0.0162
LOAN GROWTH	-0.938716	0.257859	-3.640424	0.0004
DUMMY (FINANCIAL CRISIS)	0.393716	0.157389	2.501546	0.0139
NPL(-1) ¹⁷	-0.323567	0.158806	-2.037499	0.0441
DUMMY (BREAK) ¹⁸	0.044461	0.013920	3.194052	0.0019
R-squared	0.551643	Mean dependent var		0.004340
Adjusted R-squared	0.517155	S.D. dependent var		0.096956
S.E. of regression	0.067372	Akaike info criterion		-2.480878
Sum squared resid	0.472055	Schwarz criterion		-2.263653
Log likelihood	149.1696	F-statistic		15.99478
Durbin-Watson stat	1.815848	Prob(F-statistic)		0.000000

- Numbers in parentheses under the column regressor indicate the lag of the respective variable used in model estimation
- The residuals' diagnostic tests are omitted due to space limitations.

The model's specification indicates that, taken simultaneously the unemployment rate, the construction index lagged by a 6-month period the real effective exchange rate lagged by 3 months jointly with the credit growth and the global financial crisis explain approximately 55% of the variability of credit risk in the Bulgarian banking system. The relatively good fit of the regression suggests that the non-performing loans in Bulgaria can be explained reasonably well by macro fundamentals and the global financial crisis.

The explanatory power of the Bulgarian macroeconomic variables such as is in broad agreement with related studies. Yet, the idiosyncratic features of the developing economy and also those of a banking system dominated by foreign institutions are also present in the findings. For instance, we find that construction fuelled by the lending boom in the pre-crisis period are among the important factors that influence Bulgarian credit risk.

The study is also motivated by the hypothesis that Greek-specific variables influence the Romanian banking system loan quality or alternatively the Greek crises' matter for the neighbourhood (Anastasakis et al [1]). Based on the findings, there is no evidence that supports the hypothesis of linking Greek-specific indicators to the quality of the Bulgarian loan portfolio. The Bulgarian non performing loans seem not to be affected by risks arising from the

¹⁷ An autoregressive term is included as it is strongly suggested by the data.

¹⁸ A dummy is introduced in the dataset to capture the breakpoint in mid-2006 indicated by the Chow test. The structural break is attributed to the new regulation on credit growth introduced by the National Bank of Bulgaria.

Greek twin crises. This is in contrast to a recent study for Romania (Vogiazas & Nikolaidou, 2011). Inevitably, the deteriorating asset quality and the contributing factors should be a primary concern of regulators in Bulgaria. The non-existence of linkages between the Bulgarian NPLs and the Greek crisis could be attributed to the Bulgarian banking sector stability and prudential regulation (EBRD, 2010; BNB, 2011).

It should be noted that caution is required when interpreting the empirical results. Any attempt should be done under the assumptions made and the time period considered. Future research would attempt to combine the proposed model with the VAR approach while accounting for the default risks at borrower level (households, corporations).

Conclusions

Internationally, the number of empirical studies trying to link macroeconomic factors and the asset quality of the banking sector has been growing rapidly in recent years. Addressing the high level of non-performing loans remains a major challenge as important post-crisis challenges remain.

In this study we used time series modelling techniques to investigate the deterministic factors of non-performing loans in the Bulgarian banking system; a system dominated by foreign-owned commercial banks. Credit risk is modelled in dependence of a data-intensive set of indicators ranging from macroeconomic, monetary, financial markets, interest rates and bank-related variables. The introduction of proxies for the Greek debt crisis and the Greek banks' financial distress constitutes the novelty of this paper. Apart from the standard hypotheses investigated in the empirical literature, the study is motivated by the hypothesis that the Greek crises matter for the neighbourhood.

Evidence suggest that macroeconomic and financial markets' indicators, specifically the unemployment rate, the construction index, the industrial production index and the real effective exchange rate jointly with the credit growth and the global financial crisis influence the credit quality of the Bulgarian banking system. On the other hand, there is no evidence that supports the hypothesis of linking Greek-specific indicators to the quality of the Bulgarian loan portfolio. The Bulgarian non-performing loans seem not to be affected by risks arising from the Greek twin crises.

Our findings have several implications in terms of policy and regulation. Specifically, the macroeconomic significant variables identified may serve as leading indicators of credit risk deterioration. As most SEE economies rely heavily on the financial sector in terms of growth prospects, regulators should ensure financial stability while remain vigilant on the macroeconomic prospects of the region and potential contagion risk arising from the foreign banks' subsidiaries in Bulgaria.

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- Applied econometrics
- Arms races
- Terrorism
- Defence spending in the European Union and South East European Countries
- Developments in banking and the financial system