



The  
University  
Of  
Sheffield.

DETERMINANTS OF CREDIT RISK  
IN THE BULGARIAN AND THE ROMANIAN  
BANKING SYSTEMS AND  
THE ROLE OF THE GREEK CRISIS

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Sophocles D. Vogiazas  
080247069

South East European Research Centre at Thessaloniki  
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## **Dedication**

This work is dedicated to all those people that contributed in its completion.

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## List of Abbreviations

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BIS	Bank of International Settlements
BNB	Bulgarian National Bank
BOG	Central Bank of Greece
CEE	Central East Europe
CESEE	Central East and South East Europe
EBRD	European Bank for Reconstruction and Development
ECB	European Central Bank
EU	European Union
EWS	Early Warning System
FDI	Foreign Direct Investment
FSIs	Financial Soundness Indicators
GDP	Gross Domestic Product
IMF	International Monetary Fund
LEV	Bulgarian Leva
LLPs	Loss Loan Provisions
NBR	National Bank of Romania
NISR	National Institute of Statistics of Romania
NPLs	Non-performing loans
NSIB	National Statistical Institute of Bulgaria
RON	Romanian Leu
SEE	South East Europe
WB	World Bank

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## **Abstract**

The global financial crisis of 2007-8 and the ensuing manifestation of the Greek debt crisis in the euro area have abruptly ended the credit-fuelled boom in the South East Europe (SEE). The crisis episodes have also reignited the interest of researchers and policy makers on the determinants of credit risk and the impact of crisis on the stability of the SEE banking sectors.

The contribution of this thesis lies in the fact that it provides the first systematic assessment of the relationship between credit risk and macroeconomic shocks in the Bulgarian and Romanian banking systems with an explicit role for the Greek debt crisis and the spillover effects transmitted through the Greek banks' subsidiaries in the thesis' focal countries. The empirical research uses a comprehensive dataset spanning from 2001 to 2010, thus covering a significant part of the boom-bust cycle, as well as advanced modelling approaches that have not been used before in the focal banking systems.

The results indicate that credit risk plays a central role in the linkages between banking systems and macroeconomic vulnerabilities. The determinants of credit risk in Bulgaria and Romania are macroeconomic, bank-specific and institutional. The evidence on the spillover effects from the Greek debt crisis, manifested through the strong banking linkages, differs between the two countries. The data generate evidence of a Greek crisis spillover effect on Romania but not on Bulgaria, given the pronounced differences in the economies and banking systems of these two countries. The results of the empirical research are country-specific, suggesting that the region does not form a homogeneous block, thus each country merits research on its own. The implications of the research support the view that banking stability should be at the core of central banks' policymaking, while strong regional cooperation and coordination among regulators would be beneficial in safeguarding banking systems from crisis contagion.

## **Chapter 1: Introduction**

The recent financial crisis of 2007 has manifested that market economies, irrespective of their stage of development, are susceptible to shocks. The SEE region was among those regions severely hit by the crisis. Historically, at the centre of episodes of costly banking distress and crises in the SEE developing economies has been the deterioration in the quality of banks' loans. Hence, the recent financial turmoil has underscored the importance of understanding financial instability, especially in the context of credit risk, with particular emphasis on the banking systems of the SEE region that has attracted little research interest.

This thesis unravels the determinants of credit risk in the banking systems of Bulgaria and Romania over a critical timeframe that spans over 2001-2010. As such, the research covers the SEE credit-fuelled boom that was abruptly ended by the global financial crisis and the ensuing Greek sovereign debt crisis that hit the region in 2008. The original contribution of the thesis to knowledge is to provide empirical evidence on the linkages between banks' credit risk and the business cycle as reflected in a comprehensive dataset that comprises monthly observations of macroeconomic, monetary, financial and bank-specific indicators. Bulgaria and Romania have been largely neglected in the empirical literature, as the only available studies in which these countries participated are panel estimations. However, the SEE region constitutes a unique region worldwide in terms of foreign direct investment (FDI) flows in the banking sectors (Barisitz, 2009). Within the SEE region, the cases of Bulgaria and Romania are interesting for several reasons, apart from being major FDI recipients. Both countries present a long record of crises, banking upheavals and turmoil. In their transition process, a wave of bank privatizations took place and

foreign banks dominated the financial sectors of both countries. In fact, nowhere else have foreign banks wielded such a high degree of control over banking sectors.

The banking system in both focal countries plays a central role in their economies and banks have been thought of as the major catalysts of economic growth. In their financial liberalization process, spurred on by ample liquidity at a global level, these countries have seen a growth of real credit that was among the strongest in the SEE region. Then, as the global financial crisis erupted, both Bulgaria and Romania were plagued by surging non-performing loans (NPLs) and a much deeper recession than other emerging economies. Evidently, the boom-bust cycle left a legacy of high NPLs in both countries that has impeded the stability of the banking sectors and became a drag on economic growth. It seems that addressing credit risk in the Bulgarian and Romanian banking systems is of paramount importance and a cause for serious concern for policy makers and regulators. The resolution of credit risk, manifested in rising problem loans, calls for an investigation into its determinants on a case-by-case basis.

Another key contribution of this thesis is to provide empirical evidence of the spillover effects from the Greek crises to the banking systems of Bulgaria and Romania. The financial integration and liberalization process has given rise to interconnected financial networks manifested in the substantial presence of the Greek banks in Bulgaria and Romania. The strong banking networks and links heighten the danger of cross-border transmission of risks and economic contagion (ECB, 2005; Altmann, 2006).

Hence, the original contribution of the thesis is two-fold: first, it investigates the drivers of credit risk in Bulgaria and Romania and secondly it explores the spillover effects from the Greek crisis to Bulgaria and Romania through the banking channels.

A unique element of the thesis is that it provides evidence at a country level by means of a robust and multi-staged econometric framework. In this respect, the research applies, among other estimation techniques, the autoregressive distributed lag approach to cointegration and the Markov regime switching modelling framework. Neither of these modelling approaches has previously been used in the investigation of credit risk determinants in the focal countries, while their application in other geographical areas is almost non-existent.

Credit risk is a permanent feature of banks' balance sheets. Understanding the channels between credit risk and the business cycle is important when assessing the stability of a banking system. At the same time, understanding the crisis transmission channel through foreign-based financial intermediaries questions the conventional view on the role of foreign banks as banking systems stabilizers.

The remaining part of the chapter provides the terms of reference of the thesis. As such it outlines the aims and objectives and poses the research questions. The study of financial stability has become the cornerstone of macroeconomic policy, especially for developing countries. The recent financial crisis has increased the research interest in understanding financial instability in the context of managing banks' credit risk (Ali and Daly, 2010), as a stable financial system is a key ingredient for a healthy economy. The deterioration in the quality of banks' loan portfolios has been at the heart of episodes of costly banking system distress and economic crises in both developed and developing countries. Such events have had extremely severe consequences in the case of crisis-prone Bulgaria and Romania. Arguably, there is abundant empirical literature on the interaction between macroeconomic conditions and credit market frictions, in particular rising credit risk (Nkusu, 2011). The existing literature on the determinants of credit risk deals with diverse samples and covers

many geographical areas and countries. Equally, Bulgaria and Romania have participated in several cross-sectional studies. These studies generalize the causal relationship between credit risk and macroeconomic variables across countries. The problem of cross-sectional methods is that by grouping countries at different stages of financial or economic development, they may fail to explicitly address the country-specific effects on credit risk. In particular, this method fails to address the potential bias induced by the existence of cross-country heterogeneity, which may lead to inconsistent estimates (Quah, 1993; Casselli, Esquivel and Lefort, 1996; Ghirmay, 2004; Odhiambo, 2008). On the other hand, the same set of macroeconomic and bank-specific indicators display different default rates in comparative country-specific studies (Ali and Daly, 2010; Chaibi and Ftiti, 2015).

The financial accelerator framework as developed by Bernanke and Gertler (1989), Kiyotaki and Moore (1997) and Bernanke *et al.* (1999), provides the theoretical explanation of the role of banks in amplifying economic fluctuations. Most theoretical as well as empirical studies suggest that banks tend to behave pro-cyclically. As such during expansionary periods, the financial profile of borrowers improves, asset prices rise and this euphoric situation paves the way for an increase in the demand for credit. This leads to an oversupply of credit, typically accompanied with relaxed lending standards, thus increasing credit risk. Once the downturn begins, triggered by some exogenous shock, borrowers' financial position deteriorates and as such their debt-servicing capacity. This leads to increasing credit risk manifested in rising NPLs and curtailed bank lending which, in turn, reduces the otherwise bankable investments, the demand for credit declines, amplifying the recession. In view of the negative impact of credit risk on financial stability, accompanied by the banks' pro-cyclical tendency,

the issue merits research especially in the case of the SEE region where the number of studies is modest.

Against this backdrop, the thesis sets out to investigate the drivers of credit risk in Bulgaria and Romania on a case by case basis, given that the SEE region does not constitute a homogeneous group of countries (Cottarelli *et al.* 2003; Duenwald *et al.* 2005; Zoli, 2007; Zinkovskaya, 2008). To the best of the author's knowledge, on a country-level basis, the research area remains broadly uncharted.

The thesis aims to explore the determinants of Bulgarian and Romanian credit risk measured by the ratio of NPLs to total loans in the former case and the ratio of loan loss provisions to total loans in the latter, as data constraints prevent the use of the same proxy for both countries. In this endeavour, the empirical research uses a monthly dataset spanning December 2001 to December 2010 and a comprehensive dataset that is comprised of macroeconomic-cyclical, monetary, financial and banking system specific variables. In modelling credit risk, the thesis delves into and utilises the empirical literature but also the historical evolution of the transition economies of Bulgaria and Romania that morphed the stylised facets of their respective banking systems. The research questions, which the thesis attempts to provide answers for, are:

- Can business cycle indicators explain the vulnerabilities of the Bulgarian and Romanian banking systems arising from deteriorating asset quality?
- Which are the key determinants of each country's credit risk and what is the direction of the shaped relationships?
- What is the role of credit growth and money supply in determining credit risk?
- How do the results of the research compare with past studies in other geographies or timeframes?



An equally novel aspect of the research is that it sets out to investigate potential crisis contagion stemming from the Greek debt crisis. Understanding the mechanics of crises on banks remains a key challenge in economics, as empirical studies are scarce and constrained by small samples and incomplete data (Gorton, 2012). Evidently, economic development does not result in the elimination of crises. As Minsky (1982a) suggests, the crises are systemic, endogenously generated events that manifest a fundamental instability of capitalist economies. It has been argued that the eruption of the global crisis propagated the Greek debt crisis that in turn spread like wildfire in Europe affecting mostly other countries that had strong ties with Greece. Based on Bankscope data and IMF (2013a), the Greek banks controlled 25% of the Bulgarian banking assets and 16.6% of the Romanian ones as at the end of 2011. Notably, the Greek banks accounted for a critical 33.8% of the Romanian system's aggregate share capital (NBR, 2011). In the light of the banking linkages in place, and given the large-scale banking distress in Greece, the risk of crisis spillovers into Bulgaria and Romania was extremely high. The risk of contagion was further aggravated by the buildup of large negative net foreign positions of the Greek subsidiaries in the SEE region vis-à-vis the parent banks, as during the euphoria times the credit growth had far outpaced the growth in domestic deposits. Empirical evidence suggests the existence of a strong association between banking stress in advanced and emerging economies, with transmission being stronger to emerging economies with tight banking links than to more advanced economies (Balakrishnan *et al.*, 2009). Hence, the risk of Greek-crisis contagion was high on the agenda of the central banks of Bulgaria and Romania.

The preceding analysis dictates the imposition of the Greek crisis hypothesis as a destabilizing factor of the Bulgarian and Romanian banking systems. In tackling this

challenge a set of indicators is constructed to approximate the Greek debt crisis, using the literature on financial contagion as well the empirical studies on early warning systems, on the diffusion role of credit risk. Given that, the previous hypothesis is transformed in the following research questions to be tackled using econometric analysis:

- Is there evidence of the Greek crisis in the Bulgarian and Romanian banking systems?
- What is the effect of the Greek credit risk on Bulgaria and Romania?
- What is the effect of the financial markets' turmoil, manifested in the Greek bond spreads, on the banking stability of Bulgaria and Romania?

Within this framework, the research forms the basis of a comparative analysis of two countries in the SEE region that share several common characteristics arising from the transition period, but they also present stark divergences.

Following a weak *apriorism* stance, the research questions are dealt with in a robust modelling framework that applies several estimations techniques. Most importantly, the research applies an autoregressive approach to cointegration to establish the relationship of credit risk with meaningful variables in the short and long run. The research also makes use of the Markov switching framework that allows for regime shifts in the data and can accommodate for non-linearities. Both these methods have several appealing features. Overall, the research methodological design follows an extensive modelling approach through a variety of econometric techniques that serve as a cross-validation of the robustness of the results.

The research findings provide evidence of the strong, significant effect of macroeconomic variables and bank-specific indicators on Bulgarian and Romanian credit risk. There is a pronounced effect of the institutional settings pertaining to

financial regulation and supervision in Bulgaria. Several mechanisms were found at work during the timeframe of the research. In terms of macroeconomic indicators, the results are broadly aligned with the empirical literature. As for the effect of the Greek debt crisis, there is evidence of spillovers in Romania in most modelling approaches. On the other hand, the research findings do not support the Greek crisis hypothesis for the Bulgarian banking system. As there are stark differences between the economies and banking systems of the two countries, it is reasonable to conclude that any future research in Bulgaria and Romania should be country-focused.

The results of the research facilitate a better insight into the key determinants of credit risk in the focal countries. The identified economic variables convey useful information in explaining Bulgarian and Romanian banking stability and the relationships surfaced hold during both boom and troubled economic periods.

Banks matter, both when they function well and when they function poorly. After all, banks' *raison d'être* is to maintain the capacity to deliver services needed by the public and facilitate sustainable economic growth. The results have practical applicability as they can help in the direction of policy making and equally can be utilized in the framework of stress tests. In both countries, banking stability should be at the core of macroeconomic policy. In the light of the increased risk of cross-country spillovers, the results of the empirical analysis argue that there is a strong case for regional cooperation between host country regulators from the SEE region and home country regulators.

The thesis is structured around six chapters in the following order. Chapter 2 provides an overview of the economies and banking sectors of Bulgaria and Romania along with their linkages with Greek banks. The chapter presents the stylized facts that morphed the banking systems in both countries, and surfaces their idiosyncratic

features that call for an individual, country-by-country modelling treatment. Furthermore, Chapter 2 substantiates the Greek crisis hypothesis relating to the potential spillover effect arising from the Greek crisis through the banking linkages. Chapter 3 provides the theoretical underpinnings of the research problem and identifies the determinants of credit risk in the literature while Chapter 4 delves into the empirical studies on credit risk, emphasizing the key findings and methodologies applied. Chapter 5 describes the dataset and justifies the research methodological design. This chapter translates the research questions into testable hypotheses and spells out the econometric modelling activity; it also discusses the issues that helped or hindered the research process and the econometric techniques used. Chapter 6 presents and interprets the results of the econometric analysis with respect to the research's theoretical and empirical priors. Finally, Chapter 7 provides the summary and conclusions. The chapter evaluates the research's results and provides avenues for future research.

## **Chapter 2: The economies of Bulgaria and Romania and the toxic legacy of the Greek crisis**

### **Introduction**

This chapter provides an overview of the bank-based financial sectors of Bulgaria and Romania *vis-à-vis* their linkages with the Greek banks. The aim is to give an account of the economic and banking settings in these SEE countries. More importantly, the chapter introduces and justifies one of the key hypotheses of the thesis that relates to the potential spillover effects arising from the Greek crisis. The chapter is organized in five sections as follows. Section 2.1 provides an overview of the banking transition from communism to capitalism in the SEE region. Then, Sections 2.2 and 2.3 present the economies of Bulgaria and Romania and confer on the stylized facts that have shaped the respective banking systems up to the unfolding of the global financial crisis in the SEE region. Section 2.4 draws comparisons between Bulgaria and Romania while Section 2.5 discusses the role of Greek banks in the research's focal countries. In line with the scope of the research, the section touches upon the recent evidence of crisis contagion and puts the Greek banks into perspective. As such, the section provides the rationale for the Greek banks' critical position in transmitting the crisis from the home country to Bulgaria and Romania. The last section concludes the chapter.

### **2.1 The banking transformation in South Eastern Europe**

This section provides a brief historical account of the transition processes in SEE banking. This is because financial systems need to be treated in their historical context (McGoun, 2003; Soros, 2010) since an over-reliance on models may constrain

researchers' vision, rendering them exposed to analytical myopia and theory-induced blindness (Haldane, 2012b). The crash of 2008 falsified established theories and reminded us that there are no timelessly valid laws that govern economic phenomena. Uncertainty, often neglected in the advanced quantitative models, prevails and the historical course of events should not be ignored.

The centrally-planned economies of the Soviet bloc realized at the end of the 1920s featured a state-owned banking system, essentially consisting of one large institution, the State Bank, often assisted by three or four special purpose units<sup>1</sup> with branches across the land, the so-called one-tier or mono-bank system (Green and Petrick, 2002; Barisitz, 2007). The banking activity aimed at monitoring and facilitating the plan fulfillment and payment flows. Credit evaluation and risk management were irrelevant. Banking supervision simply did not exist (Bonin and Wachtel, 2003). The comprehensive collapse of the former system triggered, almost immediately, a weakening of the state structure.

There were few indications in the SEE region of the momentous events that were about to unfold shortly after the fall of the USSR Empire. Mazower (1998) suggests that the result was the destruction of the old communist welfare system, but without anything being put in its place. Although the transition direction was clear, its final aims were not (Åslund, 2011).

Severe recession in the early 1990s intensified the massive debt problem in the corporate sector and led to an avalanche of defaults. The prior over-industrialization disappeared and the service sector began to expand. Romanians were forced to live through cold winters with almost no heat and factories had to cut back production because of limited electricity (Reinhart and Rogoff, 2009). But the decline in the

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<sup>1</sup> Typically the scheme in Bulgaria and Romania involved a central bank, a foreign trade one and a state savings bank. Later, other specialised state-owned banks entered, such as investment-development and agricultural banks.

standard of living has been much less than the real contraction of output (Åslund, 2002). Under these chaotic conditions, the Western governments kept out of the region, leaving the provision of the investment capital to the private sector (Mazower, 1998; Åslund 2002). In portraying the situation, Mazower (1998) states that:

*“The transnational and volatile financial markets which emerged in the 1970s, awash with petrodollars, saw Eastern Europe, with its highly stable regimes and well-trained workforce, as a neglected area for investment. Bankers with short memories (which certainly did not stretch back the requisite fifty years) convinced themselves that the Soviet ‘guarantee’ over the Eastern bloc ruled out any chance of default...Communists and bankers fell into each other’s arms”*(p.373).

At most, Western banks provided a kind of short-term financial aid for monetary stabilization. A new constitutional order had to be re-made in Eastern Europe, hampered initially by an uncertain legal situation. Only in Bulgaria and Romania were the new constitutions brought in relatively swiftly.

A shock therapy or the ‘Washington consensus’ became the main proposal of how to undertake the systemic change in the ex-communist countries (Åslund, 2002). That translated into a radical market reform with key elements such as the swift liberalization of prices and trade, sharp reduction of budget deficits, strict monetary policy and early privatization. In opposition to the radical reform programme, many argued that the quality of privatization was more important than its speed. According to ‘gradualists’ the state was capable of driving the social engineering (Stiglitz, 2002). The debate polarized between advocates of early mass privatization and the stance of gradualists proposing a case-by-case privatization.

In most CESEE countries, the 1990s were a decade of banking upheavals, turmoil and reform. The shock gave rise to transition recessions and caused banking crises which were followed by reform efforts. Barisitz (2007) identifies two regime changes along the process: the first embodies liberalization and the second essentially refers to

restructuring and institutionalization. Given the legacy of a state-dominated, monopolized banking system devoid of competition, the ex-communist countries initially opted for liberalization of regulation and supervision so as to inject competition into the market. As a result, numerous weak, undercapitalized banks entered the sector. The legacy of bad debts inherited from the previous times was exacerbated by a second round of loans to the same, bankrupt, state-owned enterprises due to political pressures (Altmann, 2006). Through ever-greening loans, the system swept the suspect assets under the carpet, as it was unwilling to write off bad debts. Authorities had to step in and carry out habilitation measures, replacing the bad debts in the portfolio of the state-owned banks with government bonds. Then, some tightening of monetary policy and banking oversight took place in order to combat the skyrocketing inflation and rein in the proliferation of credit institutions (Barisitz, 2009). But the soft budget constraints were retained. Lax credit policies and directed loans encouraged by the Central Bank or the government were carried over into the market-oriented economies, given the absence of the concept of bankruptcy. Table 1 provides the details of the systemic banking crises experienced in Bulgaria and Romania in the 1990s as well as some background information of each crisis, including peak NPLs as a percentage of total loans (NPLs), gross fiscal costs as a percentage of GDP, and minimum real GDP growth rate<sup>2</sup>.

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<sup>2</sup> The table lists the starting year of each banking crisis. The peak in NPLs is the highest level of NPLs as a percentage of total loans during the first five years of the crisis. Gross fiscal costs are computed over the first five years following the start of the crisis while minimum real GDP growth rate is the lowest real GDP growth rate during the first three years of the crisis (Luc and Laeven, 2008).



Table 1 The banking crises in Bulgaria and Romania (1990-2000)

Country	Banking crisis (start date)	NPLs at peak (%)	Gross fiscal cost (% of GDP)	Real GDP growth (%)	Comments
Bulgaria	1996	75	14	-8.0	The 1996 banking crisis had its roots in bad loans made during 1991-1995, but the deepening insolvency of the system was not reflected in sustained liquidity problems until the second half of 1994. Two ailing state banks required ongoing refinancing from the Bulgarian National Bank (BNB) and the State Savings Bank until they were bailed out in mid-1995. The public began to lose confidence in banks after the collapse of pyramid schemes in some cities, and in response to reports on the ill health of other banks. In late 1995 withdrawals of deposits, especially from the largest private bank in Bulgaria, were reflected in substantial BNB refinancing and falling foreign reserves. By early 1996 the sector had a negative net worth equal to 13% of GDP. The banking system experienced a run in early 1996. The government then stopped providing bailouts, prompting the closure of 19 banks, accounting for one-third of sector assets. Surviving banks were recapitalized by 1997.
Romania	1990	30	0.6	-12.9	In 1998 NPLs reached 25-30% in the six main state-owned banks.

Source: Laeven and Valencia (2008)

Barisitz (2007) recites a re-accumulation of bad debts and structural problems coupled with external shocks, arising mainly from three sources: foreign trade, exchange rates and oil prices. New banking crises ensued followed by recessions, particularly in Bulgaria, that led to a second wave of reforms that consisted of hard budget constraints for the banks initially, and the real sector later and profound restructuring. Åslund (2002) argues that the crisis in Bulgaria was rooted in excessive budget deficits that led to untenable public debt. The underlying reason was the semi fiscal expenditure that essentially involved public refinancing of loss-making banks.

During the 1990s, foreign involvement in the financial sector of the emerging SEE economies rose substantially. By the end of the decade, foreign-owned banks in Central and Eastern Europe accounted for an average of 70% of bank assets (Mathieson and Roldós, 2001). The growth of foreign banking activities in emerging economies is not an isolated phenomenon. It is part of the well-documented increase in FDI flows towards emerging economies. This has largely been led by mergers and acquisitions, reflecting the extensive privatization of state-owned assets (Herrero and Simón, 2003). In a theoretical survey, the authors explain the surge in banks' internalization by expanding in emerging countries in a 'follow the client' fashion, expected economic growth in the host country, but also in profit opportunities and risk sharing. Focarelli and Pozzolo (2001) provide evidence of institutional characteristics of the destination country that usually translate into lower regulatory restrictions on banking activities. Broadly, the authors depict macroeconomic and risk diversification theories to explain the banks' behaviour (Focarelli and Pozzolo, 2001; Herrero and Simón, 2003).

The turn of the millennium featured sector consolidation and was a culminating point of restructuring efforts. The first years of the new millennium have seen calmer and

more open banking sectors than in the 1990s. The incidence of banking crises in SEE declined sharply. However, the transition process was hardly smooth (Bonin and Wachtel, 2003). European banks stepped in and acquired the greater part of the banking sectors in most SEE countries. The introduction of foreign banks was perceived as a means of cutting the umbilical cord between the government and the banking system. Mitra *et al.* (2010) argue that foreign bank ownership helped hard budget constraints and attained macroeconomic stability. Table 2 gives a description of the swift transformation that took place in Bulgaria and Romania.

Table 2 Market shares in total banking assets (%) of State and foreign banks in Bulgaria and Romania

Country Year	Bulgaria			Romania		
	1996	2000	2005	1994	2000	2005
Majority state-owned banks	82.2	19.8	1.7	80.4	48.0	6.5
Majority foreign-owned banks	9.5	67.7	72.8	20.0	50.9	59.2

Source: Barisitz (2009), Bank-Austria Creditanstalt, Raiffeisen Bank, IMF.

Next, lending prevailed that soon turned into a credit boom in almost all countries in the region. Banks kept on searching aggressively for market share, primarily on the asset side. FDI poured into the region in record amounts, and economic growth continued unabated. In brief, the regional economies really took off rapidly. But the growth was, by and large, supported by capital inflows which are prone to reversals, given the increasing financial interconnectedness through trade, finance and confidence channels (Frankel, 2012). The latter suggests that the prospects of these economies might have been overstated. Åslund (2011) reports that, in the autumn of 2008 both Bulgaria and Romania were in a state of overheating, a standard credit boom-bust cycle, while suddenly world liquidity dried up and SEE faced a sudden

stop. The following figures display aptly the situation experienced in Bulgaria and Romania in terms of FDIs and credit acceleration.

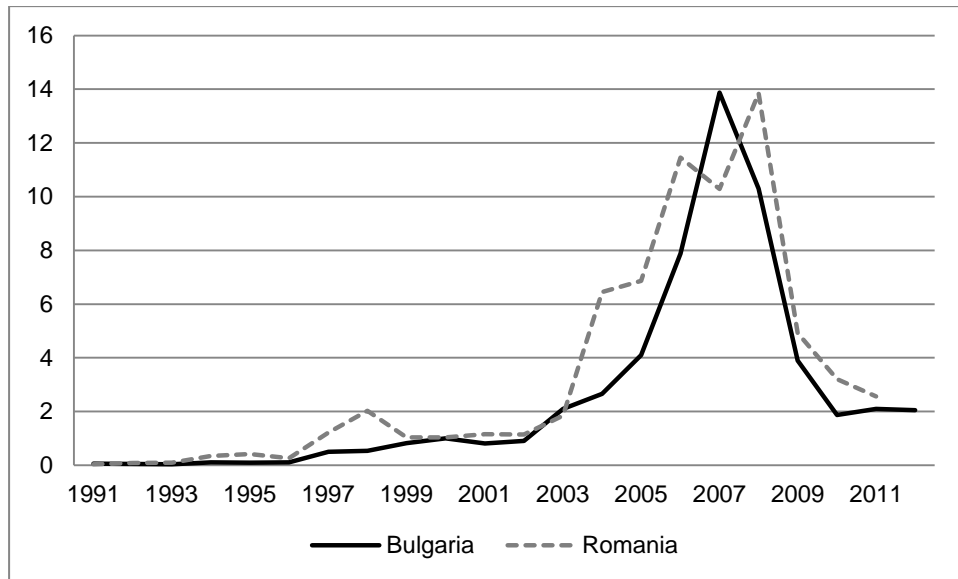


Figure 1 Foreign direct investment in Bulgaria and Romania, net inflows in billion USD, 1991-2012.

Source: IMF, International Financial Statistics

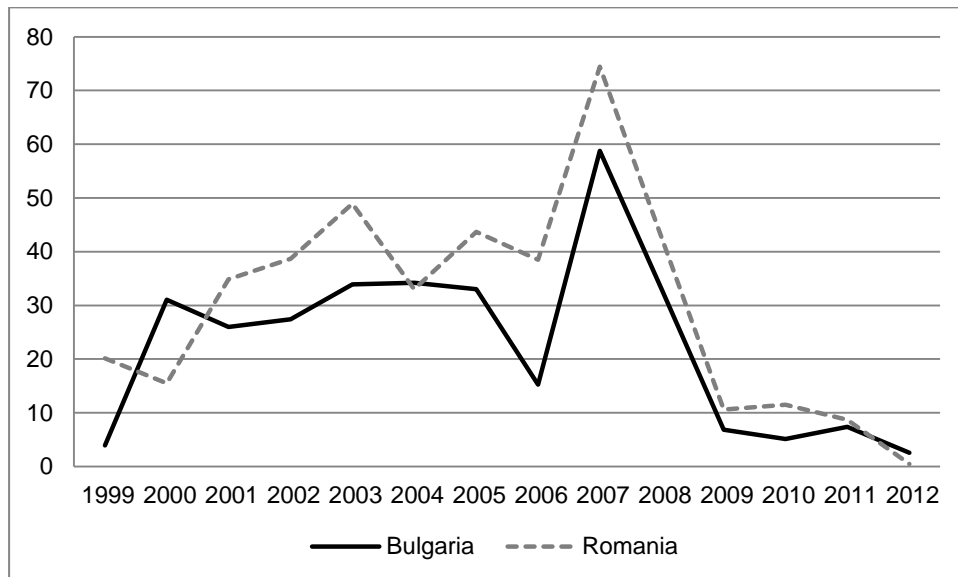


Figure 2 Credit growth (% change in bank lending to public and private sector), 1999-2012.

Source: IMF, International Financial Statistics

There is little to say in defence of the overheating and the policies that bred it, since a loose monetary policy was a global phenomenon and it was difficult for these small and open economies to defend themselves against abundant capital inflows (Åslund, 2010, 2012). Few were listening to the warning bells in the midst of the tremendous boom. Well before the global financial crisis, the IMF (2005) warned about the macroeconomic imbalances driven by the strong credit growth in Central and Eastern Europe. The key question raised was whether that was part of the ongoing process of financial liberalization or if some countries experienced a situation where credit was expanding at an unsustainable pace. A particular concern was that credit, encouraged by low interest rates, was largely being financed by bank borrowing from abroad instead of domestic deposits' accumulation. Åslund (2010) argues that the cause of the financial crisis was a long-lasting credit expansion<sup>3</sup> that eventually became excessive, especially in Bulgaria and Romania. Yet, Åslund (2010) claims that a dominant cause of the Eastern European financial crisis in 2008-9 boils down to one single factor: the exchange rate policy. Before the crisis, the 'currency board' countries, such as Bulgaria, were the most overheated economies with the highest current account deficits and the highest inflation<sup>4</sup>, and they suffered the greatest output falls. In contrast, Åslund (2010) maintains that Romania belongs to the 'successful' group of European countries that pursued inflation targeting and a floating exchange rate.

Inevitably, the banking sector in the SEE transition economies developed remarkably quickly. But banks are not immune to problems and do not always provide sufficient

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<sup>3</sup> This credit bubble was financed with capital inflows, and the larger the share of bank credit as opposed to FDI, the worse the crisis became (Åslund, 2010).

<sup>4</sup> A typical problem, especially for countries with currency boards is high inflation. Although, these countries took a hit in the midst of the global financial crisis, they had a stellar fiscal record and soon enhanced the credibility of their currency boards by standing firm (Åslund, 2010).

impetus for economic development. The market-based legislation did not lead automatically to prudential banking practices. The notion was that competition would be enhanced by easy entry and the relatively new, often undercapitalized, banks placed an added burden on an immature regulatory structure (Bonin *et al.*, 2009). Similarly, effective supervision does not follow automatically.

In retrospect, it appears that in ‘early birds’ such as Bulgaria, reforms proved less costly compared to late reformers such as Romania that ended up with a large fiscal bill for restructuring their banks (Barisitz, 2007). As a number of studies purport (e.g. Cardenas *et al.*, 2003; Cull and Martínez Pería, 2007) the entry of foreign banks in emerging economies was the result of dealing with crises. In contrast, the foreign banks’ entry into mature economies was mainly motivated by competitive forces. Thus, a key factor that contributed to the unusually high foreign ownership in CESEE banking systems is the history of the region. Equally, the main aspect of banking in the SEE was not the depth of the crises but the speed of financial restructuring (Bonin and Wachtel, 2003; Bonin *et al.*, 2009). Two interrelated phenomena explain the rapid transformation of these under-banked countries and their appeal to European banks: their desire to become members of the EU and the expectation of a quick convergence that would ultimately lead to the adoption of the euro.

The next section introduces the Bulgarian economy and the banking system, putting emphasis on these idiosyncratic elements that have shaped the landscape.

## **2.2 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 loans were a serious problem in the 1990s, 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 severe<sup>5</sup>. It made the Bulgarian banking crisis one of the most costly of all transition countries.

Following the turbulent period of 1996-1997, the Bulgarian banking system has gone through a process of stabilization which involved the privatization of most banks. Walko (2004) argues that this has led to a deepening of the financial intermediation, although the share of banking assets in terms of GDP was modest by European standards. Following major political changes, the Bulgarian banking system transformed from a one-tier to a two-tier system comprising a central bank and several commercial banks at the end of 1989. At the same time the 59 branches of the Bulgarian National Bank (BNB) were transformed into commercial banks (Barisitz, 2001). But as this large number of banks proved inefficient, the State encouraged the establishment of larger operating units through mergers. As a result the total number of banks was reduced from 81 in 1992 to 42 in 1995. It was not until 1994 that the first foreign investor – a synergy between a Greek and a Dutch bank – entered the market. As the banks' lending policy was characterized by soft budget constraints, it finally resulted in an unprecedented boom in the non-bank commercial sector that inevitably led to a surge in bad debts. To prevent large banks failures, the BNB had to intervene and provide liquidity in the market, finally losing control of the monetary policy and inflation (Barisitz, 2001; Walko, 2004). This series of events culminated in a currency and banking crisis in 1996 and a short period of hyperinflation. Several banks collapsed, thus reducing the number of banks in the system to 30 by the end of

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<sup>5</sup> Repeated rounds of recapitalization of banks resulted in a total cost to the government of 42% of the 1998 GDP.

1997. In tracing the roots of the crisis, Dobrinsky (2000) asserts that:

*“Apart from the foreign debt issue, there is nothing unique in the type of economic problems that led to the crisis. All economies in transition face the problem of restructuring state-owned firms; closing down unviable loss-making state firms is a difficult policy problem in any country in transition; keeping loss-making state firms afloat does imply fiscal costs to all governments”*(p.600).

Yet, the uniqueness of the Bulgarian case lies mainly in the combination of several serious problems that accelerated the crisis and amplified its magnitude. In fact, the Bulgarian crisis was a combination of a fiscal crisis, a banking crisis and a currency crisis. And the escalation of the crisis was indeed a textbook example of the dangers of moral hazard (Dobrinsky, 2000) manifested in the lack of commitment by the authorities to pursue hard budget constraints. Then, repeated bailouts followed that led to a complete erosion of financial discipline not only among the financially troubled firms, but throughout the whole economy. Another critical aspect of the Bulgarian crisis was the lack of coordination between monetary and fiscal policy that led to the emergence of vicious circles and widened the macroeconomic disequilibria instead of reducing them. Certainly the crisis was a lesson learned the hard way that involved the painful experience of capital flows’ short-termism and revealed the inherent degree of vulnerability of a fragile transition environment to external shocks. But under such circumstances, the crisis usually acts as a catalyst to post-crisis stabilization reforms (Dobrinsky, 2000; Iskrov, 2012). In the aftermath of the crisis, the BNB managed to tidy up the country’s banking system. Broadly, the Bulgarian policymakers reformed the laws of the Central Bank and the commercial banking sector and corrected the shortcomings of earlier regulations (Balyozov, 1999). Iskrov (2012) indicates that in 1996-97, one third of the banks went bankrupt and the confidence in the national currency vanished.



In the centre of the economic policy that followed was the currency board<sup>6</sup>. Introduced in mid-1997, the currency board imposed strict controls on money supply growth. By restricting money supply growth and eliminating the nominal depreciation of the national currency as a source of inflation, the currency board managed to limit domestic inflation. By forbidding the Central Bank to lend to the government, the board limited the amount of deficit financing of the budget that could take place. By debarring the Central Bank from refinancing commercial banks, except temporarily in the face of clear threats to stability, the board prevented ‘back-door’ deficit financing. To some extent, the ban on refinancing could deter banks from reckless lending. Finally, by imposing hard budget constraints, it also helped to restructure the real economy (EIU, 1998). Evidently, the introduction of the currency board restored macroeconomic stability (currency stability, low inflation, lower interest rates and a stable operating environment for businesses), and the banking system was rationalized quickly thereafter. Yotzov *et al.* (1998) argue that although financial stabilization was an immense success, it failed to produce the desired effect on the real sector. The state of the banking system had improved, albeit confidence in the banking system was still low. Interest rates did not encourage an increase in savings, limiting the domestic investment growth. Furthermore, the share of loans in bank assets has shrunk as most banks were reluctant to take risks associated with investment lending.

Overall, the currency board contributed to a remarkable economic recovery and to restoring some confidence in the local currency, which had plummeted during the crisis (Dobrinsky 2000). Yet, empirical evidence suggests that the sudden drop in inflation was due to a ‘confidence effect’ that created lower inflation expectations

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<sup>6</sup> The currency board pegged the Lev at a fixed exchange rate to the German Mark, and tied a selected domestic monetary aggregate to the foreign-exchange reserves of the BNB. In the light of this, the currency board made automatic many of the standard remedies prescribed by the multilaterals for emerging markets (EIU, 1998).

rather than a ‘discipline effect’ caused by a reduction in money supply growth rate (Beck *et al.*, 2003). The authors find that the budgetary restrictions imposed by the currency board had a strong effect on inflationary expectations. The relative success of the currency board critically depended on its ‘rule-based’ design but also on other supporting measures in the overall stabilization package. Given that, it is safe to conclude that the arrangement was well designed to address the pressing banking and fiscal issues, but its success can be attributed to a combination of events and actions<sup>7</sup>, of which the currency board was a crucial, but not the only, determining factor (Gulde, 1999). As IMF (2010b) suggests, the establishment of the currency board set in train rapid disinflation to single digit and helped restore confidence in the banking system. Moreover, the tight fiscal policy and debt management cut public debt in half relative to GDP and sustained a manageable current account deficit. The results of the debt management that took place can be seen in Figure 3 that presents jointly the Bulgarian and Romanian cases.

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<sup>7</sup> These were a solid legal basis and transparency, a budget stabilization programme and debt management, including the rule of not extending credit to the State, prudential regulation, independence of the BNB, ‘monitor-able’ steps to improve the operating environment, elimination of barriers to bank privatization, and broad-based parliamentary support.

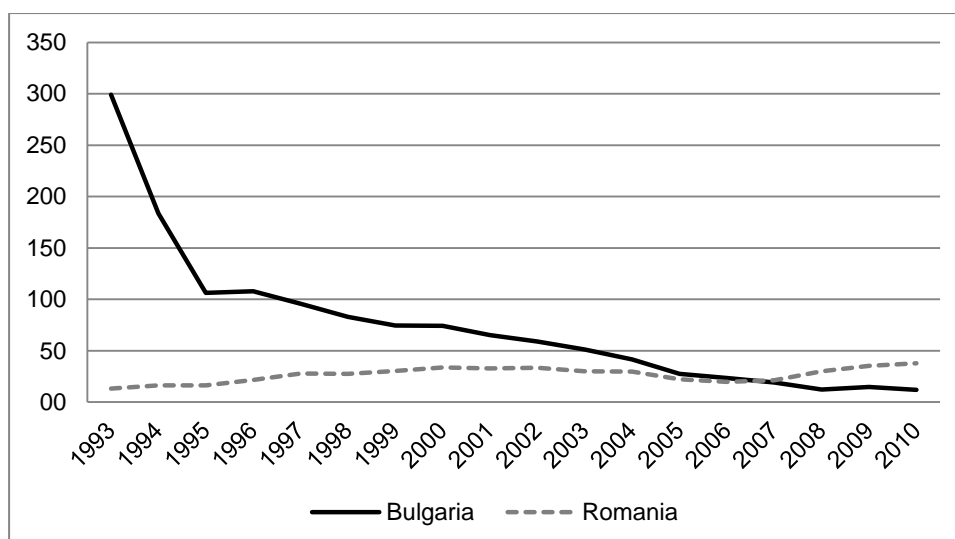


Figure 3 Total (domestic plus external) gross government debt/GDP (%) for Bulgaria and Romania, 1993-2010.

Source: Reinhart and Rogoff (2011).

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. Following the crisis of 1996-1997, the Bulgarian authorities had to build the banking sector from scratch. Gradually, the sector freed itself from political dependence, along with the privatization process and the foreign capital inflows, mainly from EU countries. But it was the stable macroeconomic policies shaped by the intense efforts of the Bulgarian authorities that enabled restoring financial stability to the country after the crisis of 1996-1997. On this macroeconomic basis, a stable, well-supervised, strongly capitalized and risk-averse banking sector was developed (IMF, 2002). Hence, the sound regulatory base was the key element that supported the process of reviving the banking sector after the first years of transition from a centrally planned to a market economy (Dobрева, 2014). The privatization of the Bulgarian banking sector began in the early 1990s following a liberal licensing regime. Despite the increasing competitiveness in the financial market, the quality of the services has not improved, compared to the time of the

centrally planned economy. In late 1996, the number of foreign banks grew substantially as the State actively encouraged the activity of foreign banks as a possible way to secure the liquidity of the system. The end result was an opaque banking sector operating with borrowed capital, which originated from unidentifiable sources (Dobrevva, 2014) with the goal of providing credit, backed by an over-estimated value of collateral, to shareholders or related parties. Thus, the banking crisis which commenced in 1996 was primarily due to a lack of sound regulation (Yonkova *et al.*, 1999). Many governments tried to ‘fix’ the sector without actually undertaking a policy reform process to lay the regulatory and institutional foundations that the banking industry needed for an independent intermediation (Andronova, 2001). Since 2001, significant progress has been made in the privatization programme for the banking sector as strong foreign banks have been attracted as strategic investors. As a result a highly capitalized and liquid banking system has been operating in an environment of fundamentally good rules and regulations on the premise of effective banking supervision exercised by an independent from political interference central bank (IMF, 2002). By the end of 2003, Walko (2004) reports that about 98% of the total banking assets were in private ownership in a financial sector dominated by banks. Benefitting from being a prospective EU country, Bulgaria has been a major recipient of capital inflows in the SEE region during 2003-2008. This has led to a surge in imports and a sharp increase in the current account deficit as domestic demand has outgrown GDP in the context of rising wages and the shift of resources towards non-tradable activities. In turn, the increase in wages has led to a significant appreciation of the real exchange rate. Therefore, the growth has relied upon both domestic and external demand. Bonin *et al.* (2008) claim that a main concern in the SEE region is that credit deepening, as measured by credit to GDP, has

come mainly in the form of rapid growth in mortgage lending and other forms of consumer credit. The accelerating lending expansion in the euphoria times led to a real estate and construction boom as the findings of numerous empirical studies on financial crises purport (Kaminsky and Reinhart, 1999; Demirgüç-Kunt and Detragiache, 1998). Financial liberalization is manifested in rapid credit growth and the burst of asset price bubbles, which are those crucial factors that propagate the boom-bust cycles. Equally, Duenwald *et al.* (2005) argue that the lending boom in Bulgaria has been driven by macroeconomic stabilization and capital inflows but, in the end, it contributed vitally to widening macroeconomic imbalances.

Notably the steep credit expansion in the aftermath of the Bulgarian crisis up to the eruption of the global financial one, presents remarkable fluctuation which is more evident in the period 2005-2006, reflecting the announcement of stricter lending controls by BNB in 2005. Opposed to external voices, the BNB decided to introduce various policy measures<sup>8</sup> in an attempt to limit bank lending and mitigate the boom-bust cycle. The growth rate of credit to the non-governmental sector, which had been a matter of paramount concern to the BNB, slowed down by mid 2006. But that was temporary, as credit started to pick up again in 2007 as a result of the BNB's decision to relax credit controls in late 2006 as part of Bulgaria's EU preparations. In co-operation with the IMF, the Central Bank established a 20% year-on-year target level for credit growth that was quickly surpassed in 2007-2008. In retrospect, IMF (2010b) considered these measures insufficient as banks, keen to fight for their market share were able to freely borrow from abroad. Inevitably, the top priority of the newly privatized banks was to boost profitability and market share, shifting the composition of their asset base towards loans mainly directed to the non-government sector.

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<sup>8</sup> For instance, BNB introduced credit ceilings whereby banks were allowed to expand credit by up to 6% per quarter. In failing to comply, the banks faced a penalty in the form of marginal reserve requirements.

Growth of real credit has been among the strongest in the SEE region, and this aggressive stance has been actively encouraged by banks' foreign parents in both Bulgaria and Romania. The credit boom was suddenly interrupted in 2008 as the domestic operating environment had been negatively affected by the global financial crisis. Inflows of FDI fell and banks started taking a more cautious lending approach. The crisis found the sector, comprising of 30 banks, to be dominated by subsidiaries of large foreign banks mainly engaged in traditional commercial banking. These major foreign banks are from other EU countries, most notably Greece, Italy and Austria. The potentially adverse impact of the Greek crisis on the Bulgarian banking system soon became a major concern for policymakers as some of the largest banks<sup>9</sup> as well as other financial institutions in Bulgaria are owned by Greek banks. Some of these banks expanded their operations in the Bulgarian territory aggressively in the years prior to the global crisis and have relied little on domestic deposits to fund their activity, as witnessed by their high loan-to-deposit ratios (IMF, 2010b). Thus, the stability of the Bulgarian financial sector in the face of a Greek collapse has been called into question. Table 3 displays the structural financial indicators and Table 4 the financial soundness indicators<sup>10</sup> (FSIs) for the Bulgarian banking system.

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<sup>9</sup>As of the end of 2009, five Greek Banks together controlled 30% of the sector's assets (BNB, 2009; IMF, 2010b).

<sup>10</sup> FSIs are indicators of the current financial health and soundness of the entire sector of financial institutions in a country, and of the corporate and household sectors that are the financial institutions' clients. These indicators represent an innovative and new field of macroeconomic data (IMF, 2006).

Table 3 Structural financial indicators of Bulgaria, 2008-2012

	2008	2009	2010	2011	2012
Number of EU subsidiaries	13	13	13	13	13
Herfindahl index, total assets (%)	0.0834	0.0846	0.0789	0.0766	0.0738
Shares of the 5 largest credit institutions in total assets (%)	57.3	58.3	55.2	52.6	50.4

Source: ECB.

Table 4 Financial soundness indicators of Bulgaria

	2008	2009	2010	2011	2012
Regulatory Capital to risk-weighted assets	14.9	17.0	17.4	17.6	16.6
Capital to Assets	11.4	10.8	10.5	10.8	10.1
NPLs to Total Gross Loans	2.4	6.4	11.9	15.0	16.6
Loans to General Government to Total Gross Loans	0.3	0.4	0.9	1.1	0.5
Loans to non-financial Corporations to Total Gross Loans	60.4	59.0	58.9	60.5	59.8
Return on Assets	2.1	1.1	0.8	0.6	0.7
Return on Equity	19.5	9.8	7.8	5.7	6.3
Liquid Assets to Total Assets	19.0	18.9	20.9	22.0	22.4
Liquid Assets to Short-Term Liabilities	26.4	26.6	30.0	29.1	30.0
Customer Deposits to Total Loans	83.9	83.0	87.8	95.4	100.2

Source: IMF Statistics.

The credit slump experienced in 2008-2009 was as sharp as the surge during the credit boom. The key risk encountered by the Bulgarian banks in the aftermath of the crisis was the weakening of asset quality. The recession caused the NPL ratio to reach 11.9% by December 2010. The challenging situation is depicted in Figure 4.

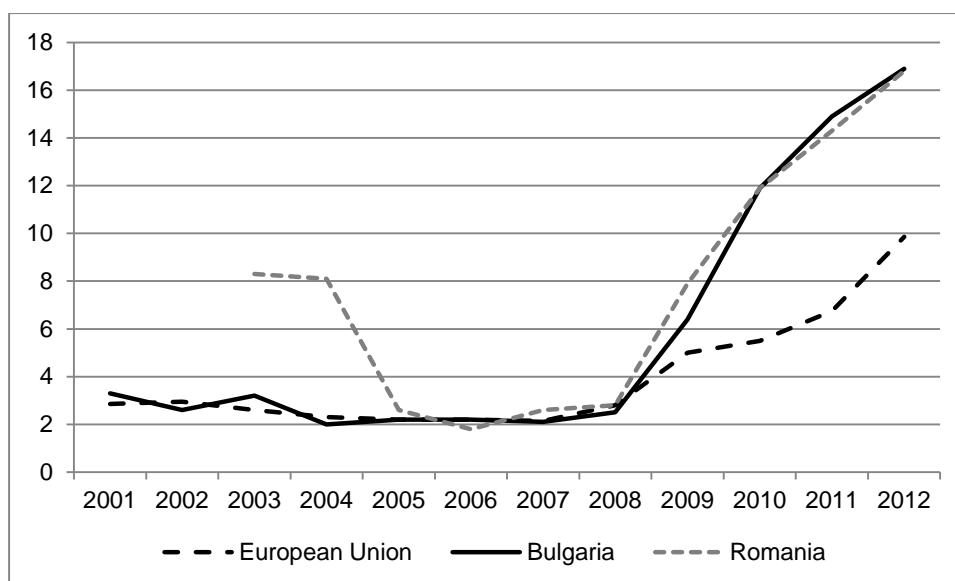


Figure 4 Bank NPLs to total gross loans (%), for Bulgaria, Romania and the EU, 2001-2012.

Source: IMF, International Financial Statistics.

However, Bulgaria's banking system has built in various buffers against external shocks. Following an assessment<sup>11</sup> of the financial sector, the IMF (2010b) has indicated that the Bulgarian authorities still have room to relax their conservative regulatory standards on bank capital in case of need, since the minimum regulatory capital is set at 12% in Bulgaria, compared to 8% at the EU level. Furthermore, the BNB has several instruments in hand to implement further a counter-cyclical macro-prudential policy<sup>12</sup> within the confines of EU (IMF, 2010b). As Table 4 shows, the Bulgarian banking system enjoys a relatively comfortable liquidity profile, even judged by EU standards. Furthermore, banks are predominantly deposit funded (Festić *et al.*, 2011). As such, banks finance their lending activity through deposits which

<sup>11</sup>It is noteworthy that the Bulgarian authorities do not make public the results of the periodic stress tests performed on an individual bank or system wide basis. The Governor of the BNB, Mr. Iskrov, confirmed this during the presentation of the preliminary results of this research in a conference organized by VUZF University on the 27<sup>th</sup> of May 2011 in Sofia, Bulgaria.

<sup>12</sup> The macro-prudential policies aim to reduce the systemic risk arising from the disruption of the provision of financial services that can have serious consequences for the real economy. Hence, the ultimate objective is to minimize the losses associated with banking crises.



makes them relatively independent of any turbulence in the international wholesale markets. Equally, the sharper increase in deposits compared to lending caused banks' liquidity to increase in the period 2008-2012. With credit demand subdued, banks opted to use the excess liquidity afforded by the increase in deposits to repay foreign debt. Bulgarian banks reduced their dependence on wholesale funding but at the expense of reduced profits, which was reflected in the performance metrics (return on equity - return on assets) that had been on a declining trend since 2008. Reduced dependence on wholesale funding was also accompanied by increasing capital buffers. The Bulgarian banks remained relatively well capitalized with an aggregate capital adequacy ratio<sup>13</sup> in excess of 17% during 2010-2012. Equally, the equity to assets ratio remained above 10% in this period. Despite the relative stability of the Bulgarian banking system, the significant risks arising from international developments (Valev and Carlson, 2004) or spillover effects of the Greek crisis cannot be overlooked. For instance, in terms of trade linkages, Greece is the fourth largest destination for Bulgarian exports, and Greek non-bank companies are among the biggest foreign investors in Bulgaria. Despite the system's deleveraging, Greek banks had still sizeable exposures in Bulgaria. Tightened capital and liquidity by the European Banking Authority could well prompt parent banks to reduce funding to their subsidiaries in Bulgaria which in turn could destabilize the system. Table 5 provides a snapshot of some economic indicators for Bulgaria.

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<sup>13</sup> Equity ratios relative to asset risk are the key attributes of interest in prudential regulation. Miles *et al.* (2011) estimate that the optimal bank equity capital should be around 20% of risk-weighted assets, a level that is much higher than Basel III requirements. Higher capital requirements create benefits by reducing the probability of systemic banking crises, as shown by Reinhart and Rogoff (2009).

Table 5 Key economic indicators of Bulgaria, 2001-2010.

Indicator/year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Real GDP (% change pa)	4.2	4.7	5.5	6.7	6.4	6.5	6.4	6.2	-5.5	0.4
Nominal GDP (billion US Dollars)	13.9	16.0	20.7	25.2	28.8	33.4	42.2	52.1	48.6	47.9
Private consumption (% of GDP)	79.3	78.6	79.0	78.5	77.6	75.8	76.6	74.0	70.6	70.8
Government consumption (% of GDP)	9.9	9.8	10.2	10.2	10.0	9.7	9.0	9.0	8.8	8.2
Gross fixed investment (% of GDP)	18.3	18.3	19.0	20.4	25.7	27.6	28.7	33.6	28.9	22.8
Industrial production (% change pa)	2.5	4.7	12.7	12.6	7.2	6.1	9.9	0.1	-18.0	1.9
Real effective exchange rate	128.1	133.9	138.9	145.9	145.9	152.3	161.1	176.1	183.9	176.6
Budget balance (% of GDP)	-0.6	-0.6	0.0	1.6	2.9	3.4	3.3	2.9	-0.9	-4.0
Public debt (% of GDP)	66.0	52.4	44.4	37.0	27.5	21.6	17.2	13.7	14.6	16.3
Domestic credit growth (%)	26.0	27.4	33.9	34.2	33.0	15.2	58.8	33.0	6.8	5.1
M2 (% change pa)	25.8	11.7	18.8	23.3	24.3	26.9	31.3	8.7	4.3	6.4
Consumer prices (% change pa)	7.4	5.8	2.3	6.1	5.0	7.3	8.4	12.3	2.8	2.4
Population	7.9	7.8	7.8	7.7	7.7	7.6	7.6	7.5	7.4	7.4
Unemployment rate (%)	17.5	17.4	14.3	12.7	11.5	9.6	7.7	6.3	7.6	9.5
Net direct investment flows (billion US Dollars)	0.8	0.9	2.1	2.9	4.0	7.6	12.9	9.2	3.5	2.1
Current-account balance (% of GDP)	-5.8	-2.0	-4.9	-6.6	-11.6	-17.0	-20.7	-22.9	-8.8	-1.5
Inward FDI flow/GDP (%)	5.9	5.6	10.1	10.5	15.0	23.3	31.3	19.2	7.1	4.9
Inward FDI stock/GDP (%)	21.6	23.1	27.5	36.5	50.7	65.3	83.7	89.0	101.5	107.7
Total foreign debt	10.5	11.5	13.4	15.7	15.7	21.0	33.0	48.6	53.5	48.1
Total external debt/GDP	75.6	71.6	64.4	62.1	54.4	62.9	78.2	93.3	110.2	100.3

Sources: World Bank, IMF, BNB, National Statistical Institute, EIU.

Bulgaria, an export-oriented country that joined the EU in 2007, presents a per capita wealth well below 50% of the euro area average (Moody's, 2012). Broadly, the country's fundamentals provide evidence of financial healthiness coupled with one of the lowest debt-to-GDP ratios in the eurozone. Past budget surpluses allowed Bulgaria to build up fiscal reserves and retain the debt at a reasonable level during the booming years. In general, these metrics are expected to contribute to a moderate susceptibility to event risk. Among the key strengths of Bulgaria is a disciplined fiscal policy, a relatively low government debt and a track record of maintaining reserves. On the other hand, the country presents a high private sector external debt and an appreciating real effective exchange rate that could raise concerns on the competitiveness of the economy. The rapid increase in the leverage of the Bulgarian economy and the overheating in the run up to the global financial crisis has led to a sharp contraction in economic growth in 2009 and deceleration compared to recent past (2004-2008).

A prudent fiscal policy and a sharp improvement in the current account balance in 2010 have helped Bulgaria to contain financial risks despite the uncertain global outlook in the aftermath of the global financial crisis. Following the booming period of 2002-2008 with a real GDP growth rate of around 6.1% on average, the output growth contracted severely in 2009 and recovered in 2010, albeit at a modest pace. The current account hit a deficit of 22.9% in terms of GDP in 2008 but stabilized below 3% thereafter as growth in exports outpaced the growth in imports. This adjustment in the current account has occurred with the maintenance of the Lev's fixed peg against the euro. With the fiscal deficit below 3% of GDP and government debt at less than 20% of GDP, sovereign financial risk was minimized. Notably, the Bulgarian fiscal policy was underpinned by a constitutional change limiting fiscal

deficits at 2% of GDP and government spending at 40% of GDP. Although GDP growth slipped to negative territory in 2008 (-5.5%), it rebounded a year later driven by increasing exports, but at a much slower pace than before the crisis. The slow output recovery as well as structural rigidities had hit the Bulgarian labour market hard, especially for those workers who lost their jobs once construction activity collapsed. Historically, the unemployment rate in Bulgaria was relatively high. In the period 2001-2008, unemployment declined from over 17.5% in 2001 to 6.3% in 2008. Similar to other countries in the SEE region, Bulgaria experienced labour shortages as a result of strong economic growth, emigration, and an ageing population. At the same time, inflation kept on rising in the period 2003-2008. Bulgaria experienced a significant domestic demand-led boom between 2005 and 2008. Large capital inflows into the banking system and real estate property fuelled an investment binge that drove the current account deficit to almost 23% of GDP in 2008. At the outset of the global financial crisis, Bulgaria had a ballooning current account deficit. Inflation peaked at 12.3% in 2008, signifying that the economy was overheating. Inflationary pressures went out of control in 2008 because the currency peg prevented BNB from raising interest rates to combat them as the country was going through a debt-financed consumer boom and commodity prices were rising relentlessly. The strong GDP growth rate and significant interest from foreign investors have propelled the residential and commercial property markets upwards. The decline in real GDP in 2008 was accompanied by a struggling construction sector, subdued industrial output, and rising unemployment. In the aftermath of the global financial crisis, FDI trends in the world have been undergoing a structural shift in favour of emerging markets. However, this trend bypassed SEE. In 2009, the region suffered the sharpest decline in FDI inflows of any emerging-market region. Inevitably, the prospects from a weak

growth have hit investors' confidence and this has been the main reason for the decline in FDI. Growth has weakened as the eurozone, the region's most important market and source of investment, has sunk into recession dragging along several countries in the SEE region.

Although the Lev is fixed against the euro under the currency board arrangement, movements in the euro - US dollar exchange rate and the weakening of currencies of most of Bulgaria's trading partners have caused Lev to appreciate in real effective terms since 2008. Standard and Poor's (2010) states that Bulgaria entered the global financial crisis with all the symptoms of an overheating economy. The rapid increase in the Bulgarian economy's leverage had led to a sharp contraction in economic growth in 2009 and deceleration compared to the recent past (2004-2008). The GDP growth was financed through FDI, two-thirds of which was directed into the sectors of real estate, construction and financial services. Overall, the banks' exposure to the construction and real estate sector, including mortgages, accounted for about 30% of total loans. Then, banks reduced their leverage and the ratio of private sector credit to GDP shrank to 72% at the end of 2012 from 75.9% in 2009. Credit to the private sector has been virtually flat since 2008. Overall the Bulgarian economy went through a 'correction' phase as the rapid increase in leverage and overheating triggered a deceleration in economic activity in 2009. Nevertheless, in the wake of high external imbalances, Bulgaria benefited from political consensus favouring macroeconomic stability and supporting the currency board.

Åslund (2011) indicates that Bulgaria weathered the global financial crisis relatively well. He notes that in the midst of the crisis in SEE, Bulgaria opposed the IMF orthodoxy of devaluing. In retrospect, it appears that the currency peg, supported by institutional commitment, survived to some extent the debt crisis on the periphery of

the euro area. Without any particular support, the country seized ownership of its stabilization programme and aimed to carry out major adjustments (Åslund, 2012). Because of the currency peg, the BNB has to maintain interest rates in line with the euro area's rates and has limited discretion in adjusting monetary conditions. Although the BNB has limited wherewithal to combat inflation with monetary policy tightening, it still needs to revive an economy that has remained in recession since 2009.

In the light of the tightness in international financial markets, in December 2008 the BNB reduced the minimum reserve requirements for commercial banks in order to boost liquidity in the domestic market. In retrospect, it seems that those measures were not sufficient to revive banks' lending to the economy. Rating agencies and the IMF consider the BNB as competent to supervise banks. The BNB has a record of playing a proactive role<sup>14</sup> in bank surveillance, identifying and addressing problems before a bank's solvency is endangered. Contrary to other SEE countries, the Bulgarian government has not adopted a large-scale action plan to support the banking system. Bulgaria has remained one of the few EU members, where not a single bank needed to be rescued with taxpayers' money in the period 2008-2010. The government has not provided support to any bank. Instead authorities urged banks to retain their earnings for the year 2008 as a buffer against the challenging market conditions. Policymakers have suggested that Bulgarian banks have not been a source of risk to the real economy. On the contrary, according to the BNB, banks remained the pillars of the macroeconomic and financial stability in the country. Several voices indicate that the Bulgarian regulatory framework is well-established with a good level of supervision exercised by the BNB which retained its independence from political

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<sup>14</sup> Unanimously, rating agencies underscore that the BNB has prudent regulatory standards in place that compare well with those in more developed markets and is continuously implementing changes in line with international best practices resulting in an improving regulatory regime.

influence or outside parties in exercising its policy-making to ensure banking stability (IMF, 2010b; Moody's, 2012; Iskrov, 2012). In this respect, the BNB played a critical role in maintaining the confidence of customers in the banking system and preventing a catastrophic deposit outflow. Hence, it appears that BNB's effective supervision during the recent boom-bust cycle, is rooted back in history. The lesson from the financial and banking crisis in the mid-1990s was well-learned. Nevertheless, the weak economic activity along with the slowdown in FDI in the aftermath of the global financial crisis resulted in a slowdown in credit. To this end, Bulgaria's currency board constrained BNB's ability to conduct monetary policy and provide support in stimulating the economy. BNB's role was to safeguard the stability of the system as the law limited its ability in extending liquidity support to solvent banks (Moody's, 2014). Provisions set by the currency board arrangement limited monetary policy flexibility. Still, there are legitimate concerns about the potential destabilizing impact of the crisis in Greece on the Bulgarian banking sector, given that Greek banks account for almost 30% of total banking assets in Bulgaria and 40% of loans (EIU, 2011). On top of that, credit risk in the banking sector was spiralling as a result of relaxed lending and underwriting standards in the pre-crisis period along with the high concentration in real estate construction (Standard and Poor's, 2014).

The next section provides an overview of the Romanian economy and the banking sector.

### **2.3 The Romanian economy and banking system**

It has long been known that when an economy is in distress, the neighbouring countries might be affected, especially if there are strong financial or trade links in place or they are in vulnerable macroeconomic situation. Being no exception to the

rule that prevails in the SEE region, the Romanian economy has also evolved from a history of defaults on sovereign debt, high inflationary periods and banking crises. During the Great Depression, many domestic and foreign banks in Romania collapsed or experienced heavy runs (Reinhart and Rogoff, 2009). The historical database of crises indicates that in 1933 the redemption for domestic and foreign debt was suspended. Later, in the Post-World War II period, the country experienced a debt crisis during the 1980s, a banking crisis at the beginning of the 1990s, and a currency one by the mid 1990s (Laeven and Valencia, 2008).

Barisitz (2005) indicates that until 1998 the Romanian banking system was overwhelmingly state-owned. Credit institutions granted loans to a largely un-restructured real economy dominated by inefficient state-owned factories, subject to ‘quasi-automatic’ refinancing by the National Bank of Romania (NBR), which conducted an accommodative monetary policy. Thus, it is not surprising that the bad loans problem of the region was also pertinent in Romania due to inherited legacies but also to continuing lending practices (Bonin *et al.*, 2008). In Romania, the dominant state-owned banks accumulated large portfolios of defaulted loans and required massive capital injections from the government. Furthermore, severe macroeconomic shocks led to banking crises and economic growth resumed only after these crises were resolved.

By the mid-1990s, a reform-oriented government initiated macroeconomic stabilization policies and decided to discontinue the refinancing of bad loans by the NBR. In 1998, legal reforms were carried out, including the new Central Bank law that strengthened the independence of the NBR and its role in banking supervision (Barisitz, 2005). However, the Russian crisis of 1998 aggravated the weak economic environment and contributed to a number of bank runs that continued up to the year



2000. In hindsight, the year 1999 proved to be sort of structural turning point for the Romanian economy as the authorities initiated the first privatizations of major Romanian banks. Given the size of the country, the Romanian financial sector promised an impressive growth potential for foreign strategic investors.

In 2001, the Romanian authorities signed a stand-by agreement with the IMF and the large scale privatization projects continued up to 2003, albeit at a relatively slow pace (Barisitz, 2005), when they then slowed down. Figures 5 and 6 depict the situation in the Romanian banking system as of mid-2010.

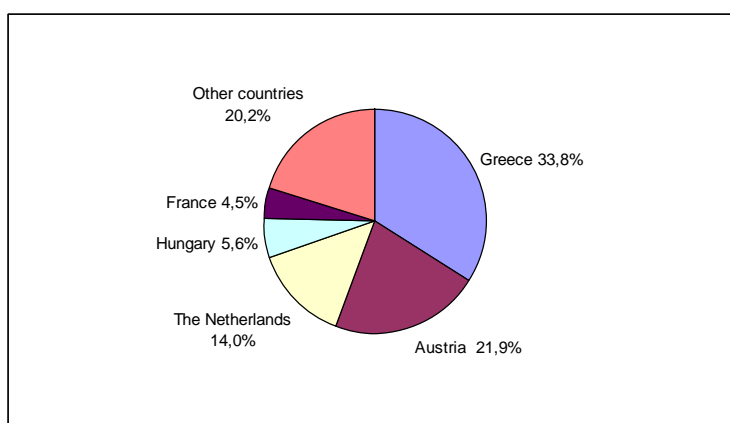


Figure 5 Structure of the share capital in the Romanian banking system by country of origin.

Source: NBR (2011).

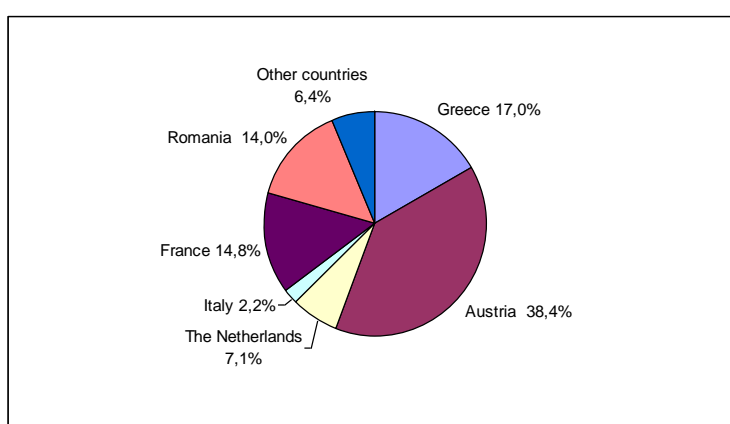


Figure 6 Market shares of credit institutions in the Romanian banking system by country of origin.

Source: NBR (2011).

In the run-up to the global financial crisis, Romania's financial sector went through a period of rapid growth, reflected in an increase in the measured financial depth. In the excitement of joining the EU in 2007, Romanians enjoyed a three-year booming period that came to a sudden stop when the crisis burst. Similarly to many other countries in the region, the rapid growth of domestic credit was fuelled by ample funding provided by parents of foreign-owned banks to their subsidiaries in Romania. The speed of lending expansion raised concerns about whether the country was experiencing a credit boom, given the structural weaknesses of the economy (NBR, 2003). Table 6 presents a set of structural financial indicators and Table 7 some FSIs for the Romanian banking system.

Table 6 Structural financial indicators of Romania, 2008-2012

	2008	2009	2010	2011	2012
Number of EU subsidiaries	23	22	22	22	21
Herfindahl index, total assets (%)	0.0922	0.0857	0.0871	0.0878	0.0852
Shares of the 5 largest credit institutions, total assets (%)	54.0	52.4	52.7	54.6	54.7

Source: ECB.

Table 7 Financial soundness indicators of Romania

	2008	2009	2010	2011	2012
Regulatory Capital to risk-weighted assets	13.8	14.7	15.0	14.9	14.9
Capital to Assets	9.0	8.6	8.9	8.1	8.0
NPLs to Total Gross Loans	2.7	7.9	11.9	14.3	18.2
Loans to General Government to Total Gross Loans	2.2	3.9	3.9	3.6	3.3
Loans non-financial Corporations to Total Gross Loans	32.7	33.3	35.9	38.4	39.8

Return on Assets	1.6	0.2	-0.2	-0.2	-0.6
Return on Equity	17.0	2.9	-1.7	-2.6	-5.9
Liquid Assets to Total Assets	47.1	57.5	60.0	58.7	57.6
Liquid Assets to Short-Term Liabilities	230.5	132.0	142.2	139.0	147.7
Customer Deposits to Total Loans	81.9	88.7	84.8	84.0	87.3
Residential Real Estate Loans to Total Loans	10.6	18.1	19.9	20.5	22.1
Commercial Real Estate Loans to Total Loans	n.a	24.6	26.8	27.6	28.2

Source: IMF Statistics.

In contrast to Bulgaria, the Romanian banking system reported losses in the period 2010-2012. On a system-wide basis, the Romanian credit risk, as measured by the ratio of NPLs to total gross loans, was historically at a higher level compared with the Bulgarian one. Overall, the Romanian banks appear more liquid<sup>15</sup> but less solvent, in terms of capital adequacy, than the Bulgarian ones.

Tables 6 and 7, justify a closer look at the sequence of events that took place in Romania as the crisis was unfolding in the region. Table 8 displays a comparison between the Bulgarian and Romanian banking systems in the middle of the SEE crisis in 2009-2010; it also presents the claims of the Greek banks in each system.

Table 8 Net bank external debt in Bulgaria and Romania and the claims of Greek banks.

Country	Net bank external debt (% of GDP)	Greek banks' claims in the banking system (in billion US Dollars)
Bulgaria	13	14
Romania	20	21

Source: FitchRatings, BIS.

<sup>15</sup> Two liquidity ratios support the argument. On the other hand, the ratio of customer deposits to total loans for the Bulgarian banks improves considerably at the outset of the global financial crisis. In the case of Romania, the trend in this ratio indicates a funding gap.

Aligned with the FSIs of each system, it appears that the Romanian banks were more leveraged than the Bulgarian ones while the Greek banks' claims were notably higher in Romania. Two diverging views describe the situation of the Romanian banking system in the period around the wake of the global financial crisis (IMF, 2010a; World Bank, 2012). On the one hand, IMF (2010a) and Moody's (2011a) suggest that the Romanian banking system, which dominates the country's financial sector, entered the crisis with relatively high capitalization and liquidity ratios. On the other hand, in a report issued later, World Bank (2012) indicates that the soundness of Romanian banks was far from perfect in the run-up to the crisis. Given that the reported ratio of NPLs before the crisis was rather low, it seems that it was mostly a reflection of the high credit growth that masked, to some extent, the underlying weaknesses in the system. Towards the end of 2013, NPLs were still increasing and reached 21.9% of gross loans. Liquidity in Romania's banking system has benefited from high reserve requirements in the past that were relaxed during 2009 to help the banks face the global deleveraging in the aftermath of the crisis (Moody's, 2011a). The system-wide deposit to loan ratio was relatively low during 2008-2010 compared to Bulgaria, pointing to the need of Romanian banks to strengthen their deposit bases and reduce their dependence on wholesale funding. Certainly, the case of Romania is interesting as it is a country whose foreign-bank dominated financial sector seemed relatively sound based on conventional ratios but was subjected to rather large shocks during the crisis (World Bank, 2012). In the aftermath, the deterioration in market confidence that put a downward pressure on the exchange rate, along with the sharp increase in NPLs, also put a strain on banks' capital positions. This sharp increase explains why the financial sector assessment performed by IMF (2010a) calls for the strengthening of capital positions of 'some' banks and suggests that parents of

foreign-owned banks should maintain those lines of credit to their subsidiaries and corporate borrowers in Romania. IMF (2010a) states that:

*“In view of the vulnerability of the economy and financial system to external financial developments, measures to strengthen the resilience of banks and to maintain access to external finance should be given a high priority”*(p.4).

In April 2008, two rating agencies issued reports warning of the impact of the US sub-prime crisis on the financial stability of Romania. At about the same time many households began to experience the impact of the increase in the NBR’s monetary policy rate (EIU, 2008). Standard and Poor’s (2009) rate Romania as the third most vulnerable emerging-market economy in the world, stressing the country’s vulnerability to any deterioration in the international financial climate. In a report issued in February 2008, i.e. prior to the explosion of the Greek debt crisis, the governor of the Central Bank of Greece pointed out that the credit risk arising from the Greek banks’ activities in the SEE region constituted the most important risk for the Greek banking system (Kathimerini, 2008). A year later, allegations in the Romanian media report that parent banks had withdrawn funds from the Romanian market to consolidate their domestic positions.

It has been argued that the presence of foreign banks in Romania has increased the efficiency of financial intermediation and the availability of credit to the real economy. Yet, there are signs that financial stress originating in euro area-based parent banks may have been transmitted to Romania. Empirical evidence by de Haas *et al.* (2012) from 1,294 banks in 30 Eastern European countries over the period 1999-2009 shows that foreign bank credit grew at a faster pace than domestic (public and private) banks before the crisis, and sharply decelerated in 2008 following a pro-cyclical manner. Morosan (2011) claims that the Romanian economic crisis in 2008-2010 was manifested in all economic activities, while the banking sector was one of

the most affected economic sectors in Romania. He maintains that Romanian banks refrained from taking drastic measures in an attempt to conceal any signal of risk in the market. In discussing the non-availability of bank-level data, Morosan (2011) states that:

*“Not even available data from the banking system can show us the true extent of the crisis faced by the banks because they are not transparent. Non-performing loans is a taboo subject for many bankers. Of the 42 credit institutions present in our country outstanding credit data can be found at only a quarter of institutions”*(p.254).

On the same wavelength, the lending surveys of the NBR indicate that the risk profile of almost all industries rose with the riskiest sectors being construction and real estate, reflecting the adverse impact of the global financial crisis and the economic downturn on the backbone of the Romanian economy. Evidently, the presence of foreign banks, particularly the Greek ones, was mostly seen as a liability rather than an asset (Lazea, 2009, Moody’s 2011a). As the twin fiscal and public crises unfolded in Greece, neighbouring countries in the SEE tried to determine how their banking systems would be affected by the developments in Athens, i.e. what would be the repercussions of the Greek crisis for Bulgaria and Romania?

The outlook for the Romanian banking system was negative, driven mainly by the tough economic conditions in the country following the severe recession in 2009. The operating environment in Romania was characterized by a contracting economy, a widened fiscal deficit and rising unemployment. In particular, the country’s macroeconomy appeared to be a source of concern for policymakers especially in the light of the sharp increase in NPLs. Furthermore the high proportion of foreign currency lending, mainly to households, elevated the banks’ credit risk profile while

the stressed liquidity, as reflected in the Greek banks' loan-to-deposit ratios<sup>16</sup>, led to a further tightening on the supply side of credit. A support package by IMF and EU was put in place in 2009 to alleviate the macroeconomic pressure as well as the solvency and liquidity of the Romanian banking system.

The global financial turmoil and the ensuing Greek debt crisis exposed the Romanian banking system to material risks. The significant presence of Greek banks mounted these risks further as their Romanian subsidiaries formed a critical maze in the respective banking system. As of the end of 2013, the Romanian banking sector was still considered to be exposed to potential contagion from the crisis in the euro area periphery (Fitch, 2014a).

Obviously, it is outside the remit of this research to find the culprits of the precarious economic situation in Romania among the players in the banking market, the bankers, the politicians or the regulators. However, as Morosan (2011) asserts, they were all synchronized to be optimistic before the crisis and pessimistic later. It seems that instead of hitting the brakes in the booming years, Romania stamped on the accelerator, ending up with a relatively high budget deficit and indebted firms and households. Table 9 displays some key economic Romanian indicators that provide insight on where the linkages between the Romanian credit risk and the macroeconomy should be sought.

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<sup>16</sup> Based on published financial statements, the loan-to-deposit ratio for the Greek banks in Romania was about 210% in Romania (198% in Bulgaria) as of mid-2009, at a relatively high level reflecting also that they were highly leveraged.

Table 9 Key economic indicators of Romania, 2001-2010.

Indicator / year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Real GDP (% change pa)	5.6	5.0	5.3	8.5	4.1	7.9	6.3	7.4	-6.6	-1.2
Nominal GDP (billion US Dollars)	40.6	46.0	59.5	75.8	99.2	122.7	170.6	204.3	164.3	164.8
Private consumption (% of GDP)	78.2	76.9	75.7	77.4	78.5	77.9	75.3	74.0	71.9	73.0
Government consumption (% of GDP)	7.3	6.7	9.8	7.9	8.3	7.7	7.6	7.7	8.8	7.1
Gross fixed investment (% of GDP)	20.5	21.3	21.5	21.8	23.7	25.6	30.2	31.9	24.4	24.7
Industrial production (% change pa)	3.9	-0.4	-0.8	2.7	-3.2	9.3	10.3	2.7	-5.5	5.5
Real effective exchange rate	125.6	126.7	124.9	127.9	150.4	160.1	174.2	165.8	153.6	156.8
Budget balance (% of GDP)	-3.2	-2.6	-2.2	-1.2	-1.2	-2.2	-3.1	-4.8	-7.3	-6.4
Public debt (% of GDP)	28.0	28.0	26.7	24.7	16.1	16.4	19.2	20.8	26.3	28.4
Domestic credit growth (%)	34.9	38.7	49.0	33.0	43.7	38.5	74.5	42.6	10.6	11.5
M2 (% change pa)	46.2	38.2	23.3	40.1	33.8	27.9	34.0	17.3	8.3	6.1
Consumer prices (% change pa)	34.5	22.5	15.3	11.9	9.0	6.6	4.8	7.8	5.6	6.1
Population	22.4	21.8	21.7	21.7	21.6	21.6	21.5	21.5	21.5	21.5
Unemployment rate (%)	8.8	8.4	7.4	6.3	5.9	5.2	4.1	4.4	7.8	7.0
Net direct investment flows (US Dollars)	1.2	1.1	1.8	6.4	6.5	11.0	9.6	13.6	4.9	3.0
Current-account balance (% of GDP)	-5.5	-3.3	-5.6	-8.4	-8.7	-10.4	-13.5	-11.6	-4.2	-4.4
Inward FDI flow/GDP (%)	2.9	2.5	3.1	8.6	6.5	9.3	5.8	6.8	2.9	1.8
Inward FDI stock/GDP (%)	20.6	17.0	20.5	27.1	26.6	37.5	37.4	34.1	44.5	43.3
Total foreign debt (billion US Dollars)	12.7	16.8	22.7	29.7	38.9	54.0	84.4	102.5	120.1	124.4
Total debt/GDP	31.4	36.5	38.2	39.2	39.2	44.0	49.5	50.2	73.1	75.5

Sources: World Bank, IMF, NBR, National Institute of Statistics, EIU.



All rating agencies seem to agree that Romania's economy is among both the least prosperous in the EU and the most vulnerable one to external shocks. Having among the lowest per capita income in the EU, Romania kept its labour costs low compared to its trading partners, thus facilitating the economy's productivity and an increasing GDP prior to 2009. During the last decade, Romania saw its exports rise by about 19% and investments increase from 18% of GDP to 29%. Arguably, Romania benefited from its integration into the EU as approximately 55% of its exports are sent to euro area countries.

Growth in GDP averaged about 5% in the decade leading up to the global financial crisis. While the return to GDP growth in the early 2000s, after falling by 12.1% in 1997-99, was partly driven by exports, the growth of aggregate demand in 2004-07 was fuelled by the growth of investment and household consumption, which outstripped the growth of domestic production and increased the deficit on net exports. Private consumption grew by an average of 10.5% per year in 2004-07 fuelled by the rapid expansion of consumer credit and increases in real wages. The growth of gross fixed capital formation accelerated from 10.1% in 2004 to 28.9% in 2007, reflecting the boom in construction. Export growth, however, has been relatively sluggish and could not match the growth in imports. As a result, the deficit on net exports grew to 14.3% of GDP in 2007.

The strong economic growth in Romania that lasted up to 2009, combined with higher disposable income, has meant a surge in lending since 2002. Between 2001 and 2008 domestic credit increased by almost 40% on average with the growth rate peaking at 75% in 2007. During the same period, the growth rate in GDP averaged at 6.3%. Loan growth slowed down in the second half of 2008 reflecting the knock-on effect of the global financial conditions, the challenging macroeconomic prospects and low

demand for financing new investment projects. Retail lending has been the driving force of credit growth in Romania. In the process of convergence with the EU levels, low interest rates and high demand for retail loans have fuelled a consumer financing frenzy (Moody's, 2014). Despite the high credit growth witnessed in the period 2001-2008, Romania has remained one of the most under-banked countries in Europe; although Romania's economy was overheating, the banking assets were less than 50% of GDP.

Typical aspects of the Romanian economy are the exchange rate volatility and the inflationary pressures that seem to be inherited from the transition period. The depreciation of leu against the euro by around 15% during 2008-2009, jointly with the fact that only 40% of total loans granted by banks were denominated in local currency, translated to increasing credit risk for Romanian banks. A sharp correction in real estate and housing prices of about 20% amid a contracting economy has put further pressure on banks' financial profiles. As a result of the global liquidity shortage, Romanian banks went through a liquidity crunch and the NBR had to provide emergency liquidity assistance.

Back in 2005 the IMF had criticized the Romanian authorities over lax fiscal, wage and monetary policies, declaring that the stand-by agreement was off-track. As part of Romania's preparations for entry into the euro area, the NBR shifted monetary policy away from exchange-rate targeting towards inflation-targeting<sup>17</sup> in August 2005.

The authorities revised the Labour Code, which was seen as one of the main factors contributing to labour-market inflexibility, and accelerated the liberalization of the capital account. Despite these measures, any potential achievements were undermined

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<sup>17</sup> The NBR maintains an inflation-targeting regime, with a target of 3% within a fluctuation of +/-1%. The objective of this strategy was to ensure aggregate price stability, with all monetary policy instruments being employed to this end. On the other hand, inflation targeting implies a floating exchange rate as it is extremely difficult for a Central Bank to simultaneously employ two anchors. The latter explains partially the exchange rate volatility in Romania.

by relatively loose fiscal and incomes policies and the expansion of consumer credit. EIU (2008) indicates that the latter policies contributed to growing external deficits and hindered the implementation of a monetary policy consistent with a reduction in inflation.

The conduct of monetary policy since 2005 has been complicated by the liberalization of the capital account. Strong capital inflows contributed to a significant real appreciation of the leu between 2005 and mid-2007. The strong rise in consumer credit forced the NBR to increase interest rates in the period from February 2006 to February 2007. However, this contributed to high capital inflows, which put upward pressure on the exchange rate and led to a further deterioration in the current account. As a result, the NBR lowered interest rates in four stages between February and June 2007. Nevertheless, the leu continued to appreciate until early July. It then started to depreciate following the turbulence in global financial markets in the summer of 2007, causing the NBR to increase interest rates in October 2007. However, this did not succeed in stemming the depreciation of the domestic currency which, combined with rising food and energy prices, led to a rise in inflation in 2007-2008, forcing the NBR to announce further increases in interest rates in 2008. The high inflation during the booming years was attributed to the overheating of the economy. Later, the inflation was driven by shocks in commodity – food and fuel – prices. Certainly, the ability of the NBR to stabilize consumer prices was constrained by the euro-ised economy and a wide interest rate corridor around the key policy rate.

Between 2004 and 2008, Romania's annual current account deficit averaged at about 10.5% of GDP, peaking at 13.5% of GDP in 2007. This reflected the country's economic boom which kept import growth consistently above export growth. However, the slowdown in growth after the global financial crisis resulted in

correcting the external imbalance as imports fell more than exports. The current account deficit narrowed to 4.2% of GDP in 2010 and remained below 4.5% in 2011. Although Romania can claim one of the lowest debt ratios across the EU, it can be seen that this ratio presents a steadily upward trend. It is argued that much of the external debt in Romania has been generated through the domestic banking sector and has been used to finance domestic growth and imports. Equally, Romania's fiscal position has proved vulnerable to crises as the government debt to GDP ratio almost doubled in a single year – inflated from 13.4% of GDP in 2008 to 23.6% in 2009. Amid volatile politics, the Romanian authorities negotiated in early 2009 a financial assistance package – bailout funds – with multilateral creditors, of €19.5 billion led by a two-year stand-by agreement of €12.9 billion by IMF.

What becomes evident from the analysis so far, are the clear-cut differences between the Bulgarian and Romanian economies and banking systems. The following section highlights the key differences between the two countries that in essence call for a case by case modelling framework, rather than a 'one size fits all' approach for the SEE region.

#### **2.4 Comparing Bulgaria to Romania**

The impact of a destabilising shock in a banking system depends upon the macroeconomic policy, and particularly the monetary and exchange rate regime in place when the shock arrives (Gavin and Hausmann, 1996). For this reason, this section goes beyond the hard numbers already discussed, by analysing the idiosyncratic aspects blended with the historical parallels that have culminated in the key differences between Bulgaria and Romania. The comparative analysis focuses on two areas: the banking systems and the monetary regimes of the focal countries.

As neighbouring countries, Bulgaria and Romania have shared many common experiences over the centuries. But they have always been rivals, despite the differences in the size and structure of their economies (Nenovsky *et al.*, 2013). The authors document that these countries were enemies in the Balkan Wars of 1912-1913 and allies in the Second World War, while they shared a common ideology as Soviet satellites for more than 40 years. Although both countries were members of the Communist bloc, Romania distanced itself from the Soviet Union by adopting more independent economic policies. Later, in the process of EU accession, Bulgaria and Romania competed with each other in fulfilling the membership criteria.

Unlike banks in western countries, which granted loans based on credit risk analysis, banks in Eastern Europe granted loans based on centrally planned decisions. In both focal countries the break-up of the mono-bank and the establishment of the two-tier banking system, which coincided with the political opening, took place in 1990. In 1992, Bulgaria introduced a new central bank which mirrored western legislation. Although Romania introduced a new central bank law, amendments to the existing banking laws and key elements of western banking legislation needed for market-based banking systems were still missing in late 1992 (Thorne, 1993). Furthermore, Bulgaria and Romania differed in terms of restrictions for the establishment of new banks. In the case of Romania, the legislation was more liberal concerning the entry of new banks than Bulgaria. Also, the Bulgarian bank legislation imposed higher minimum capital requirements than Romania. Stark differences can also be found in the measures taken by the Bulgarian and Romanian authorities in dealing with banks' institutional problems, in essence the legacy of NPLs. The differences are pronounced in the State guarantees provided for NPLs and the measures taken by Bulgaria for re-establishing state ownership of the banks. In terms of guarantees provided, Bulgaria

stood as the only country in the region that has made an open recognition of all enterprise loans. Other countries, including Romania were reluctant to do so because of the fiscal implications.

The Bulgarian banking system is considered conservative as it engages in traditional financial services with relatively low exposure in risky financial instruments. The mechanisms that are in place in the Bulgarian banking sector aim at ensuring an adequate response in case of need. These mechanisms are constructed in such a way that put the higher burden on the shareholders of the banks rather than on the State budget. The BNB has the ultimate responsibility for banking supervision. Also it has the power to replace a bank's management should there be breaches in the execution of its professional duties. Bulgaria was among the countries that tried to calm the credit boom through macro-prudential measures applicable to the banks established within its jurisdiction (IMF, 2013b).

Although notable progress has been made in the area of banking regulation and supervision in Romania, the critical steps<sup>18</sup> had been implemented by the time the global financial crisis hit the SEE region. Moody's (2011a) underscores that, in line with the development of the Romanian banking sector, it is necessary for banking supervision to focus increasingly on the qualitative aspects of banking activity, and in particular on upgrading its risk-assessment capacity, closer monitoring of banks' efforts to assess borrower indebtedness, as well as strengthening creditor rights and the effectiveness of the judicial system.

A number of authors are in agreement that the stricter the measures, including lending growth limits and capital positions, the more noticeable their impact on credit and

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<sup>18</sup> Among others, the key measures taken by the NBR were associated with tighter regulation of lending exposures, tougher criteria for sanctioning banks and for the authorisation of managers and shareholders of banks.

housing prices (Dell’Ariccia *et al.*, 2011; Kraft and Galac, 2011; Vandebussche *et al.*, 2012). Vandebussche *et al.* (2012) find that there are clear differences among countries in terms of their policy activism. The authors indicate that Bulgaria was among those countries where prudential regulation displays a clear countercyclical pattern while Romania appears to be mildly procyclical at times when some prudential policies were being relaxed upon joining the EU. In this respect, Munteanu and Göndör (2012) provide empirical evidence that the procyclical fiscal policy in Romania during 2008-2011 raises macroeconomic volatility, depresses investment and does not assist in repairing the banking sector.

Although a number of studies deal with the CESEE region and include Bulgaria and Romania in their analysis, there is a paucity of studies that focus solely on the two economies. Among the handful of studies, Andreev (2009) explores the impact of the EU accession, Kalotay (2008) discusses the quality and development impact of FDI flows, Duenwald *et al.* (2005) deal with credit growth, Pelinescu and Caraiani (2006) study the monetary regime of inflation targeting and EU convergence, and Nenovsky *et al.* (2013) focus on the impact of the different monetary regimes that Bulgaria and Romania endorsed.

The historical comparative analysis provides a fertile ground for reflection on the preferences for specific economic policies and choice of monetary regimes. In the 1920s, Bulgaria adhered strictly to the gold standard while the monetary and exchange rate stabilization was significantly more protracted in Romania. Bulgaria and Romania experienced an economic crisis in 1996-1997 which marked the adoption of different regimes. In Romania, where the crisis was milder, the State pursued and enhanced a discretionary monetary policy, even introducing inflation targeting in 2005. In contrast, Bulgaria which experienced a severe crisis, took radical steps by

adopting a currency board. Desquilbet and Nenovsky (2005) stress that this arrangement represents an ‘extremely orthodox’ monetary regime, similar to the gold-exchange standard, that corresponds to the negation of monetary policy. Although the benefits of the currency board in Bulgaria during the global financial crisis are debatable (Nenovsky *et al.*, 2013), it had a solid track record as it managed to survive the Russian and the East Asian crises.

The two radically opposed monetary regimes had an impact on macroeconomic policies and macroeconomic policies play a central role in the study of banks’ risk appetite. Countries with floating exchange rates had an easier time dealing with large capital inflows than countries with fixed exchange rates (Bakker and Gulde, 2010). On the other hand, countries with fixed exchange rates cannot let the nominal exchange rate appreciate in the face of capital inflows, and are therefore less able to insulate domestic liquidity from capital inflows. By definition, currency boards have fewer instruments<sup>19</sup>. A comparison among the new EU member states suggests that exchange rate regimes and policies have greatly affected how these countries have fared in both the boom and the bust phase of the cycle. Overall, fixed exchange regimes in the SEE region seem on average to have amplified the excesses and imbalances in the boom, and contributed to more severe declines in the bust. Nonetheless, the exchange rate regime choice in itself is not a panacea, since there are good and bad examples with both fixed and flexible regimes (Becker *et al.*, 2010). Cross border financial flows resulted in the built-up of vulnerabilities that influenced the cost of crisis in both focal countries. In retrospect, it appears that the pegged exchange rate made the adjustment more abrupt with greater costs to the real economy

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<sup>19</sup> Fixed exchange rates restrain the operations of the central bank (lender of last resort). The absence of such a lender could promote bank runs and financial turmoil. Nonetheless, a strand of literature maintains that pursuing a fixed exchange regime reduces the probability of banking crises, especially in developing countries (Domaç and Martínez Pería, 2000).



for Bulgaria.

The key macroeconomic variables show that Romania's economy is more than three times larger than Bulgaria's. This was evident in the period from 1985-1995. In the wake of the 1996 crisis, Bulgaria's inflation was much higher than that of Romania. Another crucial difference between the two countries was the accumulation of foreign debt. Bulgaria's foreign debt has been increasing since 1985. The upward trend in debt accumulation reversed in 1994. In contrast Romania followed a different strategy. In 1972, it was the first country from the Communist bloc to join IMF. Bulgaria followed in 1990. In the early, transitional period, Romania begun accumulating foreign debt but, by the start of the crisis in 1996, it was significantly lower than Bulgaria's. The severe crisis in Bulgaria coupled with the collapse of the banking system called for a radical change to restore macroeconomic stability, while Romania did not see any need to change its existing monetary regime (Nenovsky *et al.*, 2013). Hence, two different models of conducting monetary policy emerged in Bulgaria and Romania. In Bulgaria the philosophy has been passive and conservative while in Romania it has been active, discretionary and less conservative. The adoption of the currency board in Bulgaria shifted economic activity as well as the associated risks with it in a different direction from that of Romania. The constraints imposed on public finances and monetary policy in Bulgaria had a profound effect on the private sector, which expanded as state-owned enterprises were privatized or shut down in the late 1990s and early 2000s. At the same time, the currency board forced the private sector to adjust to the hard budget constraints and restructure so that it could remain competitive in an open economy.

More importantly, the restrictions on public finances in Bulgaria led to a shift from public to private debt. While the government was running budget surpluses and

paying off its external debt, private borrowing soared, leading to a sharp increase in private external debt, especially during the 2000s. The currency board reduced the foreign exchange risk and the sovereign risk and lowered the interest rates levels to those abroad, allowing the private sector to borrow at lower cost but also exposing the economy to external shocks.

In Romania, the economic situation was the opposite of the Bulgarian case. Public finances were not subject to any restrictions, and the NBR was free to use a discretionary monetary policy. Accordingly, the government was running permanent budget deficits, which became unsustainable during the global economic crisis and forced Romania to seek help from the IMF. The lack of fiscal discipline, coupled with the fact that Romania's economy is less open than Bulgaria's, led to a rapid increase in hourly labour costs. Furthermore, as borrowing was concentrated in the public sector, credit to the private sector and private external debt were only a fraction of the corresponding levels in Bulgaria.

The first period started in the late 1990s with the opening of accession negotiations with the EU; the disciplining effect of the monetary regime in Bulgaria was enhanced by the credibility effect from the prospects of EU accession. In 2004, the foreign reserves of the Bulgarian and Romanian governments exceeded their foreign liabilities for the first time since the start of the transition. The positive difference between reserves and liabilities could be viewed as collateral, offering a sort of insurance for private sector liabilities (Dooley, 2000). The constraints on fiscal and monetary policy imposed by a currency board in Bulgaria, coupled with large capital inflows in Bulgaria, translated into a rapid and dramatic rise in external private liabilities and since 2008 in NPLs. In response, the BNB raised the reserve requirements for banks and imposed restrictions on lending in 2005. While private

sector debt and NPLs in Romania increased as well, the weakening of the monetary anchor became especially evident in the area of public finances due to the discretionary monetary regime. The government budget deficit, which had been decreasing for several consecutive years, reversed its course in 2005. In the same year, the NBR introduced inflation targeting in an attempt to prevent the overheating of the economy and to slow down capital inflows. When the global financial crisis hit the Balkan economies in late 2008 and early 2009, the differences between the two monetary regimes became apparent again. In Romania, the worsening condition of public finances forced the country to seek financial support from the IMF in an attempt to provide a fiscal stimulus during the downturn. In contrast, Bulgaria implemented drastic austerity measures to safeguard the currency board arrangement but incurred budget deficits that were larger than usual.

At first glance, the economies of Bulgaria and Romania have followed similar patterns of development with only minor deviations. However, fundamental differences between the two economies have emerged over the last 15 years as a result of a strategic choice of institutional arrangements in the late 1990s. In particular, the choice of monetary regimes in the aftermath of the 1996-1997 economic crises set Bulgaria and Romania on completely different trajectories. Bulgaria opted for a currency board arrangement that effectively eliminated the country's monetary autonomy, while Romania chose discretionary monetary policy and inflation targeting. This difference was determined by the initial conditions of the two economies, particularly with regard to their external debt. Bulgaria accumulated a large debt in the late 1980s and early 1990s whereas Romania began the transition with virtually no external liabilities. Furthermore, the monetary regimes had implications for the entire economic system and policies of the two countries. With its

monetary and fiscal policies restricted, Bulgaria's economic activity shifted towards the private sector, making it the focal point of economic shocks and response mechanisms. In contrast, the discretionary policies in Romania turned the government and public finances into both a contributing factor and a response mechanism to imbalances. Accession to the EU, coupled with global excess liquidity in the late 2000s, amplified these differences by channelling moral hazard into the private sector in Bulgaria and the public sector in Romania. Accordingly, when the recent global economic crisis reached the SEE region, Bulgaria exhibited strong growth in private debt while Romania was compelled to seek financial help from the IMF as public finances deteriorated.

The following section takes stock of the significant presence of Greek banks in Bulgaria and Romania and substantiates the Greek crisis hypothesis.

### **2.5 The presence of Greek banks in Bulgaria and Romania and the risk of crisis contagion**

Measured in terms of FDI flows in the banking sector, the CESEE region constitutes a unique region worldwide. Nowhere else do foreigners wield such a high degree of control over banking systems (Barisitz, 2009). Yet, these strong banking networks and links heighten the danger of cross-border transmission of risks and economic contagion (ECB, 2005; Altmann, 2006). Due to the one-sided nature of investment, the crisis transmission channel is most likely to affect the SEE economies, rather than the investors' home countries. And this issue becomes even tenser when the banking sector ownership of a host country is concentrated in one or a few home countries.

In both focal countries, Greek banks command a remarkable share of the banking systems, thus making the transmission of shocks in Greece an immediate threat. Based on Bankscope data and IMF (2012b), the Greek banks controlled 25% of the

Bulgarian banking assets and 16.6% of the Romanian ones as at the end of 2011. Notably, the Greek banks accounted for a critical 33.8% of the Romanian system's share capital on aggregate, followed by the Austrian banks that represented 21.9% (NBR, 2011). The 'losers' are usually countries whose economies are tightly linked to countries with fiscally-troubled economies and financial intermediaries that can become illiquid or insolvent by losses arising from write-down on defaulted or restructured sovereign debt and private sector lending. Hence, the Greek debt crisis has the potential to sow the seeds of vulnerability and derail the financial sectors in both Bulgaria and Romania.

Crises typically involve contagion in banking. As the literature on bank contagion demonstrates, a propagation aspect of financial crises implies that there is a spillover dimension attached to them. Solvency, liquidity or problems faced by banks in one country can spread contagiously to banks in other countries via financial linkages (Allen and Gale, 2000). Then, the ability of a crisis to spread from one region to another depends crucially on the pattern of interconnectedness among banks (Freixas, *et al.* 2000). Contagion presents a systemic risk to financial institutions that goes beyond what their industrial counterparts can confront. Even Kaufman (1992), who argued that contagion is an overstated force in financial markets, concedes that, compared to other industries, it strikes financial institutions more often, unfolds more rapidly than in other sectors of the economy, spreads among a larger group of peer institutions and causes a larger number of failures. Effectively, contagion spills over into the real economy where it inflicts collateral damage on firms that depend on the financial sector as a source of long-term capital. Historical experience provides evidence that the problem of contagion is not a hypothetical one (Saunders and Wilson, 1996; Bernanke, 2007; Gorton, 2009).

Hence, contrary to the view that the entry of foreign banks in less developed banking markets brings in significant benefits and bolsters the banking stability of the host country (De Haas and van Lelyveld, 2006, 2010; Cull and Martínez Pería, 2007), foreign banks can also be a source of risk. Fitch (2011) states that foreign bank ownership in the region became a potential contagion channel with the onset of the global financial crisis. On the same wavelength, Canales-Kriljenko *et al.* (2010) argue that during the global financial crunch, foreign banks were potential vehicles for spreading the crisis from advanced economies to emerging markets. Going deeper, Bruno and Shin (2013) suggest that banking sector capital flows and credit growth in recipient economies are explained in part by the fluctuations in global liquidity that follow the leverage cycle of global banks. Thus, the key difference between the opposite views has to do with the role that foreign banks play in sustaining strong credit growth during the pre-crisis period. In the case of emerging Europe, it was the foreign banks that fuelled a credit boom by transferring large amounts of borrowed short-term capital to their subsidiaries (Canales-Kriljenko *et al.*, 2010).

Not surprisingly, revenues from SEE markets delivered a healthy boost to the Greek banking sector, one of the key investors in the region. Historically, the Greek banks pursued a hybrid strategy of acquisitions and organic growth in SEE. Critics suggested an opportunistic approach by banker-desperadoes who paid astronomical prices to acquire SEE banks and then used funding from the parent or wholesale markets to lend in the local economies (Economist, 2009). However, Greek bankers argued that fairly traditional business models were followed in their expansion eastwards. In consensus with Focarelli and Pozzolo (2001) and Herrero and Simón (2003), the main reasons that motivated the Greek expansion in the SEE region were:

- The foreseen decline in profit margins in the domestic market

- The ‘follow your customer’ principle commonly found in banking business
- A deep knowledge of the economies in the neighbourhood, and
- An increased window of opportunity arising from the anticipated economic development of these countries.

The end result has been “a very short history of a very rapid expansion”. Although the Greek banks’ presence in the region started around 1993-1994, a meaningful expansion was only initiated in the early 2000s. Between 2002 and 2008, banks assumed a wave of 17 acquisitions while the respective assets grew by 58% (BOG, 2010; Papadogiannis, 2013). Very few studies attempt to explain the performance and profitability of the Greek banks’ foreign subsidiaries. Kosmidou *et al.* (2005) find that subsidiaries’ profits were closely linked to those of the parent bank, the difference in GDP growth and trade balance between Greece and the host country, and the years of operation in the host market. In another study, Athanasoglou *et al.* (2006) provide evidence that bank-specific variables are the key drivers of SEE banks’ profitability in the period 1998-2002. Although the effect of the macro-economy<sup>20</sup> is not clear, the authors document a significant variation across the region in terms of macroeconomic conditions, providing the rationale that each country is a case study on its own.

Bastian (2010) and Greek bankers argue that it would constitute a historical mistake for banks to abandon their operations in the SEE region. Although banks’ strategy remains expansionary, there are material constraints challenging the banking sector’s stability:

- The negative developments in Greece.<sup>21</sup>

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<sup>20</sup> The study captures the effect of the macroeconomic environment by variables such as inflation and real per capita income.

<sup>21</sup> Greece has been compromised by challenging macroeconomics such as negative GDP growth and debt (as a % of GDP) and fiscal deficit (as a % of GDP) at record levels.

- Deteriorating asset quality across the Greek banking system.
- Strained liquidity both in-house and abroad. The over reliance of subsidiaries on parent banks in terms of funding<sup>22</sup> is a major concern.
- Funding cost is elevated relative to European peers, and severely affected by the widening spread of the Greek sovereign bonds to the German ones.
- Capital, an essential prerequisite for expansion, remains a longstanding issue.

Thus, the Greek banks' troubles at home create fears of a credit crunch or a financial meltdown in the neighboring countries, which in turn could endanger the functioning of their economies. Concerns have been raised that, faced with solvency or funding shocks, Greek banks may withdraw from cross-border banking activities and transmit these shocks to the host countries. Hence, the financial integration of the SEE countries, predisposed them to growing external imbalances, which in turn created a systemic risk to their banking sectors. Empirical evidence documents a positive correlation between parent banks' and foreign subsidiaries' default risk during the global financial crisis (Anginer *et al.*, 2014).

In contrast to other areas, research in contagion is new in economics (Edwards, 2000), which justifies the lack of a generally accepted interpretation of contagion. World Bank (2009) broadly defines contagion<sup>23</sup> as the cross-country transmission of shocks or the general cross-country spillover effects, and Constancio (2012) considers contagion to be one of the mechanisms by which financial instability becomes widespread and reaches systemic dimensions. Given that, the empirical studies on contagion that emphasize financial links are limited, especially in the context of this thesis. Most of these studies use balance sheet information to estimate bilateral credit

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<sup>22</sup> Capacity for further centralised funding was limited, given that Greek banks had to be weaned off their reliance on the ECB and also rollover substantial wholesale funding debt in the following years. In the meantime, the wholesale sources dried up.

<sup>23</sup> Typically, the literature uses contagion as a synonym for spillover effects (World Bank, 2009).



relationships for different banking systems (Allen and Carletti, 2009). For instance, Schnabl (2012) shows how the Russian crisis in 1998 spilled over to Peru as banks, including multinational bank subsidiaries, saw their foreign funding decline and had to reduce lending. In their analysis of the German banking sector, Upper and Worms (2004) show that the failure of a single bank could lead to the breakdown of up to 15% of the banking sector in terms of assets.

Moreover, IMF (2013a) suggests that foreign ownership can help transmit international shocks. In this respect, a number of studies have shown how an external shock suffered by the parent bank can lead to reduced lending by the host country affiliate (Peek and Rosengren, 1997, 2000). Using surveys of firms in 16 CESEE countries in 2005 and 2008, Popov and Udell (2012) provide evidence that firms' access to credit was affected by changes in the financial condition of their bank, if domestically-owned, or their bank's parent, if foreign-owned. Notably, the authors find that, in the spring of 2008, firms were more credit constrained if their bank or bank's parent experienced a decline in equity, or a decline in assets between 2005 and 2008.

The unfolding of the Greek sovereign debt crisis was manifested in the spread between the Greek and German long-term bond yields but also the deteriorating asset quality of the Greek banking system, as reflected in the Greek banks' loan loss provisions. Arghyrou and Kontonikas (2012) use the spread differential between the Greek and German government bond yields to show that the majority of EMU countries have experienced contagion from Greece in the recent sovereign-debt crisis. Melander *et al.* (2011) use sovereign credit default swap (CDS) spreads to measure contagion risks from Greece and Ireland to the rest of Europe. The authors claim that:

*“For the Eastern European countries, it is interesting to note that contagion risks at the end of 2010 were higher for the countries where Greek banks had a strong presence (Romania and Bulgaria) than for other countries”*(p.355).

In the same train of thought, Acharya *et al.* (2014) find that the high interdependence of bank and sovereign health is an important contributor to the severe economic downturn in Southern European economies during the sovereign debt crisis through the bank lending channel. Borrowers depending on banks affected by the debt crisis are financially constrained during the crisis. Equally, a number of studies provide evidence of the spillover effect of credit risk, proxied by NPLs or loan loss provisions, across financial institutions, banking systems or countries (Herrerias and Moreno, 2012; Allen *et al.*, 2011). Hence, it is straightforward that Greek banks, prior to their restructuring and recapitalization (BOG, 2012), were a key conduit of crisis in the SEE countries where they had a vital presence. Financial and trade channels are the main avenues, mutually reinforcing spillovers between Western Europe<sup>24</sup> and CESEE (IMF, 2013a). A tightening or intensification of the crisis in Greece is expected to travel eastwards, elevating vulnerabilities in countries where there are financial ties in place. Markedly, the banking systems of Bulgaria and Romania are closely integrated with the Greek system both in terms of ownership and financing. Although there may be other crisis transmission channels, such as the FDI links and trade flows, the most pertinent one has to do with the presence of Greek banks in the region. Furthermore, the banking linkages as a conduit for spillovers merit attention, given their role in the financial and macroeconomic stability of these countries.

The next section concludes the chapter.

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<sup>24</sup> In IMF's (2012b) report, Western Europe comprises Greece and CESEE comprises both Bulgaria and Romania.

## **2.6 Conclusions**

The last decades have been eventful for the banking systems of Bulgaria and Romania. Both systems have seen an unprecedented as well as unsustainable lending growth, fuelled by foreign banks that benefited from easy access to the liquid wholesale markets, in the context of wide open opportunities for business development. The booming period ended abruptly with the outbreak of the global financial crisis and left a legacy of NPLs. Although relatively poor compared with other countries in the euro area, both Bulgaria and Romania had a relatively speedy process of EU accession. Both countries are looking to join the euro but in terms of quantitative metrics, Bulgaria is arguably the more converged.

In the autumn of 2008, the SEE region became one of the flashpoints of the global financial crisis as it was among those regions most severely affected by the crisis. Although many countries in the SEE region registered a sharp decline in output, the economies of Bulgaria and Romania were the most distressed. Despite the shocks and prior imbalances in both countries, it was only Romania that required bailout funds.

In both countries' banking systems, the Greek banks command a significant share of assets, making the transmission of shocks stemming from Greece an immediate threat. Then, as historical experience and a number of empirical studies purport, crises involve contagion, and the banking linkages are among the most critical channels in transmitting crises. In this respect, the chapter has provided an overview of the Bulgarian and Romanian economies and banking systems and also introduced and rationalized a key hypothesis of the thesis that relates to the potential spillover effect arising from the Greek crisis.

The next chapter provides the theoretical framework of the research.

## **Chapter 3: The theoretical framework**

### **Introduction**

This chapter reviews the theoretical underpinnings of the research problem, the determinants of credit risk in Bulgaria and Romania. For most of the post-World War II era, the execution of monetary policy by central banks culminated in a period of low volatility between the mid-1990s and 2007, known as the Great Moderation. However, while most economies were sailing on an ocean of calmness, a storm was brewing out in the credit market seas (Haldane, 2014). Low inflation and stable growth fostered complacency and risk-taking, and the Great Moderation turned abruptly to the Great Recession. The global financial crisis underlined the importance of financial stability and that of a well-functioning financial system in generating investment and innovation for a healthier and more prosperous society (Arestis and Sawyer, 2012). Hence, the study of financial stability has become the cornerstone of macroeconomic policy, especially for developing countries. Against this background, the chapter builds upon two key research areas in economics: the drivers of credit risk which is closely related to the literature on the determinants of banking crises. Section 3.1 provides the framework upon which the studies on credit risk have developed and Section 3.2 delineates the drivers of credit risk in the literature. In the light of this approach, Section 3.1.1 starts off the exploration of the research's theoretical framework by looking at the role of financial intermediaries in developing economies with emphasis on the SEE region. Section 3.1.2 focuses on the banking crisis literature and Section 3.1.3 discusses the origins of the global financial crisis of 2007-2008 and the financial liberalization thesis. Building on the foundations of the first section of the chapter, Section 3.2 discusses the relationship between credit risk and

the business cycle and Section 3.3 classifies the key factors affecting credit risks, as identified in the literature. Section 3.4 concludes the chapter.

### **3.1 The determinants of credit risk in the literature**

Before the financial crisis most central bankers focused on tempering the boom-bust cycle and keeping inflation low. However, monetary policy has been in a state of upheaval ever since. The financial chaos that followed the credit crunch in 2008 led to the most significant real-economy disaster of the post-World War II era. Central banks in many developed and developing economies faced a wave of recession, soaring unemployment and surging NPLs. A saga of unprecedented financial instability hit virtually every region of the globe. The literature that examines the endogenous relationship between macroeconomic indicators and the vulnerability of the financial sector has largely focused on analyzing the determinants of banking crises. Another strand of work has sought to analyze the relationship between macroeconomic or other variables (bank-specific, institutional) and indicators of financial instability over a sample of countries and period of time including, but not necessarily limited to, episodes of banking crises (Babihuga, 2007). Although the present research focuses on the latter category, both research strands are so closely related that one cannot disentangle their boundaries.

Prior to embarking on the exploration of the contributions to the field, the essential definitions are given to frame the research context. A working definition of financial stability is critical in the process of developing analytical frameworks that can be used for examining any policy issues. In this case, a key policy objective is to avoid financial instability that sacrifices the private and social benefits of finance. Schinasi (2004) proposed a definition consistent with this broad view as follows:

*“A financial system is in a range of stability whenever it is capable of facilitating (rather than impeding) the performance of an economy, and of dissipating financial imbalances that arise endogenously or as a result of significant adverse and unanticipated events” (p.8).*

Financial stability is broadly defined as a condition in which a financial system is capable of withstanding shocks, thereby reducing the likelihood of disruptions in the financial intermediation process that are severe enough to significantly impair the allocation of savings to productive investments. Ultimately the objective of financial stability is to facilitate and enhance economic processes, manage risks, and absorb shocks (Schinasi, 2004). Hence, the financial system can be regarded as stable if it displays three key characteristics:

- Efficient and smooth transferring of resources from savers to investors.
- Reasonable and accurate assessment and management of financial risks.
- Comfortable cushions to absorb financial and real economic shocks.

If understood this way, the safeguarding of financial stability requires the identification of the main sources of vulnerability, such as inefficiencies in the allocation of financial resources and mismanagement of risks. Ideally, the monitoring of financial stability should be forward looking as inefficiencies in the allocation of capital or shortcomings in the management of risk can compromise future financial stability and therefore economic stability (ECB, 2005). Following a narrower, yet more practical view, Buiters (2008) defines financial stability as the absence of bubbles, the absence of illiquidity in financial institutions and markets, and the absence of insolvency of financial institutions. Hence, the value of financial stability is best illustrated by its absence. In a recent contribution, Arestis and Sawyer (2012) point out that financial stability has not been at the forefront of monetary policymakers. The authors suggest that:

*“The focus of financial stability should be on proper control of the financial sector so that it becomes socially and economically useful to the economy as a whole and to the productive economy in particular. Banks should serve the needs of their customers rather than provide short-term gains for shareholders and huge profits for themselves”(p.6).*

In Buiter’s (2008) view, many central banks were to a varying degree ill-prepared for the global financial crisis as *“central banking practice failed to keep up with key developments in the financial systems of advanced market economies”* (p.495). IMF (2010c) attributes this practice of central banks to the widespread belief in the efficiency of markets that prevented a realistic approach to financial stability.<sup>25</sup>As a result, bank systemic risk was ignored and financial regulation and supervision *“were increasingly light-touch and reliant on self-correcting market forces”* (IMF, 2010c).

The increased incidence of banking crises has triggered an active research agenda, not only on the underlying causes of crises, but also on their impact on the real economy. It is beyond any doubt that banking crises come at a painful social and economic cost. However, that is outside the scope of this research which focuses on the stability of the Bulgarian and Romanian banking systems. In view of the vital role of financial intermediation in developing economies, the following section provides a brief survey of the related literature. The aim is to highlight the complementarities and tradeoffs between financial stability and economic development that need to be considered in the research process.

### **3.1.1 The role of financial intermediation in developing economies**

Finance is critical to the functioning of the economy and the role of banks has always been central in the SEE developing economies. How well the financial system

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<sup>25</sup> It is noteworthy that IMF published the first issue of the Global Stability Report not earlier than 2002 in an effort to deepen the understanding of international capital flows and to strengthen the surveillance of developments in financial markets. The idea was to highlight issues of financial imbalances that could pose a risk to financial market stability and sustained market access by emerging market borrowers.

operates determines how the real economy functions, as was clearly manifested by the global financial crisis that plunged the SEE region into recession. In view of that, the repetitive nature of crises episodes forces a reassessment of the developmental role of the financial sector and its linkages with the real economy.

Banks have been present since the earliest instances of pre-capitalist societies. Their intermediation role is so pervasive and ingrained in the functioning of economies that one almost wonders about the need to discuss their importance for the real economy (Miller, 1998; Demetriades and Andrianova, 2003; Cetorelli, 2009). However, the debate on the determinants of the process of economic growth through finance has been alive and kicking for more than a hundred years. The preponderance of evidence demonstrates that financial intermediaries matter for growth. However, economists disagree sharply about the role of the financial sector on economic growth (Levine, 2005). Lin (1981) prophetically suggests that the direction of causality between finance and growth “*will probably never be settled on either theoretical or empirical grounds*” (p.44). Many authors suggest that financial intermediaries and markets drive the relationship, while their role has been readily dismissed by others (Robinson, 1952; Lucas, 1988). Yet, there are authors (Arestis and Demetriades, 1997; Demetriades and Andrianova, 2003; Arestis, 2006; Arestis and Sawyer, 2005; Haldane *et al.*, 2010) who remain sceptical not only on the direction of causality, but also on a number of issues that need to be co-estimated, such as the case of financial liberalization, the role of the supervisory-regulatory framework as well as country-specific features.

At the core of the argument lies the question whether finance is a cause of growth or just a symptom. This question matters because if finance causes growth, then a country that wants to grow fast in a sustainable mode should reform and stabilize its



financial system, whereas if finance is just a symptom, then financial reform will probably provide the trappings of growth without giving the required growth (Aghion and Howitt, 2009). On the theoretical front, pioneering authors that point out the importance of the relationship between finance and growth include Bagehot (1873) and Schumpeter (1911). Bagehot (1873) emphasized the critical importance of the banking system in economic growth and highlighted the conditions under which banks could spur on innovation and growth by funding productive investments. In Schumpeter's (1911) work the argument put forward was that financial services are paramount in promoting economic growth. The notable early works on finance and development along Schumpeterian lines include Gurley and Shaw (1955), Goldsmith (1969) and Hicks (1969). These authors argue that the development of a financial system is crucially important in stimulating economic growth; under-developed financial systems can retard economic growth. Broadly, the message of such studies is that the economic magnitude of increasing the overall scale of the banking industry is potentially very significant. The implication of this view points to the formulation of policies that aim to stabilize financial systems in fostering growth. Later, in surveying the status of knowledge in the finance-growth nexus, Levine (2005) concludes that:

*“While subject to ample qualifications and countervailing views, the preponderance of evidence suggests that both financial intermediaries and markets matter for growth and that reverse causality alone is not driving this relationship”*(p.866).

Nevertheless, it seems that economists have not reached a consensus regarding the direction of causality between finance and growth, nor do they provide a solution to the issue of endogeneity between the variables used in their analyses. Furthermore, the empirical results vary considerably due to the different institutional and structural characteristics of each economy. Sceptics in the underlying debate have always maintained that while the empirical evidence clearly indicates a correlation between

finance and real economic activity, it cannot fully address the fundamental issue at stake, namely whether banking activity is exogenously determined and if it is, whether it exerts an independent impulse on real economic sectors (Arestis and Demetriades, 1997; Calomiris and Haber, 2014). In the light of this, the findings obtained from cross-country studies are at best fragile<sup>26</sup> and ambiguous. This is because the relationship between the financial sector and the economy is largely determined by the nature and operation of the financial institutions and policies pursued in each country (Arestis and Demetriades, 1997). Therefore, without an in-depth understanding of the financial historical context and the macroeconomic environment of each individual country, the cross-country evidence yields little policy guidance. Equally, a lack of high quality data with a sufficient degree of comparability across countries is a fundamental hindrance to the applicability of the findings of broad comparative studies. Such analyses conducted at aggregate level may be unable to capture and account for the complexity of the financial environments and histories of each individual country (Ang, 2008).

Arestis and Demetriades (1997) provide several accounts for the variation in causality results from country to country. Firstly, different financial systems may have different institutional structures and certain institutional structures may be more conducive to economic growth. Secondly, financial sector policies play an important role in determining whether financial development fosters economic growth. Thirdly, two countries with identical financial systems and policies may still differ due to the effectiveness of those institutions that design and implement policy making. Hence, apart from the distinction between bank-based and capital markets-based financial systems, the country-specific features are expected to influence the direction of the

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<sup>26</sup> The results are subject to the sample countries included in the estimation, the control variables used, the time period covered and the econometric techniques employed.

relationship. The latter highlights the limitations of cross-country studies for treating different economies as a homogeneous entity (Demetriades and Hussein, 1996; Arestis and Demetriades, 1999). This idea is developed further in Demetriades and Andrianova (2003), who argue that varying causal patterns may reflect differences in the quality of finance, which are, in turn, determined by the quality of financial regulation and the rule of law. In view of the limitations in cross-country studies, a number of researchers have put forward arguments for the use of time series country-specific studies (Demetriades and Hussein, 1996; Edwards, 1996; Neusser and Kugler, 1998; Ericsson *et al.*, 2001; Kenny and Williams, 2001; Kirkpatrick, 2005; Ang, 2008).

Even though there is ample cross-country evidence pointing to the positive effect of financial development on growth, it becomes evident that there are significant discrepancies not only between developing and developed countries (Ahmed, 1998) but also within developing countries due to structural or institutional issues. The latter provides room for reviewing some indicative studies on the SEE region. A common measure frequently found in empirical studies that approximates financial development is the ratio of bank credit to GDP. Figure 7 displays the domestic credit provided by the banking sector as a percentage of GDP<sup>27</sup> in the euro area against the focal countries of the thesis.

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<sup>27</sup> The metric used is just for comparative purposes as it is well known that different measures of financial development can give rise to different conclusions in empirical studies (Stengos and Liang, 2005; Ang, 2008). Thus, the usual disclaimer applies in describing Figure 7.

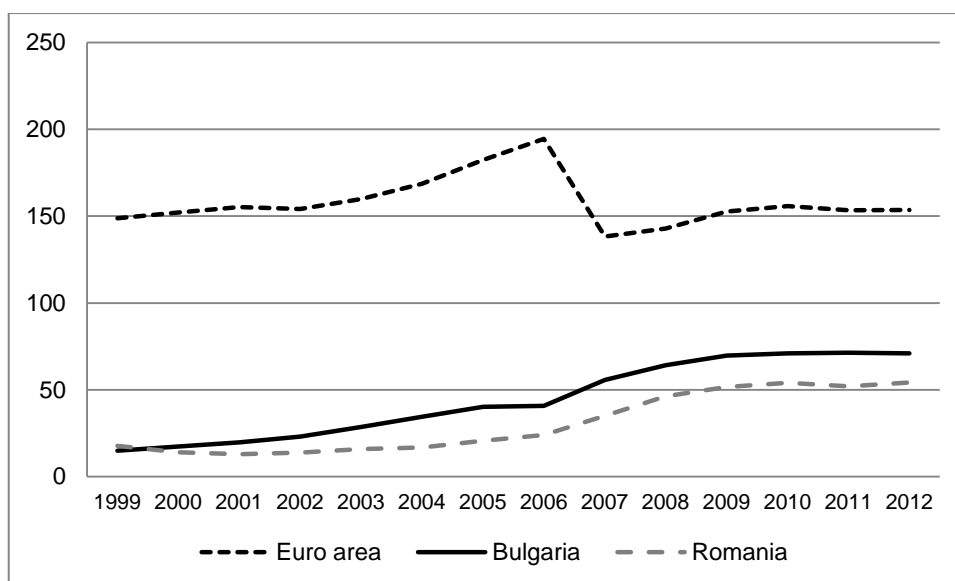


Figure 7 Domestic credit provided by the banking sector (% GDP)

Source: IMF.

As Figure 7 illustrates, the level of financial intermediation in Bulgaria and Romania remained well below the Euro area average even at the peak of the pre-crisis credit boom. Several empirical studies suggest that the level of credit was below equilibrium in the pre-crisis period. In retrospect, it seems that the speed at which the equilibrium level of credit is reached matters for macroeconomic stability (Becker *et al.*, 2010).

Despite the trend of globalization, the importance of banks in SEE economies remains critical, given that their financial systems are bank-dominated. Since the collapse of the Russian Empire, the financial sectors of SEE have undergone major structural reforms. The financial architecture in these economies converged towards bank-based systems with the notable participation of foreign banks through privatizations.

Although the empirical research on the finance-growth nexus has burgeoned in recent years, the evidence on the emerging SEE economies remains scarce. Among the limited related evidence, Fink *et al.* (2009) conclude that domestic, not private credit has a pronounced impact on growth for nine EU accession countries during the period 1996-2000. Using data for the period 1995-2005, Hagmayr and Haiss (2007)

investigate the finance-growth nexus in four SEE countries.<sup>28</sup> The authors conclude that financial intermediation, measured by private credit, has a negative effect on growth in the short-run which becomes positive, albeit insignificant, with the use of lags. Hence, the results provide support to the view that the widely accepted aggregate effect of finance on growth varies with the level of economic development. On the same wavelength, Yildirim *et al.*'s (2013) study concludes that the direction of causality in the growth-finance nexus exhibits considerable differences among emerging European economies and depends largely on the chosen indicators. Therefore, the effect of country-specific features needs to be hardwired in the equation (Arestis and Demetriades, 1999; Rousseau and Wachtel, 2005; Ang, 2008). On the other hand, Caporale *et al.*'s (2009) study that in essence extends the Hagmayr and Haiss (2007) timeline by a few years, on ten previously centrally planned economies of CEE, finds no causal linkages between credit and economic growth. Caporale *et al.* (2009) attribute their finding to the lack of financial depth in the sample countries that in turn limits the contribution of the 'under-developed' banking systems to growth. Recent research suggests that financial deepening can indeed be growth-positive but within limits. As Berkes *et al.* (2012) argue, there is a certain threshold at which the private credit-to-GDP ratio may begin to have a negative impact on GDP growth.<sup>29</sup> This finding is consistent with earlier cross-country evidence suggesting that, at credit-to-GDP ratios above unity, output volatility tends to increase (Easterly *et al.*, 2000). In a recent study of 150 countries for the period 1975-2005, Barajas *et al.* (2013) confirm the contributions of Demetriades and

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<sup>28</sup> The sample of Hagmayr *et al.* (2007) includes Bulgaria and Romania and uses Greece as a reference point.

<sup>29</sup> The authors find a non-linear growth impact of banking depth that progressively becomes weaker as the depth increases to high levels. Eventually, when the private sector credit exceeds 110% of GDP, the marginal effect of additional deepening on the economy becomes negative.

Hussein (1996) and Arestis and Demetriades (1999) by claiming that the beneficial effect of financial deepening on economic growth, in fact displays heterogeneity across regions and income levels and is driven by regulatory-supervisory characteristics.

The aim of this section was to assess the state of knowledge on the developmental impact of finance focusing on the SEE region in order to ground the research problem and facilitate the subsequent empirical research. However, a complete coverage of this well-researched area is beyond the scope of the thesis. Nevertheless and despite the absence of unanimity of results, four tentative observations emerge that advance the research frontier:

- a. Financial intermediaries matter for growth; banks are important for the real economy and vice versa. Banks ease information and transaction costs and thereby improve resource mobilization and risk management.
- b. The second observation is that regulatory, monetary and macroeconomic policies, political, legal, even historical and geographical factors all influence a country's financial sector (Arestis *et al.*, 2004; Barajas *et al.*, 2013). The results between studies and methodologies vary, given the different structural characteristics of each economy.
- c. The selection of variables to indicate the level of financial services produced in an economy and measuring the extent or efficiency of financial intermediation is a key issue in empirical studies that is more pronounced in developing economies (Demetriades and Andrianova, 2003; Ang, 2008).
- d. Although each of the different methodologies used in the literature has its shortcomings, country-specific time series studies appear superior to cross-country panel studies when it comes to relating findings to policy implications.

Finance has a vital and statistically strong relationship with the economy; it can be an important enabler of economic development. Nevertheless, in order to investigate the role of finance and its interactions with the economy, one needs to take frictions into account (Aghion and Howitt, 2009). Once frictions are considered, for instance country-specific factors, institutional framework, structure, governance, ownership and dynamics of a financial system, these enable a clearer view of the mechanisms in place. Clearly, banks provide an essential service to the economy that, under certain conditions, can work effectively but is subject to risk if some economic events trigger instability. Broadly, the evidence suggests that the economic damage from an unstable banking sector can be devastating, leaving little room for manoeuvre.

Taking the inherent financial instability as given in modern economies, the next section explores the factors that propagate banking crises, putting emphasis on their ties with macro-economy and institutional settings.

### **3.1.2 The determinants of banking crises in developing countries**

*“Apparently as the system matures the likelihood of instability increases”*

Minsky (1986)

The history of financial markets has not been a stable one. On the contrary, financial history is a roller-coaster ride of ups and downs, bubbles and busts, manias and panics, shocks and crashes (Neal, 2000). There have been numerous times when banks’ ability to serve their intermediation role was curtailed and banks actually elevated the risk level in the financial system.

A critical step prior to reviewing the literature on the triggers of crises episodes is defining banking crises. Laeven and Valencia (2008) set forth that in a systemic banking crisis, a country’s corporate and financial sectors experience a large number

of defaults, and financial institutions and corporations face great difficulties repaying contracts on time. As a result, NPLs increase sharply and all or most of the aggregate banking system capital is exhausted. Following Calomiris and Gorton (1991), banking crises consist either of panics or severe waves of bank failures. A panic is defined as a situation of temporary confusion about the unobservable incidence across the banking system of observable aggregate shocks that are severe enough to give rise to collective action by bankers. Severe waves of bank failures are defined as those resulting in the aggregate negative net worth of failed banks in excess of 1% of GDP (Caprio and Klingebiel, 1996). Calomiris and Gorton (1991) document three types of bank insolvency. Those limited to a single or a small sample of banks, which clearly are not systemic, overt banking system runs and a more silent form of financial distress. Therefore a banking crisis is a situation in which actual or potential bank failures induce banks to suspend the internal convertibility of their liabilities or a situation that compels the government to intervene by extending assistance on a large scale (IMF, 1998). In this respect a banking crisis can become as extensive as to assume systemic proportions. Under this definition, the banking crises are viewed as a subset within the broader set of phenomena known as financial crises<sup>30</sup> (Calomiris, 2009). Banking crises tend to occur around the time of cyclical downturns; they are closely associated with prior rises in the liabilities of businesses and declines in asset prices. The waves of bank failures are traceable to large declines in banks' loan portfolios and a surge in NPLs. Banking distress manifested in significant loan losses, typically poses substantial costs for the economy because of the contraction of loan and money supply.

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<sup>30</sup> Typically, financial crises that include asset price bubbles, exchange rate collapses, and a host of other phenomena, as well as banking crises, appear to be a common feature of the economic cycle.



Just as a stable and efficient banking system is expected to promote growth, a weak system grappling with NPLs or insufficient capital, or firms and households whose creditworthiness has eroded, may induce a prolonged recession. Changes in financial conditions can also play a prominent role in the contraction and recovery phases of the business cycle (Bernanke *et al.*, 1999).

In recent years there has been a profusion of banking crises in both industrial and developing countries. But crises are neither new nor unique phenomena; history is replete with crises and many of the same forces have often been at work in different crises (Demirgüç-Kunt and Detragiache, 1998; Caprio and Klingebiel, 1996; Allen and Gale, 1999; Duttagupta and Cashin, 2008; Reinhart and Rogoff, 2009). While each banking crisis has unique features, crises have a common root cause (Gorton, 2012). The antecedents of banking crises both in developed countries and emerging markets have a surprising amount in common.<sup>31</sup> Periods of high international capital mobility observed in emerging economies have repeatedly produced banking crises. When foreign capital comes to a sudden stop, economic activity goes into a tailspin (Calvo *et al.*, 2006). Hence, lessons from past crises are insightful as there are similarities across crises episodes, even when the exact triggers and timing may vary (Claessens *et al.*, 2013).

Banking crises have been dated by researchers on the basis of a combination of events. The literature is, however, less clear on whether or not the banking sector is the main trigger of the economic slowdown, as it is difficult to separate cause and effect in the relationship between the financial sector and the real economy (Kaminsky and Reinhart, 1999; Demirgüç-Kunt and Detragiache, 1998, 2005). The findings have re-ignited an interest both in academics and policy makers to assess,

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<sup>31</sup> There are broadly similar patterns in housing and equity prices, unemployment, public revenues and debt. Other macroeconomic time series, such as income, consumption, government spending and interest rates, exhibit higher volatility in emerging markets.

from a theoretical point of view, the extent to which the macroeconomy and the soundness of banking systems depend on each other another (Benink and Benston, 2005; ECB, 2006; Goodhart *et al.*, 2006). Many authors argue that deteriorating market fundamentals lie at the core of banking crises (Gorton, 1988; Mishkin, 1996; Llewellyn, 2002). Gavin and Hausmann (1996) suggest that interest rates, anticipated inflation, credit growth and the monetary and exchange rate regime constrain borrowers' loan servicing capacity. Although the authors do not imply that banking crises are always a macroeconomic phenomenon, they use the following analogy:

*“When macroeconomic forces place great strain on the banking system, the weakest banks are the ones most likely to fail, but it is the macroeconomic tension, as much as the weakness of individual banks, that causes the failures”*(p. 27).

On the same wavelength, Caprio and Klingebiel (1996) find that both macroeconomic and microeconomic factors triggered bank crises, as a macroeconomic shock has the potential to render banks' net worth negative. For instance, a volatile fiscal policy can be an important shock to a banking sector. Llewellyn's (2002) study of banking crises attests that an unstable economy reveals existing weaknesses within the respective banking system. Similarly to Llewellyn (2002), Cull and Martínez Pería (2007) provide evidence that banking crises in emerging markets have macroeconomic roots occurring in countries troubled by fiscal situations. In line with Gavin and Hausmann (1996), Demirgüç-Kunt and Detragiache (1998) suggest that inflation and the real interest rates are positively associated with a banking crisis, while the economic growth appears to have an inverse relationship. Similarly, Hardy and Pazarbaşıoğlu (1998) find that the likelihood of banking distress increases with the declining economic growth. Further, credit expansion to the private sector, associated with rising consumption and real interest rates, typically precedes banking crises.

It appears that crises are endemic to financial systems, inherent to the business cycle (Minsky, 1977) and not random events (Calomiris, 2009) that occur in waves (Reinhart and Rogoff, 2009). Minsky (1977) and Kindleberger (1978) were prominent advocates of the view that banking crises are part of the business cycle, and result from the propensity of market participants for irrational and myopic behaviour (Calomiris, 2009; Haldane, 2009). Minsky (1982b) suggests that financial instability which fuels the boom is the prelude to financial crisis. Hence, a key element in the escalation of individual financial distress to systemic risk is the onset of financial problems in banks. As Silipo (2011) points out, the risk appetite of financial intermediaries shapes the business cycle more than monetary policy. A perceived low credit risk environment induces banks to fuel more and more credit to the economy while at the same time the lending criteria are relaxed.

The rich history of banking crises traces unusual bank fragility to risk-inviting rules of banking, usually supported by a number of factors. The database of Laeven and Valencia (2008, 2012) identifies 147 systemic banking crises over the period 1970 to 2011, episodes in which bad debts soared across the economy and much of the banking sector was insolvent. Most of those episodes occurred in the developing world. All involved deep recessions, required massive government intervention to clean up bust banks, and led to substantial increases in public debt as economies shrank while government spending soared. Narrowing down to the focal countries of the research, Table 10 lists the systemic banking crises, currency crises, and sovereign debt crises of Bulgaria and Romania, along with the timing of those episodes.

Table 10 Timing of financial crises in Bulgaria and Romania (1980-2000)

Country	Systemic Banking Crisis	Currency crisis	Debt Crisis (default year)	Debt restructuring
Bulgaria	1996	1996	1990	1994
Romania	1990	1996	1982	1987

Source: Laeven and Valencia (2008).

Both focal countries experienced a variety of crises, albeit at different periods and in a different order. Notably, the banking crises in the SEE were accompanied or preceded by a steep rise in NPLs (Bonin and Wachtel, 2003; Bonin *et al.*, 2009). Caprio and Klingebiel (2003) record that in 1995 Bulgaria faced a systemic run and about 75% of bank loans were substandard. In Romania, the same authors indicate that in 1990, NPLs reached 25-30% in the six main state-owned banks. Several decades earlier, in 1931, Bernanke and James (1990) cited in Reinhart and Rogoff (2009) document that German-controlled banks in Romania as well as other banks collapsed as there were heavy runs on banks. As in many earlier crises, the rapid expansion of credit played a key role in the run-up to the most recent crisis in SEE (Claessens *et al.*, 2013). Credit aggregates grew fast, fuelling real estate booms in both Bulgaria and Romania. Hence, the problems associated with banking crises in developing countries are deep-rooted, and usually such episodes emerge from a property bubble and a credit boom. It is also well-documented in the literature that credit booms are often associated with deterioration in lending standards. In this setup, debt servicing becomes vulnerable to economic downturns and changes in credit or monetary conditions. The latter maximizes default correlations across loans and systemic exposure to macroeconomic shocks, generating loan books highly exposed to declines in house prices, confirmed *ex-post* through the large fraction of NPLs, especially in both focal countries (Claessens *et al.*, 2013).

Many banking crises in developing countries seem endemic, displaying a recurrent pattern of distress with an interaction between banks' insolvency and illiquidity. But the more interesting cases are those that involve endogenous macroeconomic disturbances, a boom-bust cycle, where banks, riding on a wave of optimism, overlend to risky projects which have poor prospects (Honohan, 1997; Minsky, 1982a). The costly adjustments that economies undergo in the event of crises have stimulated an interest in studies designed to identify indicators that can serve as an early warning of banking crises (Kaminsky *et al.*, 1998; Kaminsky and Reinhart, 1999; Kaminsky, 1999; Vlaar, 2000). A commonly used approach is to construct an early warning system (EWS) by identifying a set of variables such as country fundamentals, developments in global economy and financial markets, whose behaviour prior to episodes of banking crises is systematically different from that during 'tranquil' periods. By closely monitoring these variables, it may be possible to detect patterns similar to those that in the past have preceded crises. Thus, the challenge of the endeavour lies in identifying these critical variables that need to be monitored.

In a seminal paper, Kaminsky *et al.* (1998) find that the real exchange rate, the occurrence of a banking crisis, the growth rates of exports, the stock prices, the money supply and the domestic credit to GDP ratio are among the variables with explanatory power during 1970-1995 in a sample of 15 developing economies. Aligned with the research findings in the growth-finance studies, country-specific threshold levels for the economic variables should be established to account for heterogeneity. In an extensive study, Kaminsky and Reinhart (1999) find that most banking crises include multiple indicators, while excessive credit growth, recessions, and the burst of asset price bubbles tend to precede banking crises. In addition, the authors use a list of

indicators that are associated with financial liberalization such as the money supply (M2), the ratio of domestic credit to GDP, real interest-rate differentials, bank deposits, the terms of trade, reserves, output, and stock prices. In a study that uses balance sheet indicators of individual banks, Gonzalez-Hermosillo (1999) provides evidence that loan quality and equity deteriorate rapidly before a bank fails. However, the lack of consistent cross-country results and the scarcity or lack of timeliness of data on these variables in emerging markets make the individual bank failure quite difficult to predict (IMF, 2002). In an assessment of the EWS, Sahajwala and Van den Bergh (2000) indicate that aggregate data may conceal problems within individual banking institutions. Furthermore, the authors' survey reveals that leading indicators of bank problems are the asset quality indicators. Solvency, liquidity, or profitability indicators also constitute either concurrent or lagging indicators of bank distress. But the first signs of bank problems are often detected in asset quality – credit risk indicators.

Banking crises are more difficult to identify empirically compared to other types of crises because of the nature of the problem and partly because of data non-availability. Unlike currency crises,<sup>32</sup> the lack of high-frequency and quality data that could be used to mark the onset of banking distress in a consistent manner makes the construction of leading indicators more difficult. The previous argument highlights the difficulty in identifying a set of indicators that could detect future banking crises in a timely manner and with a reasonable degree of certainty (Berg *et al.*, 2004). The authors propose a thorough country-specific assessment<sup>33</sup> that relies on all available

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<sup>32</sup> In currency crises the availability of high-frequency data such as interest rates and exchange rate movements make the dating of crises relatively straightforward.

<sup>33</sup> These could derive from the analysis of country experts who utilize a broad set of quantitative and qualitative factors, ranging from macroeconomic variables to the strength of the banking system and the political stability.

qualitative and quantitative information. Table A1 in Appendix A provides a synoptic overview of the financial - banking crises indicators found in the literature.<sup>34</sup>

There are various characteristics found in a banking crisis, which include periods of high international capital mobility, periods of surges in capital inflows, lending boom and rising real housing prices, and a preceding expansion in the number of financial intermediaries on a country level (World Bank, 2010). Yet, some indicators have a recurring and persistent pattern behind most banking crises, as is well-documented in the studies shown in Table A1. For instance, the property-asset boom along with a credit spree are among the most common and significant predictors in the long chronicle of banking crises (Minsky, 1982a; Reinhart and Rogoff, 2009; Gourinchas and Obstfeld, 2011). Interestingly, these indicators remain robust, irrespective of whether a country is in an emerging or advanced stage (Reinhart and Rogoff, 2009; Gourinchas and Obstfeld, 2011). Banking crises share several common determinants with other financial crises; for instance, sovereign debt or currency crises and many times a banking crisis are closely intertwined with other types of crises, as was the case in the past crises in the SEE region. Banking crises are intimately linked to borrowers' financial distress, and tools need to be developed to explain in a systematic and consistent way credit risk that could be used complementarily to the EWS framework.

So far, the theoretical framework of the research has considered the developmental role of finance in economic growth and the banking crises literature by focusing on the SEE developing countries. Although these strands of the literature do not attempt to explain banks' risk taking, they highlight a wide array of issues and variables that need to be accounted for in the estimation of credit risk. Moving forward, the next

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<sup>34</sup> Table A1 provides an indicative account of some of the milestones of the crisis-related literature. The aim is to identify the key variables and the findings, along with ensuring that previous work is recognized without claiming to be extensive.

section discusses the triggers of the Great Recession focusing on the financial liberalization thesis.

### **3.1.3 The origins of the Great Recession and the financial liberalization thesis**

The recent turmoil of 2007 that put the global financial system under enormous stress has re-ignited the debate on crises' driving forces. A key lesson of the global financial crisis was, clearly, to re-emphasize the significance of financial stability. International evidence documents that several common elements and recurring patterns are at the heart of international crises episodes and this section sets out to identify the culprits in the occurrence of the global financial crisis (Reinhart and Rogoff, 2009). For instance, Åslund (2010) claims that the crisis experienced in the SEE region is a repetition of the East Asian crisis of 1997.

The global financial crisis hit the financial markets and the real economy of Europe severely, substantiating the evidence that the relationship between finance and growth is complex and not necessarily stable over time (Grochowska *et al.*, 2014). Although financial markets are crucial for the functioning of the real economy, the exact contribution to growth is uncertain and varies over the cycle. Engaging in a comparative analysis of almost all post-war banking crises, Reinhart and Rogoff (2009) convey a simple message: "*We've been here before since the development of money and financial markets*". Each new crisis bears remarkable similarities to past events. Excessive debt accumulation, whether by governments, banks, corporations or consumers, often poses increased credit risk that serves as a prelude to greater systemic risks. Even though the search for reliable crisis predictors may seem a hopeless task, it is worthwhile exploring which are the variables systematically associated with vulnerability in the more recent financial crisis.



Reinhart and Rogoff (2009) investigate the early warning indicators for both banking and currency crises. Among the meaningful banking crisis indicators, the authors discern the real exchange rates, the real housing prices, short-term capital inflows to GDP, and the stock prices. Rose and Spiegel (2009) model the causes of the global financial crisis along with its manifestations in a sample of 107 countries. Although a number of possible causes have been used, the authors were unable to link most of the commonly cited crises' causes to their incidence across countries. In a study that covers around 160 economies, Lane and Milesi-Ferretti (2010) find that the severity of the 2008-2009 global recession is systematically related to pre-crisis macroeconomic and financial factors. The authors document that increases in the ratio of private credit to GDP, current account deficits, and openness to trade are helpful in understanding the intensity of the global financial crisis. The latter explains why the SEE region was among the most severely hit regions at an international level. Drehmann and Juselius (2013) analyse a wide range of potential indicators covering macroeconomic variables, market indicators and banking sector conditions. In line with the theoretical proposition of Minsky (1982a), the authors provide evidence that the measures of excessive credit and asset prices booms perform well as early warning indicators. On the other hand the signalling quality of real GDP in banking crises is poor.

Besides the scepticism that rises on the accuracy of EWSs, the findings of Rose and Spiegel (2009) suggest that the causes of crises differ among countries, making it difficult to establish a common statistical tool to predict them. It follows then, that any analysis of banking sectors in individual countries, or any comparison of financial institutions across a range of different countries, needs to account for the various exogenous factors specific to those sectors and countries (Drake *et al.*, 2006). And

this is the case with the SEE region, where many external factors appear to affect each country's economy and banking system as highlighted in Chapter 2. Thus any modelling attempt should incorporate the potential impact of economic, regulatory, and geopolitical factors in the region and in each country separately.

Increasingly, financial liberalization is mentioned as a cause of bank insolvency and in many cases a variety of regulatory and bank-specific management factors creep in behind banks' distress (Reinhart and Rogoff, 2009). In an analysis on the determinants of banking crises in 53 countries during 1980-1995, Demirgüç-Kunt and Detragiache (1998) find that financial liberalization yields a large and significant positive effect on banking crises, even after controlling for other possible determinants of banking crises. In the wake of the Mexican and Asian twin crises, Kaminsky and Reinhart (1999) also find that financial liberalization and increased access to international capital markets play a key role in explaining crises. The authors examine the empirical regularities and sources of 76 currency crises and 26 banking crises and point out that both types of crises are closely linked with financial liberalization that in turn triggers lending booms. Stiglitz's (2000) insight into a number of crises such as the Asian one in 1997-8 but also the Russian and the Latin American crises, suggests that premature financial liberalization was at the heart of these crises. Such linkages can be found in many empirical models (Allen and Gale, 1999; Morris and Shin, 1999; Shin, 2005) in which it is argued that financial liberalization has led to asset price bubbles in numerous countries around the world, and the banking crises are the end result of the burst of the asset bubbles.

It follows that a main factor of the Great Recession is the financial liberalization that took place with the repeal of the Glass-Steagall Act and emerged hand in hand with light-touch regulation worldwide.

Undoubtedly, the financial crisis of 2007-2008 that was triggered by the US housing market, spread internationally and developed into the deepest recession since the Great Depression. Claessens *et al.*'s (2013) contribution suggests that the recent financial crisis shared at least four major features with earlier episodes: increases in asset prices, credit booms, a dramatic expansion in marginal loans, and regulation – supervision that failed to keep up with the developments. Arestis and Karakitsos (2014) state that three main factors, namely the distributional effects, the financial liberalization and financial innovation, along with the contribution of the international imbalances, the impact of the monetary policy and the role of the credit rating agencies, accentuated the process that led to the paralysis of the global financial system in 2007. Hence, it seems that risk spread in normal times transforms to risk concentration in crisis times (Berg, 2011).

In Arestis and Sawyer (2005), the financial liberalization thesis, can be summarized as amounting to freeing financial markets from any intervention and letting the market determine the allocation of credit. Other economists refer to financial liberalization as the transition process away from a financial system characterized by state intervention and ownership, towards a more market-oriented one. This phase is commonly associated with the expansion of liquidity in high-income countries and the consequent fall in the pricing of risk that dramatically changes developing-country finance (IMF, 2010c). This liquidity over-supply facilitates an easy access to finance that leads to excessive consumption, unproductive investments, and the formation of asset price bubbles in many developing countries, especially those in the SEE region. Yet, financial liberalization needs to be viewed in discrete historical phases that differ by region, country and level of development. What is common ground though, is that financial liberalization involves the lifting of State controls on the flow of finance

between the country in question and international financial markets. Usually, a simultaneous stage involves the relaxing of banking regulation and the removal of restrictions on business practices including allowing for stiff competition among foreign banks operating within a country's financial system. Then, an over-supply of credit, foreign in origin in the case of SEE, becomes a source of vulnerability that exceeds the absorptive capacity of the economic units and reinforces a vicious circle from financial instability to economic recession and vice versa. Hence, financial liberalization as a key euphoria-inducing factor has actually been at the root of many cases of financial fragility and crises. It is the chief factor that *"intensifies the threat by adding further major stresses to the financial infrastructure"* (Arestis and Glickman, 2002). So the focus seems to be on systemic bank stability, as it is argued that liberalization is accompanied by insufficient prudential supervision of the banking sector which results in excessive risk-taking (Noy, 2004). In the light of this, there is a compelling case for strengthening banking regulation and supervision to *"allow countries to sail smoothly through the perilous waters of financial liberalization"* (Kaminsky and Reinhart, 1999). Mason (2009) posits that financial innovation creates conditions of asymmetric information that can lead to banking crises.

*"When the incentive of bankers to do their homework on borrowers is removed, institutions make many poor choices in lending"*

The credit boom that led to the housing bubble was the result of the excessive liquidity that was created and passed through the channel of 'financial liberalization'. In this setup, the worst affected developing countries by the burst of the credit bubble worldwide, essentially 'pay the price' of encouraging financial liberalization policies in a speedy, not a gradual process, without safeguarding the behaviour of the banks.

These conditions were conducive to excessive risk-taking by the banks, a form of moral hazard that also resulted in a loss in transparency (Gorton, 2008). The onset of the global financial crisis has been described by many authors as a Minskian moment: the euphoria of the credit and house price bubbles in the US and many other places, turned into panic, resulting in a major recession. Against this background, asymmetric information, resulting in adverse selection and moral hazard, explains the freezing of credit once the crisis has been set in motion (Ali and Daly, 2010). The global financial crisis that left the edifice of the global financial system in a state of coma, contributed to an intensive debate on how better financial regulation frameworks should be designed. It emerges that financial liberalization has a dual effect as a trade-off mechanism between economic development and crises episodes. On the one hand financial liberalization, if properly managed, can lead to financial deepening and higher growth. On the other hand, it can lead to disastrous crises episodes.

Building on the foundations conveyed in the first part of this chapter, the next section traces the determinants of credit risk in the literature. Section 3.2 discusses the relationship between credit risk and the business cycle and Section 3.3 surfaces the key factors identified in the literature, hence enables formulating the research hypotheses.

### **3.2 The relationship between credit risk and the business cycle**

The literature on banking crises reveals that NPLs acted as a catalyst in inducing such episodes. Most banking problems in recent years have not originated on the liability side of balance sheets. The subprime turmoil as well as past banking crises has demonstrated that the roots of financial problems remain the same and that banking

crises generally stem from the asset side of banks' balance sheets,<sup>35</sup> usually from a protracted deterioration in asset quality (Calomiris and Gorton, 1991; Reinhart and Rogoff, 2009). In 33 banking crises from 1977 to 2002 studied by Hoggarth *et al.* (2003), NPLs ranged between 17% and 33% of total loans. Similarly, in Japan's crisis, Reinhart and Rogoff (2009) record that NPLs peaked at about 35% of total loans. Nakaso (2001) describes the banks' behaviour leading up to Japan's crisis, by suggesting that banks engaged in risky operations are driven by intense competition for market shares. It seems that the role of credit in the banking crisis literature is overwhelming; credit lies at the heart of crises as they are typically preceded by credit booms (Aikman *et al.*, 2011). This is the well-known "*lending booms often end in tears*" as the prosperous times are usually bad times for learning. It becomes evident that a long record of banking crises supports that credit is among the predictors of crises and economic downturns (Loayza and Ranciere, 2005).

The Great Moderation saw European banks expanding rapidly into emerging economies. Within these economies, the SEE countries were among those hardest hit by the global financial crisis that left banks' balance sheets saddled with high NPLs (Berg, 2011). Although there are many different kinds of risk against which banks' management and supervisory authorities need to guard, for most banks the key risk is credit risk, the risk of counterparty failure. Directly implicated in the global financial crisis, credit risk remains a critical field of top priority in banking (Gavalas and Syriopoulos, 2014).

The literature on the determinants of credit risk and the interaction with the macroeconomic conditions is grounded in theoretical models as well as empirical regularities that deal with the business cycle with an explicit role for financial

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<sup>35</sup> This needs to be considered in the light of the role of banks in maturity transformation. Banks transform short-term deposits into long-term loans. The latter makes banks uniquely vulnerable to bank runs or asset quality problems in the case of sudden liquidity stops.

intermediation. These theoretical business cycle models offer the background for modelling credit risk as they highlight the counter-cyclicality of bank risk and business defaults. In the spirit of these models, the financial accelerator theory as discussed in Bernanke and Gertler (1989), Bernanke *et al.* (1999) and Kiyotaki and Moore (1997) has become the most influential theoretical framework for modelling macro-financial linkages.

Initially, Minsky (1964) theorized that financial fragility, which is related to the business cycle and to financial leverage, is a typical feature of any capitalist economy. As Minsky's financial instability hypothesis suggests, when optimism is high and ample funds are available for investment, investors tend to migrate from the safe hedge end to the risky, speculative and Ponzi end. The potential for financial crises is generated endogenously by the interplay of real and financial factors and crises can be sparked by exogenous or endogenous shocks, such as the shifts in Keynesian 'animal spirits'. One of the critical features of Minsky's worldview is that borrowers, lenders, and regulators are lulled into complacency as asset prices rise (Yellen, 2010). Essentially, Minsky builds on Keynes (1936) who attempted to highlight the general theory's basic ingredients and explain why output and employment are so liable to fluctuations. Broadly, Keynes' (1936) general theory explains the capitalist process and the instability of the financial and real sector as a result of market behaviour in the face of uncertainty. Normally, the cycle is originated in real factors but money and credit play a significant role in the propagation of the cycle and are primarily responsible for speculative booms and crises. "*Money enters into the economic scheme in an essential and peculiar manner*" (Keynes, 1936, p.vii), as a "*financing veil*" (Minsky 1982a, p.61) interposed between the real asset and the wealth owner,

i.e. the banks<sup>36</sup> (Mullineux, 2011). The Minskian path-breaking hypothesis suggests that economies with modern financial systems are built on commitments to pay cash today and in the future. Money today is exchanged for money in the future by loan contracts and commitments to pay. Hence, cash in the future is exchanged for cash today. The viability of such relations rests upon cash flows received as a result of income-generating activities. Minsky focuses particularly on business debt, which is an essential characteristic of capitalist economies. To service debt, firms must generate sufficient reserves to meet payments due or to refinance. Therefore, an economy with an ever-increasing private debt becomes vulnerable to changes in the pace of investment, which is an important determinant of both aggregate demand and the viability of debt structures (Minsky, 1982a, 1986; Mullineux, 2011). In Minsky's view, in an economy in which debt finance prevails, instability follows from the expectations of the future level of investment and profits arising from it, and the determination by banks of the appropriate liability structure for financing positions in different types of capital assets. Thus, uncertainty becomes a major determinant of cycles and instability is inevitable, like a system attribute (Flanders, 2015).

The prevailing view before the crisis was that central banking had mastered the management of the business cycle, and the application of modern risk management tools had greatly increased the stability of the financial system (Yellen, 2010). The underlying notion posed by the School of Chicago was that financial markets should be as free as possible from regulatory fetters. Markets never fail, or to a considerable extent, can police themselves (Androulakis, 2008). But, regardless of how well prudential supervision is executed, it will never be adequate to safeguard the economy from the destructive boom and bust cycles that Minsky considered endemic in

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<sup>36</sup> Typically, wealth owners have claims on money rather than real assets.



capitalistic systems. The cult of risky behaviour is deeply engrained not only in financial institutions but also within households and corporations that, during the euphoric times, enthusiastically become highly leveraged. Then, changes in the macroeconomic outlook can play a key role in the contraction and recovery phases of the business cycle (Bernanke *et al.*, 1999). The authors refer to the amplification mechanism of initial shocks through changes in credit market conditions as the ‘financial accelerator’ effect<sup>37</sup>. In essence, this theory suggests that financial cycles are likely to have a larger amplitude than real activity cycles and that the financial accelerator effects tend to amplify real economic cycles owing to the pro-cyclicality of bank lending. Such pro-cyclicality arises because changes in asset prices affect the external finance premium (Bernanke and Gertler, 1989), the value of collateral (Kiyotaki and Moore, 1997) or banks’ leverage (Adrian and Shin, 2008; Berger and Bouwman, 2009).

In more detail, Bernanke *et al.* (1999) combine nominal rigidities with agency cost to investigate the interaction between credit market factors and price stickiness. Frictions in credit markets are widely known to amplify business cycles. The presence of market frictions gives rise to the financial accelerator mechanism that typically works via leverage of the borrower and affects output dynamically (Fuerst *et al.*, 2014). An adverse macroeconomic shock reduces the value of the assets of credit constrained borrowers. The resulting fall in borrowers’ net worth increases leverage. In turn, higher leverage makes an underlying credit friction more severe and raises credit spreads. As a consequence, demand for investment falls by more than would happen in a world without credit market frictions, depressing asset values further. This sets in motion a feedback loop between rising spreads and falling asset prices that lies at the

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<sup>37</sup> The financial accelerator model of Bernanke *et al.* (1999) is widely used as a convenient mechanism for integrating financial factors into an otherwise standard DSGE model.

heart of the financial accelerator. More formally, the market friction creates a wedge between uncollateralized external finance and internal finance. The external finance premium that affects the overall cost of capital and investment decisions is inversely correlated with the financial condition of potential borrowers. Firms or households use assets as collateral when borrowing in order to ameliorate information and agency costs that otherwise would prevent the extension of credit. Thus, the pro-cyclical movements of a potential borrower's net worth translate into counter-cyclical movements of the external finance premium, which in turn amplifies the fluctuation in investment and output. For instance, a positive output shock increases asset prices, reduces the external finance premium and boosts investment. Then, the increase in investment will lift asset prices and cash flows up, inducing feedback effects on spending. In this set up, the financial accelerator mechanism implies that a positive output shock will have a negative impact on banks' credit risk.

A rich theoretical literature has studied the spillovers from the financial system to the economy using models with financial imperfections. Concretely, this literature focuses on the 'financial accelerator', arguing that the amplification and propagation of a credit shock operates through information asymmetries between lenders and borrowers and a balance sheet effect. An increase in asset prices pushes up the net worth of firms, households or countries, and improves the capacity to borrow. Through general equilibrium effects, this dynamic then leads to further increases in asset prices. In this way, strong balance sheets in boom periods may lead to lending against inflated values of collateral. Therefore, the development of the financial accelerator framework (Bernanke and Gertler, 1989; Bernanke *et al.*, 1999) provides the theoretical framework of the studies on credit risk or alternatively, a model in which endogenous variations in the banks' asset quality amplify fluctuations in

business cycles and vice versa. In principle, a real shock to financial conditions could lead to persistent fluctuations in the economy, even if the initiating shock had little or no intrinsic persistence (Bernanke and Gertler, 1989; Bernanke, 2007). The inverse relationship of the external finance premium<sup>38</sup> and the financial condition of borrowers creates a channel through which otherwise short-lived economic shocks may have long-lasting effects on banks' risk-taking. A variant of the financial accelerator is the collateral channel that captures how an increase in housing prices can introduce a relaxation of lending conditions and oversupply of credit (Arestis and Gonzalez, 2013). The increasing value of the collateral during the good times and the related wealth effect contributes to boosting the demand for credit. In principle, the financial accelerator effect applies to any shock that affects borrowers' balance sheets or cash flows (Bernanke, 2007). From a financial perspective, the most striking developments of the Great Recession experienced in the aftermath of the global financial crisis have been a series of corporate bankruptcies and sharp declines in asset values affecting many financial systems around the world.

Taking stock of the preceding analysis, the analytical framework used for assessing the effect of the business cycle on banks' credit risk is based on a three components transmission mechanism. The first step is represented by the effect of credit growth on the dynamics of NPLs, given that the volatility of credit flow has a direct effect on the quality of bank portfolios. The second step is represented by the deterioration of the Greek sovereign risk and the effect of the global financial crisis on the loan quality of the banking systems in the focal countries. The dynamics of the transmission channel is based on the premise that both strong accelerations in lending as well as sudden

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<sup>38</sup> Bernanke and Gertler (1989) define the finance premium as the difference between the cost to a borrower of raising funds externally and the opportunity cost of internal funds. External finance, i.e. raising funds from lenders, is virtually always more expensive than internal finance because of the costs that lenders bear in evaluating borrowers' prospects and monitoring their actions.

deceleration feed the increase of credit risk. The conceptual model for the dynamics of non-performing loans assumes an initially linear relationship, where the set of determinants also includes macroeconomic and monetary variables, such as unemployment or money supply<sup>39</sup>. These indicators are expected to influence the borrowers' repayment capacity, hence ultimately banks' credit risk. Other indicators, for instance financial variables or institutional factors may enter this conceptual framework, which could affect directly or indirectly borrowers' financial burden. The conceptual framework is presented schematically in Figure 7, which is a modified version of Jakubik and Moinescu (2012).

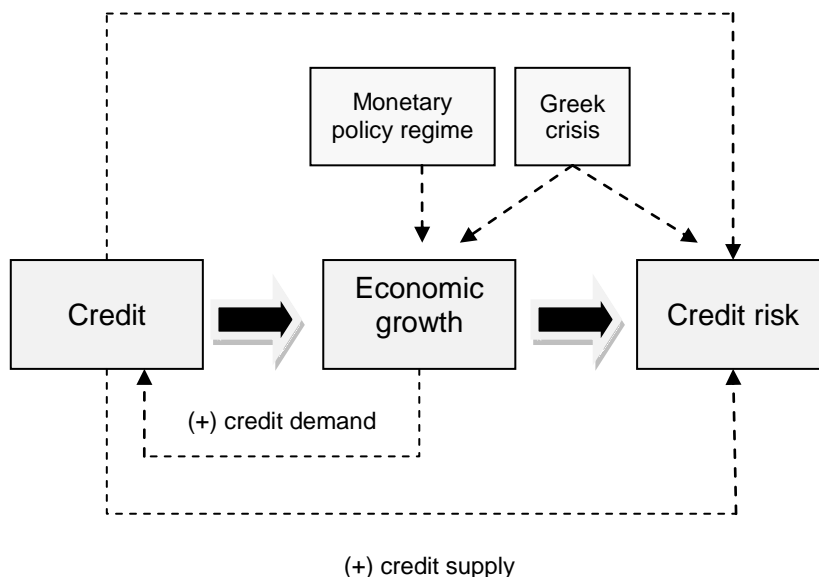


Figure 7 Transmission mechanism of credit accelerator to credit risk

The first component of the credit accelerator mechanism concerns the interaction between credit and macroeconomic dynamics. Additional pressure could arise from external factors (Greek crisis) or institutional ones (monetary policy regime,

<sup>39</sup> Following the analysis in Section 2.5, the monetary policy regimes in the focal countries had an impact on macroeconomic policies, which in turn affect credit risk.

regulation) that could affect through direct or indirect channels credit risk in the focal countries.

Summing up, theoretical as well as empirical considerations in credit risk modelling lie at the heart of the literature propagated by the Great Depression (Bernanke *et al.*, 1999; Calomiris and Mason, 2003). In shaping the underlying relationships of NPLs with the macroeconomy, researchers tend to substantiate the financial accelerator theory. Typically, the modelling regularities include the cyclical nature of bank credit, NPLs and loan loss provisions (LLPs).<sup>40</sup> Thus, in the upturn of the cycle, contemporaneous NPLs tend to be low and provisioning subdued. Also, the pressure from competition and the optimism about the macroeconomy can lead to a loosening of lending standards and an accelerating credit expansion, thus sowing the seeds of borrowers' and lenders' financial distress later. Certainly, the loosening of lending standards during the upturn depends crucially on the regulatory and supervisory framework. In the downturn, the higher than expected NPLs, coupled with the declining value of collaterals, lead to a tightening of credit with an adverse impact on domestic demand.

A strand of literature that is usually found under the 'balance sheet effect' type of studies, maintains that banking fragility is the end result of a chain of events (Beim and Calomiris, 2001; Allen *et al.*, 2002; Borio, 2004; Goldstein, 2007). The balance sheet approach suggests that banking distress emerges from weaknesses in banks' balance sheets, vulnerabilities in corporate and household balance sheets, and problems in the government's balance sheet. Although this chain of events can begin anywhere, the end result is a vicious circle. Hence, the balance sheet approach

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<sup>40</sup> The measures of credit risk, typically met in related studies, are NPLs, LLPs, loan losses - write offs, or corporate bankruptcies.

suggests that variables such as the proportion of NPLs in banks' loan portfolios,<sup>41</sup> large fluctuations in asset prices, or indicators of business failures, could be used to assess banking stability and disentangle its key drivers. As IMF (2007) states:

*“Surveillance in financial systems with a large foreign-owned component needs to pay close attention to actual or potential macroeconomic and financial interactions”.*

The role of macroeconomic instability, reflected in policies that have spurred on lending booms, has been already discussed. For instance, one fundamental reason documented by Lane and Milesi-Ferretti (2010) is the strong link between pre-crisis fast private credit growth, current account deficits and the decline in the growth rate of output. The authors indicated that a key channel of crisis transmission operated through the reliance on those financial systems<sup>42</sup> that were hit hardest by the crisis.

Usually, in countries that experience accelerating credit growth during the booming years, there is a high risk that NPLs will rise sharply during the economic downturn, destabilizing the banking sector which, in turn, would adversely impact the real sector. Rising domestic NPLs and inadequate provisioning thereof pose significant risks to growth by restricting capital availability as the banking systems remain practically frozen. The damage that financial instability can cause in poor and developing economies can be particularly severe as the long chronicle of crises in the SEE region purports. It is also argued that the NPLs are one of the major causes of economic stagnation (Hou and Dickinson, 2007). From this point of view, the eradication of NPLs is a necessary condition to improve the state of an economy. If NPLs are kept and continuously rolled over, then valuable resources are locked up in unprofitable sectors, hindering economic growth and efficiency. One striking fact

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<sup>41</sup> The ratio of NPLs to total gross loans is widely acknowledged as a standard measure of banking distress, either on an individual bank or at a system-wide level.

<sup>42</sup> By pulling back funds and curtailing lending, foreign banks can become an obvious channel of crisis transmission (Lane and Milesi-Ferretti, 2010).

about recessions associated with banking crises is that credit demand becomes muted and growth takes longer to pick up, due to the overhang of debt and high leverage built up by households, small businesses and corporations, but also banks, during the boom cycle of the economy. Banks turn their back on otherwise productive as well as profitable investment projects proposed by firms.

The phenomenon that banks become reluctant to take on new risks and commit to new loans is described as a ‘credit crunch’;<sup>43</sup> this is a situation in which the supply of credit is restricted to below the range usually identified with prevailing market interest rates and the profitability of investment projects. The idea of a credit crunch has received attention when the traditional views failed to explain the economic state of the countries that suffered from the Asian financial crisis in 1997. The term was adopted from a discussion in the US that related to contractions in credit and the slowdown of economic activity (Bernanke and Lown, 1991). Then a number of authors attributed the credit crunch phenomenon to surging NPLs (Krueger and Tornell, 1999; Agung *et al.*, 2001). Agung *et al.* (2001) investigated the relationship between loan supply and real lending capacity, lending rates, real output, bank’s capital ratio, and NPLs. The authors’ results show negative and significant coefficients on NPLs, which indicate that as credit supply declines the NPLs’ problems heighten. Hence, NPLs constitute one of the most important factors that make banks unwilling to provide credit. Hou and Dickinson (2007) suggest that in a high NPL environment, banks’ primary focus is to consolidate internally in their aim to improve asset quality rather than providing credit. In addition, the regulator usually requires banks to raise provisions for potential loan losses that in turn decrease the banks’ revenue as well as their available

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<sup>43</sup> A ‘credit crunch’ is essentially a disequilibrium phenomenon that is present when banks are unwilling to lend. Under this framework, a firm that generates profitable projects cannot obtain credit in spite of low interest rates prevailing in the market. A credit crunch results in excessive demand for credit and hence credit rationing, where loans are allocated through a non-price-based mechanism. Effectively, the credit crunch phenomenon imposes additional pressure on monetary policy.

loanable funds. The cutback on loans impairs the corporate sector and blocks any chance of resuming normal operations and growing. Unavailability of credit to finance firms' needs for working capital or investment might well trigger a second-round business failure which in turn exacerbates the quality of bank loans, resulting in re-emerging banking crises. In essence, this process triggers a vicious spiral, as depicted in Figure 8.

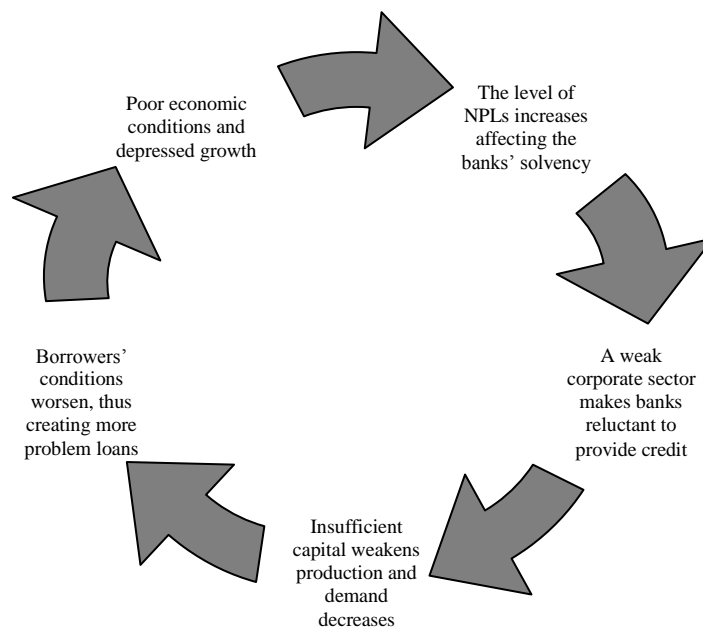


Figure 8 The effect of a credit crunch on banks and the economy

Theories of credit have been developed by several schools of thought including the Monetarism, the Post Keynesians and the DSGE model among others. However, Ali and Daly (2010) argue that the existing theories do not provide an adequate account<sup>44</sup> of the key empirical features of the recent credit cycle. Broadly, theoretical models have not explicitly studied the effects of macroeconomic conditions including monetary policy or institutional factors on bank credit risk (De Nicolo *et al.*, 2010).

<sup>44</sup> The authors suggest that the macroeconomic models developed are more interested in quantity rather than quality of credit.



On the same train of thought, Zhang (2009) states that theoretical models assuming financial contracts that isolate banks from macroeconomic shocks miss the interactions between banks and the macroeconomy. As banks operate under asymmetric information and limited liability they tend to assume more risk than is optimal. Since banks are typically highly leveraged, the moral hazard problem provides the rationale for prudential banking regulation.

Taking stock of the theoretical considerations on credit risk, the following section aims to classify the determinants of credit risk found in the literature.

### **3.3 Classification of credit risk determinants**

There is a great deal of literature that covers the determinants of credit risk. These can be macroeconomic, bank-specific, institutional or a combination of factors of these three categories. This section identifies and classifies the determinants of credit risk found in the literature. Table A2 in Appendix A provides the theoretical background of the SEE-related studies by presenting a brief account of the potential explanatory variables of credit risk.

The first category describes the factors related to the macroeconomic environment.

#### **a. Macroeconomic indicators**

The literature studying the relationship between credit risk and the business cycle focuses on the banks' cyclical behaviour. A wealth of studies uses loan loss provisions to proxy credit risk while other authors use NPLs or problem loans. In line with Borio and Lowe (2002), Quagliariello's (2008) survey finds that models using macroeconomic variables tend to perform better than those that only use bank-specific ones. Broadly, studies conclude that declining economic activity remains the most important risk factor for banks' asset quality. Also, factors such as GDP,

consumption, investment, unemployment, capital accumulation or inflows are associated with credit risk that builds up during the boom but materializes in the downturn. Adverse macroeconomic shocks make it difficult for borrowers to repay their debts in full or on time, thus threatening the solvency of banks (Gavin and Hausmann, 1996). Babihuga (2007) demonstrates that NPLs fluctuate strongly with both the business cycle and the inflation rate. Notably, she documents a considerable degree of heterogeneity in the relationship between macroeconomic indicators and NPLs across the sample of countries used in the study. Figure 9 illustrates the relationship between NPLs and the business cycle, proxied by the cyclical component of real GDP.

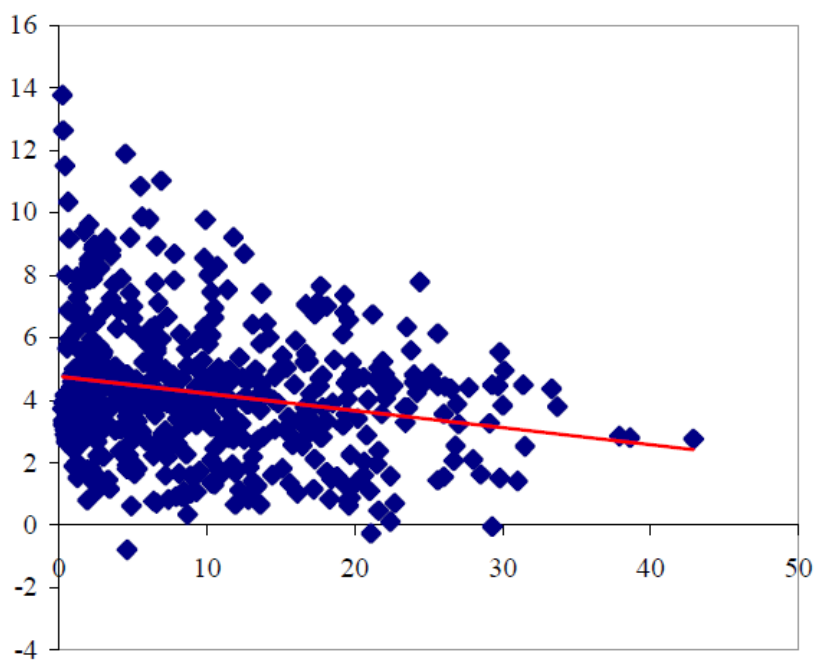


Figure 9 NPLs and the business cycle, 1998-2005.

Sources: Babihuga (2007) and sources cited therein.

Despite the degree of heterogeneity across Babihuga's (2007) sample, which includes 96 countries, NPLs appear to have a strong negative relationship with the business cycle. Interestingly, the author underscores that NPLs appear to behave

countercyclically in emerging Europe while in Western Europe their relationship with the business cycle appears flat. In line with the collateral channel, Hilbers *et al.* (2001) who extend the study of Kaminsky and Reinhart (1999), document that a downturn in property prices increases financial instability. Hilbers *et al.* (2001) find that banks tend to lend more to real estate projects in booming periods, since the collateral value rises and the perceived risk diminishes. In effect higher property prices are associated with increased indebtedness of the non-financial sector which becomes more vulnerable to macroeconomic shocks, hence credit risk increases. Salas and Saurina (2002) find a negative effect of the business cycle on problem loans. In the same spirit, ECB (2001), Cavallo and Majnoni (2001), Laeven and Majnoni (2003) document a negative relation between loan loss provisions and the economic cycle. These studies confirm the procyclicality of banks' behaviour by using the income-smoothing hypothesis and suggest that banks' provisioning policy magnifies the effect of the negative phase of the cycle.

Overall, it appears that credit risk is associated with a wide set of regressors that proxy economic activity. For instance, a fall in GDP growth, rising unemployment, swings in inflation, rising interest rates or volatile real exchange rates, all signal weaknesses in borrowers' debt-servicing capacity and increasing credit risk (Arpa *et al.*, 2001; Bikker and Hu, 2002). In countries with developed capital markets, the stock market activity can potentially affect banks' credit risk, as found by Beck *et al.* (2013), as stock market indices tend to follow or lead the cyclical trends of the macroeconomy (Kalirai and Scheicher, 2002). Hence, the finding of a negative relationship between credit risk and economic growth is a common thread among the surveyed studies (Pain, 2003; Nkusu, 2011; Gavin and Hausmann, 1996). While macroeconomic developments can lead to financial vulnerability, it is equally true that

imperfections in the intermediation process can contribute to instability of the banking sector. Hence, economic activity cannot fully explain the evolution of credit risk (Beck *et al.*, 2013). Additional factors may affect asset quality, especially in countries where their banking systems are fragile in the sense that present idiosyncratic vulnerabilities.

#### **b. Bank-specific indicators**

Most studies have been developed in relatively favourable economic conditions when bank-specific factors were likely to be more relevant in explaining credit risk. Against this backdrop, Quagliariello (2008) suggests that bank-specific indicators can outperform macroeconomic ones especially when the reliability of balance sheet data is high. It is well documented in studies that inefficient institutions tend to have large proportions of NPLs prior to failure. This strand of literature suggests that the major risks facing financial institutions are caused internally. In a prominent study that builds upon four key hypotheses, Berger and DeYoung (1997) document that cost efficiency is an important indicator of future problem loans. Cost-inefficient banks may tend to have high NPLs for a number of reasons: bad luck, bad management, skimping or moral hazard. Essentially the ‘bad luck’ hypothesis reverts to exogenous factors including operating conditions. Under the ‘bad management’ hypothesis, credit risk is attributed to poor management practices reflected in reduced cost efficiency and poor underwriting and monitoring practices. The ‘skimping hypothesis’ deals with the trade-off between short-term operating costs and future problem loans while the ‘moral hazard’ one refers to the classical problem of excessive risk-taking (Berger and DeYoung, 1997). Banks tend to assume more risk when another party – depositors, investors, taxpayers – bears part of the risk and cannot charge or prevent that risk-taking. Nonetheless, the literature suggests that Berger and DeYoung’s

(1997) hypotheses are not mutually exclusive but also that neither hypothesis clearly dominates the other. Yet, almost unanimously, studies indicate that banks' asset quality is a statistically significant predictor of insolvency (Demirgüç-Kunt, 1989).

Within the bank-specific indicators, many studies use the stock or growth of loans (Salas and Saurina, 2002; De Bock and Demyanets, 2012; Klein, 2013). In this setup the decline or increase in bank lending is perceived to be the result of supply and demand factors. On the supply side, the combination of protracted economic weaknesses with legacy balance sheet problems is causing credit risk to rise. This, in turn, hampers the ability and willingness of banks to lend. A high level of NPLs ties up capital and funding, and reduces the capacity of banks to extend new loans, causing the credit crunch problem. On the demand side, the high level of corporate indebtedness, matched with deteriorating economic conditions, weigh on borrowers' debt-servicing capacity and demand for new credit. However, the effect of the protracted credit boom during the global financial crisis has already been extensively discussed. According to Keeton (1999), loan growth leads to higher problem loans when there is a shift in supply, i.e. loan interests and credit standards are relaxed, lending soars and latent credit risks accumulate. Keeton (1999) suggests that the association between loan growth and loan loss provisions turns negative when the loan growth relates to borrowers' demand shift and improved creditworthiness or an increase in the return on investment.

Several recent studies use Berger and DeYoung's (1997) hypotheses along with economic activity factors in their attempt to explain credit risk (Espinosa and Prasad, 2010; Louzis *et al.*, 2012). Nonetheless, the research that uses both types of credit risk determinants (macroeconomic and bank-specific) is the exception and includes Salas and Saurina (2002) for Spain and Louzis *et al.* (2012) for Greece.

A third branch of studies focuses on explaining NPLs in the context of institutional factors without excluding macroeconomic indicators.

### **c. Institutional Factors**

The institutional or structural factors pertain to regulation and supervision, and the incentive structure therein (Nkusu, 2011; Calomiris and Haber, 2014). Disparities in regulation can affect banks' lending behaviour and risk appetite, and as such credit risk. Podpiera's (2004) study is concerned with the effects of the quality of regulation and supervision on the banking sector's asset quality. The author also controls for macroeconomic and structural factors, as well as the level of development of the economy and the financial system. In this respect, his study builds bridges with the well-documented literature strand on finance-growth nexus.

The effect of the institutional-structural factors that relate to liberalization and supervision has been thoroughly explored in previous sections. Several studies document that financial liberalization increases bank risk-taking in both developed and developing countries as it expands opportunities for banks to take on risk (Demirgüç-Kunt and Detragiache, 1998; Cubillas and González, 2014). Typically, financial liberalization unleashes competition that does not merely increase efficiency. Competitive pressure also carries risks as it raises the incentive for bankers to adopt excessively risky lending strategies and incur large loan losses. Demirgüç-Kunt and Detragiache (1998) find that a strong institutional framework can curb the adverse effects of liberalization on the financial sector. Cubillas and González (2014) find that bank liberalization increases bank risk-taking through different channels, depending on each country's specificities. In this respect, the authors indicate that the effectiveness of supervision and regulation varies across countries. Hence, a banking sector's shortcomings are the consequences of political bargains structured by the

country's fundamental political institutions. In this respect, each country has a banking system that is consistent with the political institutions of the society that structures the incentives of politicians, bankers, shareholders, debtors, depositors and taxpayers in order to shape policies and regulations in their favour (Calomiris and Haber, 2014).

Overall, good economic conditions jointly with healthy financial metrics – capital, efficiency – affect positively the banks' asset quality. The theoretical background documents that macroeconomic forces and banks' credit risk are closely related and that macroeconomic factors are among the key determinants of financial vulnerability. Furthermore, banks present cyclical behaviour as, typically, NPLs and loan loss provisions are low during booms and rise in the downturn (Quagliariello, 2008).

Summarizing so far the key points of the previous sections, it is evident that managing credit risk is the cornerstone of preserving a country's financial stability. In turn, financial stability is paramount for economic growth, as most transactions in the real economy are processed through the financial system. If policies that ensure financial stability are not pursued, then the growth that comes in the upturn of the credit cycle will be dissipated in the bust phase. Then, the consequences for the stability of the financial sector and the functioning of the real economy are dramatic (Sinha, 2012). These are usually manifested in the form of large output losses, sluggish growth, rising unemployment, non-functional financial markets, weak banks, impaired monetary policy transmission and a sense of pessimism in society. In view of the costly effects of the banking crises, it appears that the banks' contribution to the economy may have been overstated by their proponents. A key lesson from the global financial crisis is that a banking system that does not accurately assess risk is adding little to the economy (Haldane *et al.*, 2010). This is a serious problem as it seems that

the banks, not only in the US or other developed economies, but also in the research's focal countries, have systematically underpriced or mismanaged risk in the boom period leading up to the crisis. Such behaviour casts doubts on the *raison d'être* of banks, especially if we consider that only a small portion of bank activity concerns the channelling of savings to productive investments (Turner, 2010). But it also calls for a closer look at the determinants of NPLs as the key culprits of financial instability.

The next section provides the concluding remarks of the chapter.

### **3.4 Conclusions**

The role of banks is critical in facilitating the efficient deployment and allocation of economic resources over time, and bringing about a positive impact in the society, under conditions of uncertainty. The well-researched finance-growth area demonstrates that the role of finance is indeed associated with growth. Yet, a number of country-specific factors need to be embedded in the equation to allow for macroeconomic and monetary policies, regulatory, legal, historical and even geographical considerations.

A healthy and efficient financial system is integral to the sound fundamentals of an economy. Hence, designing policies for economic development and at the same time ignoring the stability of the banking system can have disastrous results. Although predicting the timing of crises may still be an elusive goal, the identification of indicators that signal financial vulnerability, provides a valuable insight for research development. A lengthy chronicle of banking crises internationally, including the crisis-prone countries of the SEE region, purports that prior to or during these episodes, banks' asset quality deteriorates sharply and NPLs surge, thus exhausting the aggregate banking system capital. Typically, problems associated with banking



crises in developing countries emerge from a credit boom and a property bubble. It is also plausible to conclude that comprehensive, country-specific assessments based on all available qualitative and quantitative information, should be used in sync with any modelling endeavour, given the complexity of the financial stability problem and the inherent difficulty to ‘see’ behind the banks’ veil.

At the heart of the global financial crisis, there has been a financial liberalization credit spree that has gone haywire, usually abated by lax fiscal or monetary policy, or a lack of supervision that has brought mounting NPLs and financial instability in many developing countries, resulting in a deep recession. The chapter has made clear that a key warning indicator of banking crises is the deteriorating asset quality in banks’ loan books that usually occurs after a boom-bust cycle, spurred on by an overheated economy through accelerating credit. The task for cleaning up banks’ balance sheets then becomes huge as it typically involves public funds, while the subsequent recession is amplified by stagnant pro-cyclical credit policies in the framework of the credit crunch. A key lesson from the global financial crisis is that a banking system that does not accurately assess risk may add little to the well-being of the economy. The latter calls for a closer look at credit risk as the key culprit of financial instability.

The financial accelerator model, which provides the theoretical underpinnings on the determinants of credit risk is a framework where endogenous variations in banks’ asset quality amplify fluctuations in the business cycle and vice versa. Against this background, the sources of credit risk can be macroeconomic, bank-specific or institutional, or a combination of factors of these three categories.

The next chapter delves into the quantitative approaches, as applied in the empirical literature on banks’ credit risk.

## Chapter 4: Empirical studies on credit risk

*“Over the past 30 years, we have had rather too much Merton (1990) and rather too little Minsky (1982) in our thinking about the roles of money and finance in the business cycle”*

Buiter (2008)

### Introduction

The deterioration in the quality of banks' loan books has been at the epicentre of costly episodes of bank distress and crises in both transitional and advanced economies. The bitter reality is that elevating NPLs dampen growth<sup>45</sup> (World Bank, 2013). Hence, a degenerating asset quality has been generally considered as the channel for macroeconomic shocks to banks' balance sheets. This explains why the assessment of credit risk in the financial sector is a key element of macro-prudential surveillance (ECB, 2012). This chapter takes stock of the empirical studies on banks' asset quality, usually met as credit risk, and builds on the theoretical foundations touched upon previously. Within this framework, this chapter reviews the most influential studies that lie at the core of the empirical work developed in modelling credit risk, by focusing on the different methodologies used. Hence, Section 4.1 embarks on an exploration of the quantitative approaches widely used in studies that investigate the determinants of banks' asset quality. Next, Section 4.2 presents the time series models while Section 4.3 the panel data ones. Both sections 4.2 and 4.3 put emphasis on the timeframe and the methodology employed in the empirical literature as well as the paucity of related studies on SEE emerging economies. Section 4.4 identifies the gaps found in the empirical studies with the explicit aim of

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<sup>45</sup> Reflecting the challenging macroeconomic situation, NPLs reached worrying levels of above 15% in Bulgaria and Romania by the end of 2012. Their rise was driven by a mix of weak economic activity and borrower vulnerabilities, and loans to the construction and retail sectors.

establishing linkages to the case study under investigation: the credit risk of the Bulgarian and Romanian bank sectors and the effect of the Greek sovereign debt crisis on them. The last section concludes the chapter.

#### **4.1 Modelling credit risk**

Although the empirical literature on banks' credit risk has a relatively short history, a substantial number of studies have been produced on the stability of the banking systems in the aftermath of crises episodes. However, as pointed out by Schinasi (2005), compared with the analysis of monetary and macroeconomic stability, the analysis of financial stability is still in the developing stage. The events leading to the Great Recession testify to the importance of this requirement. Radical measures proposed to increase the stability of the financial sector seem to have been bypassed or fiercely objected to. In response to the global financial crisis, the authorities in the UK, Europe and the US tried to introduce new legislation and regulation in an attempt to make banks more resilient to shocks, easier to fix when they get into difficulties, and to reduce the severity of future financial crises. In the UK, the Vickers Commission recommended ring-fencing banks' retail-utility operations from their investment banking activities. In Europe and the US similar initiatives<sup>46</sup> were aimed at assuring the solvency of large banks and financial institutions, and avoiding the necessity of future bailouts. Even though the global financial crisis has revealed significant deficiencies in the institutional framework, financial institutions retain

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<sup>46</sup> In Europe, the Basel III regulatory framework introduced bank capital and liquidity standards. In the US the Congress passed the Dodd-Frank bill aimed at increasing the oversight of large financial institutions. This bill included the Volcker rule, a modern version of the Glass-Steagall Act of 1933, attempting to restrict riskier investment bank activities and insulating such activities from commercial banking loans financed by bank deposits. The core idea of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 was to promote financial stability by improving accountability and transparency in the financial system, to protect taxpayers by ending bailouts and consumers from abusive financial services practices, in an attempt to end the 'too big to fail' concept.

excessive incentives for risk-taking associated with the ‘moral hazard’ problem (Arestis and Karakitsos, 2014). According to the authors “*financial stability has not been addressed properly and as such it requires further investigation*”. Focusing on the solvency of individual institutions is not enough; authorities need to take a system-wide perspective in regulation and supervision (Cecchetti, 2011). In this respect, a supervisory viewpoint that focuses on the financial system as a whole – macro-prudential – is of utmost importance. The global crisis has highlighted the need for constructing a system that reduces the risk of financial institutions, new crises as well as spillover in the event of an international or regional crisis. A number of econometric models have been developed aimed at analysing banks’ resilience to shocks and detecting those indicators that cause vulnerability and the action needs to be taken.

Assessing credit risk varies from country to country with the changing characteristics of each financial system. Accordingly, the data requirements are broader for countries with developed financial markets than for those with less developed markets (Howard, 2009). The literature that relates financial to macroeconomic shocks is closely linked to macro-stress testing.

A separate stream of studies derives from the stress testing approach formalized by the FSAP,<sup>47</sup> and analyses the relationship between macroeconomic indicators and financial stability. Stress testing is usually country-specific and aimed at calibrating potential financial system risks from macroeconomic shocks. Notable studies in this area include stress tests of UK banks (Hoggarth *et al.*, 2005a,b) and Austrian banks (Arpa *et al.*, 2001). This stream of studies adopts two broad methodologies:

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<sup>47</sup> The acronym stands for the Financial Sector Assessment Program (FSAP), established in 1999 by IMF, as a comprehensive and in-depth analysis of a country’s financial sector.

- a. The balance sheet models that explore the link between banks' accounting measures of vulnerability, such as NPLs and LLPs and the business cycle, and
- b. The value-at-risk models, combining the analysis of multiple risk factors into a probability distribution of mark-to-market losses that the banking system could face under a stress scenario.

Typically, the latter methodology that is more data-intensive, analyses the impact of macroeconomic factors on the corporate or household sector default risk and maps those developments into banks' loan losses under a mark-to-market framework. Since the exploration of this methodology is beyond the scope of the present research, the former one is considered next. The econometric models following the balance sheet methodology can be further classified into two main categories:

- a. Time-series or panel data techniques, and
- b. Models that analyse the vulnerability of the banking system to changing macro-fundamentals in the context of economy-wide or inter-industry structural models.

The second category essentially involves embedding the reduced form equation of the first category into structural macroeconomic models developed and used by central banks in the monetary policy decision-making (Sorge, 2004). In view of that, the review of the empirical studies continues by considering the time series and panel data modelling techniques.

In these models the key dependent variable is either the ratio of NPLs or the ratio of LLPs. Other measures of credit risk have also been used in empirical studies, such as the historical default rate of loans, but on a limited scale. Hence, the general framework of these methodologies differs from the literature on early warning systems as the risk measures are not leading indicators of the probability of a crisis,

but actual metrics to be estimated as a linear function of relevant macroeconomic and bank-specific variables. Time series analysis is useful in assessing the build-up of financial sector vulnerabilities over time while panel studies can also evaluate the role of country-specific or bank-specific factors. On the other hand, studies that use structural macro-econometric models allow studying the repercussions of an exogenous shock on all macroeconomic variables. As such, they allow the evaluation of trade-offs and potential conflicts between the pursuit of monetary and financial stability or the assessment of structural interdependencies and production flows among industries (Sorge and Virolainen, 2006). Broadly, both reduced-form and structural econometric models are appealing for being intuitive and relatively straightforward to implement. On the other hand, this approach has the limitation that it relates to rigid linear relationships.

The use of the appropriate methodology depends not only on the type of study, country-specific or cross-country, but also on data availability since the data requirements are one of the main hindrances for many countries when trying to assess the vulnerabilities within their financial systems (Sorge, 2004; Howard, 2009; Gorton, 2012). A wealth of studies adopts each of the modelling options described.

The following section reviews the time series models on the determinants of credit risk.

#### **4.2 Time series models**

Studies analysing the macroeconomic determinants of banks' NPLs or loan losses include Arpa *et al.* (2001), Kalirai and Scheicher (2002) and Boss (2002) for Austria, Delgado and Saurina (2004) for Spain, Baboucek and Jancar (2005) for the Czech

Republic, Zeman and Jurca (2008) for Slovakia, Bhattacharya and Roy (2008) for India, Filosa (2007) for Italy, and Hoggarth *et al.* (2005a,b) for the UK.

Typically, these studies find a negative association between the measure of credit risk and the GDP growth or money supply, a positive one with interest rates and unemployment, while evidence on the effect of loan growth is mixed. The framework for studying the impact of GDP growth, and consequently the loan growth on credit risk, is represented by two competing theories. The first stresses that credit risk is pro-cyclical while the second theory defends the counter-cyclical view. The common view implies that an economic upswing reduces the likelihood of loan defaults, whereas a recession will have the opposite effect (Bikker and Metzmakers, 2005). Accordingly, the banks' provisioning policy is pro-cyclical,<sup>48</sup> meaning that it reinforces the development of the business cycle. Hence, banks are expected to reflect this feature in their decision-making by lowering provisions during an economic boom and increasing them in a downturn. The alternative counter-cyclical view states that credit risk is built up in a boom and materializes in the downturn (Borio *et al.*, 2001; Lowe, 2002). The favourable conditions of an economic expansion could lead to an excessive increase in credit lending coupled with relaxed credit criteria. The counter-cyclical view associates the latter with higher risks and the build-up of financial imbalances that increase the likelihood of economic contraction (Borio *et al.*, 2001; Lowe, 2002). However, there are other factors that can reasonably explain the bank's lending behaviour vis-à-vis credit risk, such as income smoothing,<sup>49</sup> economic policy and banking regulation (Athanasoglou and Daniilidis, 2011).

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<sup>48</sup> A common explanation for the pro-cyclicality of the financial system is rooted in the information asymmetries between borrowers and lenders. When economic conditions are depressed and collateral values are low, information asymmetries can mean that even borrowers with profitable projects find it difficult to obtain funding.

<sup>49</sup> For instance, Cavallo and Majnoni (2001) and Laeven and Majnoni (2003) suggest that bank risk management is imprudent if loan provisions are negatively associated with loan growth.

Arpa *et al.* (2001) and Kalirai and Scheicher (2002) model the aggregate LLPs of the Austrian banking system as a function of an extensive array of macroeconomic variables. Arpa *et al.* (2001) find that risk provisions rise when the growth in real GDP declines, real interest rates fall and real estate prices increase. Kalirai and Scheicher's (2002) study in addition, finds that a fall in business confidence, a decline in the stock market and in industrial production, all affect negatively the LLPs. In the same spirit, Boss (2002) estimates a macroeconomic credit risk model for the aggregate corporate default rate in Austria. Boss's findings that are broadly aligned with Arpa *et al.* (2001) and Kalirai and Scheicher (2002), suggest that industrial production, inflation, and the price of oil are among the important determinants of corporate default rates.

Similarly to Boss (2002), Kalfaoglou (2006) provides evidence that credit risk prevails among all other risks in the Greek banking sector. Despite the satisfactory results of the Greek banks' stress-tests, Kalfaoglou (2006) highlights that their cross-border operations can become a source of vulnerability, and in effect, require intensive risk management. The IMF's (2010b) assessment of the Bulgarian banking system views the reversal of parent funding to their domestic subsidiaries as a material risk for the banking system. The macroeconomic variables found by the IMF (2010b) to be econometrically significant are the output gap and the loan growth during 1998-2002, which reduced the classified loan ratio of corporations as the share of legacy NPLs in that segment gradually shrank. Furthermore, the study that is based on quarterly data spanning 1998-2009 uses an autoregressive term as it is strongly suggested by the data and dummy variables to account for a change in the definition of the series in 2006, the loosening of loan classification rules in 2009, and the output gap. However, the estimation of the output gap is among the caveats attached to the



IMF's (2010b) results, together with the fact that the sample does not include a full economic cycle.

Still, it is possible that the impact of macroeconomic conditions on the evolution of the quality of banks' loan portfolio are asymmetric during recessions and recoveries as well as the fact that some banks are ever-greening loans and under-reporting restructured loans, similarly to other countries of the region (IMF, 2010b). On the other hand, the IMF's (2010a) assessment of Romanian banks that is based on data up to the end of June 2008, finds them vulnerable to the country's output gap, a slowdown or reversal of capital inflows,<sup>50</sup> and an associated downward pressure on the exchange rate.<sup>51</sup> The latter study does not explicitly assess the impact of the sharp slowing of lending, either as a result of tightening credit standards or in response to reduced funding from foreign parent banks. As Romanian banks are dependent on external sources of liquidity, a significant contraction in sources of funds would lead to a credit crunch in Romania. Furthermore, IMF's (2010a) study does not account for external spillovers arising from the pressure on Greek banks amidst concerns over the Greek public debt sustainability.

Summing up both studies, i.e. IMF (2010a,b), it emerges that credit risk is the major risk factor for both the Bulgarian and the Romanian banking systems. While the effect of the output gap is dominant in both countries' credit risk, there are ambiguities over its estimation. Other key determinants depend on each country's distinctive features.

Since the seminal work of Sims (1980) on the investigation of monetary policy shocks, the vector autoregressive (VAR) approach has gained momentum. Several

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<sup>50</sup> IMF (2010b) indicates that a sharp contraction in capital inflows could lead to a major slump in the Romanian property market and a substantial rise in unemployment, particularly in the construction sector, with adverse consequences for the asset quality of the banking system.

<sup>51</sup> The effect of the exchange risk in Romania is indirectly incorporated in credit risk, since most loans are denominated in euros.

studies apply VAR models to investigate the macro-fundamentals' transmission mechanisms in the US, Japan and many other countries.<sup>52</sup> Foglia's (2008) survey indicates that researchers in the area of financial stability adopt VAR models because they are more flexible and retain several of the desirable policy-analysis features of a structural model. Typically, these models include various macroeconomic factors, ranging from two to five, depending on the country. In some cases, variables more directly related to the asset quality of banks are added, such as measures of household indebtedness or firms' financial leverage; in other cases, market-based indicators of credit risk, such as equity prices and corporate bond spreads, are used.<sup>53</sup>

The estimation process normally requires the selection of a set of macroeconomic and financial variables that, according to economic theory and empirical evidence, are expected to affect credit risk. In this regard, variables such as economic growth, unemployment, interest rates, equity prices and corporate bond spreads, contribute to explaining credit risk (Foglia, 2008). Gambera (2000) uses univariate VAR models to investigate the impact of regional- and national-wide macroeconomic variables on the quality of loan portfolios measured by NPLs and loan delinquencies, of a large sample of US banks using quarterly data for 1987-1999. He reports that unemployment rate, farming income, housing permits, bankruptcy filings were among the significant predictors of bank asset quality.

Blaschke *et al.* (2001) propose the use of VAR methodology to investigate the impact of inflation, nominal interest rate, output and changes in terms of trade to the ratio of NPLs to total loans or total assets of the banking sector. The estimated coefficients of

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<sup>52</sup>These models are used in the studies developed at the Central Banks of the UK, Spain and the Netherlands, and also at the European Central Bank, among others.

<sup>53</sup> 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.

the regressions provide an estimate of the sensitivity of loan performance to macroeconomic factors.

Similarly, Hoggarth *et al.* (2005b) 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. They employ quarterly data for the period 1988-2004 and provide evidence of a significant and negative relationship between the output gap and the write-off ratio, with the maximum impact occurring after one year. Furthermore, the findings indicate that the banks' write-off ratio increases after an increase in retail price inflation and nominal interest rates.

Baboucek and Jancar (2005) apply an unrestricted VAR<sup>54</sup> model to investigate the effects of macroeconomic shocks on the loan quality of the Czech banking sector using monthly series from 1993-2006. Employing the NPL ratio as an indicator of loan quality, the authors find robust causal relationships in place between loan quality and a number of macroeconomic variables based on impulse response analysis.<sup>55</sup> Unemployment and inflation were found to affect positively the NPL ratio, both cited as early warning indicators of credit portfolio deterioration. However, other variables, such as loan stock and money supply failed to concur with other empirical studies. Notably, Baboucek and Jancar's (2005) simulations fail to support the hypothesis that a slowdown in credit expansion is a response to deteriorating credit risk. In contrast they indicate a weak feedback between the NPL ratio and lending growth, suggesting

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<sup>54</sup> 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, unemployment rate, consumer price index, domestic real three-month interest rate and the share of NPLs in aggregate bank loans to clients.

<sup>55</sup> The analysis of feedback effects is a core concern for financial stability, as the global financial crisis has aggravated the downside risks to growth. The typical econometric framework that allows for feedback effects between a banking system and the real economy is the VAR methodology, in which a vector of endogenous variables includes both a measure of credit risk and the economic variables associated with the state of the business cycle.

that faster loan growth decreases NPLs. Equally, they provide evidence that an accelerating economic activity goes hand in hand with a rising NPL ratio, noting that failure to support a hypothesis can be reasonably explained by country-specific features revealing the evolving nature of a developing economy.

Marcucci and Quagliariello (2008) employed a reduced-form VAR to explore the effect of business cycle conditions on the default rates of customers in Italian banks over the period 1990-2004. Their results show that default rates follow a cyclical pattern, falling during macroeconomic expansions and increasing during downturns. Several studies (e.g. Boss, 2002; Virolainen, 2004) analyse the impact of macroeconomic fundamentals on the credit quality of banks' debtors using Wilson's (1997a,b) framework. For instance, Virolainen (2004) estimates a macroeconomic credit risk model for the Finnish corporate sector over the period 1986-2003.<sup>56</sup> The results of Virolainen's (2004) SUR model suggest a significant relationship between corporate sector default rates and key macroeconomic factors including GDP, interest rates and corporate indebtedness. Similar to many other studies, the model of Virolainen (2004) is used to analyse the corporate credit risk conditional on the prevailing macroeconomic setting. In the spirit of Virolainen (2004), Trenca and Benyovszki (2008) estimate a macroeconomic credit risk model for the Romanian corporate sector over the period 2002-2008. They find a significant relationship between industry-specific default rates and macroeconomic factors such as GDP growth rate, consumer price index, real interest rate charged on loans, the exchange rate and industry-specific indebtedness.

Contrary to the VAR methodology, cointegration analysis has received less attention

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<sup>56</sup> A distinguishing feature of the study is that the sample period used to estimate the model includes both a severe recession and a banking crisis.

in the credit risk related literature, although several methods are available for conducting cointegration tests, such as the Engle-Granger approach, the maximum likelihood based Johansen test and the Autoregressive Distributed Lag(ARDL) approach to cointegration. The latter approach, as re-examined by Pesaran and Shin (1999), has become increasingly popular in recent years because of its flexibility and several other appealing features<sup>57</sup> that are hardly found in other cointegration techniques. In the literature on the determinants of credit risk, the use of cointegration analysis is generally limited, with the ARDL approach to cointegration being almost non-existent, although it has been utilised in other research areas of economics, such as the finance-growth nexus. The latter is attributed to the fact that the ARDL approach is a relatively new technique compared to other econometric techniques, as is also the case with the literature on the relationship between credit risk and the macroeconomy. Among the few studies traced in the literature that apply cointegration techniques to study the relationship between NPLs and a set of macroeconomic variables, are those of Zeman and Jurca (2008), Greenidge and Grosvenor (2009), Bofondi and Ropele (2011) and Abedola *et al.* (2011). Zeman and Jurca (2008) employ the vector error correction model (VECM) to assess the impact of a slowdown in real GDP, interest rate and exchange rate on the NPLs of the Slovak banking system. Using quarterly data over the period 1996-2006, the authors report a negative association between NPLs and GDP growth and a positive one between NPLs and nominal interest rate in the long-run. Turning to the scarce studies that apply the ARDL approach to cointegration, Greenidge and Grosvenor (2009) forecast the NPLs in Barbados, Bofondi and Ropele (2011) examine the drivers of bad debts in Italy, and Abedola *et al.* (2011) those in the Islamic banking system of Malaysia.

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<sup>57</sup> Pesaran and Shin (1999) demonstrate that the appropriate lags in the ARDL model correct for both serial correlation and endogeneity problems.

Bofondi and Ropele (2011) use a quarterly sample spanning 1990-2010 and report that the loan quality to households and firms can be explained by a small number of macroeconomic variables<sup>58</sup> which enter the cointegrating equation with different lags, cost of borrowing and level of indebtedness. Abedola *et al.* (2011) provide evidence of a significant positive long-run effect of interest rates on NPLs.

As for the studies that use Markov-switching models in the credit determinants' literature, there is also a paucity of related work. Among the most relevant, in a broader sense, studies on the context of the thesis are those of Frömmel and Karagyozova (2008) and Eller *et al.* (2010), both driven by Kiss *et al.* (2006). In the former study, the authors examine the relationship between bank lending and asset prices in Bulgaria by using a Markov-switching error correction model to control for regime changes. The authors find a positive relationship between real estate prices and banks' lending to households, and provide evidence of regime switches linked to regulatory measures for curbing credit expansion. Instead of looking at the excessive credit growth in terms of the distance to equilibrium,<sup>59</sup> Frömmel and Karagyozova (2008) examine the adjustment process towards equilibrium levels through the error correction coefficients. A regime is then interpreted as unstable if cointegration between credit growth and its determinants is not evidenced for particular sub-periods,<sup>60</sup> which does not necessarily coincide with the error exceeding a particular threshold. In their study, Eller *et al.* (2010) explore the long- and short-run

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<sup>58</sup> In particular, the Italian bad debts of households are found to be negatively correlated with GDP growth and positively with the unemployment rate and the short-term nominal interest rate. As for the firms, bad debts increase in line with unemployment and diminish as the consumption of durables increases.

<sup>59</sup> Kiss *et al.* (2006) define a credit boom as one of the following two cases: (a) the observed credit growth exceeds the one implied by the long-run equilibrium relationship on the basis of macroeconomic fundamentals, or (b) the observed credit growth rate is higher than the speed of adjustment to the credit equilibrium in the error correction model.

<sup>60</sup> In the wording of the Markov-switching models, the identified sub-periods are called regimes.

determinants of bank lending to the private sector in eleven CESEE countries. Based on the identified regime shifts for the observation period 1997-2009, they find that the sub-periods are characterized by a different impact of the credit growth determinants. Eller *et al.* (2010) conclude that, for most of the countries in their sample, there is a cointegrating relationship between credit and economic activity in the long-run. Also, the inflation shows the expected negative relation to lending growth for most countries, whereas the lending rate displays, in some cases, a counter intuitively positive sign. In exploring the short-run dynamics, the authors apply both a linear and a non-linear Markov-switching error correction model. They suggest that the identified regime switches in the short-run relation are driven primarily by differences in the credit supply factors rather than by the adjustment towards the credit equilibrium. In terms of regime switching, Eller *et al.* (2010) distinguish between two groups of countries<sup>61</sup>: those with one dominant regime, which is briefly interrupted by a second one, and those with two equally pronounced regimes where a marked switch occurs just before or when the global crisis hits the CESEE region, i.e. in the second half of 2008.

Having reviewed the literature of time series models, the following section focuses on the country-specific and cross-country studies that explore the determinants of credit risk using panel models.

### **4.3 Panel data models**

The literature that uses panel estimations to model the linkages between banks' asset quality and macroeconomic conditions at a cross-country bank-system level has grown rapidly, especially in the years following the global financial crisis (Nkusu,

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<sup>61</sup> Eller *et al.* (2010) suggest that while Bulgaria shows clear and long-lasting regimes, Romania stays mainly in one regime with only short-lived switches.

2011; De Bock and Demyanets, 2012; Beck *et al.*, 2013). Previously most studies dealt with a country's individual financial institutions (Berger and DeYoung, 1997, for the US; Pain, 2003, for the UK; Jiménez and Saurina, 2006, for Spain; Quagliariello, 2007 for Italy) but also with individual financial institutions in a cross-country context (Bikker and Hu, 2002, for 29 OECD countries; Bouvatier and Lepetit, 2008, for 15 European countries). Broadly, the studies that analyse the phenomenon at a country level use an adequate sample of the country's banks balance sheets. Similarly, the studies performed on a cross-country level either use a broad sample of individual banks, or aggregate data of the banking systems of the countries involved in the study.

In essence, the strand of literature that uses panel models seeks to exploit the time and cross-sectional dimensions of macroeconomic variables and bank-specific data to explain credit risk. Most studies underscore the linkages between financial and macroeconomic shocks, thus build upon the relationship between the business cycle and credit frictions denoted by rising NPLs, LLPs or other proxies. Usually, the literature associates episodes of sharp increases in NPLs with asset price declines and disruptions to the supply of credit. Overall, the findings suggest that the determinants of NPLs can be macroeconomic, financial, or institutional. The macroeconomic environment influences borrowers' balance sheets and their debt servicing capacity. The set of macroeconomic variables used varies across studies, but broad indicators of macroeconomic performance, such as GDP growth and unemployment, are generally included in the panel data literature. Disparities in regulation and supervision affect banks' behaviour and are important in explaining cross-country differences in NPLs. In a study of 186 European banks from 1992-2004, Bouvatier and Lepetit (2008) find that LLPs amplify credit fluctuations, while Jiménez and Saurina (2006) provide



evidence of a positive relationship between rapid credit growth and loan losses, confirming theoretical models based on disaster myopia and herd behaviour (Guttentag and Herring, 1984; Rajan, 1994). Foos *et al.* (2010) examine a broad sample of banks from 1997-2007 to test the loan-seasoning<sup>62</sup> hypothesis in line with Berger and Udell (2004). Foos *et al.*'s (2010) findings are in consensus with Jiménez and Saurina (2006) but in sharp contrast to those of Laeven and Majnoni (2003), which find a negative contemporaneous relationship between loan growth and loan losses. Espinosa and Prasad (2010), using bank level data for a sample of 80 banks in the Gulf Cooperation Council region, show that NPLs increase as economic growth decelerates and interest rates increase. Nkusu (2011) estimates a panel VAR model and applies cointegration techniques on a sample of 26 advanced economies that span the period 1998-2009. The analysis of the impulse responses underscores the importance but also the persistence of NPLs in the macro-financial linkages. Specifically, Nkusu (2011) suggests that the confluence of adverse responses in key macroeconomic indicators, such as GDP and unemployment, leads to a downward spiral in which banking system distress and the deterioration in economic activity reinforce each other. Broadly, Nkusu's (2011) results are in agreement with those of Marcucci and Quagliariello (2008) which also rely on the VAR approach to highlight the feedback loop between NPL and macro-financial performance.

Louzis *et al.*'s (2012) study that covers Greece's nine largest banks during 2003-2009, uses NPLs decomposed by type of loan, i.e. business, consumer, and mortgages. Utilising quarterly data, the authors suggest that management quality and macroeconomic fundamentals explain the NPLs of the Greek banks. In line with Espinosa and Prasad (2010), Louzis *et al.* (2012) provide evidence of a positive

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<sup>62</sup> According to the loan-seasoning hypothesis, the loan growth translates into an increase in credit risk but with some lag in the light of experience, saying that borrowers do not immediately default after receiving a loan.

relationship between NPLs and real lending rates. As for the bank-specific characteristics, Louzis *et al.* (2012) find that management inefficiency is positively associated with NPLs, a result that is also in consensus with Espinosa and Prasad (2010).

Rinaldi and Sanchis Arellano (2006) model NPLs arising from households' debt for a panel of seven euro area countries. Using panel cointegration techniques, the authors find that a higher ratio of debt-to-income is associated with a higher level of NPL later. A noteworthy finding in Rinaldi and Sanchis Arellano (2006) is that, in the short-run, house prices are negatively related to NPL, lending support to the view that borrowers' wealth can play the role of a buffer in case of unexpected shocks.

In an exploration of the credit risk drivers in Greece, Spain, Portugal, Italy and Ireland, Castro (2013) finds that the macroeconomic environment significantly affects banks' credit risk. Using dynamic panel estimations over the period 1997-2011, the author documents that credit risk increases as GDP growth and real estate price indices decrease, and rises when unemployment rate, loan growth, and the real exchange rate increase.

While numerous empirical studies are devoted to other geographical areas, the credit risk of the SEE transition economies is less closely examined, despite the legacy of high NPLs either historically, or as a bitter memory of the recent boom-bust cycle. Notably, the banking sectors of Bulgaria and Romania participate in only a few panel studies (Festić *et al.*, 2011; De Bock and Demyanets, 2012; Klein, 2013; Jakubík and Reininger, 2013). In effect, these studies do not always account for the fact that the SEE economies form a rather heterogeneous set of countries with a clear division between front-runners and late reformers (Zinkovskaya, 2008). For instance, Cottarelli *et al.* (2003) provide evidence that, in the 'early bird' countries, the bank

credit to the private sector has been rising considerably faster than GDP, while in other countries, i.e. ‘the late risers’, the credit started flowing later. Finally, in a third group of countries ‘the sleeping beauties’, Cottarelli *et al.* (2003) do not find a clear increase in credit. Bulgaria is among the early bird countries that registered an average annual real growth rate in credit of 33% in the period 1998-2002, while the respective growth for the sleeping beauty Romania was just 4.7%. They assert that the acceleration in credit and, most importantly, the differences across countries reflect primarily the overall financial deepening, the speed of privatization, crowding-in forces, and the overall progress towards market institutions. The observed differences across the countries as highlighted in Cottarelli *et al.* (2003) are also evidenced in Mannasso and Mayes (2005)<sup>63</sup> and Backe *et al.* (2006). In line with Cottarelli *et al.* (2003), Backe *et al.* (2006) use a quarterly dataset that covers 43 countries in the period 1975-2004. They provide evidence that while Romania’s ratio of credit-to-GDP is below the level justified by the country’s fundamentals, Bulgaria might have surpassed the equilibrium by 2004, a case that perpetuates boom-bust cycles and can trigger unsustainable current deficits. Notably, Backe *et al.* (2006) assert that the rapid pace of credit expansion does not in itself pose a risk of deterioration in banks’ asset quality.

In a panel study across 75 countries, Beck *et al.* (2013) find that the real GDP growth is the main driver of NPLs. Other important factors linked with increasing NPLs are exchange rate depreciations – especially in countries with a high degree of lending in foreign exchange – and also equity prices, in countries with large stock markets relative to the size of the economy, and interest rates. Nevertheless, Beck *et al.* (2013) disclose that the results should be treated cautiously in the context of individual

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<sup>63</sup> In a study of 21 CEE countries over the period 1996-2003, Mannasso and Mayes (2005) provide evidence that problem loans are the clearest indicator of banks’ distress.

countries as country- or sector-specific factors may have an impact on NPLs. The latter is also a clear-cut result in the country-specific comparative studies of Ali and Daly (2010) and Chaibi and Ftiti (2015) that investigate the credit risk determinants of the US and Australia,<sup>64</sup> and Germany and France respectively. Employing quarterly time series over the period 1995-2009, Ali and Daly (2010) indicate that the same set of macroeconomic variables, i.e. GDP, short-term interest rates and total debt, display different default rates for both countries. They find that compared to Australia, the US economy is much more susceptible to adverse macroeconomic shocks. On the same wavelength, Chaibi and Ftiti (2015) document that the credit risk of the French banks is more susceptible to bank-specific variables and the inflation rate, compared to the German ones. The latter provides support to the argument that each country has its own distinguishing features that cannot be fully captured in a panel framework.

In a recent study that unfolds along the lines of Beck *et al.* (2013), Jakubík and Reininger (2013) focus on the nine CESEE countries and use quarterly data over the period 2004-2012. Their results that are in broad agreement with Beck *et al.* (2013), present an inverse relation between credit risk and the stock market index, and a strong positive one with past credit growth. On the same wavelength as Ali and Daly (2010), Jakubík and Reininger (2013) conclude that, despite their geographic proximity, a number of differences are manifest among the countries in their panel, including for instance, the quality of institutions, repayment culture and market standards. Therefore, these factors “*may still influence the country-specific strength of response to shocks of the same variable*” (Jakubík and Reininger, 2013). Given that, the authors maintain that while their panel model may still be useful for identifying economic processes that are relevant for all the countries in their sample, it can be

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<sup>64</sup> It is noteworthy that both countries witnessed an above average historically high increase in credit lending, over an unusually prolonged period.

considered less reliable for each individual country. In the light of this, further topical research is required.

Using quarterly data for the period 1995-2008 for the Baltic States, Bulgaria and Romania, Festić *et al.*'s (2011) findings support the hypothesis that accelerating lending growth harms banks' performance. They explain that this result could be due to soft loan constraints, ample liquidity of the banking systems as a result of capital inflows and overheating economies. Essentially, Festić *et al.* (2011) confirm the theory of pro-cyclicality by showing that increasing exports or investments improve the NPL ratio. Overall, a rising economic activity positively affects the loan portfolio quality of the sample countries' banking sectors as NPLs decelerate. Furthermore, Festić *et al.* (2011) document that the appreciation of the real effective exchange rate improves loan quality, due to the high share of loans denominated in foreign currency, as well as productivity increases. The results of Athanasoglou's (2011) research that makes use of a panel of SEE banks spanning 2001-2009, provide evidence of a positive relationship between capital and credit risk. Nevertheless, the statistical significance of those results and the causation depends on the level of banks' capital profiles. Hence, in less-than-adequately capitalized banks there is a two-way relationship between bank capital and risk, while in well-capitalized banks the relationship is not significant.

Among the most recent studies, De Bock and Demyanets (2012) cover 25 emerging markets during 1996-2010 while Klein (2013) uses a sample of 16 CESEE economies over the period 1998-2011. In agreement with De Bock and Demyanets (2012), the results of Klein (2013) confirm the responsiveness of NPLs to macroeconomic conditions such as GDP growth, unemployment, exchange rate and inflation. Furthermore, Klein (2013) provides evidence of a less pronounced effect of bank-

specific factors.

The panel model literature provides sufficient evidence that the determinants of credit risk can be macroeconomic, bank-level or institutional. Episodes of rising NPLs are associated with declines in asset prices and declines or disruptions in the supply of credit. Broadly, the stylized facts suggest that good economic conditions positively affect the quality of banks' loan portfolios, whereas disturbances anywhere in the business cycle and the macro-economy are likely to have repercussions for the banking system (Arpa *et al.*, 2001; Quagliariello, 2004). Overall, studies concur that during prosperous times, banks may underestimate their exposures, relax credit criteria and report lower than needed provisions for loan losses. Empirical evidence suggests that any improvement in the real economy translates into lower corporate defaults (Borio *et al.*, 2001; Ghosh, 2005; Beck *et al.*, 2013; Packer and Zhu, 2012). During recessions, this relationship could magnify the effect of the negative phase of the business cycle (Laeven and Majnoni, 2003; Quagliariello, 2004). Also, many studies reveal that bank-specific variables are informative of banks' credit risk (Pain, 2003; Quagliariello, 2004; Louzis *et al.*, 2012). Furthermore, models that include macroeconomic variables as regressors perform better than those that employ solely bank-specific variables (Demirgüç-Kunt and Detragiache, 1998; Hardy and Pazarbaşıoğlu, 1999; Kaminsky and Reinhart, 1999; Hilbers *et al.*, 2001; Quagliariello, 2008). This section provided a concise account of the empirical studies and the methodological approaches used in the literature on credit risks determinants. The next section underscores the gaps identified in the empirical studies.

#### **4.4 Identified gaps in empirical studies**

It becomes obvious from the preceding discussion that a wealth of studies deals with the drivers of credit risk while the literature continues to evolve, given the importance of a healthy financial system for the economy and society. A variety of time-series and panel models have been developed that extract from historical data an *ex-post* relationship between credit risk and macroeconomic indicators that inevitably incorporate past behavioural responses. Against this background, the determinants of NPLs are found to be macroeconomic, bank-specific and institutional. The use of the appropriate methodology depends not only on the type of study, country-specific or cross-country, but also on data quality and availability issues, since the data requirements are one of the main hindrances for many countries when trying to assess the vulnerabilities of their financial systems. However, a number of gaps have been identified in reviewing the empirical literature. These are the following:

- a. Although Bulgaria and Romania participated in several panel estimations, there is a notable absence of country-specific studies for both countries. Yet, as the authors of many studies purport, panel estimations can account for a heterogeneous sample to a certain extent. By design, panel studies do not narrow down to each individual country's idiosyncratic features. Equally, the reviewed panel studies do not usually account for structural breaks. In some studies, researchers avoid the problems of structural breaks by focusing on sub-samples which are assumed to have the same data generated process. But, this approach decreases drastically the time span of the studies.
- b. The use of the ARDL approach to cointegration is scarce among the studies that use cointegration techniques in exploring the short and long run

relationships of the credit risk drivers. In any case, no studies were found to apply the ARDL approach to the focal SEE countries.

- c. The lack of studies that use the Markov switching framework in modelling credit risk in the research's context. Most empirical studies use data up to the recent financial crisis. This is so because a broader sample that includes post or around the crisis data is subject to regime shifts. On the other hand reduced-form models that assume and estimate a time-invariant relationship between macroeconomic factors and financial vulnerability indicators may encounter problems due to parameter instability, as large macroeconomic shocks usually lead to structural breaks. In other words, endogenous responses of economic agents, instead of following similar reaction functions as in the past, might change altogether. As many authors suggest, substantial changes in the properties of a series can be attributed to large-scale events, such as financial crises (Ang and Timmermann, 2011; Gorton, 2012). In the same line of argument, the existing literature on the relationship between credit risk and the macroeconomy broadly uses linear models. A frequently mentioned concern is the inability of linear models to capture relationships between macroeconomic variables that may become non-linear at times of stress (Foglia, 2008). Thus, statistical models that overlook the presence of non-linearities in the data generating process may yield misleading results.
- d. The role of credit growth on credit risk does not present a clear-cut picture in the empirical literature. There are several studies that find a statistically significant negative coefficient for credit growth, for instance Nkusu (2011), while other studies report a positive relationship (Festić and Beko, 2008; De Bock and Demyanets, 2012). Similar is the case of the lagged effect, i.e. time



persistence of credit growth on credit risk. Some authors stress the lagged effect of loan growth on credit risk while others find a contemporaneous effect. The country-specific effect of both those issues is usually ‘hidden’ in a cross-country panel framework.

- e. The effect of money supply on credit risk does not present a clear-cut picture in the empirical literature. The global financial crisis in 2007-2008 made it clear that the monetary transmission mechanism might be a more complex process than earlier thought. For instance, Angeloni *et al.* (2010), among others, argue that if monetary policy contributes to the formation of banks’ risk, and if the latter feeds back on macroeconomic variables with an unknown lag, then monetary policy has to co-estimate the implication of financial stability. Thus, it is important to gain an understanding of the linkages in place between credit risk, monetary policy and the business cycle in the focal countries.
- f. Existing studies in the SEE region do not account for cross-border transmission channels of risk. In the face of the Greek debt crisis that ensued after the global financial crisis, the existence of any spillover effects has not yet been researched. Given the strong banking linkages in place between Greece and the neighbouring countries of Bulgaria and Romania, any crisis transmission mechanism, for instance through the credit risk channel, is worth investigating since it could have an adverse impact on the banking stability of these countries.
- g. Last but equally important is the lack of cross-validation of the results reported in the literature. Typically, the studies make use of a single methodological framework without accounting for the possibility that the results may be

influenced by the model specification, the econometric methodology applied, and the country samples used. As shown in Cuaresma *et al.* (2011), these latter cases can materialize. In a meta-analysis study on the determinants of foreign currency loans in the CESEE countries, they collected nearly 300 estimation equations providing roughly 800 coefficients on the seven most common determinants. Among other issues, Cuaresma *et al.* (2011) find that roughly half of the published coefficients are actually significant. Moreover, the economic significance of the coefficients differs widely. The authors assert that these differences are not surprising considering the heterogeneity of the analysed data and the methods applied. The panel data literature analyses developments in usually highly heterogeneous countries, including EU Member States and Western Balkan countries or even CIS States. There are even studies that choose a more general focus and additionally include developing countries from Latin America. Given that, the level of data aggregation is highly different and diverse to produce meaningful country-specific conclusions.

Following the identification of the gaps in the empirical literature the next section concludes the chapter.

#### **4.5 Conclusions**

This chapter provided a critical review of the empirical studies that deal with the determinants of credit risk. The surveyed literature presents relatively consistent ways of estimating the relationships shaped between asset quality and economic activity, and uses diverse aspects of samples covering different geographic areas and country groups. Both time-series and panel models extract from historical data an *ex-post*

relationship between macroeconomic and financial stability indicators that inevitably incorporates past behavioural responses. Yet, the vast majority of empirical evidence for the SEE region arrives from panel cross-country studies. Hence, the paucity of country-specific studies is evident.

Both countries under investigation in this thesis provide interesting case studies of open, emerging economies that were hit hardly by the global crisis. Despite their proximity, those countries cannot be treated as a homogeneous group. Among the shared features is the accelerating credit growth prior to the crisis followed by a stark deterioration in credit risk. In this respect, adverse shocks to the economy may be amplified by worsening credit conditions in the spirit of the financial accelerator theory. The aforementioned studies highlight the significant interactions between credit risk and macroeconomic conditions. Besides the lack of country-specific studies in the crisis-prone Bulgarian and Romanian context, there is also a lack of empirical evidence on the drivers of credit risk that apply the ARDL approach to cointegration and the Markov regime switching framework. The latter reiterates a key contribution of the thesis.

The next chapter paves the way for the empirical research. Building upon the theoretical underpinnings of the research and equipped with the empirical studies reviewed as well as the identified country-specific features, the following chapter discusses the data and the methodological framework and enables a smooth deployment of the empirical part of the thesis through the formulation of testable hypotheses.

## **Chapter 5: Data and Empirical Methodology**

### **Introduction**

This chapter presents the dataset and provides a concise account of the methodological approaches used in conducting the empirical research of the thesis. A variety of time series econometric techniques have been used in an attempt to demystify the puzzle of credit risk in Bulgaria and Romania and to explore any spillover effects arising from the Greek debt crisis. The comprehensive dataset collected, along with the use of reasonable econometric methodologies, allows capturing the drivers of credit risk in the banking systems of both countries. Founded on the theoretical underpinnings and the review of empirical studies, the chapter aims to relate the research questions posed earlier to testable hypotheses and facilitate the empirical research. Section 5.1 details the data employed in the research, discloses the data constraints and formulates the set of hypotheses under investigation. Next, Section 5.2 presents the methodological framework emphasising the rationale of the econometrics techniques applied, instead of outlining them in a textbook approach. Hence, this section critically discusses and evaluates the limitations of each econometric technique. The last section concludes the chapter.

### **5.1 The dataset and the formulation of testable hypotheses**

Taking stock from the theoretical underpinnings and the empirical studies reviewed, the primary hypothesis under investigation addresses the linkages between credit risk and a set of macroeconomic-cyclical, financial, monetary and bank-related factors. Thus, the variables' selection relies to some extent on indicators that emerge from the literature review to ensure comparability of results. The availability and quality of

data are central to most econometric studies, and the present research is no exception to this rule. The issue becomes even more crucial in the case of the SEE countries, given the lack of studies and the weaknesses in problem loan reporting.

In both Bulgaria and Romania, deteriorating asset quality<sup>65</sup> is by far the greatest risk faced by banks (IMF, 2010a,b). A rapid lending growth over the last decade, a high exposure to the construction and real estate sectors, growing consumer indebtedness, relatively weak enforcement of credit rights, competitive pressures and looser lending policies, can all easily lead to asset quality deterioration in a sharply worsening macroeconomic environment (Åslund, 2010). Credit risk is simply defined as the potential that a bank borrower or counterparty will fail to meet its obligations in line with the pre-agreed terms (BIS, 2000). Given that, banks need to actively manage credit risk that is inherent in their intermediation role but also embed in their models any interconnections between credit risk and other sources of risks. Hence, the effective management of credit risk is an essential ingredient to the long-term success of any financial institution or sector.

The typical proxies of banks' credit risk used in related studies are the ratios of either NPLs or LLPs to total loans. By definition, an NPL is an extension of credit for which there are valid concerns on the borrower's ability to repay the principal or the interest in line with the original contractual terms of the loan.

The most widely known international definition of NPLs is the one developed by the IMF (2006). According to this definition a loan should be classified as non-performing when:

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<sup>65</sup> The terms asset quality and credit risk are used interchangeably throughout the thesis to denote the vulnerability in banks' loan portfolios arising from the impaired conditions of borrowers. Equally, the terms NPLs and problem loans are used interchangeably to denote the indicator used to measure banks' asset quality.

- Payment of principal or interest is past-due by three months (90 days) or more,
- Interest payments equal to three months' interest or more have been capitalized (re-invested into the principal amount), refinanced or rolled over (payment has been delayed by arrangement), or
- Payments are less than 90 days past-due but sufficient evidence exists to classify a loan as non-performing, i.e. when the debtor files for bankruptcy.

For such loans, bank supervisory authorities require banks to set aside sizeable provisions against loan losses. Cross-country comparisons are inherently difficult because there is no universal definition of problem loans. Especially in the SEE region, the banking sectors' data should be viewed in the light of inconsistencies between banks (Fitch, 2014b). But differences exist also across countries in their provisioning standards and practices. In short, it is difficult to make cross-country comparisons on the basis of the relative magnitude of problem loans, irrespective of the credit risk metric used, i.e. NPL ratios or the level of provisioning. A number of other proxies for credit risk have also been used in the literature such as loan write-offs (Hoggarth *et al.*, 2005a,b), credit default swap spreads (Casu and Chiaramonte, 2011), equity prices or composite indices, corporate or household bankruptcies or loan defaults (Carling *et al.*, 2003; Jacobson *et al.*, 2005).

Despite the reporting weaknesses, the credit risk indicators and especially the NPLs and the LLPs convey meaningful information in assessing the vulnerability of a banking system and in fostering financial stability. A strand of studies, for instance the literature on EWS, denotes that the credit risk indicators can also provide signals on the state of the economy or a particular economic sector. In this respect Čihák

(2007) divides the bank stress-test approaches into two classes: one based on data on loan performance, such as NPLs, LLPs and historical default rates, and the other based on micro-level data related to the default risk of the household or corporate sector. Although the NPLs and the LLPs are most frequently used in empirical studies, the choice of a reasonable credit risk proxy is by and large driven by the availability and quality of data. The NPL ratio that is a clear-cut measure of the credit quality of banks' loans is classified among the core set of FSIs (IMF, 2006) while the LLPs to total gross loans has been extensively used in the empirical literature in the absence of other more accurate measures of credit risk (Arpa *et al.* 2001; Cavallo and Majnoni, 2001; Bikker and Hu, 2002; Laeven and Majnoni, 2003; Pain, 2003; Quagliariello, 2004).

Financial institutions typically cover expected losses through appropriate provisioning. In the case of Bulgaria and Romania, the respective central bank provides the guidelines and directives on provisioning policies. Provisions appear as both a flow and a stock measure in banks' reporting statements. As doubtful debts arise, a new charge (flow) is posted to the profit and loss account and this is added to the stock of provisions, typically reported as a contra asset account in the balance sheet. When bad debts are actually written off in future periods, these loans are not charged off directly against net income but instead reduce the balance in the stock-of-provisions account. If the bank subsequently recovers part of a loan that it had previously written off, the recovery is added back to the stock of provisions. Formally, the accounting treatment as described by Pain (2003) is provided in the following equation:

$$\text{Stock of provisions}_t = \text{Stock of provisions}_{t-1} + \text{New charge to P\&L}_t - (\text{Write-offs}_t - \text{Recoveries}_t) + \text{any adjustments}$$

Given this accounting identity, the stock measure of provisions may give a misleading picture of current developments in *ex post* credit risk.<sup>66</sup> Yet, each measure comes with its limitations. As Sorge (2004) underlines, a number of studies indicate that LLPs or NPLs could be imperfect proxies of the evolution of credit risk in a banking sector over the business cycle. For instance, the accumulation of LLPs may not only be due to credit risk and loan impairment since LLPs are tax deductible in most countries. Also they can be used to meet regulatory capital requirements. Foglia's (2008) survey suggests that loan loss provisioning rules may vary across jurisdictions and legal protocols may determine whether or not banks actually write off NPLs or keep them on their financial statements with appropriate provisioning. Another opaque area has to do with the restructured loans that can be classified either as performing or problem loans, given the diversity of measures applied by banks. Equally, variations in LLPs may be driven by changes in credit risk or other bank-specific factors, such as income-smoothing policies.

In principle, many variables are potentially able to convey signals about the evolution of banks' health over the business cycle. However, NPLs and LLPs have generally been considered to be the transmission channels of the macroeconomic shocks to banks' balance sheets (Quagliariello, 2004).

Following the preliminary discussion on the credit risk indicators, the next section discusses the data used in the case of Bulgaria.

### **5.1.1 Description of the Bulgarian dataset**

The Bulgarian dataset consists of aggregate time series sourced from the Bulgarian National Bank (BNB), the National Statistical Institute of Bulgaria, and the European

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<sup>66</sup> In particular, large write-offs in any one period may falsely signal that the stock of provisions falls, even though significant new bad debts have arisen.



Central Bank (ECB), spanning from December 2001 to December 2010. Table B1 in the Appendix presents the dataset used in modelling the Bulgarian credit risk.

The proxy used for the Bulgarian banks' credit risk is the system's aggregate ratio of loss and doubtful loans to total loans<sup>67</sup> (non-performing loans or NPLs). The chosen proxy for credit risk is aligned to a substantial body of literature on NPLs. Notably, the IMF reports the Bulgarian NPLs and regulatory capital ratios starting from 1998. The analysis of the Bulgarian credit risk does not use other proxies, such as LLPs, as these series were not available.<sup>68</sup> Table 11 presents the asset classification requirements of the Bulgarian banks in accordance with the BNB directives.

Table 11 Asset classification requirements of Bulgarian banks

Standard	Principal and interest repaid on a timely basis or with a delay of up to 30 days when justified or accidental. The debtors provide the bank with the required information on their financial state and the sources of loan repayment.
Watch	Principal or interest is overdue from 31 up to 60 days or the debtor uses the loan for purposes other than those specified in the loan agreement, or there is evidence that the financial position–debt servicing capacity of the debtor worsens.
Substandard	Principal or interest is overdue from 61 to 90 days or the debtor's financial position has substantially deteriorated and could hinder the loan repayment.
Non-performing	Principal or interest is overdue by more than 90 days or the debtor suffers a permanent shortage of funds or has been declared bankrupt or is in liquidation or the claim on the debtor is subject to court proceedings or the claim has been awarded to the bank by the court but has yet to be collected, or there is evidence of significant deterioration in a debtor's financial condition which could hinder the repayment of obligations.

Source: BNB and Fitch (2007)

<sup>67</sup> In accordance with the BNB, the doubtful loans include all past-due loans (91 to 180 days) as well as those loans where the debtor's financial standing has substantially deteriorated. Loss loans are defined as past-due loans over 181 days and credit exposures in which there are valid grounds to consider a permanent financial inability of the borrower to repay their obligation.

<sup>68</sup> Even if the data on LLPs were available, other limitations would have limited the use of this time series. For instance, in 2004, the BNB introduced a new loan classification methodology and loan classification categories were reduced to four from five previously.

Figure 10 presents the evolution of the Bulgarian credit risk in the sample's period (2001-2010).

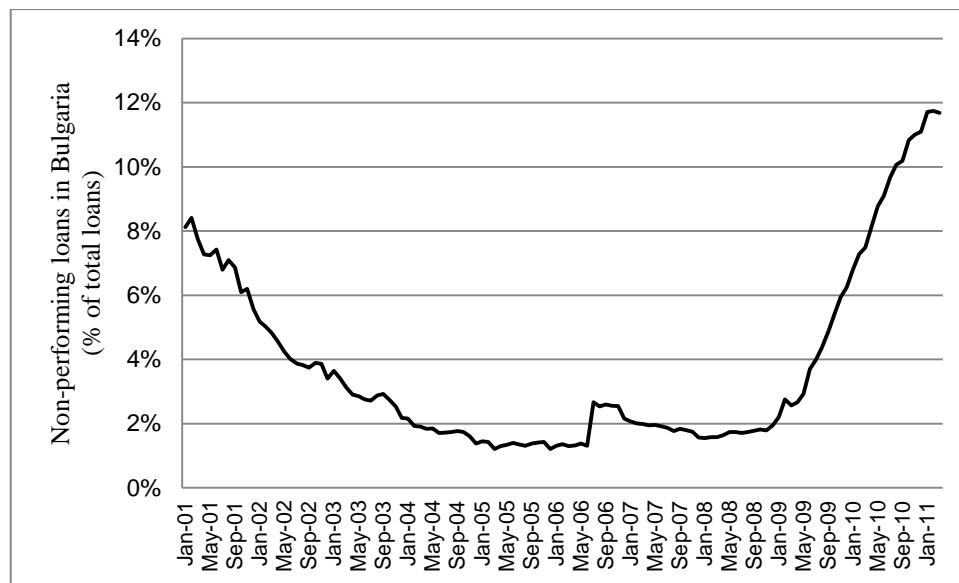


Figure 10 Credit risk for the Bulgarian banking system (2001-2010)

Source: BNB.

Bulgaria appears to be saddled with rather high NPLs in the beginning of the sample period that, in the run up to 2006, exhibits a steadily downward trend. Then, around mid-2006, this trend is interrupted and a hike in NPLs is evident. Thereafter the level of NPLs starts declining again up to the onset of the financial crisis at the end of 2008 where the trend reverses and NPLs start picking up steeply. Notably, the pattern evidenced in the Bulgarian NPLs is almost uniform across the countries of the SEE region (Barisitz, 2011). Moreover, the slope of the crisis-triggered line in NPLs, i.e. after 2008 is sharper than that of the downward sloping line during the euphoria period that is broadly defined up to the end of 2008.

In line with the findings in the theoretical and empirical literature review, the next step involves the selection of the bank-specific dataset. In both focal countries, the loan growth is used as a potential driving force of credit risk. This is because a key

lesson of past financial crashes is that credit lies at the heart of crises (Kindleberger, 1978; Reinhart and Rogoff, 2009; Aikman *et al.*, 2011) fuelled by the expansion of liquidity in high-income countries and a fall in the price of risk. The latter development has changed dramatically the supply of finance in the developing countries since 2000 and up to the end of 2007 (World Bank, 2010). Hence, an insight into the dynamics of the credit cycle is important in assembling the pieces of the credit risk puzzle in both Bulgaria and Romania. Continuing with this argument, a shortage of credit is likely to affect adversely Bulgaria's critical economic sectors, such as manufacturing and construction.<sup>69</sup> Figure 11 displays the evolution of credit in the Bulgarian banking system.

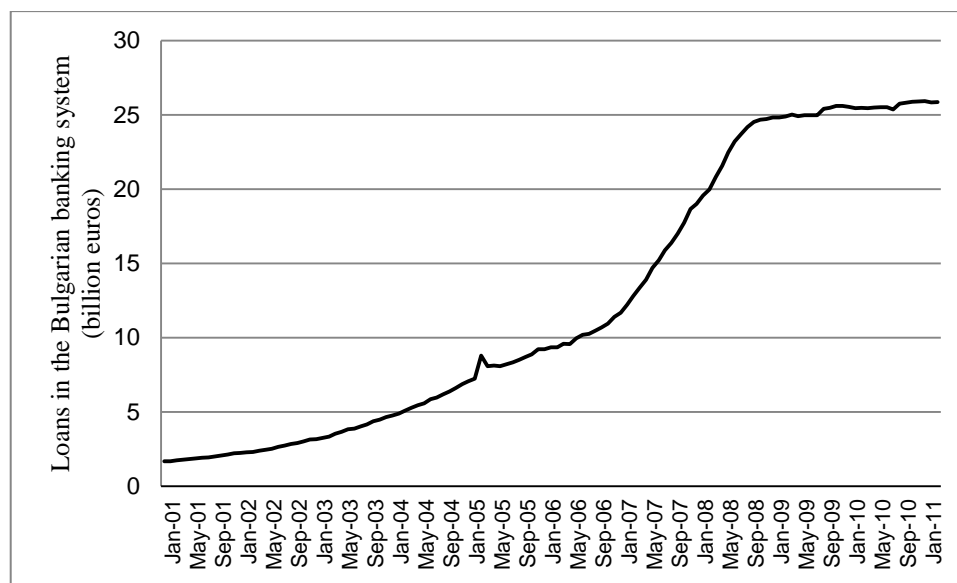


Figure 11 Bank loans to the non-bank sector in Bulgaria (2001-2010)

Source: BNB.

Figure 11 shows that the period 2001-2008 is marked by an accelerating upward trend in credit with a spike at the beginning of 2005. Then, the Bulgarian loans follow an even steeper hike that becomes flat, implying a stagnation in lending growth by the

<sup>69</sup> Real estate surveys as well as studies indicate that the property market and the construction activity in both countries have slowed down drastically in the aftermath of the global financial crisis (De Haas and Knobloch, 2010). A sharp contraction in the construction sector could ignite a major economic downward spiral with adverse consequences for banks' loan portfolios.

end of 2008 when the global financial crisis hits the country. The aggressive credit expansion, especially during the period 2005-2007, has been actively encouraged by the foreign banks in both Bulgaria and Romania (De Haas and Naaborg, 2007; Åslund, 2010). In several emerging European economies, deposit growth was lagging behind, since the evidence suggests that foreign borrowing mainly fuelled the credit growth. Apart from the lending growth, several other bank-specific variables complement the Bulgarian dataset in an attempt to explore the potential effect of endogenous factors on credit risk. For instance, the dataset comprises of capital-leverage and liquidity indicators, such as the capital ratio and the loans to deposit ratio.

Broadly, the Bulgarian dataset consists of a wide selection of indicators grouped into four broad categories: macroeconomic-cyclical, monetary, financial and bank-specific indicators. A variety of indicators can measure the impact of macroeconomic shocks on the asset quality of a country's banking system. In line with the literature and utilizing the insight into the structure of the Bulgarian economy, the research considers an extensive set of indicators in the data collection activity. As such, the research considers among the macroeconomic indicators the real GDP, the unemployment rate and consumer price index, construction indices,<sup>70</sup> foreign trade as captured by the country's imports and exports, the ratio of current account to real GDP,<sup>71</sup> the industrial production index (IPI), the real effective exchange rate (REEL) and the average monthly wage (AMW). As Åslund (2010) points out, prior to the

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<sup>70</sup> The construction index is an indicator of the construction production activity and includes building construction - residential and non-residential buildings - and civil engineering infrastructure construction such as roads, telecoms and other types of construction.

<sup>71</sup> Duenwald *et al.* (2005) argue that the credit growth in Bulgaria has been driven by the perceived macroeconomic stabilization and capital inflows. Nevertheless, the credit boom over the period 2001-2008 contributed significantly to widening macroeconomic imbalances.

crisis the Eastern Europe region was in a state of severe overheating. And lending in Bulgaria was dominated by the residential property cycle<sup>72</sup> (IMF, 2012c). Then, as the crisis erupted, economic output plunged and unemployment soared. The inflation surged, reaching double digits in Bulgaria, wages and real estate prices skyrocketed, rendering the economy less competitive, which further undermined Bulgaria's current account balance. The 'bad habit' of debt growth is also included in the dataset as its growth dynamics may affect the real economy and subsequently the credit risk. The effect of the money supply on credit risk is explored through the monetary aggregates M1, M2<sup>73</sup> and M3. Other indicators used to capture the effect of the financial markets are the price of Brent crude oil, the oil imports as a share of GDP, and the stock markets' composite indices as forward looking indicators of the economy. The Euribor and Sofibor<sup>74</sup> rates cover the effect of interest rates on NPLs as well as the yield of the long-term Bulgarian government bond yield and its differential with the Greek and the German bond yield. The interest rates' dataset is further complemented by the average lending-deposit rate applied by Bulgarian banks to non-financial corporations and households.

Taking into account the limitations, the Bulgarian dataset can be considered as a comprehensive one that captures adequately the business cycle as it uses a substantial range of macroeconomic, financial, market and bank-specific indicators.

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<sup>72</sup> IMF (2012c) includes Bulgaria among the boom-bust countries, suggesting that real house prices increased by more than 10% in the run-up to the global financial crisis and have declined since then.

<sup>73</sup> The growth in the monetary aggregates, M1 and M2, is often met in empirical studies as measures of the liquidity in the system. High growth of these indicators might indicate excess liquidity in the system that under certain conditions can lead to financial crises (Eichengreen *et al.*, 1995; Bhattacharyay, 2003). Equally, there are studies that associate the M2 with financial liberalization (Kaminsky and Reinhart, 1999; Calvo and Mendoza, 2000). Other studies use the money supply indicators as proxies for GDP (Baboucek and Jancar, 2005).

<sup>74</sup> The Euribor rates are considered to be the most important reference rates in the European money market. The interest rates provide the basis for the price and interest rates of all kinds of financial products. Sofibor rates that are the reference rates in Bulgaria are based on a contract between the Association of Bulgarian Banks and the BNB. In detail, the Sofibor reference rate is a fixing of the quotes for unsecured deposits in domestic currency offered in the Bulgarian interbank market.

The next section discusses the Romanian dataset.

### **5.1.2 Description of the Romanian dataset**

The Romanian dataset consists of aggregate time series sourced from the NBR, the National Institute of Statistics in Romania and the ECB. The dataset used in modelling credit risk that uses monthly observations spanning from 2001 to 2010 is presented in Table B2 in the Appendix.

In the case of Romania, three different aggregate indicators were considered to approximate the credit risk of the banking system. These are the ratio of loan provisions to total gross loans (LLPs), the credit risk ratio and the ratio of total loan defaulters to total debtors. The LLP ratio uses as nominator the provisions set aside for loans classified as doubtful and loss on an aggregated system level. Then, credit risk is defined by the NBR as the ratio of unadjusted bank exposure – capital plus interest – for loan exposures categorized as doubtful, and loss, to total gross loans. The third metric is constructed as a ratio in which the nominator, the defaulters, comprises the legal entities and private individuals that have defaulted on their loan obligation while the denominator, the debtors, comprises all types of borrowers, i.e. legal entities or private individuals. The plots of the three indicators are presented in Figure 12.

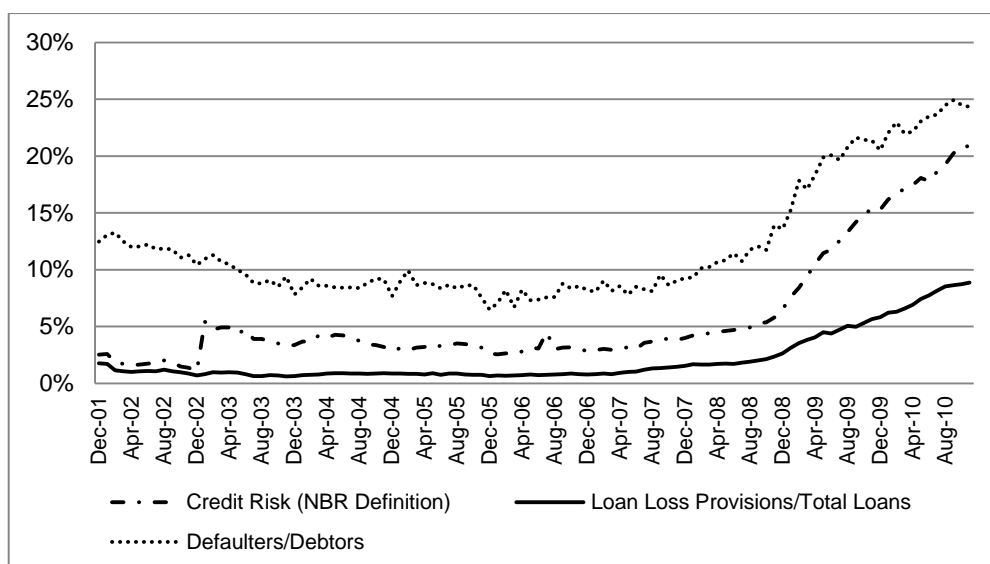


Figure 12 Credit risk metrics for the Romanian banking system (2001-2010)

Source: NBR and author's calculations.

Broadly all three measures move in tandem and start rising steeply by the end of 2008 reflecting the deteriorating asset quality of the Romanian banking system as the veil of the global financial crisis covers the region. Despite being overshadowed by the rapid lending growth, the share of problem loans begins to pick up by the end of 2006. The share of NPLs<sup>75</sup> in total loans in Romania reached 9.7% at the end of 2007 and accelerated in the second half of 2008 reaching a staggering 13.8% at the end of 2008 due to the adverse economic conditions. Notably, the trend evidenced in Romanian credit risk metrics resembles the one observed for Bulgaria in Figure 10. The Romanian banking system also appears to be plagued by high NPLs at the beginning of the data sample.

However, the use of NPLs as a measure of the Romanian credit risk was not feasible because of the small number of observations. The Romanian authorities began

<sup>75</sup> The NPLs reflect the unadjusted exposure to loans classified as loss, doubtful, and substandard, according to the NBR's loan classification regulations, as a percentage of total loans using the balance sheet approach, which may differ from the data published in the NBR's Monthly Bulletin. Notably, the numbers reported deviate significantly from those in the IMF Statistics, as shown in Table 7 of Chapter 2. The latter manifests the data constraints and concerns that may arise on the quality of data.

reporting NPLs, defined as loans past-due over 90 days, in 2004 while the IMF database reports Romanian NPLs from 2003 onwards on a quarterly basis. Hence, the use of NPLs as credit risk proxy would have limited considerably the sample's size in the research. Moreover, a series of changes in the regulatory framework<sup>76</sup> on loan classification prohibited the use of the credit risk ratio. Besides the changes in regulation, both the ratios of credit risk and defaulters to debtors do not account for the entire system's loans while the reported series that refer to foreign currency loans are updated with a month's lag. The plots of both these indicators in Figure 12, present a certain degree of instability over time, suggesting the possibility of a number of breaks or potential reporting problems (Barisitz, 2011). It is worth noting that the preliminary empirical results produced through the use of the credit risk ratio or the ratio of defaulters to debtors were inconsistent and unstable, possibly owing to the frequent changes in the regulatory framework.

Another issue encountered in the selection of an appropriate credit risk proxy for the Romanian banking system is that the NBR's loan classification is not fully aligned with the treatment of loans under the International Financial Reporting Standards (IFRS). In this respect, a study by Fitch (2009) indicates that the provision coverage of problem loans in Romania may be low, in the light of the potential difficulty of banks to recover the collateral in times of borrowers' stress. The latter underlines a backward looking property of the LLP series as the provisioning policy of banks may not reflect the actual size of the problem loans in a timely manner. However, in view of the structural problems in using other indicators, the LLP ratio is chosen as the best

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<sup>76</sup> In the timeframe of the research, the classification of Romanian loans changed several times. Initially, the classification followed the NBR's Regulation no. 2/2000 that was subsequently amended by Regulation no. 5/2002. Thereafter several amendments followed as introduced by the Regulations nos. 7/2002, 8/2005, 12/2006, 4/2007, 5/2007, 4/2008, 3/2009, 7/2009, 13/2009 and NBR Order no. 5/2009. The respective changes in the calculation method of the ratio prevent any practical use of the NBR's credit risk series.



alternative proxy for the Romanian credit risk. The choice is justified to some extent by the empirical evidence that suggests a high correlation between LLPs and NPLs (Cavallo and Majnoni, 2001; Quagliariello, 2004).

As the literature purports, the determinants of credit risk in a country's banking system should not focus exclusively on macroeconomic variables. Hence, in line with the Bulgarian case, the dataset involves a broad set of Romanian bank-specific indicators, as shown in Table B2 in the Appendix. These are measures of banks' leverage and liquidity, such as the loan to deposits ratio that provides a crude indication of the ability and the extent to which the banking system mobilizes deposits to meet credit demand, highlighting also the banks' risk attitude. Furthermore, the leverage ratio is used to validate the moral hazard hypothesis that suggests a positive relationship between low capitalized banks and increasing NPLs. The system's loans were also incorporated in the dataset as the credit growth dynamics may interact with the economy and affect the banks' credit risk, as the Minskian hypothesis suggests. Figure 13 shows the evolution of the loans granted on an aggregate level in Romania in the timeframe of the research.

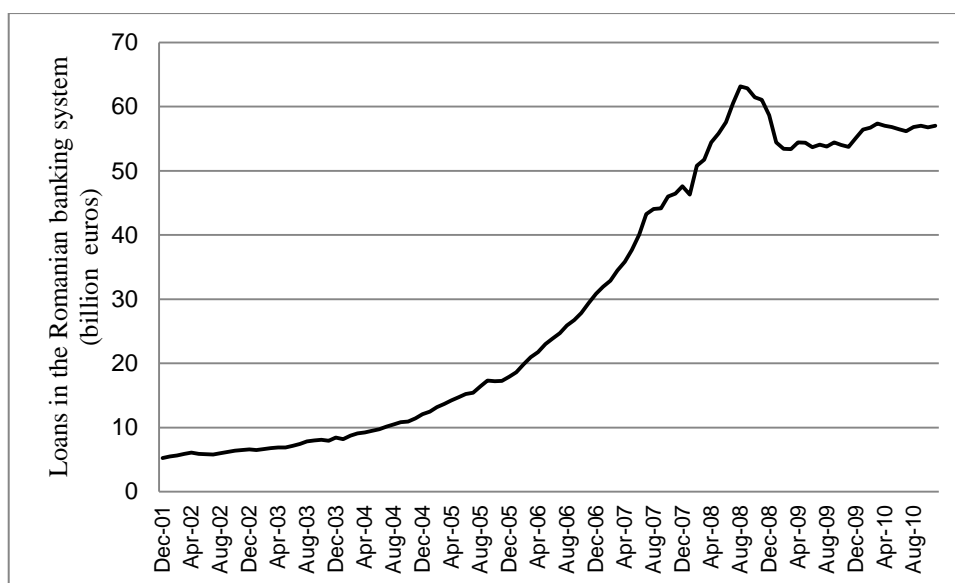


Figure 13 Bank loans to the non-bank sector in Romania (2001-2010)

Source: NBR and author's calculations.

Since the beginning of the sample period, the euphoric trend in loan volumes is evident. Notably the upward trend in 2005 becomes even sharper as the system's reforms were largely completed. This can be also explained in the light of Romania's late start in credit growth relative to the GDP growth, as compared to other CESEE economies (Cottarelli *et al.*, 2003). Once the credit started flowing, its growth rate soon exceeded that of other transition countries raising concerns about the supervision implications. In about the second half of 2008 the upward trend reverses drastically and in 2009 the outstanding loans stabilize at considerably lower levels compared to the pre-crisis period.

In the country's report, IMF (2010a) reiterates that credit deterioration is the primary risk to the Romanian banking sector. A sharp rise in NPLs, coupled with weak growth prospects and exchange rate depreciation, is expected to impair the ability of households and corporations to service their loans.

Similarly to Bulgaria, the Romanian data consist of an extensive set of indicators aimed at capturing all potential variables with explanatory power on the country's

credit risk. The indicators were again grouped into four broad categories: macroeconomic-cyclical, monetary, financial and bank-specific indicators. The macroeconomic indicators include, among others, the real GDP,<sup>77</sup> unemployment rate, consumer price index, FDI, investment expenditure, construction activity,<sup>78</sup> consumption, and foreign trade as captured by the country's imports and exports. The choice of meaningful indicators is driven by their representativeness of the Romanian economic cycle. As such, the FDI and the country's debt ratios have also been included in the data.

The literature indicates that risks to financial stability may be increasing in emerging banking systems because of rapid credit growth that typically goes hand in hand with rising asset prices. Many studies and market reports indicate that lending in Romania was dominated by the residential/real estate boom, thus providing the rationale for including the construction indices in the dataset. This cycle is self-reinforcing, as theory and evidence suggests that more lending pushes up property prices which encourages more lending. At the onset, any modest benefits from the construction boom in the SEE region are outweighed by the accompanying financial and economic instability. The current account also serves as a meaningful variable in most transition countries in view of its sensitivity to workers' inward remittances that may save the current account from becoming an unmanageable deficit. A sharp contraction or reversal of inflows could threaten the financial stability through a drying up of credit to the private sector, resulting in a slump in economic activity, along with increasing

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<sup>77</sup> An inherent difficulty in using the GDP series in the research emanates from the quarterly frequency of reporting. To overcome the problem, an interpolation method was used to transform the series frequency from quarterly to monthly. However, the process did not go far enough in view of the debate in the empirical literature on transforming a series frequency.

<sup>78</sup> The construction activity in Romania was measured by two indices: the construction production index (CON) and the building construction index (BCON). Broadly, these indices measure the volume of output in construction. BCON includes residential and non-residential building activity whereas CON considers civil engineering works.

loan defaults. On the same wavelength, almost all emerging regions experienced expansions, such as the FDI ‘bonanzas’ in 2001-2005, with emerging Europe economies being among the key beneficiaries.

The monetary aggregates are included in the dataset as rough measures of liquidity in the system, also signalling potential pressure on the exchange rate. Deteriorating market confidence can lead to downward pressure on the free-floating exchange rate of the Romanian currency, a possible upward pressure on interest rates, and volatility in equity values, with the overall result being a degeneration of the Romanian credit quality. Although the stock exchange markets in the SEE region are less developed compared to the euro area counterparts, the dataset includes financial markets’ indicators such as indices BET and BET-C of the Bucharest Stock Exchange, and the over-the-counter market index RASDAQ. Typically, a sharp decline in stock prices globally signals adverse market perceptions of the financial markets’ health. Given the sensitivity of small, open, emerging economies in financial markets’ turbulence, the Dow Jones Euro Stoxx 50 equity index is used as a forward-looking indicator of the economic prospects in the euro area and the markets’ expectations. Through the price of Brent oil, a commodity is introduced in the data, as fluctuations in oil prices affect the economic activity in most SEE countries. A sharp weakening of the Romanian national currency against the euro would adversely affect the households’ and businesses’ balance sheets, thus leading to a substantial increase in NPLs (IMF, 2010a; Brown and De Haas, 2012). The latter is further supported by the tendency in Romania to borrow and lend in foreign currency. Given that, a substantial proportion of the loans granted to households and corporations in the euphoria times were denominated in euros. Brown and De Haas (2012) find that the foreign banks in Romania have been driving foreign currency lending as a result of easier access to

foreign wholesale funding. In view of its fluctuation historically, the exchange rate between the Romanian currency and the euro is also considered in the dataset. Similarly is the case of the Euribor and Robor reference rates that broadly determine the cost of borrowing in foreign and domestic currency respectively. As with Bulgaria, an equally comprehensive dataset has been collected for Romania to facilitate the investigation of the credit risk determinants in these countries.

Table 12 summarizes the credit risk measures employed in the empirical research for each country.

Table 12 Credit risk metrics considered per country

Bulgaria	Romania
Non-performing loans	Credit risk
	Loan loss provisions
	Defaulters to debtors

The ideal case would have been to use a common credit risk proxy in both focal countries. Such an approach would facilitate comparison between the two SEE countries but it was not feasible due to data limitations.<sup>79</sup> In most SEE countries, the local supervisory authority (Central Bank) issues prudential regulations with respect to loan classification. Certainly, such local-level legislation is liable to frequent changes, challenging the consistency of time series. Yet, as Barisitz (2011) indicates, the definitions of problem loans based on the national credit quality classifications of CESEE countries appear largely comparable.

The rapid credit growth in the SEE region, driven mainly by foreign banks, poses a material risk factor in banking stability. In other words, the dominance of foreign

<sup>79</sup> The empirical research could not consider the LLPs for the Bulgarian banking sector as they were not available and, as already mentioned, the Romanian NPLs are only available since 2004.

banks in both Bulgaria and Romania has been a mixed blessing in view of the banking linkages in place that considerably increase the possibility of intra-regional contagion risk. Typically, these banks, in pursuing aggressive credit expansion strategies, expose themselves to similar risks in both home and host countries. In view of the critical presence of Greek banks in both countries, and in the endeavour to investigate any spillover effects of the Greek crisis to the Bulgarian and Romanian banking systems, the next section discusses the indicators used to approximate the Greek debt crisis.

### **5.1.3 Description of the Greek crisis dataset**

A substantial part of both the Bulgarian and Romanian banking systems' assets belongs to Greek banks. As the parent banks suffer severe shocks because of the Greek sovereign debt turmoil, the Greek subsidiaries in Bulgaria and Romania, albeit liquid and well capitalized (NBR, 2011; IMF, 2010a,b) encounter the material risk of coming under pressure and even collapsing. Equally, these banks are considered as crisis transmission channels through their close ties with the parent banks. Many authors suggest that the Greek banking system was negatively affected by the Greek fiscal crisis (Dalianes and Vayanos, 2011; Mitsopoulos and Pelagidis; 2011; Bank of Greece, 2012). The long record of bank crises documents that such episodes are contagious as the crisis in one country can cause a loss of confidence in the neighbouring countries' banks.

A key contribution of the thesis has to do with the inclusion of a set of indicators that capture the Greek debt crisis and the distress situation experienced by the Greek banking system.<sup>80</sup> In view of that, the research uses a representative set of Greek bank-specific, financial and market indicators in an endeavour to explore the spillover

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<sup>80</sup> Reference is made to Type II banking crises as defined by Reinhart and Rogoff (2009). This is a milder banking crisis, also known as financial distress. That was the case with Greek banks' financial profiles in the timeframe of the research.

effect of the Greek crisis on the Bulgarian and Romanian credit risk. The set of indicators that spans from 2001 to 2010 is sourced from the Bank of Greece (BOG) and the ECB. This dataset can be viewed in Table B3 in the Appendix. The plots of the three key variables used to approximate the impact of the Greek crisis are presented in Figures 14, 15 and 16. These are the Greek banks' credit risks that are captured by the ratio of the aggregate loan loss provisions to total system's loans<sup>81</sup> (LLPGR), the yield of the Greek long-term government bond as well as its spread to the German one (SPGD), and the ratio of assistance financing granted by ECB to total liabilities of the Greek banks (ECBI). The latter constitutes an emergency measure that was adopted by the European authorities to support the liquidity of the Greek banking system. As the Greek crisis became aggravated, the financial institutions in Greece experienced a severe liquidity shock stemming from the lending expansion prior to the crisis and exacerbated by a deposit flight that reflected a loss of confidence in the system and fears of a Greek default.

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<sup>81</sup> Retrospectively the aggregate balance sheet of the Greek banking system went through several changes thus, affecting the data series. For instance, starting from June 2010 Greek banks reported the securitized assets that were not disclosed previously. Subsequently, the Greek banks had to reduce the value of the government bonds held in their portfolio of Greek government securities several times; in August 2011 by the amount of euro 4 billion, in January 2012 by euro 5.8 billion, in March 2012 by euro 15.2 billion, and in April 2012 by euro 4.1 billion on a system wide level. As the empirical research had to establish a cut-off point, only the initially accessed series in January 2011 is considered.



Figure 14 Credit risk metric for the Greek banking system, 2001-2010.

Source: BOG.

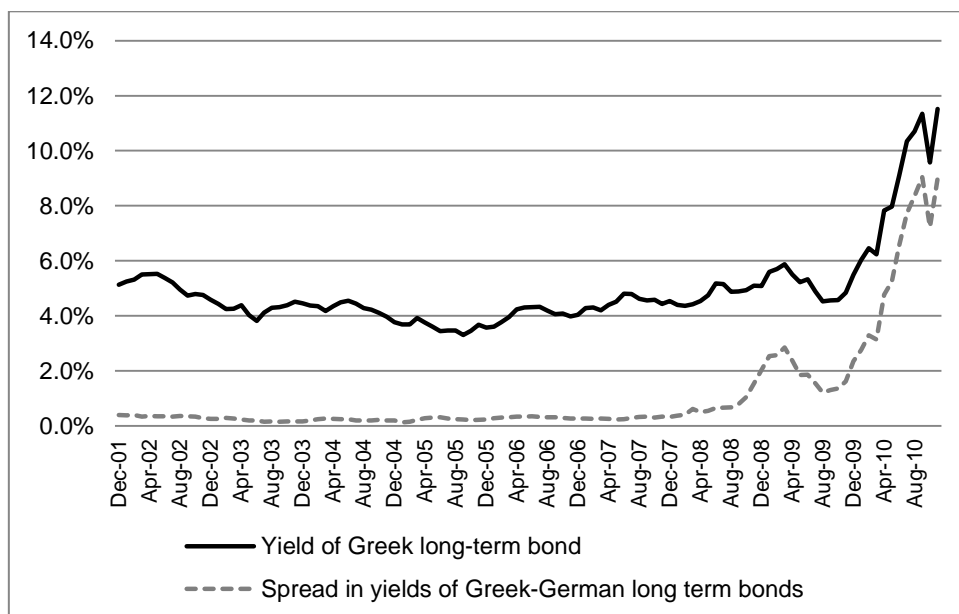


Figure 15 Spread between the Greek and German 10-year government bond yield, 2001-2010.

Source: ECB.



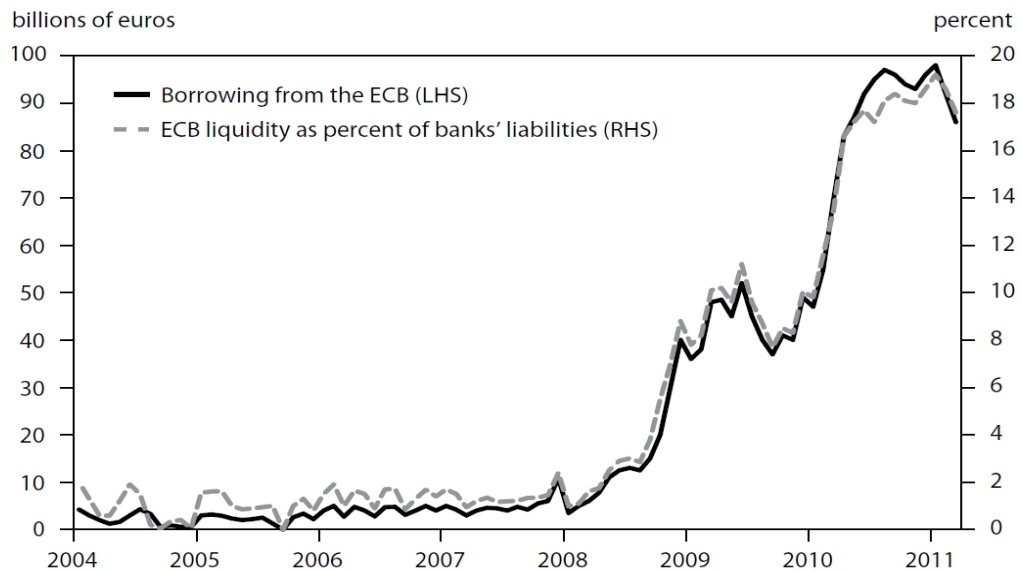


Figure 16 Greek banks' borrowing from the ECB, 2004-2011.

Source: ECB and European Commission.

The plots present a steeply upward trend, visible in all variables, that begins in 2008. The LLPGR ratio presents more unstable and volatile behaviour over time. Prior to the crisis, the LLPs in Greece were driven by tax considerations rather than the underlying economic realities. Fitch (2007) underscores that the calculated provisions are generally significantly higher than the corresponding expected loss figures. In the light of this and given the lack of data<sup>82</sup> on Greek NPLs, the LLPGR ratio is considered to be an adequate proxy of the Greek banks' distress. Overall, the variables presented in Figures 14-16 are expected to capture the potential spillover effect of the Greek crisis in the SEE banking systems under investigation. The main reasons for selecting the specific variables to approximate the Greek crisis are the following:

<sup>82</sup> The series on Greek banks' NPLs is not available in the statistics database of the Bank of Greece.

- a. The rapid expansion of Greek banks in both Bulgaria and Romania has resulted in imbalances and funding deficits<sup>83</sup>. In turn, these could have been transmitted in both SEE countries through the Greek subsidiaries that represent a critical maze in both banking systems. Then, the Greek banks' credit risk is expected to convey meaningful information of the sovereign debt and banking crisis in Greece and as such to be viewed as a crisis transmission mechanism.<sup>84</sup>
- b. The unfolding of the Greek debt crisis can be evidenced in the volatile yield spread between the Greek and German long-term government bonds as a number of studies indicate (Tavlas *et al.*, 2011, Arghyrou and Kantonikas, 2012).
- c. The deteriorating asset quality of the Greek banking system, together with the drained liquidity is marked by the banks' over-reliance on rescue funds provided by the ECB. Hence, it makes sense to employ a ratio that captures this monetary phenomenon which displays bank distress.
- d. The Greek banks offered investors a good emerging-market exposure platform. Consequently, the prospects of Greek banks in the region as well as the turbulent times in Greece may be reflected in stock market indices.

A large body of literature shows that the macroeconomic or banking sector conditions have explanatory power at the level of the credit risk (Festić *et al.*, 2011). Importantly, other authors provide evidence of the spillover effect and long-run diffusion of credit risk across financial institutions or regions (Herrerias and Moreno, 2012). Similarly,

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<sup>83</sup> Domestic banks in SEE region have built up large negative net foreign positions *vis-à-vis* parent banks and international lenders, as credit growth has far outpaced growth in domestic deposits (IMF, 2012b).

<sup>84</sup> For instance, see Herrerias and Moreno (2012) on the spillover effects of credit risk.

the IMF (2013a) finds that the euro area market is highly integrated. Given that, the yield spread of the 10-year euro area government bonds over the German ones is influenced by country-specific risks. Other empirical studies document a strong link between financial stress in advanced and emerging economies where transmission is stronger to emerging economies with tighter financial links to advanced economies (Balakrishnan *et al.*, 2009). Hence, through the Greek crisis indicators' dataset, the research sets out to investigate whether the Greek debt and banking crises have had an impact on the stability of the Bulgarian and Romanian banking sectors.

So far, the research activity has identified the dataset of both SEE countries as well as the indicators that approximate the Greek crisis. A comprehensive set of explanatory variables has been drawn from various sources in line with theoretical propositions and the findings from empirical studies in other geographical areas or time-periods.

The following section sets forth the testable hypotheses and maps them to the research questions. It also defines the timeframe of the empirical research and discusses issues pertaining to data quality.

#### **5.1.4 Formulation of hypotheses**

In line with the theoretical framework of the research and past empirical studies, the research develops with the formulation of testable hypotheses in accordance with the standard econometric methodology. In essence, this activity links the theoretical underpinnings of the research with testable hypotheses. Table 13 lists the set of hypotheses to be tested in the empirical part of the research.

Table 13 The set of testable hypotheses in the research

Hypothesis	Evidence: theory or empirical background
1. Deteriorating credit risk is negatively related to with good economic conditions (pro-cyclicality hypothesis).	Financial accelerator effects (Bernanke <i>et al.</i> , 1999; Bernanke, 2007; Kiyotaki and Moore, 1997), Quagliariello (2008), Babihuga (2007), Festić <i>et al.</i> (2011).
2. Credit risk is positively (negatively <sup>85</sup> ) related to increasing lending growth (excess lending/financial liberalization hypothesis).	Banking crises literature (Demirgüç-Kunt and Detragiache, 1998; Kaminsky and Reinhart, 1999; Hardy and Pazarbaşıoğlu, 1999; Reinhart and Rogoff, 2009), Nkusu (2011), De Bock and Demyanets (2012).
3. Regulation (lending restrictions) decreases credit risk (regulation hypothesis).	Demirgüç-Kunt, A. (1998), Kaminsky and Reinhart (1999), Podpiera, (2004).
4. Credit risk is negatively (positively) related to increasing money supply (monetary transmission hypothesis).	Financial accelerator effects (Bernanke <i>et al.</i> , 1999; Bernanke, 2007), De Graeve <i>et al.</i> (2007), Zhang (2009), Angeloni <i>et al.</i> (2010).
5. Credit risk is positively related to the Greek crisis - global financial crisis (crisis spillover hypothesis).	Peek and Rosengren (1997, 2000), Allen and Gale (2000), Freixas <i>et al.</i> (2000); Herrerias and Moreno, 2012, Bruno and Shin (2013), Shostya (2014).

Table 13 summarizes the hypotheses to be tested by econometric analysis and maps each hypothesis with evidence arising from theory or studies. In this respect it addresses the aims and objectives of the research and puts the terms of reference in context to facilitate the data analysis and the estimation of regressions.

The empirical research uses monthly observations spanning from December 2001 to December 2010. The following arguments are decisive in defining the timeframe of the research:

- a. The starting point of the research coincides with the completion of the privatization process of commercial banks in Bulgaria and Romania. In the former case the process was virtually completed in 2001-2002 (Frömmel and

<sup>85</sup> Denotes that literature has not reached a clear-cut conclusion on the influence of credit growth and money supply on credit risk.

Karagyozova, 2008). Previously, the competition in the banking market was distorted by state-owned banks. In the same spirit, the Romanian authorities initiated the first privatizations in the banking system by 1999-2000 following a restructuring programme launched by the NBR (2001). Therefore, the expansion of foreign banks in both Bulgaria and Romania took place around 2001 concurrently with the introduction of the euro and the subsequent decline in interest margins in the foreign banks' homelands.

- b. Although it is not feasible to capture a full business cycle, the dataset attempts to cover, at least partially, the boom-bust period up to the onset of the global financial crisis and the subsequent Greek one. Evidence suggests that the SEE region imported the crisis by 2008 through a sudden shrinkage of capital inflows, thus with a lag, compared to more developed economies.
- c. The need to establish a cut-off point in the empirical research. The supervisory authorities in the SEE region by mid-2010 began to impose emergency rules to prevent local banks from being drained by the parent banks in Athens (Economist, 2010). Contagion fears receded as drastic measures were taken to avert a financial and banking meltdown in Greece through rescue funds supplied by the IMF, EU and ECB. Similarly, in 2009 the 'Vienna initiative'<sup>86</sup> was launched with the aim of supporting several banking systems of Central and Eastern Europe.

Many authors suggest that the data requirements for modelling credit risk are the main hindrances in many countries when trying to assess the vulnerabilities of their

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<sup>86</sup> The 'Vienna Initiative', a joint International Financial Institution action plan was a response to the continuing impact of the euro area's problems, sparked by the rising debts and deficit of Greece, on the economies of emerging Europe. The EIB Group, the World Bank Group and the European Bank for Reconstruction and Development together committed funds to avert a systemic banking crisis and a collapse in credit to the real economy (De Haas *et al.*, 2012). By the beginning of 2011 the situation in the region had stabilized as significant funds were mobilized in support of banking stability.

financial sectors (Segoviano and Padilla, 2006; Howard, 2009). Clearly, modelling credit risk, regardless of the methodology chosen, requires a great deal of good quality data as the review of the empirical studies identifies. Often what prevents a country from including banks' stress tests within their surveillance toolkits is some form of data constraint (Howard, 2009). For example, the required information may present inconsistencies or there may be concerns over the accuracy of the data. Equally, countries are occasionally forced to compromise when it comes to data and this can affect the results of the research. The lack of adequate data may make it difficult to calibrate the assumed distributions of the data. In turn, the calibrated distributions may not be consistent with the analysed data generating processes. Clearly, if such shortcomings are evidenced and not addressed adequately, erroneous statistical inferences may result and interpretations would be incorrect, undermining the validity and reliability of the research findings. As already discussed, the credit risk time series in the SEE countries are relatively short or present interruptions and breaks (Barisitz, 2011). The lack of adequate and quality data represents a central problem for researchers who attempt to evaluate the impact of specific macroeconomic, financial indicators and events such as crises in banks' credit risk. Given that, the measurement and subsequently the modelling of credit risk can be affected by data constraints.

The previous section defined and discussed the datasets collected and formulated the testable hypotheses for the empirical research. The timeframe of the research has been justified and the issues related to the availability and quality of data have been disclosed and addressed.

The next section provides the methodological roadmap of the empirical research and presents the econometric techniques utilized.

## 5.2 The methodological approach

The underlying notion that dictates the choice of an appropriate methodological framework has to be consistent with the *a priori* expectations from economic theory and the empirical evidence but also has to provide modelling flexibility within data constrained environments. It has been defended since the early chapters of the thesis that the focal SEE countries would be best explored using a country-specific research design. On the other hand, several recent studies that focus on the region have used cross-country modelling techniques, running the risk of paying little attention to the distinctive aspects of each country's economy and banking system. Equally the variation in the definition of problem loans as well as the diverse institutional environments among countries can cast doubt on the findings of cross-country panels. It could be argued that the collection of individual banks' data for each country would solve the issue and at the same time exploit both the time series and the cross-sectional dimensions of the sample. However, individual banks' data could not be assessed for both countries for a number of reasons (Morosan, 2011), including the financial reporting framework. Still, if that were possible, it would have resulted in a considerable loss of observations, as banks report on a quarterly basis. The aims and objectives of the research, and the collected data, lead to time series modelling techniques in assessing the building up of a specific financial sector's vulnerabilities over time. The estimation process requires the selection of a set of variables that, according to economic theory and empirical studies are expected to reasonably explain each country's credit risk. The crude form of the model adopted for analysing the determinants of credit risk is defined as follows:

$$Credit\ risk_t = f(\text{macro}_t, \text{bank-specific}_t, \text{structural}_t, \text{Greek crisis}_t) \quad (1)$$

Where  $t$  denotes time. Credit risk is modelled as a function of macroeconomic, bank-specific, institutional-structural and Greek-crisis related variables. The model controls for variables that capture the macroeconomic environment in which banks operate. The bank-specific variables included in the model have been shown in the literature review to be instrumental in explaining credit risk. The structural variables that usually take the form of dummy variables are related to the supervisory-regulatory policies. Lastly, the Greek crisis indicators are variables that proxy the effect of the Greek sovereign and banking crisis on the banking sectors of Bulgaria and Romania. In this setting, the research hypotheses will be tested. At the same time, the research sets out to investigate whether the Greek crises are associated with credit risk and subsequently the stability of the banking sectors of the focal countries.

Broadly, the empirical research consists of five stages, performed for each country separately. These are the following:

- a. Unit root tests: standard as well as tests that account for the presence of endogenous structural breaks;
- b. Univariate OLS regressions to identify the variables that have explanatory powers for Bulgarian and Romanian credit risk;
- c. Multivariate regressions using OLS and GMM estimators that are based on the variables identified by the univariate regressions;
- d. Estimation of cointegration models: autoregressive distributed lag models (ARDL) and vector error correction models (VECM); and
- e. Estimation of Markov switching structural vector autoregressive models (MS-SVAR), combined with the estimation of time varying structural vector autoregressive models (TV-SVAR).



In formal modelling terms, in stages (b) to (d) the reduced-form relationships rather than structural models are estimated as the aim is to uncover the statistical linkages in place as well as explore the cointegrating relationships shaped between the key explanatory variables and credit risk for each country. In this respect, a relationship is posited between credit risk and a host of potential explanatory variables that is assumed to be exogenous or at least pre-determined. Then, the models are qualified and their robustness validated using specification and diagnostic tests, as suggested by econometric theory. The functionality offered by Eviews 7.1 software is employed for the unit root tests, the estimations of the linear regression models and the VECM models. The ARLD models were estimated using Microfit 3.1 software. Lastly, the estimations of the MS-SVAR and TV-SVAR models were based on the use of routines, kindly provided by Dr. Karoglou, that identify the regime switches, developed in the Ox 6.2 platform.

Prior to any modelling attempt, the time series were tested for unit roots to determine their order of integration and avoid spurious regressions. The next subsection describes this activity.

### **5.2.1 The unit root tests**

Having defined the modelling setup and gained some insight from the data plots that are studied in line with the institutional context of each country, the next step involves the unit root tests since it is well known that macroeconomic variables are usually non-stationary in their levels. Unit root testing has become mandatory in modern time series analysis, as the application of classical methods of estimation to models with non-stationary time series can give rise to spurious results and misleading inferences (Phillips, 1986; Stock and Watson, 1989). The order of integration is critical in the

application of cointegration modelling techniques. However, while the application of VECM requires pre-testing the variables to determine their order of integration, such a condition is not always necessary when applying the ARDL approach to cointegration. Thus, the empirical research proceeds with the standard unit root testing, although most macroeconomic time series can typically be described as  $I(1)$  with the imposition of a deterministic seasonal pattern (Osborn, 1990).

The findings of Nelson and Plosser (1982) spawned a wave of research that emerged on the unit root hypothesis. Specifically, the traditional view that the current shocks only have a temporary effect and the long-run movement in the series is unaltered by such shocks was challenged by Nelson and Plosser (1982) who consider that random shocks are bound to have permanent, as distinct from transitory, effects on the long-run level of macroeconomics. In view of the developments in the literature, a testing strategy that incorporates all available information is required as opposed to mere calculation of test statistics.

Judging from the empirical studies, the augmented Dickey-Fuller (ADF) (1979) test has become the most popular of many competing unit root tests in the literature. In the light of this, the time series were initially tested using the ADF test as proposed by Dickey and Fuller (1979) and refined in Dickey and Fuller (1981). Next, the tests proposed by Phillips and Perron (1988) and Kwiatkowski *et al.* (1992) are applied to increase the validity and reliability of the ADF results. Technically speaking, the series entering this thesis models should present a constant long-run mean and a finite variance that do not depend on time, i.e. the model is stationary. On the other hand, non-stationary series present changing means and variances over time, thus series do not return to their long-term averages after short-run deviations. Nevertheless, if properly differenced, time series that are initially non-stationary can be turned into

stationary ones (Granger, 1986). The unit root tests are performed using the general form of the equations<sup>87</sup> as Campbell and Perron (1991) argue that the improper exclusion of either the intercept or trend can jeopardize the power of the test.

The Phillips and Perron (PP) (1988) test, considered next, is an alternative unit root test that is also frequently used in empirical studies. In addition, the test proposed by Kwiatkowski *et al.* (1992), known as the KPSS test is considered. The choice of the KPSS test to complement the widely employed ADF and PP tests is motivated by the argument that tests designed on the basis of the null hypothesis that a series is integrated of order one, have a low power of rejecting the null. Since economic series are not very informative about whether or not there is a unit root, it would be useful to perform tests of the null hypothesis of stationarity as well as tests of the null hypothesis of a unit root (Kwiatkowski *et al.*, 1992). Moreover, a common pitfall of the ADF and PP tests relates to their sensitivity to different functional forms. Hence, these tests can provide misleading results if an inappropriate number of lagged coefficients is introduced into the model. To this end, the selection of the appropriate model is based on the Akaike Information Criterion (AIC) proposed by Akaike (1974) and the Schwarz Information Criterion (SIC) introduced by Schwarz (1978).

More recent studies, however, have generated evidence indicating that in the presence of a structural break, the standard unit root tests are biased towards the non-rejection of the null hypothesis (Perron, 1989). The visual inspection of the plots of the Bulgarian and Romanian credit risk metrics as well as the loan growth in both countries and the Greek crisis proxies suggest the possibility of breaks in the data. For instance, the plot of NPLs in Bulgaria presents a hike by mid-2006 while the plot of growth in loans appears to have a break in early 2005. A number of scholars tried to

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<sup>87</sup> On the general form of the equations used in the unit root tests, see Maddala (2001), Harris and Sollis (2003) and Asteriou and Hall (2007).

overcome the issue of breaks by proposing a specific treatment, which is the endogenous determination of the break point using the existing data (Banerjee *et al.*, 1992; Zivot and Andrews, 1992; Perron and Vogelsang, 1992; Perron, 1997; Lumsdaine and Papell, 1997). It should be stressed, however, that the proposed endogenous tests have received criticism for their treatment of breaks under the null hypothesis (Lee and Strazicich, 2003). In view of the criticism surrounding the conventional unit root tests, the unit root tests continued by testing if the previous results are biased because possible breaks in the series have been ignored (Perron 1997; Zivot and Andrews, 1992). In passing, it is worth mentioning that the model developed by Perron (1997) slightly differs from the one coined by Zivot and Andrews (1992) in that the latter is devoid of the one-time break dummy.

Overall, the advantages emanating from utilizing this procedure for testing the unit root hypothesis while allowing for the possible presence of structural breaks are twofold. This procedure generates results free from bias towards non-rejection as well as tracing the possible presence of a structural break. Clearly, a problem faced when applying unit root tests relates to their poor size and power properties, i.e. the tendency to over-reject the null when it is true and under-reject the null when it is false (Harris and Sollis, 2003). The latter justifies the extensive unit root testing strategy followed in the research.

Having established the order of integration, next the estimation of univariate and multivariate OLS regressions follows. This modelling activity is discussed in the following subsection.

### 5.2.2 The univariate and multivariate models

Even today, the core methods of applied econometrics remain largely unchanged as the most important tools that an applied econometrician can use are regression models. As Angrist and Pischke (2008) state, “*regressions, carefully applied to coherent research questions, almost always make sense*”. Following an approach that is analogous to Arpa *et al.* (2001), Kalirai and Scheicher (2002) and Boss (2002), initially ordinary least squares (OLS) univariate regressions are estimated to identify the indicators with explanatory power on the credit risk of both countries. A central assumption of this modelling stage is that the time series of the variables do not contain unit roots. The latter has already been dealt with in the previous section. The generalized regression model that provides the basic framework, obtains the following form:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_{1t} + \dots + \alpha_i \Delta X_{it} + \varepsilon_t \quad (2)$$

Where  $\Delta Y_t$  denotes the first differences of the credit risk variable employed for each country,  $\Delta X_t$  the change in explanatory variable  $X_i$  at time  $t$ , which could have an impact on the credit risk with direction and magnitude defined by  $\alpha_i$ , and  $\varepsilon_t$  is the error term at time  $t$  that is assumed to be an independent, normally distributed random variable, i.e.  $\varepsilon_t \sim i.i.d. (0, \sigma^2)$ .

Thus the monthly changes of the credit risk variables used for each country are regressed against each indicator that was included in the datasets which are presented in Tables B1 and B2 in the Appendix. The univariate regressions provide fertile ground for identifying the variables that are correlated with the dependent variable. The credit risk indicators are regressed against each possible explanatory variable at time  $t$  but also at all lags up to one year, i.e. up to  $t-12$ . The rationale behind this extensive approach is to capture the potential lagged effects of any explanatory

variable on the credit risk indicators, implying that asset quality issues are usually disclosed on the banks' financial statements quite a time after the bad loans' problem emerges. The latter argument which finds support in many empirical studies (Kalirai and Scheicher, 2002; Boss, 2002; Quagliariello, 2004). Another advantage of this repetitive approach is that it enables analysis of the robustness of the models' specification (Kalirai and Scheicher, 2002). In addition, Boss (2002) adds a dynamic component to his model by assuming that each of the macroeconomic, explanatory variables follows a univariate autoregressive process of order two, i.e. an  $AR(2)$  process. As this is considered a rather restrictive assumption, it was not adopted.

In the next stage of model estimations, the statistically significant variables, as identified in the univariate regressions, are used in the estimation of a multivariate credit risk model. This stage uses the general-to-specific methodology as developed by Hendry (1993). The criteria to arrive at a final model formulation are as follows:

- a. The variables in the final specification of the multivariate model should bear the 'correct' economical sign.
- b. Ideally, one significant indicator from each group of variables<sup>88</sup> should enter the model.
- c. The model should be reasonably plausible and simple. Such models are more easily interpreted and communicated (Maddala, 2001).
- d. All variables that enter the multivariate model should be significant at the 10% level of significance.
- e. The standard diagnostic tests should indicate no pathological issues in terms of first and second order serial correlation, multicollinearity or heteroskedasticity in the error terms.

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<sup>88</sup> The groups of variables as presented in Tables B1 and B2 in the Appendix are broadly defined as macroeconomic-cyclical indicators, monetary, financial markets-interest rates, and bank-specific variables.

A drawback of the OLS findings relates to a potential issue of endogeneity among variables. These are accommodated through the General Moments Method (GMM) estimations that under proper specification, instrumental variables (IV) can overcome the problem of endogeneity. In principle, estimations using IV can avoid biases that OLS estimation suffers when explanatory variables are correlated with disturbances (Murray, 2006). The real challenge in this endeavour is finding appropriate instruments. In this respect, the strategies outlined in Murray (2006) and Roodman (2009) have been utilised. However, it should be noted that there is a trade-off between OLS and IV as there is a trade-off between bias and efficiency in GMM estimators. In detail, there is an efficiency loss in IV estimation compared to OLS, especially in small samples (Altonji and Segal, 1996; Canova, 2007). On the other hand, the GMM estimators perform better when the number of observations is large (well-above 100) but, for small samples, their performance can be far from appealing (Canova, 2007).

The use of univariate and multivariate OLS regressions provides some preliminary indications on the relationships among the variables of interest. Building on the premises provided by the previously outlined modelling stage, the empirical analysis proceeds by using cointegration techniques in an endeavour to unravel credit risk in Bulgaria and Romania.

### **5.2.3 Cointegration analysis techniques: ARDL and VECM modelling**

In recent years, reams of academic papers have been produced proposing different methodologies on how to investigate long-run equilibrium between time series variables. In this respect, cointegration analysis can prove fruitful in providing information on the long-term equilibrium relationships among credit risk and a set of

explanatory variables. On the other hand, the error correction modelling (ECM) as a tool of analysis overcomes the problems of spurious regression through the use of appropriate differenced stationary residuals in order to determine the short-term adjustments in the model. Within the spectrum of cointegration techniques, the vector error correction model (VECM) and the autoregressive distributed lag (ARDL) approach to cointegration<sup>89</sup> occupy the lion's share in empirical studies. On the univariate front, cointegration techniques such as those of Engle and Granger (1987) and Phillips and Hansen (1990) have been applied. As for multivariate cointegration, the Johansen (1988) and Johansen and Juselius (1990) maximum likelihood procedures, i.e. the VECM framework, are extensively used in empirical research. A relatively new procedure is the ARDL approach that has gained increasing popularity in recent years. The approach that has been advanced by Pesaran and Smith (1998), Pesaran and Shin (1999) and Pesaran *et al.* (2001), presents flexibility as well as several appealing aspects that are not present in other cointegration techniques. For instance, as long as the ARDL model is free from residual correlation, endogeneity becomes less of a problem. Pesaran and Shin (1999) demonstrated that the appropriate lags in the ARDL model correct for both serial correlation and endogeneity problems. The ARDL approach to cointegration has been applied in studies dealing with the finance-growth nexus. However, in the case of credit risk determinants, studies that use the VECM framework are limited, while those that apply the ARDL approach are rare. This can be attributed to the fact that the ARDL approach is relatively new, as is broadly the case with the banks' stability studies that link credit risk to the macroeconomy.

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<sup>89</sup> Also found in the literature as a bounds testing approach within the ARDL framework.



The ARDL approach yields certain econometric advantages over other cointegration techniques. More specifically, endogeneity problems and the inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle-Granger method are avoided; the long and short-run parameters of the model are estimated simultaneously; all variables are assumed to be endogenous; it also obviates the need to establish the order of integration amongst the variables (Alexiou *et al.*, 2008). The bounds testing method as proposed by Pesaran *et al.* (2001) can be implemented regardless of whether the underlying variables are  $I(0)$ ,  $I(1)$ , or fractionally integrated. Another advantage of this approach is that the model takes a sufficient numbers of lags to capture the data generating process in a general-to-specific modelling framework. Lastly, a dynamic error correction model (ECM) can be derived from ARDL, which integrates short-run dynamics with the long-run equilibrium without losing long-run information (Shrestha and Chowdhury, 2005; Mallick and Agarwal, 2007; Masih and Hamdan, 2008) through a linear transformation (Banerjee *et al.*, 1992).

For reasons of simplicity, equation (3) provides the generic framework of the ARDL model as used in the empirical research:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^p \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta X_{1t-i} + \sum_{i=1}^p \beta_{3i} \Delta X_{2t-i} + \sum_{i=1}^p \beta_{4i} \Delta X_{3t-i} + \sum_{i=1}^p \beta_{5i} \Delta X_{4t-i} + \lambda_1 Y_{t-1} + \lambda_2 X_{1t-1} + \lambda_3 X_{2t-1} + \lambda_4 X_{3t-1} + \lambda_5 X_{4t-1} + \varepsilon_t \quad (3)$$

In the first part of equation (3) the terms denoted by  $\beta_i$ , in the summation operators, represent the error correction or short run dynamics of the model, whereas the second part with the terms denoted by  $\lambda_i$  represent the long run relationship,  $\Delta$  denotes the first difference operator,  $p$  is the optimal lag length and  $\varepsilon_t$  is a random disturbance term. To keep the model tractable and interpretable, five variables at most enter the

cointegrating equation, taking into account the sample size and the loss in degrees of freedom. It is worth noting that the ARDL approach to cointegration estimates a considerable number of regressions in an attempt to obtain the optimal lag length for each variable. Specifically, the ARDL approach estimates the  $(p+1)^k$  number of regressions, where  $p$  is the maximum number of lags to be used while  $k$  is the number of variables in the equation. As the sample includes monthly data, a sensible option is to set the maximum lag length at twelve periods (Pesaran and Pesaran, 1997). The determination of an appropriate and correctly specified ARDL model, i.e. the optimal lag-length of each variable, is based on selection criteria, either the SIC or the AIC. Next, the null hypothesis of  $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$ , which implies the non-existence of a long-run relationship against the alternative that at least one is non-zero, is tested. If a cointegrating relationship exists, then the null hypothesis can be rejected. Hence, the long run relationship amongst the variables is put to the test using the bounds testing approach coined by Pesaran *et al.* (2001). This approach is based on the F-test or Wald-test statistics. Once a long-run relationship is established, the long-run estimates can be obtained as well as the speed of adjustment to equilibrium level after a shock that is captured by the error correction representation, as conveyed in the following form:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^p \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta X_{1t-i} + \sum_{i=1}^p \beta_{3i} \Delta X_{2t-i} + \sum_{i=1}^p \beta_{4i} \Delta X_{3t-i} + \sum_{i=1}^p \beta_{5i} \Delta X_{4t-i} + \lambda EC_{t-1} + u_t \quad (4)$$

Where  $\lambda$  is the speed of adjustment and EC is the error correction component defined as:

$$EC = Y_t - \beta_0 - \sum_{i=1}^p \beta_{1i} \Delta Y_{t-i} - \sum_{i=1}^p \beta_{2i} \Delta X_{1t-i} - \sum_{i=1}^p \beta_{3i} \Delta X_{2t-i} - \sum_{i=1}^p \beta_{4i} \Delta X_{3t-i} - \sum_{i=1}^p \beta_{5i} \Delta X_{4t-i} \quad (5)$$

Following the estimation of the ARDL model, standard diagnostics and stability tests are performed to test the model's validity. The results obtained from the ARDL approach for both countries are subsequently cross-checked using the cointegration techniques of Johansen (1988, 1991) and Johansen and Juselius (1990, 1992). The authors proposed a maximum likelihood testing procedure for the number of cointegrating vectors that also include testing procedures for linear restrictions on the cointegrating parameters. The general framework of the VECM specification is described in equation (6). Any  $p$ -dimensional vector  $X_t$  of non-stationary variables which follows a Gaussian VAR process with lag order  $k+1$  and a drift  $\mu$  can be written as:

$$\Delta X_t = \sum_{i=1}^k \Gamma_i \Delta X_{t-i} + \Gamma_{k+1} X_{t-k-1} + \mu + \varepsilon_t \quad (6)$$

Where  $t = 1, \dots, T$ ,  $\varepsilon_t$ , is an independently and identically distributed  $p$ -dimensional vector, and  $T$  is the sample size. The dimension of the cointegrating vector is given by the rank of matrix  $-\Gamma_{k+1}$ . When the rank is  $r$ , we can decompose  $\Gamma_{k+1}$  into  $-\Gamma_{k+1} = \alpha\beta'$ , here  $\alpha$  and  $\beta$  are  $p \times r$  matrices. The rows of  $\beta'$  from the  $r$  represent cointegrating vectors. If we consider the elements of the  $r \times 1$  vector  $\beta'X_{t-k-1}$  as 'error correction' terms, then the elements of matrix  $(-\alpha)$  show the speed of adjustment of the dependent variables towards the equilibrium. Johansen (1988, 1991) proposed how to derive maximum likelihood estimates of  $\alpha$  and  $\beta$  and suggested two likelihood ratio test statistics to determine the rank of the cointegration space. Using the trace statistic, the null hypothesis under test is that there are at most  $r$  cointegrating vectors. With the use of maximum eigenvalue statistics, one can test for the presence of  $r$  versus  $r+1$  cointegrating vectors. Similar to the ARDL approach, the issue of finding the optimal lag length is important as it is required to have Gaussian error terms. Hence, the lag

length selection criteria are utilized, i.e. the AIC and SIC information criteria as well as the standard diagnostics of the error terms.

The next step entails the estimation of the VECM models based on the Pantula principle as suggested by Johansen and Juselius (1992). This involves the estimation of all possible models and a model selection procedure that moves from the most restrictive hypotheses in intercept and trend to the least restrictive ones. According to Granger and Lin (1995) causality in the long-run exists only when the coefficients of the cointegrating vector are statistically significantly different from zero. In the present research, the variable deletion (F-type) tests have been applied for the coefficients of the cointegrating vector and for the lagged values of the Bulgarian and Romanian credit risk proxies.

In essence, the VECM framework is used as complementary to the ARDL one since it has been noticed in the empirical literature that researchers rarely cross-validate the estimated cointegrating vectors through an alternative technique. Certainly, this is not always feasible as the cointegration framework applied is dictated to some extent by the order of integration of the participating variables. Although the ARDL approach to cointegration can accommodate for a mix of  $I(0)$  and  $I(1)$  variables,<sup>90</sup> the same is not desirable in the VECM framework, as the inclusion of such variables can massively affect the results (Asteriou and Hall, 2007). The present research allows the validation of the ARDL findings using the VECM, as the variables that entered the ARDL cointegrating equations were found to be integrated of order one, i.e.  $I(1)$ .

Cointegration analysis is a useful tool that is used extensively in applied research. The estimated models provide information on the long run equilibrium relationships between the Bulgarian and the Romanian credit risk and a set of endogenous variables

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<sup>90</sup> Yet, it should be pointed out that the ARDL approach to cointegration fails to provide robust results when dealing with  $I(2)$  variables (Pesaran *et al.*, 2001).

that were selected on the basis of the OLS regression equations estimated previously. Nonetheless, cointegration is a purely statistical concept that is based on the properties of the time series considered. It is a-theoretical econometrics (Maddala, 2001). As such, it lacks the theoretical foundations of economics and for this reason the estimated models cannot be taken as *de facto* 'true' or 'realistic' representations of the underlying relationships. Instead, the estimated models should be viewed as an attempt to capture empirically relevant features of the observed data that may have arisen from a variety of different structural models.

Since its birth, the cointegration approach has received criticism for several reasons. Smith (2000) commented on the low power of unit root tests, implying that it is dangerous to insist on pre-testing for unit roots and then develop models, while Hendry (2000) criticized the error-correction mechanisms for not being in reality what their name suggests. It is also often not clear how the coefficient estimates should be interpreted, especially in the short-run relationships when signs are not as expected. In particular, some lagged variables may have coefficients which may change sign across the lags, and this, together with the interconnectivity of the equations, could render it difficult to see what effect a given change in a variable would have upon the future values of the variables in the system. Hendry (2000) states that multicollinearity occurs appallingly in models that use many cointegrated variables with uninterpretable effects. Hence, in the estimation of cointegrating regressions, many of the problems found in usual regressions, such as parameter instability due to structural change, multicollinearity and heteroskedasticity, are often ignored. In the present thesis the residual diagnostic tests are properly disclosed.

Although both cointegrating techniques used in the research are widely accessible to applied economics, the author of this thesis justifiably limit the number of variables

that enter the model in order to simplify the cointegrating relationships. In this respect, both cointegration techniques provide reasonable approximations of the relationships and the models obtained were plausible, informative and stochastically simple. The estimated relationships allow the consistency of the proposed hypotheses to be tested without pretending to, literally, represent the phenomena under study. Cointegration models intend merely to clarify the relationships among general concepts. As such, they are simplified to exhibit that the author understands that the real world is in fact more complicated. The bottom line is that applied research needs to overcome the obstacles encountered due to the complex nature of the phenomena involved. To model phenomena, one needs to simplify them. And simplifications of the real world rely on a set of assumptions that may prove invalid. This is because the exact distributions for finite samples are unknown. Equally, most tests do not follow their usual distributions or hold asymptotically.

Macroeconomic theory is interested in long-run equilibrium relationships. As these relationships hardly ever hold exactly in reality, there is a need for empirically supported knowledge on the long-run equilibrium relationships. Such information can be generated much better and more precisely by using cointegration analysis, rather than by employing traditional econometric models (Kirchgässner *et al.*, 2013).

So far, the empirical research provides valuable insight into the long run relationships between credit risk and a set of variables. As the evidence in favour of unit root processes in most economic time series has been found to be fragile, preoccupation with cointegration as a sole vehicle for studying dynamic relationships is unwarranted (Maddala, 2001). For this reason, the research considers next the Markov regime switching models that account for non-linearities in the data.

#### 5.2.4 The Markov switching vector autoregression modelling approach

The motivation for using the Markov switching structural vector autoregression (MS-SVAR) framework is the crises episodes, the global financial crisis and the Greek debt crisis and their potential influence on the Bulgarian and Romanian credit risk indicators.

Reflecting on the global financial crisis, Gorton (2012) suggests that a crisis is a regime switch-type event that puts under scrutiny the assumed linearity of models (Blanchard, 2014). Evidently, many studies on credit risk determinants use series up to 2008 as further estimation may reveal potential signs of instability in the coefficients. Several authors report that the statistical properties of the data during or around crises periods depart from those in stable times (Danielson, 2002; Haldane, 2009). However, models that are built upon forward looking agents should account for potential parameter changes in the future.

The original application of regime switching can be found in Hamilton's (1989) seminal work on business cycles expansions and recessions, where the regimes capture cycles of economic activity around a long-term trend. Markov switching models generally have the ability to fit the data better in a sample, compared to other time series methods (Smith and Summers, 2005; Brooks, 2008). Furthermore, ordinary VARs have the drawback that the generated impulse responses cannot be given any structural interpretation because their innovations are not identified with the underlying structural error. Hence, following the argument found in the burgeoning literature coining that "*the data ask for Markov switching models*" and the extensive application of these models in empirical finance<sup>91</sup> (Ang and Timmermann, 2011;

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<sup>91</sup>Applications of the method in empirical finance can be found in asset returns modelling, interest rates and exchange rates. Typical applications of the Markov switching models relate to the study of business cycles (Kim and Nelson, 1999; Smith and Summers, 2005).

Guidolin, 2012), the approach is potentially a useful one, given that there is no related empirical evidence<sup>92</sup> in the research's area of investigation.

The MS-SVAR framework combines two important developments of VAR analysis, the Markov regime-switching and the identification<sup>93</sup> one. Under the Markov switching approach, the universe of possible outcomes is split into  $n$  states, denoted  $s_t$ ,  $t=1, \dots, n$ , corresponding to  $n$  regimes. Hence, it is assumed that  $Y_t$ , the credit risk variable, switches regime according to an unobserved variable  $s_t$ . Movements of the state variable between regimes are governed by a Markov process that can be expressed as:

$$P(a \langle Y_t \langle \beta \mid Y_1, Y_2, \dots, Y_{t-1} \rangle) = P(a \langle Y_t \langle \beta \mid Y_{t-1} \rangle) \quad (7)$$

Equation (7) implies that the probability distribution of the state at any time  $t$  depends only on the state at time  $t-1$  and not on the past states,  $t-2, t-3, \dots$ . Thus, the Markov processes are not path dependent. In the research's context, the estimated MS-SVAR model obtains the following form that describes an autoregressive process:

$$Y_t = \sum_{i=1}^p \Phi(s_t) Y_{t-i} + \varepsilon(s_t) \quad (8)$$

Where  $s_t \in \Omega = \{1, \dots, n\}$  is the unobserved state variable which follows a Markov process with transition probability matrix  $P = (p_{ij})'_{i,j \in \Omega}$ . The elements of the transition

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<sup>92</sup> Among the few studies that use Markov models in the Romanian context, but not on banks' credit risk, are those by Racaru *et al.* (2006), Caraiani (2010) and IMF (2012a). Racaru *et al.* (2006) test two early warning systems on currency crises in a sample of emerging economies based on the methodology initiated by Kaminsky *et al.* (1998). IMF (2012a) uses ARCH Markov regime switching techniques to examine financial stress in Romania. The results of the analysis that uses daily data from 2007 to mid-2012 indicate that Romania's bond and equity markets moved to a high volatility state, suggesting that domestic asset prices have been impacted on from European crisis spillovers. Based on the findings, IMF (2012a) suggests that the recessionary period starts in 2008, earlier than conventional thought. Caraiani's (2010) study signals a great potential in using regime switching models for the analysis of Romanian macroeconomic dynamics.

<sup>93</sup> Structural VARs (SVAR) solve the problem of interpreting VARs by introducing restrictions sufficient to identify the underlying shocks. In turn, these restrictions used for identifying the model can be a mix of theoretical and a-theoretical ones.



probability matrix suggest that if the unobserved state variable at time  $t$  is in regime  $i$  there is a probability  $p_{ij}$  will move to regime  $j$  at time  $t+1$ , i.e.  $p_{ij} = P(s_{t+1} = j | s_t = i)$ . As for the error terms, it is assumed that  $\varepsilon(s_t) \sim \text{NID}(0, \sigma_{s_t}^2)$ . According to Krolzig's (1997) taxonomy, MS-VAR models can be classified into two broad categories: models with switches in their intercept and models with switches in their mean. Then, these two categories can be further classified, depending on which of the VAR parameters are allowed to vary across regimes: the intercept (or mean), the autoregressive coefficients, or the variance-covariance matrix. Assuming no prior knowledge, all parameters are allowed to be state dependent in the context of the research. Hence, the approach allows the data generating process to exhibit completely different dynamics across a predefined number of regimes. The process can switch from one regime to another several times yielding a stochastic behaviour that resembles the presence of breaks, which the relevant literature often calls endogenous to signify that their appearance can be modelled.

Next, a state-dependent structural shock  $u(s_t) = A(s_t)\varepsilon(s_t)$  is identified by imposing sign restrictions on the impulse response of credit risk to a set of macroeconomic, bank-specific and Greek-crisis related shocks. The impulse responses that are regime-dependent are computed based on the  $QR$  decomposition of an  $n \times n$  random matrix  $K$  and the Cholesky factor of:

$$\Sigma_{\varepsilon}(s_t) = A(s_t)A(s_t)' \quad (9)$$

Where  $Q$  is a unitary matrix and  $R$  is an upper triangular matrix. More concretely, using a random matrix  $K$  of dimension  $n \times n$  from the  $N(0, I)$ , the  $QR$  decomposition of  $K = QR$  is obtained and the structural impact matrix  $A(s_t) = A(s_t)Q'$  is computed. If the draw satisfies the restriction it remains in the model, otherwise it is disregarded. In

line with the set-up in the cointegrating equations, the sample data consist of five variables in order to keep the models tractable. Furthermore, in the Markov switching setting, a common set of indicators has been used for both countries<sup>94</sup> to facilitate comparisons. In order to achieve identification of the VAR system, a positive response of credit risk (NPL or LLP) to shocks from LOAN, UN and the Greek crisis (LLPGR) is imposed. Alternatively, a negative response of credit risk to M2 is imposed. Although there may be arguments for a positive response of credit risk to M2 through the risk taking channel, it is assumed that a positive money supply shock is the response to an increase in economic activity. It should be mentioned though, that the approach allows the ‘data to speak’. In other words, if the restrictions prove invalid then they will be rejected by the shape of the impulse responses. Next, the parameters of the MS-SVAR models are estimated using the maximum likelihood method as described by Kim and Nelson (1999).

The MS-SVAR modelling framework is complemented by the use of a time-varying structural vector autoregression model (TV-SVAR) which allows parameters to change across different regimes, assuming that regimes change exogenously. The approach differs from the standard time-varying VAR model where parameters evolve slowly and the MS-SVAR model where the parameters change across different regimes but remain the same within the same regime. In the TV-SVAR approach employed, the time variation of the parameters is driven by exogenous shocks that alter the mean or the volatility dynamics of the stochastic process. In line with the views of Ang and Timmermann (2011), who treat financial crises as dramatic events that change the dynamic interaction between financial and macroeconomic variables, the TV-SVAR modelling approach suggests that the time-variation of parameters is

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<sup>94</sup> These are the NPL (or LLP in Romania), LOAN, M2, UN and LLPGR.

driven by dramatic exogenous shocks. The TV-SVAR approach involves (a) the identification of the number and timing of shocks using a two-step procedure proposed by Karoglou (2010) and (b) estimating the impact of the structural shocks using a structural VAR based on the same model-consistent restrictions imposed in the case of MS-SVAR.

Karoglou (2010) proposed the ‘nominating-awarding’ procedure to identify the timing of an unknown number of breaks. In essence, the procedure involves two stages: a nominating stage of break dates and an awarding one. The nominating stage is an algorithm-based procedure that uses one or more statistical tests to identify the possible break dates in the data. The procedure utilises some recently developed tests<sup>95</sup> for structural breaks that have different properties from the standard ones (Sansó *et al.*, 2003). The aim is to take advantage of the special characteristics of each test and particularly the trade-off between size distortions and low power. The underlying idea of the procedure is that discrepancies in the detected break dates could be informative about the properties of the stochastic process. The algorithm used in the nominating procedure is implemented with each of the single break date statistics of the unit root tests and is applied to each series in ascending and descending time order to avoid masking effects. Following the nomination of the potential breakdates, the awarding stage serves as a screening process for the detected (nominated) ones. Essentially, the awarding stage describes the process used in deciding whether a nominated breakdate is indeed a break date. Initially, the procedure assumes that all potential nominations are breakdates. Then, it unites the contiguous nominated segments, i.e. the segments identified by the nominated break

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<sup>95</sup> These tests have been developed by Inclán and Tiao (1994), Andreou and Ghysels (2002) and Sansó *et al.* (2003). Nevertheless, Karoglou (2006) suggests that the relative performance of each of the tests depends on the underlying data generating process.

dates, unless the means or variances of the contiguous segments are statistically different. In essence, the tests in the awarding stage follow a different approach to the one used in the nominating stage, as they test for the equality of means and variances of different samples, which in this case are two contiguous segments. This testing procedure is repeated until no further segments can be united.

The described approach allows the estimation of the MS-SVAR model under the different predefined regimes and the TV-SVAR model under the time segments identified by the use of the ‘nominating-awarding’ procedure. Through the estimated models, the impulse responses are uncovered. The impulse responses trace out the responsiveness of credit risk to shocks to each of the other variables in the SVAR models. Thus, for each variable from each model separately, a unit shock is applied to the error, and the effects upon the SVAR models over time are interpreted. As Runkle (1987) argues, the impulse responses are difficult to interpret with any great accuracy. For this reason, Runkle (1987) suggests, confidence bands around the impulse responses are constructed.

The MS-SVAR framework jointly with the TV-SVAR provides a useful, yet unexplored tool for analysing the dynamics of credit risk in Bulgaria and Romania by identifying the different regimes in the former case and the time segments in the latter. Occasionally, the Markov regimes in models where all parameters are allowed to switch can be hard to interpret. In this respect, the regime segment-dependent impulse responses, where the credit risk of both countries is subjected to an unexpected shock, can be of benefit.

Certainly, non-linear time series models are not a panacea and have their own limitations. For instance, the number and frequency of observations are critical for the sensitivity of the estimated models. Secondly, MS-SVARs possess multiple regimes,

and the number of impulse responses is equally augmented, which can lead to cumbersome empirical analysis as different regimes with diverging dynamics can become hard to interpret. Furthermore, Haldane and Madouros (2012) suggest that the complexity of models may generate robustness problems. Equally the complex dynamics intervening in the propagation of shocks due to the possibility of regime switches over the studied horizon, can lead to large error bands with low significance. Despite these limitations, the Markov switching models can yield significant improvement, compared to the constant-parameter, linear time series models. In this respect the approach provides valuable results in the context of the thesis and any reliability issues that may arise are dealt with through the variety of estimation techniques used in the research.

The next section concludes the chapter.

### **5.3 Conclusions**

This chapter presented the dataset and provided a critical account of the methodological approaches used in the empirical part of the thesis. Founded on the research's theoretical underpinnings and the review of empirical studies, the chapter presented the formulation of testable hypotheses. The data constraints have been disclosed and the limitations of each econometric technique acknowledged.

The dataset collection process has identified the credit risk metrics for the Bulgarian and the Romanian banking systems. The choice of credit risk proxies is dictated by data availability issues. In this respect, the measurement of credit risk suffers from a lack of directly comparable data. Given the importance of addressing credit risk in the SEE emerging economies, the ability to quantify it adequately in data-restricted environments becomes a challenging task. Broad sets of macroeconomic, financial,

monetary and bank-specific indicators with potential explanatory power on each country's credit risk were collected. The monthly datasets for both countries span from 2001 to 2010, thus covering part of the boom-bust cycle in both countries. A set of indicators was also collected to approximate the spillover effect of the Greek crisis in the banking systems of the focal countries.

To the author's knowledge this is the first empirical study that deals with the Bulgarian and Romanian banking systems on a country level. Although both countries have participated in panel estimations, critical idiosyncratic factors related to each country's economy and banking sector have not been addressed. As the chapter identified and the data plots displayed, there are stark differences between the two countries in terms of credit risk evolution, growth in credit and regulatory framework. In view of the endeavour to explore an uncharted territory, the empirical research applies a robust five-staged approach to tackle the drivers of credit risk and examine the potential spillover effect from the Greek crisis. As such, an extensive unit root strategy is applied that makes use of the standard tests as well as those that account for the presence of structural breaks. Then, univariate and multivariate OLS and GMM regressions are estimated to provide an insight into the explanatory variables for the focal countries' credit risk. Subsequently the analysis applies cointegration techniques that were rarely used in related studies. Driven by the crises episodes that suggest regime shifts and non-linear data generation processes, the empirical analysis is further complemented by the Markov switching framework that is used jointly with a time varying structural VAR model. The latter approach mitigates the problem of structural changes in the data and facilitates the investigation of credit risk's responses to shocks originating from a set of variables under different regimes.

A key contribution of the empirical research relates to the choice of econometric techniques used, namely, the ARDL approach to cointegration and the Markov switching modelling. Although both techniques have been used in other fields of economic research, in the case of empirical work on credit risk determinants, the evidence is almost non-existent. The application of these techniques allows the gaining of an insight into a turbulent period for both banking systems. In view of that the next chapter discusses the empirical findings.

## Chapter 6: Empirical Evidence

### Introduction

The aim of this chapter is to present and interpret the findings of the econometric modelling with respect to the scope of the thesis. The empirical analysis purports to investigate the determinants of credit risk in the Bulgarian and Romanian banking systems. Furthermore, the empirical research explores the spillover effects from the Greek sovereign debt crisis that transmitted almost instantly to the Greek banks and soon became a threat to the SEE countries, where the presence of Greek banks' subsidiaries is substantial.

Using a comprehensive monthly dataset comprised of macroeconomic, monetary, financial and bank-specific variables that spans the period 2001-2010, the research follows a four-stage modelling route to embrace the phenomena in a systematic methodological research design. The roadmap of this chapter is closely aligned to the previous one to preserve consistency. Hence, Section 6.1 discusses the unit root tests and Section 6.2 sheds light on the shaped relationships by reporting the findings of the univariate and multivariate regressions. Section 6.3 presents the results of the cointegration analysis, and Section 6.4 interprets the responses of credit risk to a common set of key variables for both countries, as uncovered by the Markov regime switching models. In the case of the business cycle and bank-specific determinants, the results in all sections are assessed in the light of theoretical and empirical studies that deal with different samples covering diverse geographical areas or different countries. The last section concludes the chapter and provides the implications of the empirical analysis.



## 6.1 Unit root tests

The issue of unit roots in macroeconomic time series has received a considerable amount of both theoretical and applied research over recent decades. Conventional regression estimators, including VARs, have good properties when applied to stationary time series, but encounter difficulties<sup>96</sup> when applied to non-stationary processes. The insight of Granger and Newbold (1974) jointly with Nelson and Plosser's (1982) views that unit roots may be present in a wide variety of macroeconomic series either in levels or in logarithms, gave rise to the industry of unit roots testing, and the implication that variables should be rendered stationary by differencing before they are included in an econometric model. Since the work of Nelson and Plosser (1982) and further theoretical developments by Engle and Granger (1987), there has been much controversy on the issue and no consensus has been reached on the most appropriate methodology when applying unit root tests (Libanio, 2005).

In line with the unit root testing strategy, as depicted in Chapter 4, initially the standard tests of Augmented Dickey-Fuller(1979), Phillips and Perron (1988) and Kwiatkowski *et al.* (1992) are applied to the time series. In addition, the research uses the tests proposed by Perron (1997) and Zivot and Andrews (1992) that allow for the presence of endogenous structural breaks, given the preliminary indications arising from the inspection of the data plots. Tables C1 to C4 in Appendix C report the unit root results for Bulgaria and Romania respectively. Similarly, the unit roots tests for the Greek crisis indicators are reported in Tables C5 and C6, also in Appendix C. The results suggest that all series used in the research are integrated of order one, i.e.  $I(1)$ . As such, the first differences are taken to obtain the required stationarity. This

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<sup>96</sup> These difficulties were illustrated by Granger and Newbold (1974) when they introduced the concept of spurious regressions.

transformation applies to all variables that enter the models, with the exception of the Bulgarian and Romanian systems' loans and the monetary aggregates that are differenced in logarithmic form to obtain elasticities.

In the case of Bulgaria, the standard unit root tests provide evidence that all series are integrated of order one. The tests of Perron (1997) and Zivot and Andrews (1992) suggest that a structural change in most variables takes place around the end of 2008. However, the graphical inspection of the Bulgarian NPLs suggests a spike that occurs mid-2006 while the loan series appear to hike by early 2005 and then return to their 'normal' upward trend up to the end of 2008. This is explained by the policy measures introduced by the BNB in early 2005 in an attempt to impose ceilings on bank lending (Frömmel and Karagyozova, 2008; IMF, 2010b) in view of the overheating economy. As the new measures were announced and prior to their implementation, the banks rushed to disburse any outstanding loan applications knowing that in a few months credit ceilings would apply. Later, as the regulatory authorities lifted these measures, the credit flowed in the system in high volumes until the burst of the global financial crisis that landed in the region in 2008. Hence, the removal of policy measures in 2006 explains the mid-2006 jump in the Bulgarian NPLs.

The results of the unit root tests for the Romanian variables provide similar evidence to the Bulgarian ones, that all the time series are integrated of order one. Notably, the tests that accommodate for structural breaks in several Romanian macroeconomic time series hint at a possible structural break occurring at about the end of 2006 to mid-2007. This latter break could be the effect of a sharp depreciation in the domestic currency from its peak level that happened in early 2007 (IMF, 2010a). Initially, the capital inflows in Romania led to an appreciation of the exchange rate in both real and nominal terms, eroding the country's external competitiveness. The NBR confronted

with a dilemma in view of the newly adopted inflation targeting regime, initiated interventions in foreign exchange markets by purchasing considerable amounts of foreign currency in an attempt to prevent the appreciation of the national one.

In the case of the Romanian credit risk, loan growth and unemployment rate, a common break date is detected in 2008. This can be attributed to a confluence of the global financial crisis and the Greek sovereign debt crisis in the country. Similarly to the Bulgarian and Romanian time series, the unit root tests of the Greek indicators provide evidence of  $I(1)$  series, while the tests that allow for structural changes in the data generating process signal a possible break occurring somewhere between the end of 2008 and mid-2009 as the Greek sovereign crisis deepens. This crisis is also reflected in the spread between the Greek and the benchmark German long-term government bond. A visual inspection of the evolution of the Greek credit risk (NPL) and the spread between the Greek and the German bond (SPGD) suggests that the Greek debt crisis almost in synchronization transmits to the Greek banking system's balance sheet. In broad agreement, policymakers and researchers suggest that if Greece were to default on its sovereign debt, the Greek banking system would default on its debt as well, given the close ties in place (Bank of Greece, 2010; Moody's, 2011b; Pagratis, 2012).

Overall, the unit root tests of Augmented Dickey-Fuller (1979), Phillips and Perron (1988) and Kwiatkowski *et al.* (1992) in some cases yield conflicting results. This can be attributed to power and size distortion issues, subjects that are thoroughly discussed in the literature. However, the use of the standard unit roots tests, jointly with those tests that account for structural changes and facilitated by the analysis of the times series in their historical context, provides insight and equips adequately the econometric setting. The first step of the modelling approach involves the estimation

of univariate and multivariate models. The respective results are reported in the next section.

## **6.2 The results of the univariate and multivariate models**

The starting point of the econometric analysis applies the method proposed by the IMF in their assessment of financial sectors (Blaschke *et al.*, 2001). In this setting, the impact of macroeconomic shocks on credit risk, which by and large represents the most significant risk faced by banks worldwide, is modelled using a linear regression. The advantage of this approach is the considerable flexibility in specifying the aggregate credit risk proxy that is regressed on potential factors. In the research's framework the proxies of credit risk of Bulgaria and Romania are regressed against all the potential explanatory variables, which can be macroeconomic-cyclical, monetary, financial, and bank-specific, as shown in Tables B1 and B2, Appendix B. Then, the effect of the Greek crisis is investigated using the respective variables displayed in Table B3, Appendix B. The regression coefficients in the specified framework capture the sensitivity of credit risk to a number of identified factors.

Following an analogous modelling approach to that of Kalirai and Scheicher (2002) and Boss (2002), initially the research set out to estimate univariate regressions. Drawing on Wilson's (1997a,b) approach, Boss (2002) assumes that each explanatory variable follows an autoregressive process of order 2, i.e.  $AR(2)$ . However, this assumption has not been used in the research since the aim of the univariate and multivariate regressions, in contrast to Kalirai and Scheicher (2002) and Boss (2002), is to provide preliminary indications of the underlying relationships that will facilitate more advanced modelling techniques. The next subsection reports the regression results for Bulgaria.

### 6.2.1 Univariate and multivariate results for Bulgaria

The selected proxy of the Bulgarian credit risk (NPL) is regressed against each indicator, as shown in Table B1 at time  $t$  but also at all lags up to one year. This intensive approach enables the capture of any possible lagged effects of the explanatory variables on the credit risk of Bulgaria but also the analysis of the robustness of the specifications (Kalirai and Scheicher, 2002). Following the methodology detailed in Chapter 6, the estimated univariate OLS models are reported in Table D1 in Appendix D together with the expected signs of the coefficients. A positive sign suggests that factor  $X_t$  (or when lagged,  $X_{t-s}$ ) is expected to yield a positive impact on the changes of the NPL ratio in line with empirical evidence and vice versa. Broadly, the results obtained are in consensus with the expectations. Hence, the univariate regressions show a pronounced effect of cyclical indicators, such as construction (CON), industrial production (IPI), unemployment (UN), and real effective exchange rate (REEL), either at a contemporaneous or lagged level. As for the monetary indicators, M2 which approximates money supply, is significant in determining credit risk in both contemporaneous and lagged levels. In terms of the interest rate and financial markets' variables, the evidence suggests that only the lagged 3-month Euribor rate is associated with the Bulgarian NPLs. The latter makes sense in a bank-based financial sector, such as the Bulgarian one, where the share of foreign currency loans<sup>97</sup> considerably exceeds those granted in domestic currency (Brown and De Haas, 2012).

The univariate results lend support to the credit growth hypothesis, suggesting that rising loans potentially mask asset quality problems. Notably, the results do not provide evidence of a statistically significant association between the Bulgarian credit

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<sup>97</sup> In essence these loans are denominated in euros and as such the rate applied is based on the Euribor reference rate.

risk and the Greek crisis indicators, either at the current or lagged level. The variables that yield the highest predictive power appear to be the loan growth (LOAN) jointly with unemployment (UN), the construction activity (CON), and the industrial production (IPI).

Building upon the statistically significant factors identified in the univariate modelling approach, a multivariate credit risk model is estimated following the general-to-specific methodology and using the model selection criteria outlined previously. The final specification of the multivariate model for Bulgaria is presented in Table 14.

Table 14 The multivariate model for Bulgaria

Dependent Variable: NPL				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011	0.011	0.967	0.336
NPL(-1)	-0.324	0.159	-2.037	0.044
CON (-6)	-0.004	0.002	-1.882	0.063
IPI	-0.004	0.002	-1.947	0.054
UN	0.065	0.025	2.612	0.010
REEL(-3)	-0.008	0.003	-2.445	0.016
LOAN	-0.939	0.258	-3.640	0.000
DUMMY (FINANCIAL CRISIS)	0.394	0.157	2.502	0.014
DUMMY (2006)	0.044	0.014	3.194	0.001
R-squared	0.552	Mean dependent var		0.004
Adjusted R-squared	0.517	S.D. dependent var		0.097
S.E. of regression	0.067	Akaike info criterion		-2.481
Sum squared resid	0.472	Schwarz criterion		-2.264
Log likelihood	149.1	F-statistic		15.994
Durbin-Watson stat	1.816	Prob(F-statistic)		0.000

The numbers in parentheses indicate the number of lags in months of the respective variables used in the model.

As Table 14 displays, the multivariate model uses an autoregressive term of order one for the Bulgarian NPLs, which was strongly suggested by the data. In the light of the unit root test results, two dummy variables are introduced in the final specification of the model. The first one, also evidenced by a Chow test,<sup>98</sup> accounts for the breakpoint in the series identified in mid-2006. The second dummy that starts as of end-2008, also in line with the unit root tests, captures the effect of the global financial crisis<sup>99</sup> on the Bulgarian credit risk. The model's specification suggests that, taken simultaneously, the construction activity lagged by a period of six months, the industrial production, the unemployment rate, and the real effective exchange rate lagged by three months jointly with the credit growth, and accounting for the effect of the global financial crisis, the change in regulation and the persistent effect of problem loans, together explain about 55% of the variation of credit risk in the Bulgarian banking system. The relatively good fit of the regression suggests that NPLs in Bulgaria can be reasonably explained by a set of macroeconomic variables that embrace the Bulgarian business cycle. The findings are in broad agreement with related studies. For instance, a breadth of studies that uses either time series or panel estimations, evidences the linkages between macroeconomy, construction or real estate activity, credit growth, and effective exchange rates on NPLs (Hoggarth *et al.*, 2005b; Jiménez and Saurina, 2006; Espinoza and Prasad, 2010; Nkusu, 2011; De Bock and Demyanets, 2012).

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<sup>98</sup> The Chow test, which tests the hypothesis of a break in the Bulgarian loans, that occurs in June 2006 produces an F-statistic of 4.391 and a log likelihood ratio of 26.195. Both statistics are significant at the 1% level of significance, providing evidence that June 2006 is a breakdate.

<sup>99</sup> The use of the dummy variable to account for the global financial crisis is also supported by market evidence. For instance, EBRD (2010) reports that the crisis started to aggravate in Bulgaria towards the end of 2008. According to EBRD's (2010) report, all countries in the SEE region registered a sharp output decline by that time, with the Bulgarian and the Romanian economies being the most distressed.

Turning to the role of the lagged real effective exchange rate in the model, a plausible explanation relates to the empirically grounded association between capital inflows and real exchange rate appreciation (Kaminsky and Reinhart, 1999; Demirgüç-Kunt and Detragiache, 2005; Reinhart and Rogoff, 2009). Data suggest that the countries of emerging Europe were among the main recipients of FDIs on a global scale during 2003-2008. At the same time, Bulgaria<sup>100</sup> and Romania experienced large real exchange rate appreciations. These inflows contributed to rapid growth in demand and significant appreciation in real exchange rates. But countries that experience large real exchange rate appreciations, historically have witnessed large current account deficits, less buoyant exports, and a shift in resources from the tradable to the non-tradable sector. As the capital inflows reverse, the NPLs rise and the effect becomes more visible after a quarter of a year. Overall, the effect of the real effective exchange rate on the Bulgarian credit risk is in consensus with country-level empirical studies in both developed and developing economies (Marcucci and Quagliariello, 2008; Baboucek and Jancar, 2005).

Broadly, the Bulgarian results are aligned with the Minskian meltdown and Arestis and Gonzalez (2013). The negative effect of construction activity on credit risk signals a speculative boom-bust cycle fuelled by the lending acceleration in the pre-crisis period. During the good times, both borrowers and lenders are lulled into complacency, construction activity booms and asset prices rise. As credit flows freely, households and corporations alike take on greater risk, borrowing to the hilt. However, when construction activity plunged in the aftermath of the crisis and credit came to a halt, the NPLs started to mount (De Haas and Knobloch, 2010).

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<sup>100</sup> Bulgaria was by far the main recipient of FDI between 2003 and 2008. Average annual FDI inflows reached almost 28% of 2003 GDP, peaking at 165% of GDP in 2008 (IMF, 2010b).



The findings can also be interpreted under the ‘collateral channel’ view in the contribution of Arestis and Gonzalez (2013) that essentially explains how rising asset prices introduce a relaxation of the conditions that a borrower has to face in obtaining and repaying a real estate-backed loan. Furthermore, as the IMF’s (2010b) country report stresses, the recession in Bulgaria in the aftermath of the global financial crisis was preceded by an investment boom in construction and real estate. Hence, as in the West-European economies, the root cause of the bad debt problem was the abundant and cheap funding that goes hand-in-hand with a gradual relaxation of banks’ lending standards and an excessive reliance on rising real estate values (De Haas and Knobloch, 2010).

The hypothesis that the Greek crisis matters for its neighbouring countries (Bartlett and Monastiriotis, 2010; Anastasakis *et al.* 2011) was not found to be supported by the data. Specifically, a potential adverse effect of the Greek crisis on the Bulgarian credit risk is not evidenced in both the univariate and multivariate model specifications. These results have remained consistent, irrespective of the chosen proxy for the Greek crisis. Equally, the effect of the financial markets and interest rate variables was insignificant. The results can be explained in the light of the relatively immature capital market in Bulgaria which has low liquidity and attracts little interest from foreign investors. On the other hand, the global financial crisis appears to be a significant external shock for the stability of the banking system. Overall, the growth model of reliance in rapid credit growth, sparked by foreign banks under the financial liberalization thesis, has been called into question by the global financial crisis.

The diagnostic tests for the error terms of the multivariate model are reported in Table D2. The issue of heteroskedasticity is dealt with by the use of White’s consistent

estimators. On the basis of the Breusch-Godfrey test, there is insufficient evidence of serial correlation in the error terms.

Theory suggests that the presence of lagged values of the dependent variable (NPL) in the equation can be a reason for inconsistency in the OLS estimators. In general, the issue of endogeneity, i.e. one or more regressors to be correlated with the error term, gives rise to the need for estimating the multivariate model by the use of instrumental variables (IVs). Overall, the results of the GMM estimators reported in Table D3, converge reasonably with the OLS model. The magnitude of the coefficients is close to those obtained through OLS, while all variables present the expected signs. The effect of the financial crisis, the regulation and the effective exchange rate, are less pronounced compared to the OLS model, still significant at the 10% level of significance, while CON becomes insignificant. Overall, the re-estimation of the multivariate model regression using instrumental variables provides a useful ‘bracketing’ property to the OLS results.

The next section reports the results of the univariate and multivariate estimations for Romania.

### **6.2.2 Univariate and multivariate results for Romania**

In the endeavour to investigate the determinants of Romanian credit risk, an identical process to that described for Bulgaria is applied. Hence, univariate regressions are initially estimated using a single explanatory variable. As such, the selected proxy for the Romanian credit risk proxy, i.e. the ratio of loan loss provisions to total loans (LLP), is regressed against each of the Romanian indicators shown in Table B2 in Appendix B, at time  $t$  but also at all lags up to one year. Then, the process continues using the Greek crisis indicators, as shown in Table B3. The rationale of this

systematic approach is to capture potential lagged effects of the explanatory variables on LLP, considering that the LLPs are a backward-looking measure of credit risk. In effect, this approach introduces a ‘regulatory-lag’, as LLPs appear on the rise in banks’ financial statements quite a time after the problem has actually begun to emerge. A higher need for provisioning puts a strain on banks’ profitability. As such the banks tend to increase provisions in the face of increased credit risks as these become more certain.

Table D4 in Appendix D summarizes the results of the univariate regressions along with the *a priori* expected signs of the regression coefficients. A positive sign indicates that the respective factor  $X_t$  (or when lagged,  $X_{t-s}$ ) exhibits a positive impact on the changes in the LLP ratio and vice versa. In tandem with the empirical evidence, a broad set of macroeconomic indicators is found to be associated with the asset quality of the Romanian banks. The results indicate that in each data category of Table B2, with the exception of the one that captures the effect of the financial markets and interest rates, there is at least one variable that enters significantly and with the expected directional impact in the regression. Specifically, the construction output, the investment expenditure as proxied by the gross fixed capital formation, the ratio of the country’s debt to GDP, the consumption, the inflation rate, the unemployment rate and the trade balance, are all significant in explaining the Romanian credit risk. Furthermore, almost all macroeconomic indicators present the expected directional effect on the LLP ratio. The inflation rate yields the highest  $t$ -statistic and the best fit of all univariate regressions. This result is not surprising as a high inflationary environment has prevailed in the country since the market transition period. As the data suggest, the growth in the Romanian CPI averaged 43% annually from 1995 to 2005. In line with the stylised facts, the regression results suggest that the hypothesis

that inflationary pressures drive up credit risk cannot be rejected in Romania. None of the financial markets indicators appear to exert a significant role on the dependent variable. Despite the rapid growth of the trading volumes on the Bucharest Stock Exchange in recent years, the deepening of the stock market remains relatively poor. In contrast to Kalirai and Scheicher's (2002) study for Austria, the indicators related to volatilities, commodity prices and exchange rates do not yield a statistically significant effect on the Romanian endogenous variable, as was the case in Bulgaria. This result can be attributed to the different structure between a developed financial sector and one in transition. At the same time, the result provides support to the view that banks dominate the financial sector in Romania leaving little room for other types of financial intermediation.

As for the interest rate indicators, only the 3-month Euribor rate is significant both at current and lagged levels. In line with the Bulgarian case, the share of foreign currency loans in Romania far exceeds that of domestic currency (Brown and De Haas, 2012). The lion's share in foreign-currency denominated loans is occupied by loans in euros, given that both countries are considered to be euro accession ones. Respectively the interest charged on these loans is determined by the Euribor rate. Foreign banks in both countries were motivated to lend in euros in order to match their funding. This lending created imbalances in the system that turned out to be one of the greatest vulnerabilities in the economy. The negative sign in the Euribor rate coefficient diverts from the expectation that credit risk increases in tandem with higher borrowing costs. Although there is a wide consensus that real interest rates affect the capacity of borrowers to serve their loans, there is some evidence in the literature that this may not be the case for transitional economies (Baboucek and Jancar, 2005).

Except for the lending growth (LOAN), all the other bank-specific indicators are found to be statistically insignificant in explaining credit risk. The credit overheating that occurs in the period up to the burst of the crisis raises questions on the lending criteria during the euphoric years. It may be the case that risks were not accurately evaluated by the banking system (Louzis *et al.*, 2012). Given the ambiguous effect of the loan growth, as evidenced in theory as well as other empirical studies,<sup>101</sup> the variable is dropped from the final specification of the multivariate model. Turning to the monetary aggregates, both M1 and M2 are significant in explaining the variation in credit risk, presenting also the expected direction. Interestingly, four indicators that proxy the dynamics of the Greek crisis are highly significant in affecting the Romanian credit risk in the expected positive direction. Hence the result provides evidence of spillover effects from the Greek crisis to the Romanian banking system. Building upon the factors identified in the univariate estimations, a multivariate credit risk model is estimated using the general-to-specific methodology used in the variable selection criteria outlined previously. Table 15 presents the estimated model.

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<sup>101</sup> Effectively, the univariate results maintain that increasing credit growth reduces bad debts. This result goes against the procyclical credit policy hypothesis which implies that banks adopt a liberal credit policy during the boom of the cycle and a tighter policy in the contraction phase. On the other hand the result implies that ever-growing loan books could mask the quality of the loans.

Table 15 The multivariate model for Romania

Dependent Variable: LLP				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001	0.000	1.317	0.193
CPI	-0.001	0.000	-4.100	0.000
UN	0.001	0.000	3.423	0.001
CON	-0.003	0.001	-2.807	0.006
INV(-12)	-0.004	0.001	-2.467	0.016
DGDP (-3)	0.012	0.002	4.615	0.000
M2	-0.008	0.002	-3.536	0.001
LLPGR	0.453	0.194	2.332	0.022
SPGD (-1)	0.001	0.000	2.843	0.006
R-squared	0.657	Mean dependent var		0.001
Adjusted R-squared	0.625	S.D. dependent var		0.002
S.E. of regression	0.001	Akaike info criterion		-11.046
Sum squared resid	0.000	Schwarz criterion		-10.801
Log likelihood	522.6	F-statistic		20.128
Durbin-Watson stat	2.261	Prob(F-statistic)		0.000

The numbers in parentheses indicate the number of lags in months of the respective variable used in the model.

The model's final specification suggests that, taken together, inflation, unemployment, construction output, investment activity in lagged form, the country's external debt to GDP lagged by a quarter, money supply jointly with the Greek banks' credit risk and the one-month lagged spread between the Greek and the German long-term government bonds, explain a substantial fraction (66%) of the variation in the Romanian credit risk. The good fit of the regression indicates that the banks' credit risk in Romania can be reasonably explained by macroeconomic fundamentals and Greek crisis indicators in the light of the substantial presence of Greek banks in Romania.

The explanatory power of the Romanian macroeconomic variables such as inflation, unemployment rate and money supply, is aligned with expectations as well as related studies (Hardy and Pazarbaşıoğlu, 1998; Boss, 2002; IMF, 2010a; Trenca and Benyovszki, 2008; Marcucci and Quagliariello, 2008; Louzis *et al.*, 2012). The external debt can have a destabilising impact on the domestic banking system as it significantly and positively affects credit risk. A look at the Romanian data, reveals that the growth of external debt has been particularly strong since the onset of the crisis. The potential channels of transmission could be the relationship between debt dynamics and asset bubbles or weaknesses in the banking sector (Becker *et al.* 2010). The idiosyncratic features of the Romanian transition economy and those of a sector dominated by foreign banks are also evident in the findings. For instance, the construction output, as fuelled by the lending boom in the pre-crisis period, is among the critical factors that determine the Romanian credit risk. Based on the results, the hypothesis that the Greek crisis exerts an adverse effect on the Romanian financial stability cannot be rejected. The Romanian credit risk (LLP) seems responsive to risks arising from Greece. In other words, there is evidence that spillover effects stemming from the Greek twin crises are manifest in the Romanian banking sector, raising the risk of contagion.

The adjusted R-squared provides evidence of a satisfactory closeness of fit in the multivariate regression model. Equally, the F-test that tests the joint significance of the regressors suggests that the null hypothesis, that none of the coefficients is significant apart from the intercept, can be rejected. As in the Bulgarian case, the estimated results for Romania are adjusted with the use of White's heteroskedasticity consistent estimators. The diagnostic tests for the Romanian multivariate model,

reported in Table D5, do not provide evidence of first and second-order serial correlation.

The results of the OLS multivariate model for Romania have been validated through the GMM estimation that uses instrumental variables (IVs) to accommodate for potential endogeneity in the regressors. This process serves as a robustness test of the OLS results, considering that the extensive dataset facilitates a reasonable selection of acceptable sets of instrumental variables in both countries' models. Overall, the GMM results converge reasonably with the OLS ones in terms of coefficients' signs and magnitude with the exception of two variables. Although bearing the correct sign, INV and DGDP were not found to be insignificant in the GMM estimation. The latter is consistent with Canova (2007) who documents the trade-off between OLS and IV suggests that the performance of GMM estimators in small samples can be far from appealing. Nonetheless, the use of GMM is more justified in Bulgaria, as OLS estimates of the AR parameters are biased when the model is dynamic. In both countries' GMM models, as Tables D3 and D6 display, the overidentifying test statistic (J-statistic) suggests that the null hypothesis, that all the instruments are exogenous, i.e. uncorrelated with the error term, cannot be rejected.

The OLS results, supported by the 'bracketing' property of the GMM estimations for the multivariate models, rely upon comprehensive datasets for both countries. Hence, the shaped relationships provide a solid ground for the use of the more advanced econometric techniques that follow in Sections 6.3 and 6.4. The estimations so far clarify the picture and the underlying relationships that do not deviate from the theoretical and empirical expectations. Notably, the Greek crisis appears to be a destabilizing factor for the Romanian banking system. On the other hand, the effect of the Greek crisis on the Bulgarian system, while positive, was not found to be



significant. The Bulgarian credit risk seems to be more sensitive to the global financial crisis and shifts in the regulatory policy.

Blaschke *et al.* (2001) propose that conclusions obtained from a one model, estimation technique should be cross-checked with those derived from different approaches. The next section presents the results obtained from the cointegration techniques.

### **6.3 The results of the cointegration analysis**

Cointegration models have been in use for decades, but in more recent times they have been shown to provide a valuable as well as reliable vehicle when testing for the presence of long-run relationships between economic time series. More concretely, these models solve the problem of spurious regressions while the error correction mechanism that measures the disequilibrium from the previous period provides remarkable economic implications. However, the empirical literature on credit risk that applies cointegrating techniques is rather lacking, and becomes almost non-existent in the case of the ARDL approach.

The next subsection presents the results of the cointegration analysis for Bulgaria.

#### **6.3.1 Results of the cointegration analysis for Bulgaria**

Having established that all variables are integrated of order one through the use of a comprehensive unit root testing strategy, the aim now is to uncover the potential short- and long-term relationships among a set of significant variables in determining the credit risk in Bulgaria. To this end, initially the ARDL approach to cointegration is applied. The ARDL modelling in both countries uses four to five variables at most to avoid complexity, as simple models can more easily be interpreted and communicated (Maddala, 2001), considering also the sample's size. On the other

hand, increasing the number of variables in a cointegrating vector comes at a non-negligible cost in terms of parameters to be estimated. In view of this, variables found not to possess any meaningful additional information are discarded from the final ARDL specifications. Through the use of a systematic analysis on the cointegrating relationships, the equation that describes adequately the determinants of the Bulgarian credit risk in the timeline of the research obtains the following crude form:

$$NPL = f(NPL_{-t}, LOAN, UN, CON, LLPGR, SHOCK) \quad (10)$$

Where NPL is the non-performing loans as a share of total loans in the Bulgarian banking system,  $NPL_{-t}$  is the lagged value of NPL, LOAN is the loan growth, UN is the unemployment rate, CON measures the construction output in Bulgaria, and LLPGR denotes the proxy for the Greek crisis<sup>102</sup>. SHOCK is a dummy variable that captures the effect of the regime change in Bulgaria but also accounts for the global financial crisis aligned with the results obtained from the tests of Perron (1997) and Zivot and Andrews (1992). Theoretically, LOAN is expected to affect positively the NPLs, as credit booms could imply lax lending standards and deterioration in the loan quality in line with the hypothesis that lending booms end up in tears (Gavin and Hausmann, 1996; Duenwald *et al.*, 2005; Aikman *et al.*, 2011; Zemel, 2012). For instance, Zemel (2012) provides evidence of a predictive power of credit growth in determining future NPLs. In this respect, the expansion of the loan portfolio conveys useful information in assessing a system's resilience, suggesting that unhealthy banks may hide problem loans by ever-growing their loan portfolios. Hence, an accelerating

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<sup>102</sup> In the context of the cointegration analysis, two Greek crisis proxies have been used to explore the effect of the Greek crisis on the Bulgarian credit risk. These were the loan loss provisions as a share of total loans of Greek banks (LLPGR) and the spread differential between Greek and German long-term bond yields (SPGRD).

lending growth can serve as a ‘red flag’ for future banking distress. However, an opposite direction in the association between LOAN and NPL should not come as a surprise, given the theoretical grounding discussed in the estimation of the multivariate models. A negative impact is expected from CON, a proxy of construction output,<sup>103</sup> a positive impact from unemployment and a positive effect from the Greek debt crisis indicators, given the dominant position of Greek banks in Bulgaria and aligned with the formulated hypotheses.

A preliminary finding is that both proxies of the Greek crisis are insignificant,<sup>104</sup> in consensus with the OLS and GMM regressions. This result lends evidence to support that the effect of the Greek crisis in the Bulgarian system is not material and has somehow been neutralised through the regulatory-supervisory policies. On the basis of the Schwartz-Bayesian criterion, the specification ARDL (1,1,0,0,0) is selected.

Table 16 reports the long-run estimates of the specified model.

Table 16 Estimated long-run coefficients using the ARDL approach to cointegration for Bulgaria

Dependent variable is NPL		
Regressor	Coefficient	t-ratio
LOAN	0.049	2.683
UN	0.006	3.754
CON	-0.001	-2.857
LLPGR	0.870	1.425
C	-1.128	-2.692
SHOCK	0.031	4.228

<sup>103</sup> Based on data from the National Statistical Institute of Bulgaria (NSI), the influx of foreign funds in Bulgaria led to rapid construction and real-estate development, with property prices appreciating by over 50%. Also Moody’s (2012) stresses that the construction and real-estate sector is the primary source of credit risk.

<sup>104</sup> The results reported include only one of the two Greek-crisis proxies used, the LLPGR. Similar results were obtained when the proxy SPGD was used instead of the LLPGR. The effect of both variables, although positive, was not found to be significant in explaining the Bulgarian credit risk.

Evidently, all the variables, with the exception of the Greek-crisis proxy (LLPGR), are significant at the 1% significance level, presenting also the expected sign. Under the pro-cyclicality hypothesis, the credit boom in Bulgaria induces NPLs in the long run. The construction activity yields the expected negative effect on credit risk while rising unemployment renders the banks' loan books vulnerable because of the deteriorated capacity of borrowers to service their debts. Broadly, the findings are in tandem with other country-specific studies that apply different econometric techniques (Quagliariello, 2004; Baboucek and Jancar, 2005). Furthermore, the shock dummy used is highly significant at the 1% significance level. Notably, the inclusion of other macroeconomic variables that were identified as significant in the estimation of the multivariate model for Bulgaria, such as the industrial production or the real effective exchange rate, do not add any substantial improvement in the estimated model. The long-run relationship among the cointegrated variables is examined using the bounds testing methodology of Pesaran *et al.* (2001). The F-statistic for testing the joint null hypothesis, that the coefficients of the variables in levels are jointly zero, i.e. there exists no long-run relationship between them, is 7.24, thus it exceeds the critical lower and upper bounds of 3.41 and 4.68 respectively at the 1% significance level. Hence, the null hypothesis of no long-run relationship between NPLs, loan growth (LOAN), unemployment (UN) and construction (CON) can be rejected. Alternatively, the results suggest that LOAN, UN and CON can be treated as the long-run forcing variables for the explanation of the Bulgarian credit risk. The short-run dynamics of the model are reported in Table 17.

Table 17 Error correction representation for the ARDL model of Bulgaria

Dependent variable is dNPL		
Regressor	Coefficient	t-ratio
dLOAN	-0.015	-1.852
dUN	0.001	3.741
dCON	0.001	-4.215
dLLPGR	0.143	1.137
dC	-1.851	-3.934
dSHOCK	0.005	4.255
ECM(-1)	-0.164	-3.717
$R^2 = 0.59$	$F(6,99) = 23.396$	

Table 17 reports that all variables with the exception of the Greek crisis proxy (LLPGR) are statistically significant. As was the case in the long-run relationship, the effect of the Greek crisis on Bulgaria's credit risk remains insignificant in the short-run as well. The error correction coefficient (ECM) is highly significant, bears the correct sign and points to the existence of a long-run relationship between the variables in the equation. Estimated at -0.164, the ECM suggests a moderate adjustment process. Specifically, about 16.4% of the disequilibria of a shock in the previous month adjust back to the long-run equilibrium in the current month. Table E1 in Appendix E provides the regression statistics and Table E2 reports the diagnostics tests. The results in Table E2 indicate that the underlying ARDL model passes all the diagnostic tests.

Next, the results obtained from the ARDL approach to cointegration are validated using the framework developed by Johansen (1988) and Johansen and Juselius (1990). The summary results of the Johansen cointegration analysis are presented in Table E3. Specifically, the result of the cointegration test presented in the first panel of Table E3 suggests that there exists one cointegrating vector based on the maximal eigenvalue

statistic. The long-run equilibrium relationship is reported in the second panel of Table E3 that presents the normalized coefficients so that the coefficient on NPL is unity. According to the cointegrating equation, a strong positive relationship is observed between NPL, LOAN and UN and a negative one between NPL and CON while the effect of LLPGR is insignificant, yet positive. The ECM component that indicates the speed of adjustment towards the long-run equilibrium is statistically significant and has the correct negative sign. The ECM's value of -0.164 suggests a moderate adjustment process of about 6.4 months for the equation to return to its equilibrium once it has been shocked. The diagnostic tests reported in the last panel of Table E3 suggest that there is no serial correlation or heteroskedasticity in the error terms as the Johansen method presupposes. The VECM results present reasonable convergence with those derived from the ARDL model taking into account the underlying estimation procedure.

The research is also motivated by the hypothesis of spillover effects from the Greek crisis to the Bulgarian banking system through a credit or sovereign risk transmission channel. However, the findings do not provide evidence linking the Greek-crisis indicators to the Bulgarian credit risk. The stability of Bulgarian banks seems to be insulated from contagion risks from Greece, but is affected by the global financial crisis and institutional factors pertaining to the regulatory framework. The lack of sufficient evidence to associate the Bulgarian NPLs with the Greek crisis can be attributed, to some extent, to the regulatory/supervisory policy exercised by the BNB (IMF, 2010b). Overall, the explanatory power of the Bulgarian macroeconomic variables is in agreement with empirical studies in other geographies, samples or estimation techniques (Nkusu, 2011; Klein, 2013). Also, the idiosyncratic features of the developing economy, including those of a banking system dominated by foreign

institutions in the financial liberalization process, are evident in the findings. For instance, the construction activity, as fuelled by a lending boom in the pre-crisis period, was among the important influences of the Bulgarian credit risk. The pronounced role of unemployment has also surfaced, asserting that deteriorating conditions in labour induce asset quality problems in the respective banking system. Broadly, the cointegration analysis for Bulgaria suggests that a long-run relationship is shaped between credit risk (NPL), unemployment (UN), construction (CON) and lending growth (LOAN), and that UN, CON and LOAN can be treated as the long-run forcing variables for the explanation of the Bulgarian credit risk.

The following section presents and interprets the results of the cointegration analysis for Romania.

### **6.3.2 Results of the cointegration analysis for Romania**

In the attempt to identify the cointegrating relationships in the case of Romania, a systematic analysis analogous to the Bulgarian case has been pursued. The equation that best describes the determinants of the Romanian credit risk in the period of the research has the following crude form:

$$LLP = f(LLP_{-t}, LLPGR, M2, LOAN, UN) \quad (11)$$

Where LLP is the loan loss provisions as a share of total loans in the Romanian banking system,  $LLP_{-t}$  is the lagged value of LLP, LLPGR the proxy for the Greek crisis<sup>105</sup>, M2 is the respective monetary aggregate that approximates the money supply, LOAN is the growth in loans of Romanian banks, and UN is the

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<sup>105</sup> Similarly to the cointegration analysis for Bulgaria, two Greek crisis proxies have been used to explore the effect of the Greek crisis on the Romanian credit risk: the loan loss provisions as a share of total loans of Greek banks (LLPGR), and the spread between the Greek and the German long-term bond (SPGRD).

unemployment rate. Theoretically, we would expect a positive impact on LLPs from LOAN as accelerating credit expansion usually goes hand in hand with a deterioration in the lending standards, a negative impact from M2 that proxies money supply, a positive impact from unemployment and a positive impact from the Greek banks' loan loss provisions (LLPGR), given the preliminary indications arising from the OLS/IV framework.

Initially, the maximum number of lags is set at 12 and subsequently is gradually reduced on the basis of the formal lag selection process that was followed. The final specification which is an ARDL (1,1,0,0) model is selected on the basis of the Schwarz Bayesian criterion that has a lower prediction error in comparison with the Akaike-based model. The long-run estimates of the final ARDL model specified for the Romanian credit risk are presented in Table 18.

Table 18 Estimated long-run coefficients using the ARDL approach to cointegration for Romania

Dependent variable is LLP		
Regressor	Coefficient	t-ratio
LLPGR	2.8581	20.667
M2	-0.0142	-4.217
LOAN	0.0118	4.835
C	0.0109	3.193
UN(-10)	0.0001	2.516

The results depicted in Table 18 suggest that all the variables included in the cointegrating equation are statistically significant at the 1% level of significance having also the expected sign. A pronounced, yet lagged effect is evidenced in the case of unemployment (UN). The latter deviates from the OLS findings for Romania



where the effect of UN was contemporaneous, albeit is in agreement with empirical evidence that uses the VAR framework in modelling NPLs. These studies find that unemployment has a significant lagged effect on NPLs of almost a year (Baboucek and Jancar, 2005; Jakubík and Heřmanek, 2008). Most importantly, the lagged effect of unemployment on credit risk is in agreement with a study conducted in NBR by Moinescu (2008). Using a panel of 31 Romanian banks during 1999-2007, he documents that the key transmission channels of instability in the sector are the unemployment rate and the lending growth. The effect of unemployment on the Romanian credit risk is positive and has a lag of one year, suggesting that the Romanian credit risk is inelastic to shocks in the labour markets.

What appears to be in broad consensus with the estimated multivariate OLS model is the pronounced effect of the Greek crisis spillovers on Romanian banks. Specifically, the Greek crisis, proxied by the ratio of loan loss provisions to total loans (LLPGR), yields a highly significant positive influence in the long-run on the Romanian credit risk. Furthermore, the loan growth (LOAN) positively affects credit risk in the long-run, suggesting that the foreign-bank dominated system of Romania may have disbursed loans of questionable quality in the upper side of the cycle (De Haas and Knobloch, 2010). Lastly, M2 which proxies the money supply in the system, appears to retain the expected negative effect on credit risk. The result suggests that the effect of a monetary policy shock is contemporaneous and highly significant in the Romanian credit risk. Overall, the findings of the macroeconomic determinants of credit risk in Romania are strongly supported by the evidence provided by Quagliariello (2004), Baboucek and Jancar (2005) and Moinescu (2008), among other studies.

The validity of the estimated long-run relationship is confirmed using the bounds

testing methodology proposed by Pesaran *et al.* (2001). Specifically, the null hypothesis that the long-run coefficients are jointly zero is tested using the F-statistic. As the latter has a value of 6.51 that exceeds the upper bound of the critical value band tabulated in Pesaran *et al.* (2001), the null hypothesis of no long-run relationship between the Romanian credit risk (LLP), the Greek credit risk (LLPGR), the money supply (M2), the credit growth (LOAN) and the unemployment (UN), can be rejected. The short-run dynamics of the model are reported in Table 19.

Table 19 Error correction representation for the ARDL model for Romania

Dependent variable is dLLP		
Regressor	Coefficient	t-ratio
dLLPGR	2.097	12.089
dM2	-0.004	3.558
dLOAN	0.004	3.974
dC	0.003	2.746
dUN(-10)	0.001	2.658
ECM(-1)	-0.298	5.048
$R^2 = 0.84$		$F(5,80) = 83.80$

As Table 19 depicts, all variables are statistically significant in the short-run. In particular, the Greek crisis appears to have an influential role on Romania's credit risk, also in the short-run. The change in money supply (M2) presents a significant negative effect on the change in LLP, while the changes in loan growth and unemployment present a statistically significant positive effect, although unemployment has a relatively small coefficient. The ECM is highly significant and presents the correct sign, thus it is pointing to the existence of a long-run relationship between the endogenous variables. The magnitude of the ECM coefficient, which is

estimated at -0.298, suggests a relatively quick speed of convergence to equilibrium. Specifically, about 30% of the disequilibria of the previous month's shock adjusts back to the long-run equilibrium in the current month. Table E4 in Appendix E presents the key statistics of the regression and Table E5 reports the diagnostics tests of the ARDL model. The test results are acceptable, apart from the evidence of heteroskedasticity that is dealt with by the use of White's (1980) adjusted standard errors.

Next, the results obtained from the ARDL approach to cointegration were cross-checked against those obtained using the maximum likelihood (ML) procedure proposed by Johansen (1988) and Johansen and Juselius (1990). The summary results obtained using the Johansen approach are reported in Table E6 in Appendix E. The first panel of Table E6 presents the test of cointegration. Based on the maximum eigenvalue, the null hypothesis of no cointegration can be rejected against the alternative of one cointegrating vector. The second panel of Table E3 reports the long-run equilibrium relationship in normalized form, so that the coefficient on LLP is unity. A strong positive relationship is evidenced between LLP, LLPGR, LOAN and UN while a negative one appears to exist between LLP and M2. The ECM that is presented in the third panel of Table E3, along with the results of the regression, is statistically significant and has the correct negative sign. The diagnostic tests reported in the last panel of Table E3 suggest that there is no serial correlation in the error terms, while the evidence of heteroskedasticity is dealt with by the use of White's (1980) adjusted standard errors. Similarly to the Bulgarian case, the Romanian results obtained from the Johansen cointegration approach converge reasonably with the ARDL approach, conditioned to the estimation process that each cointegration

technique follows. Given that one cointegrating vector has been found in both countries, no further restrictions were imposed on the coefficients.

The evidence in Romania provides support to the Greek-crisis hypothesis, suggesting a channel of contagion arising from the interlinked banking systems. Initially, when the problem of a potential Greek sovereign default emerged, some dismissed it as trivial, given the country's small weight in the euro area's GDP. Ever since the Greek sovereign debt crisis deepened, policymakers have feared that the turmoil afflicting Greece would engulf larger developed economies. In contrast, limited attention was paid to the peripheral economies in the SEE region. As such, the consequences of a potential collapse of Greece's banking sector in the neighbouring banking systems have not been thoroughly addressed. Yet, the empirical research provides evidence that relates the Greek crisis to the long-run stability of the Romanian banking system.

The interconnectedness of the Greek and the SEE banking systems has increased the risk of contagion. Hence, systemic risk in one country can wipe out a large share of cross-border liabilities and ultimately undermine banking assets in other countries through direct linkages among the banks. Besides the macroeconomic and bank-level variables documented in the literature, the research provides evidence that a key driver for the Romanian credit risk appears to be the Greek crisis emanating from the close links between the two banking systems. The cointegration analysis for Romania evidences a long-run relationship between credit risk (LLP), money supply (M2), lending growth (LOAN), unemployment (UN) and the Greek credit risk (LLPGR). Hence, these indicators can be treated as the long-run forcing variables for the explanation of the Romania credit risk.

In both focal countries, the cointegration results highlight the effect of a credit expansion gone wild in the pre-crisis period fuelled by ample liquidity in both

banking systems in an unfenced financial liberalization process, and the role of unemployment in deepening banks' asset quality problems.

The empirical evidence so far lies in the assumption of linearity in the models, put into question in the aftermath of the global financial crisis. The following section discusses the results obtained from using the Markov switching modelling framework.

#### **6.4 The results of the Markov switching models**

One increasingly popular and useful advance in empirical studies is to allow for Markov switching effects in the specified model. Although in many areas of macroeconomics, it has become common to model time series as vector autoregressive processes subject to regime changes, the evidence on credit risk is almost non-existent. In the light of Gorton's (2012) view that '*a crisis is a sudden event, a structural break or a regime shift*', the empirical research sets out to explore the credit risk in Bulgaria and Romania by applying the Markov switching setting. To this end, and considering the lack of comparable results with other studies, the Markov switching modelling approach uses a common set of variables for both countries, namely the loan growth (LOAN), the monetary aggregate M2 as a proxy for money supply, and the unemployment rate. As for the Greek crisis hypothesis, the Greek credit risk (LLPGR) is used in the modelling approach as the crisis transmission channel. The inclusion of the monetary aggregate M2 in the sample of both countries allows not only the investigation of the role of money supply on credit risk but also exploring its interaction with the loan growth in proliferating credit risk in the focal SEE countries. As Buiters (2008) suggests, too little attention has been paid, especially during the asset and credit boom that preceded the global financial crisis, to the behaviour of the monetary and credit aggregates.

In the endeavour to trace the drivers of credit risk, the research estimates a Markov switching structural VAR model (MS-SVAR) that allows for non-linear endogenous or exogenous stochastic processes. The Markov switching setting can overcome the assumption that the statistical properties of the data during stable periods remain the same as after a crisis episode. Hence, the approach allows for the data generating process to exhibit different dynamics across a predefined number of regimes. The process can freely switch from one regime to another several times yielding a stochastic behaviour that resembles the presence of breaks, which the literature often calls endogenous to signify that their appearance is modelled.

The Markov switching approach is complemented by a linear SVAR model that traces the different segments identified in the data on the basis of the nominating/awarding procedure proposed by Karoglou (2010). This approach allows for either endogenous or exogenous breaks in the time series. Based on the research's theoretical underpinnings as supported by the evidence from the OLS-GMM estimations and the cointegration techniques, sign restrictions are applied to the impulse responses of credit risk.

The following section reports the results for Bulgaria.

#### **6.4.1 The Markov switching model results for Bulgaria**

The Markov switching model is estimated, allowing means, intercepts, autoregressive parameters, variances and covariances to switch. In the identification stage, restrictions are imposed on the parameter estimates on the basis of the previous estimated models in order to derive a separate structural form for each regime, from which the regime-dependent impulse response functions are calculated. Two regimes are identified in the case of Bulgaria. Figure F1 presents the filter probability of these

two regimes. Regime 1 is distinguished as the ‘low volatility’ regime and regime 2 determines a period of high volatility. The data provide evidence of a regime switch from the low to the high volatility state in November 2008. The result is in line with the findings in the unit root testing when accounting for structural breaks, as shown in Table B2. Hence, it can be argued that the low volatility regime coincides broadly with the booming period and the high volatility regime with the bust that followed, as the global financial crisis was unveiled in the SEE region. Furthermore, Figure F1 provides evidence of short-lived regime switches from the low to high volatility state in September 2004 and June 2006, also in line with the unit root tests discussed earlier in the chapter (Table B2). The upper plot of the filtered probabilities maintains that, with the exception of short-lived disruptions, regime 1 yields a high probability up to October 2008. Thereafter, the high volatility regime 2 takes on and remains present with high probability up to the end of the sampling period.

Figure F2 presents the impulse responses of the Bulgarian credit risk, as obtained from the MS-SVAR model, to innovations in the other endogenous variables. Traditional impulse response analysis reports the results of an experiment where a shock hits a system at time  $t$ , with no further shocks hitting afterwards, compared to the case where a system stays undisturbed all of the time. In this case, the impulse responses reflect the responsiveness of NPLs to shocks in each of the variables – LOAN, LLPGR, M2 and UN. In the case of the low volatility regime – regime 1 in Figure F2 – none of the variables appears to affect significantly the Bulgarian credit risk. In essence, the weak response of credit risk in LOAN, M2 and UN reflects the low variability of the data in the period before the financial crisis in 2008. However, in regime 2, with the exception of Greek crisis proxy (LLPGR), all variables appear to have a significant and theoretically-consistent effect on Bulgarian credit risk. As the

impulse responses in regime 2 suggest, the Bulgarian credit risk increases after a positive shock of LOAN and decreases after a positive shock of M2, in line with expectations. Moreover, the response of credit risk to a shock by M2 is explosive in the sense that the, initially negative, trend becomes significant in about three months after the shock. Equally, there is evidence of a volatile response of credit risk to a positive shock by UN, though not significant in the first three months following the shock. Although there is evidence of a positive reaction of credit risk to a positive shock by UN, the confidence interval includes the baseline, as shown in Figure F2, regime 2. Nevertheless, the response of credit risk has a positive trend without declining to zero. An implication of such an explosive response in the context of the Markov switching framework can be related to self-fulfilling expectations. For instance, an expectation for future recession will have a negative impact on investment and employment, hence aggravating the current recession and generating expectations for further distress in the banking system. Thus, the model is subject to the omitted variable problem which concerns expectations about future banking distress in the face of a negative shock in economic activity. As for the Greek crisis hypothesis, the impulse responses in both regimes suggest that there is no spillover effect from the Greek crisis to the Bulgarian credit risk. Although, LLPGR seems to yield a positive and sizeable impact on the Bulgarian NPLs, it is not statistically significant. Hence, in line with the previous modelling techniques, the data do not provide evidence of Greek crisis contagion in the Bulgarian banking system.

The next stage involves the treatment of regime switches as exogenous, using a set of structural break tests in the spirit of the nominating stage (Karoglou, 2010). Table F3 reports the results of the tests for the nomination of break dates in the data and Table F4 the results of the awarding stage. On the basis of the findings, the sample is



divided into three contiguous segments as follows: segment 1 spans from January 2001 to June 2006, segment 2 spans from July 2006 to October 2008, and segment 3 starts in November 2008 and continues to the end of the sample period in December 2010. Then, for each segment a SVAR model is estimated using the same model-consistent restrictions that were imposed in the MS-SVAR approach. Figure F5 presents the impulse responses for the three identified segments. As in the case of the MS-SVAR model, the plots do not suggest a significant response of credit risk to a shock by any of the variables in the timeframe of segments 1 and 2, which in essence cover the period before the financial crisis hits the SEE region by the end of 2008. The finding can be explained by the fact that the period before the crisis is less volatile, compared to the period after the eruption of the crisis. Evidently, under this setting it becomes difficult to estimate the true relationship among the model's variables in a sample where the variability of the data is low. On the other hand, the results in segment 3 are aligned to those obtained in regime 2 of the MS-SVAR model, albeit the responses of credit risk are now more sizable. However, in the TV-SVAR model the response of credit risk to a shock by UN is more stable compared to the volatile one evidenced in the case of the MS-SVAR model.

The observed differences between the time varying SVAR and the MS-SVAR model may be driven by expectation formation effects. The latter is accounted for in the case of the MS-SVAR model but not in the TV-SVAR one.<sup>106</sup> The MS-SVAR model makes use of an unobserved state variable as a proxy of market expectations while the time varying SVAR ignores market expectations about future regime changes.

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<sup>106</sup> The expectation formation effects emphasized by Davig and Leeper (2007) can be explained as an omitted variable problem that proxies the expectation about future regimes. The authors show that impulse responses from a model where agents account for possible regime changes are different from those where agents assume that the regime change is a once and for all event.

The following subsection discusses the Markov switching modelling results for Romania.

#### **6.4.2 The Markov switching model results for Romania**

Following an approach analogous to the Bulgarian one, a Markov switching model is estimated allowing all parameters to switch freely. Using the MS-SVAR analysis, two regimes are evidenced in Romania, regime 1 that is identified as the low volatility regime and regime 2 that determines a period of high volatility. The timing of the switches as depicted by the filter probabilities in Figure F6 suggest that the low volatility regime coincides with the booming period while the high volatility relates to the recession that reigns next. The filter probability of regime 1 suggests that, with the exception of a few short-lived disruptions, regime 1 yields high probability up to September 2008. Following the 2007-08 financial crisis the high-volatility regime (regime 2) becomes fixed, retaining a high probability up to the end of the sampling period.

The next stage involves interpreting the impulse responses of the Romanian credit risk to a shock of a standard error from each variable in the model, LOAN, LLPGR, M2 and UN, for each regime identified. Figure F7 displays the impulse responses of the Romanian credit risk (LLP) to innovations in the other endogenous variables in the two regimes as identified by the MS-SVAR model. Evidently, in both regimes LOAN appears to have a positive and significant effect on credit risk. In regime 1, the response of the Romanian credit risk to a LOAN shock is increasing and remains above the baseline for the remaining period. Turning to regime 2, it appears that the effect of LOAN on credit risk becomes larger compared to regime 1. As for the effect of M2, there is evidence of a significant negative effect on credit risk in line with the

traditional monetary channel view. Hence, an expansionary money supply shock reduces rates and stimulates investment and output. In turn, rising output boosts current cash flows, which in turn enhance the internal funding sources of firms, thus generating financial accelerator effects. Taken together, the positive effect of LOAN and the negative one of M2 on credit risk, provide support to the risk-taking channel view of the monetary transmission mechanism. An expansionary monetary policy lowers nominal rates, increases investment and output growth. Yet, in a low interest rate environment and high economic growth, banks will aim to maximize profits by extending more credit. Banks increasingly search for yield in a low interest rate environment (De Haas and Knobloch, 2010). However, this tendency increases banks' leverage but also magnifies the system's credit risk (Buiter, 2008; Admati and Hellwig, 2013). In Buiter's (2008) view, every asset, credit boom, or institution in history has been characterized by rising and, ultimately, excessive leverage. Hence, the banks' leverage appears to be the key in the Romanian case. Duenwald *et al.* (2005) argue that the fall in SEE countries' risk premium, matched by improving business conditions, whetted the appetite for borrowing and improved the banks' perception of borrowers' creditworthiness. Therefore, it is no surprise that risk assessment may have suffered from the sizeable amount of new loans extended to the previously credit-constrained households and firms, a situation that eventually led to lax lending practices. As a wealth of studies support, the perceived risk during lending booms is usually underestimated as is it based on the prevailing euphoric conditions (De Haas and Knobloch, 2010).

Turning to the role of UN, Figure F7 displays a positive effect on the build up of credit risk in both regimes. Yet, the impact of unemployment is significant only in the high volatility regime. Specifically, the evidence from regime 2 suggests that credit

risk increases in response to a positive shock of UN and remains above the baseline for the remaining period. As for the role of the Greek credit risk (LLPGR) on the Romanian one, Figure F7 (regime 2) suggests positive but marginally significant spillover effects.

The next modelling stage involves the treatment of regime switches as exogenous using a battery of structural break tests in line with the nominating stage (Karoglou, 2010). Table F8 reports the results of the tests for the nomination of breakdates in the data and Table F9 the results of the awarding stage that, in essence, tests for the equality of means and variances of the contiguous segments identified in the nominating stage. Based on the results, reported in Table F9 the sample is divided into three contiguous segments. Specifically, segment 1 covers the period from February 2001 to August 2003, segment 2 from September 2003 until October 2008, and segment 3 from November 2008 to December 2010. Then for each segment a SVAR analysis takes place using the same model consistent restrictions that were imposed in the estimation of the MS-SVAR model. Figure F10 presents the impulse responses of the credit risk for the three identified segments. An initial observation is that in segments 1 and 2, which coincide with the low volatility regime in the MS-SVAR approach, none of the variables seems to have a significant effect on the Romanian credit risk. As in the case of Bulgaria, this can be attributed to the less volatile period before the crisis in comparison with the after-crisis period. An exception is the effect of LOAN in segment 1 and M2 in segment 2. The lending growth (LOAN) has a positive and significant effect only at the shock while M2 has a negative influence that becomes significant after three periods following an expansionary shock. Nevertheless, the size of the impact in both cases is relatively small. On the other hand, in segment 3, all variables with the exception of LLPGR, yield a significant and

prolonged effect on the Romanian credit risk. In line with the results obtained from the Markov switching analysis, LOAN, UN and LLPGR affect positively the Romanian credit risk while M2 yields a negative effect. In the cases of LOAN, UN and LLPGR, the impulse responses remain above zero, below in the case of M2, without presenting any tendency of convergence on the baseline.

The results for both countries using the Markov switching framework put the linearity assumption into question, suggesting that linear models may work well under regular economic conditions but, as the impulse responses suggest, relatively small shocks in the models' variables could have large effects on banking stability (Blanchard, 2014). Yet, the study of crises is, by definition, challenged by small samples and incomplete data (Gorton, 2012), and this also applies in the Markov switching framework in the research.

This section completes the empirical results of the research, which broadly suggest that macroeconomic shocks, lending booms and busts, along with the crises episodes, took their toll in determining the credit risk in the banking systems of both Bulgaria and Romania. Equally, unemployment has a pronounced role in credit risk in both countries.

The next section concludes the chapter.

## **6.5 Conclusions**

This chapter presented and interpreted the results of the empirical analysis in the thesis based on the theoretical underpinnings and relevant empirical studies. Following an analytical and systematic methodological design, several estimation techniques were applied in an endeavour to unravel the determinants of credit risk in Bulgaria and Romania in a comprehensive dataset over a critical time period. The

empirical part of the research used a robust multi-staged modelling framework that encompassed unit root tests, univariate and multivariate regressions, cointegration techniques (ARDL and VECM) and the Markov switching framework supported by a time varying SVAR setting. To the author's knowledge, this is the first attempt to apply the ARDL approach to cointegration and the Markov switching framework to modelling credit risk in Bulgaria and Romania.

The unit root testing strategy that encompassed standard unit root tests as well as tests that account for the presence of structural breaks are aimed at identifying the order of integration of the variables – a critical issue in avoiding spurious regressions. The results of the unit root tests, in the light of the historical evolution of the Bulgarian and Romanian banking systems within the timeline of the research, have facilitated insights into the patterns and trends of the time series.

Next, a set of econometric techniques allowed the development of credible estimations and testing of the hypotheses set earlier in the research. In view of the debate in economics over methodological approaches, a set of different techniques was utilised. The univariate and multivariate models provided some preliminary evidence on the drivers of credit risk in the focal countries. Besides the linkages between credit risk and the macroeconomic conditions that are well documented in the literature, institutional and bank-specific factors were found to convey significant information in explaining credit risk in the context of the focal SEE countries. The next modelling stage involved the use of cointegration techniques. One of the appealing features of cointegration analysis is that it facilitates the estimation of models that describe the long-run relationships among the variables of interest. The results from the ARDL approach to cointegration that were cross-checked by the VECM framework, were broadly aligned with the initial modelling results, albeit

utilizing a smaller set of meaningful variables. In this respect the estimated relationships were tractable and comprehensible. It seems that in the case of Bulgaria and Romania, small models, apart from being more delicate, can tell the underlying story equally as well as models that use many variables. The research findings were broadly consistent with the expectations arising from theory and empirical evidence. In both countries' banking systems, lending growth and unemployment were found to be significant in determining credit risk in the long run. Contrary to Bulgaria, in Romania there was evidence of spillover effects from the Greek crisis. In the case of the Bulgarian credit risk, the role of the construction activity, the effect of the global financial crisis and that of the regulatory policies were decisive. In Romania, the money supply appeared to exert a negative significant effect on the credit risk, given the stylised facts associated with the established monetary regime.

In the final modelling approach, the research benefited from the appealing features of the Markov switching model that produced promising results in the exploration of credit risk. Unlike the existing literature on credit risk, the research triggered by the crises episodes accounted for regime changes. In this respect, an MS-SVAR was used jointly with a time varying SVAR model. The empirical findings were broadly consistent with the previous modelling approaches and theoretical priors. In both countries the loan growth and unemployment had a positive and significant effect on credit risk, while the money supply had a negative and significant effect. Taking together the effect of the lending growth and monetary aggregates in credit risk, it is reasonable to assume that their interaction deserves more attention in future research, especially under irregular economic conditions. The evidence of spillover effects arising from the Greek crisis on the Bulgarian and Romanian banking system was

limited, yet positive, possibly constrained by the small sample size in the volatility regimes.

Overall, the modelling treatment of credit risk in Bulgaria and Romania and the meaningful results lend support to the argument that the SEE countries do not form a homogeneous block. As such, the implicit hypothesis that country-specific research yields superior results to cross-country research was confirmed. Furthermore, the empirical results broadly confirm the testable hypotheses, namely the banks' procyclicality, the excess lending, the monetary transmission and the crisis spillover hypotheses. Considering the data constraints, the empirical results for both countries are interesting and important in many respects.

The next chapter, which concludes the thesis, provides an evaluation of the findings by addressing the research questions and the objectives of the research. Using the knowledge from previous chapters, the last chapter draws comparison lines between the two countries, discusses the limitations, provides recommendations and sheds some light on future research avenues.



## **Chapter 7: Summary and Conclusions**

Some years on, the global financial crisis of 2007-2008 still haunts the SEE region, one of the worst affected regions in the emerging world. In the aftermath, the economic impact was more severe than anticipated, reflecting home-grown vulnerabilities. While the crisis spread relatively quickly into the euro area, contagion in the transitional economies of Bulgaria and Romania was delayed. Institutional settings including, among others, the process of liberalization, left the banking sectors in both countries exposed to a number of risks, highlighting the complementarities and trade-offs between financial stability and economic growth. In the years prior to the global financial crisis, the literature on finance and growth accumulated a body of evidence suggesting that financial sector deepening is a key component of the economic development process. Encouraged by such evidence, policy makers in the developing countries questioned little the ability or willingness of the financial sector to channel funds to socially productive uses.

The global financial crisis made it clear that the idiosyncratic features of a country's banking sector such as liberalization, competition, size, cross-border linkages, and regulation, can exacerbate the trade-off between economic efficiency and banks' stability. In other words, the crisis of 2007 has qualified the conventional wisdom that finance always interacts with growth in a positive way. The expansion of the banking sector in the SEE region has signalled a misallocation of credit to less productive economic activities. The spike in financial intermediation before the crisis in the research's focal countries was associated with household credit, and mostly credit allocated to the real estate/construction sector. As discovered from the empirical evidence, the development of the banking sectors in Bulgaria and Romania has

increased risk-taking. The intense competition between the foreign banks encouraged in-country banks to engage in imprudent behaviour that weakened the resilience of both systems to external shocks. A liquidity-abundant environment combined with highly leveraged banks exacerbates moral hazard problems, increasing banks' appetite for risk. In turn, increased risk-taking if left unchecked by regulators can render the banking sector more fragile, thereby increasing the probability of a systemic meltdown with harmful effect on long-term growth. Households and corporations alike in the SEE region became dependent on debt-financing promoted by rising property prices (De Haas and Knobloch, 2010). The banks that had staked their prospects on ever rising asset prices and unstoppable 'hot money' inflows, found themselves in trouble from rising problem loans.

The liberalization process of the SEE markets has given rise to an unprecedented, high penetration of foreign banks<sup>107</sup> that were eager to establish subsidiaries and exploit profitable opportunities available in these transitional economies. It has also created highly interdependent banking systems in which shocks in one system can quickly spread and threaten the others. In this respect, foreign banks appear to have played a key role in the dynamics of the crisis in the region. Although a crisis can spread through many channels, most of them are closely connected to cross-border banking linkages.

The accelerating credit growth during the euphoria times appears to have been unique in the SEE region, judging by the banks' lending ratios that have been greater than average on a worldwide scale. The growth model of reliance on abundant credit gave rise to an unsustainable boom that was ended abruptly by the crisis. The legacy of the

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<sup>107</sup> Cross-border penetration from EU countries reached 82% of total banking assets in Bulgaria and 89% in Romania in the period 2006-2010 (EU Banking Structures, ECB).

boom-bust cycle in the region was reflected in the accumulating problem loans that challenged the banks' soundness and became a hindrance to economic growth.

For several decades, little interest has been paid to financial stability (Goodhart and Tsomocos, 2012). However, all that changed and now central banks and academics unanimously agree that banking stability is a key policy objective, underscoring that monetary policy and financial stability are interrelated.

The crises episodes have highlighted the importance of understanding the causes of financial instability, especially in the context of banks' credit risk. A prerequisite in establishing the long-term viability of a country's banking sector involves an in-depth diagnosis of the determinants of credit risk.

This chapter concludes the thesis by drawing on the results of the empirical research obtained via a variety of econometric techniques applied rigorously in an endeavour to unravel the determinants of credit risk in Bulgaria and Romania. The chapter's roadmap begins by evaluating the results with respect to the research questions and the formulated testable hypotheses. Next, the chapter draws comparison lines between the two countries and provides policy recommendations. The chapter closes by shedding some light on future research avenues.

The aim of the thesis was to explore the determinants of credit risk in Bulgaria and Romania in a critical timeframe spanning from 2001 to 2010 that embraced a rapid lending growth up to 2008 and accelerating problem loans thereafter. The empirical research focused on two individual countries, Bulgaria and Romania, using time series models after accounting for the specificities in the institutional settings of each country. In contrast, most studies that have involved the focal countries in panel estimations, broadly treat the SEE region as a homogeneous area. Deviating from the latter approach, the research has taken a case-by-case approach treating each country

separately. Comprehensive monthly datasets were collected for both countries and the potential drivers of credit risk were grouped into four broad categories: macroeconomic, monetary, financial markets, and bank-specific indicators. Next, a set of Greek indicators was selected to trace the crisis spillover effects from Greece to the neighbouring two countries, given the banking linkages in place. As the twin – sovereign debt and banking – crises unfolded in Greece, the authorities in Bulgaria and Romania tried to determine if and how they would be affected by these developments in the light of Greek banks' substantial presence in the region. The risk of contagion became a key concern for policy makers (Bartlett and Monastiriotis, 2010; Allen *et al.* 2011).

Assessing the credit risk determinants in the Bulgarian and Romanian banking systems has been a research-stimulating area, especially in the aftermath of the global financial crisis of 2007-2008 and the ensuing Greek crisis that was instantly transmitted to the domestic banking system, causing enormous distress. The transition economies of Bulgaria and Romania provided a particularly motivating setting in which banks played a key role. The banks in those countries emerged from the centrally planned economies that followed a less than smooth process of development amid macroeconomic collapses and banking crises. Both these nascent banking sectors inherited a legacy of problem loans that continued to evolve, even during the last phase of the large-scale bank privatization.

Credit risk has always been central to all banking crises experienced in both countries starting from the collapse of the Soviet bloc and leading up to the recent financial turmoil. The banking sectors of Bulgaria and Romania developed remarkably quickly, albeit with stark differences between them, and reached a point that looked similar to their counterparts in other emerging economies, except for the high percentage of

foreign ownership. The policy in both countries encouraged foreign bank participation as it was viewed as a vehicle for liberalizing their banking sectors and importing expertise. With hindsight, it appears that a banking system dominated by foreign banks is a mixed blessing. In general, foreign bank participation is expected to reduce volatility in developing countries, as their lending operations tend to be less pro-cyclical, and increase efficiency, but all this depends on individual country circumstances. The massive entry of foreign banks in the SEE region seems to have increased contagion risks without providing guarantees for the smooth process of finance and growth. The unprecedented credit expansion followed by rising investment activity in construction and skyrocketing property prices was mainly driven by foreign banks competing for market share. That came to a sudden halt in the aftermath of the global financial crisis as liquidity drained and the result of the 'easy-credit' growth model was mirrored in the balance sheets of both banking systems with evident implications for their stability. The banks in both focal countries were found at the forefront of a severe credit crunch with deteriorating asset quality and problem loans on the rise.

The research problem is built upon a set of questions in which the key area of focus is the financial stability of Bulgaria and Romania. Since credit risk is the primary source of risk in both countries' banking systems, a number of related proxies have been used. Table 20 presents the central research questions as transformed into testable hypotheses and investigated in the empirical part of this thesis.

Table 20 Research questions of research and mapping to the hypotheses explored by econometric analysis

Key research questions	Testable hypotheses
1. Can business cycle indicators explain the vulnerabilities of the Romanian and Bulgarian banking systems arising from deteriorating asset quality?	Deteriorating credit risk/asset quality has a negative relationship with economic growth (pro-cyclicality hypothesis).
2. What is the role of lending growth in determining credit risk?	Credit risk is positively (negatively) related to increasing lending growth (excess lending/financial liberalization hypothesis).
3. What is the role of money supply in determining credit risk?	Increasing (decreasing) money supply has a negative impact on credit risk (monetary transmission mechanism hypothesis).
4. Is there evidence of the Greek crisis (global financial crisis) in the Bulgarian and Romanian banking systems?	Credit risk is positively related to the Greek crisis - global financial crisis (crisis spillover hypothesis).
5. What is the effect of the Greek credit risk on the Bulgarian and Romanian banking systems?	

Although the empirical literature on the linkages between credit risk and macroeconomic performance has recently gained momentum, a number of gaps have been identified and these motivated the research that has been undertaken. They are summarized in the following list:

- a. There is a notable absence in the literature of country-specific studies for Bulgaria and Romania. Both countries have been used in cross-country studies that could not fully account for each individual country's idiosyncratic features and particular circumstances. In general, panel studies that include the focal countries do not explicitly account for structural breaks.
- b. To the author's knowledge no studies have been undertaken to apply the ARDL approach to cointegration or the Markov switching framework to the focal countries. The former approach proved useful in exploring the long-run

relationship of credit risk and its key drivers. The latter allows for regime shifts and non-linearities in the data generating process.

- c. The role of credit growth and the effect of money supply on credit risk do not present a clear-cut picture in the empirical literature.
- d. Empirical studies in the SEE region have not explored or accounted for the spillover effects arising from the Greek debt crisis.
- e. Cross-validation of the empirical results reported in the related literature is absent.

The identified gaps along with the theoretical underpinnings of the research rationalize the country-level research approach followed in the thesis. The research employs a methodological design that benefits from the appealing features of several econometric techniques. Specifically, a multi-staged modelling framework is applied that uses a detailed unit root testing strategy, OLS and GMM regressions, cointegration techniques (ARDL and VECM), and the Markov regime switching modelling approach. Using this robust framework, the research provides evidence on the determinants of credit risk in two SEE countries that have been neglected in the empirical studies. The novelty of the research involves the investigation of the effect of the Greek crisis on the banking systems of Bulgaria and Romania, by identifying the Greek bank subsidiaries operating in the SEE region as the most likely channel of contagion. The contribution of the thesis is largely determined by the critical timeframe used that covers, at least in part, the boom-bust cycle, but also the empirical treatment of the datasets, as it applies several methodological approaches to cross-validate the robustness of the findings. Table 21 summarizes the key findings of the empirical research on credit risk determinants.

Table 21 Summary of findings by country and type of econometric technique used in the research.

Methodology	Bulgaria	Romania
Ordinary Least Squares	Lagged NPLs, lagged construction, industrial production, unemployment, real effective exchange rate, loan growth, global financial crisis and regulation.	CPI, unemployment, construction, lagged investment, external debt, M2, Greek credit risk, Greek bond yield and lagged spread between Greek and German long-term bonds.
ARDL - VECM	Loan growth, unemployment, construction, global financial crisis and regulation.	Loan growth, unemployment, money supply, Greek credit risk.
Markov Switching SVAR	Regime 1 (pre-crisis): none Regime 2 (crisis): loan growth, unemployment, money supply.	Regime 1 (pre-crisis): loan growth Regime 2 (crisis): loan growth, unemployment, money supply.

Against the backdrop of the research's findings, a numbers of conclusions can be drawn. A first observation is that a small set of explanatory variables are relatively good predictors of credit risk in both countries. Particularly in the context of more advanced estimation techniques, the use of small-scale models renders them tractable and interpretable (Foglia, 2008). The empirical findings agree broadly with the theoretical underpinnings and the empirical evidence underlying the investigated transmission channel that runs from the macroeconomy on bank's credit risk. In this respect the prevailing macroeconomic conditions in both countries are vital in conditioning credit risk. In broad consensus with the literature on banking crises and credit risk, leading economic indicators such as unemployment, construction activity, effective exchange rate, industrial production and investment are found to be closely related to the stability of the banking sectors in either Bulgaria or Romania (Kaminsky



*et al.*, 1998; Demirgüç-Kunt and Detragiache, 1998; Arpa *et al.*, 2001; Barro, 2001; Boss, 2002; Calomiris and Mason, 2003; Hoggarth *et al.* 2005a,b; Bhattacharya and Roy, 2008; Crotty, 2009; Nkusu, 2011; Klein, 2013). In both countries, loan growth and unemployment were found to be key channels in transmitting instability in the respective banking systems. Given the joint effect in explaining system-wide movements in credit risk, it is reasonable to conclude that the resilience of the banking systems in Bulgaria and Romania could weaken significantly in the case of a wave of unemployment.

Notably, both countries relied excessively on foreign bank credit that fuelled the construction activity, which has been the worst affected sector by the global financial crisis in terms of unemployment. Certainly the effect of credit is complicated, especially during the above average booming periods, as it usually masks the problem of quality in lending standards. Nevertheless, the findings support the view that in the case of Bulgaria and Romania, the rapid lending growth increased credit risk substantially. Both countries encouraged the rise of financial intermediation through the entry of foreign banks. In retrospect, it seems that the contribution of foreign banks to intermediation and financial deepening was not as straightforward as it was expected to be by the proponents of a fast financial liberalization in these countries. Furthermore, it seems that the period marked by excessive lending in highly competitive market structures may have incentivized lax loan screening and underwriting policies. When the negative shock hit, the financial fragility paved the way to financial instability manifested in a surge of NPLs. The experience of Bulgaria and Romania accords well with the empirical priors, while the global financial crisis was a severe crash test of the intense process of cross-border banking. The results of the impact of loan growth and unemployment are robust in the long term estimated

relationships, as the cointegration techniques highlighted, but also in the high volatility regimes as traced by the Markov switching model. In the latter case, the growth of the broad monetary aggregates seemed to track adequately the credit risk in Bulgaria and Romania, suggesting that central banks should pay attention to those aggregates and the behaviour of credit in their effort to maintain banking stability. In accordance with the transmission mechanism of monetary policy, during the business cycle upswing, the low interest rates – increased money supply environment – encouraged credit but also induced banks to take greater risks.

The research also indicates that the cross-border effects of contagion pose important implications for credit risk. As for the role of the Greek debt crisis specifically, a broad observation is that the SEE region policymakers face great challenges in navigating risks that are differentiated across countries, given the inter-linkages of banking systems. The financial turbulence that engulfed the SEE region provided a stark reminder that the ties in place between the banking systems of Bulgaria and Romania and the Greek system do matter as they affect the risk of cross-border spillovers. The findings suggest that compared to Bulgaria, Romania faced greater downside risks from potential spillovers arising from the Greek sovereign debt crisis and bank distress. This result was robust in the univariate and multivariate regressions, and cointegration estimations, but not in the case of the Markov switching model. In the latter case the Greek crisis effect was found to be positive but not significant. A potential explanation relates to the small number of observations in the ‘high volatility’ regime as it is well documented in the literature that these models are sensitive to the sample’s observations.

The research forms the basis of a comparative analysis of the credit risk determinants in Bulgaria and Romania. Evidently, the results of the univariate-multivariate

regressions and those of the cointegration, purport that the set of explanatory variables was not identical in both countries. As expected from the outset, the Bulgarian credit risk was more affected by construction activity and the regulatory framework, especially when the authorities attempted to stave off the overheating of the economy through the introduction of credit ceilings. Drawing comparison lines between the two countries is constrained to some extent by data limitations that prevented the use of a similar proxy of credit risk in Bulgaria and Romania. However, a number of studies have indicated that both metrics – LLPs and NPLs –are imperfect proxies for the evolution of credit risk in a banking sector over the business cycle. In practice, LLPs are backward-looking, as banks tend to underestimate future losses in periods of economic expansion because of disaster myopia or herding behaviour. Yet, both proxies have been widely used in empirical studies as reliable credit risk indicators whilst there is clear evidence in the literature that the proportion of either NPLs or LLPs increases dramatically before and during banking crises (Demirgüç-Kunt and Detragiache, 1998; Gonzalez-Hermosillo, 1999). Similarly there is an almost contemporaneous relation between loan loss provisions and NPLs. Under the caveat of the different credit risk proxies used in Bulgaria and Romania, an evident divergence between these countries relates to the spillover effects of the Greek crisis. The latter stirs the need to examine the past and can be explained in the light of the following factors:

- It seems that in Bulgaria the memory of the severe crisis of 1996-1997 was still fresh. The hard lesson from the banking collapse that followed was well learnt by the authorities. In retrospect, the introduction of the currency board along with the disciplined fiscal policy appear to have contributed to the stability of the banking system during the research's timeframe. Bulgaria did

not request any external help in stabilizing either its fiscal position or its banking system.

- The speed of adjustment that differed considerably between the two countries, from the previous centrally-planned regime to the new market-based one. It is well documented that Romania was a late starter while Bulgaria was an early bird in terms of the adjustment period and the process of bank privatization. In view of this, it seems that the Bulgarian authorities had more time to adjust to the new setting and understand the potential drawbacks of the regulatory framework by adopting a more proactive stance. This is reflected in the credit ceilings imposed on lending by 2006, which aimed to slow down, even temporarily, the economy's overheating.
- The Bulgarian sovereign and banking system balance sheet was healthier than the Romanian one when the crisis erupted. In terms of the banking systems, it appears that the degree of leverage prior to the crisis was critical. The Bulgarian banks were better capitalized and less leveraged. Overall, a stronger capital position ring-fences the system more effectively. The imposition of tighter regulation on capital buffers in Bulgaria limited the contagion from parent banks. During the boom years, regulation in Bulgaria required banks to reinvest their profits rather than repatriating them to their foreign parents. Hence, as numerous sources suggest, a prudent regulatory framework was in place in Bulgaria. (EBRD, 2010; BNB, 2011, Moody's 2012).
- In terms of macroeconomic policy, it may be that the currency peg implemented in 1997 in Bulgaria that put in place hard budget constraints and limits to the financing of the State via the banks, may have worked as a stabilizer in the banking system. Another possible reason for the insignificant

effect of the Greek crisis on the Bulgarian credit risk, despite the larger market share of Greek banks compared to Romania, relates to the lowest exposure of Greek banks in Bulgaria in monetary terms.

Overall, it is safe to conclude that in the aftermath of the past crises episodes, the credit risk emerged to varying degrees, depending on the initial conditions in Bulgaria and Romania. In common with both transition countries, what was considered to be an advantage during booming times, such large FDI inflows and liberalization of the financial system, became a disadvantage during the crisis, exposing these countries to greater risk of ‘catching a virus’ (Shostya, 2014). Starting in the autumn of 2008, economic output and real estate prices plunged, along with the construction sector, unemployment soared and banks that were engaged in excessive lending faced a rapidly deteriorating asset quality. The banking systems of Bulgaria and Romania had to face a number of challenges as they adapted to the post-crisis economic environment. The key policy recommendations of the research are the following:

- The central banks have to safeguard financial stability. When a crisis strikes, the connections between the real economy and the banking system are manifest and overstressed. There is a central role that problem loans play in banking crises; usually a large increase in NPLs marks the onset of the crisis. In times of stability, there is a tendency to downplay these connections. Hence, the links between banks and the economy are always relevant – not only in crises times. The degree to which central banks can use policy instruments to counter the effect of the crisis and support the resilience of the banking sector presents heterogeneity, as it depends on factors such as fiscal conditions, exchange rate and monetary regime.

- Regulators and supervisors in different countries with interconnected banking systems need to collaborate in designing and implementing macro-prudential policy. On the same wavelength, the banking regulation in the EU needs to go beyond the home country principle. The latter recommendation reinforces the urgent need for a pan-European regulation that will also account for cross-border banking linkages. In the meantime, regulators need to explicitly coordinate across borders taking steps towards ring-fencing the activities of foreign subsidiaries and burden-sharing arrangements in the event of cross-border crisis.
- Regional dialogue and joint bank monitoring between the host country regulators in SEE region and the home country regulators of more advanced European economies may be particularly useful, especially in cases where the exposure of foreign banks to host countries are significant. In countries such as Bulgaria and Romania, where Greek banks control a relatively large market share, potential spillover and contagion risks need to be closely monitored. Contingency plans that will aim to contain any potential shocks to confidence in the banking systems should be in place.
- Bulgaria and Romania are among the new members of EU with the prospect of adopting the single currency at some point in the future. Both banking systems are dominated by foreign banks of EU origin and also appear vulnerable to sudden swings in global sentiment. Once the hot money stops flowing globally, a credit crunch is on the doorstep. The latter, in conjunction with the evidence of spillover effects from Greece, may have implications not only for the financial stability of the focal countries but also for the euro area.

- Closely interrelated banking systems make them susceptible to shocks. Reducing vulnerabilities at their roots, such as the Greek crisis, will effectively make the Bulgarian and Romanian banks more resilient and minimize the effect of potential instability in Bulgaria and Romania from transmitting to other countries either in the neighbouring or euro area.
- In the light of the uncertain environment, it is important that both countries' central banks continue their intensive bank supervision and expand their crisis preparedness. Careful planning and imposition of speed limits on credit growth, as proposed by Honohan (1997) and Hellmann *et al.* (2000), especially when the economy begins to overheat, are expected to address the moral hazard in banking and encourage prudential lending.
- Banking and monetary stability are closely intertwined. As such, the authorities should pursue a stability-oriented monetary policy. An empirical implication of the bank-centric view of monetary transmission is that lending growth should be closely monitored along with measures of economic activity. Following changes in monetary policy, there is a strong correlation between credit risk, bank lending and unemployment, and other key macroeconomic indicators. The scale of unemployment can be devastating for the resilience of the financial sectors in the focal countries. Unemployment is undoubtedly a complex phenomenon and in the case of the research's focal countries, caused by a large and sustained negative shock to the GDP as a result of the Great Recession in the aftermath of both the global financial crisis and the Greek sovereign debt one. In the context of the research, unemployment lies at the heart of the problem loans' dynamics meaning that it adds pressure to central

banks and requires a coherent strategy by policy makers in achieving a sustainably high level of employment.

This research has surfaced the fragility of the banking sectors in Bulgaria and Romania both of which are exposed to the macroeconomic conditions and spillovers from the Greek crisis. Broadly, the data suggest that credit risk is sensitive to macroeconomic shocks which in turn quickly transmit to banks' balance sheets. As such, the research yielded tangible results and contributed to knowledge and the existing literature on credit risk determinants. The thesis surfaced the control variables in both countries, illuminated the relationships shaped in the research's timeframe and provided a number of policy recommendations. Understanding the mechanics of crises in the Bulgarian and Romanian banking systems remains a key challenge limited by the lack of related studies. The crises soon become a "*forgotten story*" and the crisis-related studies are constrained by small samples and incomplete data (Gorton, 2012). A drawback of the research relates to data limitations. Constraints such as the availability and quality of data, the frequent revisions and other reporting weaknesses, restrict the modelling approaches. For instance, the quarterly GDP data for the emerging EU countries, including Bulgaria and Romania, are available only after 2002, the Romanian NPLs after 2003, while the Greek data had seen several revisions. In the latter case, in the light of the 'new' Greek time series, the results of the research may have been different. Regarding future research directions, it will be worth reviewing the situation in the Bulgarian and Romanian banking systems as of 2014. In Bulgaria, the banking sector's liquidity remains high, supported by deposit growth that outstripped lending growth. Banks have wound down external debt positions between 2008 and 2013 while increasing their assets held abroad over the same period. The currency board regime and the high share of loans in foreign



currency restrict the monetary flexibility of the central bank and limit its ability to act as a lender of last resort. Credit growth has been anaemic, reflecting banks' low risk appetite along with the poor demand from the real economy. The resolution of NPLs has been slow, given that they remain high at about 17% of total loans. In June 2014, deposit runs at two large domestic banks<sup>108</sup> stirred concerns about the state of the Bulgarian banking system. Swift actions by the BNB helped to head off a large scale bank run in EU's poorest member state (Hope, 2014). Hence, it is safe to conclude that the problem seems to persist in Bulgaria's financial sector, which faces rising rates of NPLs in a weak economy. Although the BNB was found to be a stabilizer for the system during the sovereign debt crisis, it has limited power to revive the economy. On top of that, political uncertainty<sup>109</sup> poses further risks for the country's financial sector.

In the light of this, a possible direction for future research in Bulgaria's banking system entails the extension of the dataset with more observations as well as qualitative variables, such as political stability, rule of law or regulation. Such approach would try to explain the variables effect on bank's credit risk as well as the factors that prevent the resolution of NPLs in Bulgaria.

In the case of Romania, which has a flexible exchange rate regime, the independent monetary policy remains constrained by a relatively high share of foreign currency in the economy. The financial sector's stability appears to be on track, albeit with an elevated level of NPLs. The subdued growth increased the banking system's NPLs to

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<sup>108</sup> Savers withdrew more than 20% of deposits from the Corporate Commercial Bank, the country's fourth largest bank, causing a liquidity crunch that forced the bank to seek emergency funding from the BNB. The collapse of one of Bulgaria's largest banks, one with political connections, has further unsettled a country that has increasingly become a source of concern within the EU for poor governance. The BNB decided to recapitalize the bank by a state-owned one and the Deposit Insurance Fund in an attempt to protect the stability of Bulgaria's banking system.

<sup>109</sup> By the end of July 2014, Bulgaria's prime minister resigned leaving his successor to sort out the Balkan state's worst banking crisis since the 1990s (Reuters, 2014).

21.9% of total loans, as of December 2013. Hence, over the past few years, the banking sector's asset quality has weakened while the slow credit growth has had an impact on domestic demand recovery. Overall, the banking sector weaknesses remain a constraining factor as well as a key risk factor for the economy (Moody's, 2014). These weaknesses are counterbalanced to some extent by the strong capital adequacy ratio in the Romanian banking system and the high level of bank provisioning for problem loans. Hence, it seems that further investigation of credit risk determinants is high on the research agenda for Romania, accounting also for the role of the institutions and the political turmoil during the crisis.

Few years have passed since the global financial architecture came to the brink of collapse and the global economy was plunged into the Great Recession. Europe was hit by the global financial crisis and recession, but this external crisis soon transformed into a home-grown one, dubbed the 'euro sovereign debt crisis'. Although sentiment has improved, several voices still contend that the crisis in the euro area is not over yet. Growth remains lethargic; unemployment and the standard of living has deteriorated in the affected countries, and peripheral economies are adjusting to tough economic realities. The Greek debt crisis has cast a shadow in both focal countries' banking sectors. Both countries had limited policy manoeuvring room just when they needed it most, i.e. in the wake of the worst recession since the Great Depression. Banks continue to take a cautious stance in lending to the real economy and NPLs have been rising since the onset of the crisis. Without promoting investment in the real economy as credit is shrinking, the chances are high that this could lead to a self-reinforcing downward spiral. In this setting, policymakers have to rediscover that monetary policy works through the stability of the financial system.

In the light of the previous analysis, future research entails the extension of both datasets. The latter will not only allow the re-evaluation and validation of the relationships identified but is expected to shed some light on the persistent problem of credit risk and its interactions with the real economy.

Another reason for refreshing and extending the dataset is that loans which have been restructured during the crisis may turn up in the NPL statistics with some delay. Furthermore, more data will allow the investigation of the channels through which macroeconomic, financial or monetary variables affect credit risk. The effect of the sovereign debt crisis on bank's credit risk calls for further research, including the investigation of second round effects, given that financial channels can amplify sovereign risks and vice versa. Financial sector linkages can transmit one country's sovereign or banking credit risk to other economies and financial sectors, especially in SEE countries that have proved to be sensitive to external shocks. The confluence of monetary policy and lending growth on credit risk in Bulgaria and Romania needs further examination as well as the feedback effects of credit risk to the real economy and the macro-financial performance. In this respect, the measure of credit to GDP that has proved to be useful in analysing cyclical variations can be used for the focal countries. A measure of bank stability that increasingly gains popularity is the z-score, which measures banks' solvency risk and distance to default. Certainly, variables such as NPLs or LLPs are extensive, but they are also known to be lagging indicators of banks' soundness (Čihák and Schaeck, 2010).

Research questions arising from the global financial crisis and the ensuing Greek sovereign debt crisis identified several macro-prudential policy challenges. Such questions are identified to be at the leading edge of research that integrates financial intermediation and the macroeconomy (Ali and Daly, 2010; Gorton, 2012). Amongst

these challenges are improving our understanding of macro-financial linkages and developing tools that can be utilised in macro-prudential surveillance. In terms of modelling approaches, the future research avenue points to three possible directions. Given that the evidence from past banking crises suggests irregularities under economic stress, the relationship between credit risk and the business cycle continues to pose modelling challenges and remains an open question in developing economies. In view of the limited attention attracted by empirical studies, the ARDL approach to cointegration and the Markov regime switching models are promising in explaining credit risk. As such, these approaches need to be applied in the context of other developing countries and be complemented by the use of other modelling techniques to study how credit risk shocks are propagated across countries with financial or economic inter-linkages. Secondly, the dynamics of the relationship in question could imply two-way causality that is worth investigating, also under the non-linearity assumption, given the stagnation in lending and the recession in the aftermath of the crises. A growing body of empirical literature that uses threshold VAR models has demonstrated the existence of non-linear conditions among credit conditions, monetary policy and real economic activity in a number of countries (Balke, 2000; Li and St-Amant, 2010; Avdjiev and Zeng, 2014). Hence, this empirical stand is a research avenue worth exploring in the focal countries. A third strand of future research that provides a promising way forward can be built around the transmission mechanisms between credit risk and exogenous events in the spirit of the modelling framework developed by Pesaran *et al.* (2004) and Segoviano and Padilla (2006). The effort to get the banking right is a major thread in the research as the cult of risky behaviour is ingrained not only in banks but also in corporations and households,

especially when both the latter were for a long time credit constrained, as in the case of the focal countries in the thesis.

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## Appendix

### Appendix A: Financial crisis indicators and credit risk determinants in the literature

**Table A1** Financial crisis indicators in the literature

<b>Authors</b>	<b>Indicators</b>
Kindleberger (1978)	Asset price bubbles.
Minsky (1982a)	Reinforcing process between financial and real economy, credit and asset prices boom.
Bernanke (1995)	Monetary contraction and deflation.
Cole and Gunther (1995, 1998)	Bank solvency and risk.
Kaminsky and Reinhart (1999)	Financial liberalization.
Honohan (1997)	Aggregate banks' balance sheet indicators and macroeconomic indicators: loan-to-deposit ratio, foreign borrowings to deposits, credit growth, reserves to deposits, lending to government, central bank lending to banking system.

Demirgüç-Kunt and Detragiache (1998)	Weak macroeconomic environment, high inflation and real interest rates, banking sector problems.
Corsetti <i>et al.</i> (1998)	Depreciation in exchange rate and change in foreign reserves, stock of NPLs to total assets, stock of NPLs to GDP, current account balance to GDP, ratio of monetary aggregate and foreign exchange reserves, foreign debt payment to foreign reserves.
Goldstein (1998)	Credit boom to real estate, export slowdown, fixed exchange rates, liquidity-currency mismatches, connected lending, low levels of transparency, current account deficits, low quality of investment, deteriorating competitiveness reflected in real exchange rates.
Kaminsky <i>et al.</i> (1998)	International reserves, real exchange rate, credit growth, credit to public sector, inflation, real exchange rate, banking crises, exports, stock prices, M2 to international reserves output.
Baig and Goldfajn (1998)	Nominal exchange rates, stock markets, interest rate (overnight rate), interest rates on foreign currency–denominated debt, and spread with US treasury bill yield.
Gonzalez-Hermossilo (1999)	Measures of bank solvency and risk: loan-to-assets ratio.
Kaminsky <i>et al.</i> (1998)	Foreign exchange reserves, domestic-foreign interest rate differential on deposits, increasing M1-M2, domestic credit to GDP, real interest rate, lending to deposits, M2 to reserves, bank deposits, exports-imports, terms of trade, real exchange rate, foreign exchange reserves, output, stock prices, fiscal deficit to GDP.
Berg (1999)	GDP, inflation, exports, imports, terms of trade, exchange rate, real effective exchange rate, trade balance, current account, capital inflows, short-term external debt, public debt, domestic debt to GDP, domestic credit growth, short-term debt to reserves, M2 to reserves, export growth, NPLs to total loans, debt to equity, return on assets, private bank lending to GDP, current account deficit, spread differential on dollar-denominated sovereign bonds, stock market indices, real interest rate.
Reinhart <i>et al.</i> (2000)	Growth rate in real output, M2 to international reserves, bank deposits growth rate, M2 multiplier, equity prices, international reserves, exports-imports, terms of trade, general government consumption, and domestic credit to GDP. Domestic-foreign real interest rate differential, excess real M1 balances, real interest rates on deposits, lending-deposit interest rate, real exchange rate deviation from trend, sovereign credit rating monthly-semiannual change, budget deficit to GDP ratio, public sector credit to GDP, central bank credit to public sector to GDP, short-term capital inflows to GDP, FDI to GDP, current account imbalance to GDP.

Barro (2001)	Currency depreciation, nominal interest rate, real per capita GDP, investment to GDP, stock market prices. The explanatory variables were the per capita GDP, measures of human capital, government consumption to GDP, openness to international trade, terms of trade, inflation, and real investment to GDP.
Neftci (2002)	Pegged exchange rate, open foreign exchange position in the banking system, non-transparent bank books, undercapitalized banks, ownership in banks and limited prior experience with banking crises.
Collins and Senhadji (2002)	Real estate-property prices, stock market prices, property prices, consumer price index, credit to private sector, bank lending, real GDP per capita.
Calomiris and Mason (2003)	Degeneration of banks' fundamentals: bank solvency, credit risk, idiosyncratic and country-specific characteristics.
Caprio (2009)	Financial innovation without adequate regulation.
Crotty (2009)	Low interest rates, low loan default rates, low risk spreads and security price volatility jointly with high profits and rising stock prices.
Reinhart and Rogoff (2009)	CPI, exchange rate, real GDP, exports, public-government debt, current account deficit, short and long-term interest rates, commodity prices, currency, other crises, external and domestic default.
Rose and Spiegel (2009)	Real GDP, stock market, sovereign credit ratings, exchange rate, share of bilateral trade between a pair of countries in total trade, a country's balance sheet.
Frankel and Saravelos (2010)	Central bank's reserves, real effective exchange rate overvaluation, current account, and national savings.
Gourinchas and Obstfeld (2011)	Credit boom, real currency appreciation.

**Table A2** Credit risk determinants found in the SEE-related literature and theoretical background

<b>Authors</b>	<b>Determinants</b>	<b>Theoretical background</b>
Babihuga (2007)	Macroeconomic variables, bank-specific and structural factors in 96 countries. Macroeconomic factors: GDP growth, unemployment, inflation, real interest rates and exchange rates. Bank-specific factors: bank deposits. Structural: banking regulation and supervision.	Endogenous relationship between macroeconomic indicators and the financial sector, determinants of banking crises (Demirgüç-Kunt, 1998; Demirgüç-Kunt and Detragiache, 1998; Hardy and Pazarbaşıoğlu, 1998; Demirgüç-Kunt and Detragiache, 2005), stress testing approach (Arpa <i>et al.</i> , 2001; Hoggarth <i>et al.</i> , 2005a).
Festić <i>et al.</i> (2011)	Macroeconomic variables, bank-specific variables in 5 CESEE countries (new EU member states). Macroeconomic factors: FDI in financial intermediation and real estate, exports of goods and services, gross fixed capital formation, net foreign assets and compensation to employees. Bank-specific factors: deposits to loans and loans to assets. Structural: concentration and Basel core principles.	Empirical studies showing that credit risk is procyclical with respect to economic growth (Borio and Lowe, 2002), financial crises related studies (Kaminsky and Reinhart, 1999; Calvo and Mendoza, 2000), interaction between the business cycle and the financial sector (Arpa <i>et al.</i> , 2001; Blaschke <i>et al.</i> , 2001; Schinasi, 2005; Babihuga, 2007).
De Bock and Demyanets (2012)	Macroeconomic and bank-level factors in 25 emerging markets. Macroeconomic factors: GDP growth, exchange rate, terms of trade and capital inflows. Bank-specific factors: lending growth.	Interactions between the financial sector with the real economy (financial accelerator framework), information asymmetries between lenders and borrowers, balance sheet effect (Fisher, 1933; Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997; Kaminsky and Reinhart, 1999; Borio <i>et al.</i> , 2001; Jimenez and Saurina, 2006; Nkusu, 2011).
Beck <i>et al.</i> (2013)	Macroeconomic factors in 75 countries. Macroeconomic factors: GDP growth, exchange rate, share prices and lending interest rates.	Interactions between the financial sector with the real economy (King and Plosser, 1984; Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997; Bernanke <i>et al.</i> , 1999).



Klein (2013)	<p>Macroeconomic and bank-level factors in 16 CESEE countries.  Macroeconomic factors: unemployment rate, exchange rate, GDP growth and global risk aversion.  Bank-specific factors: equity-to-assets, return to equity, lending growth.</p>	<p>Macroeconomic factors: past empirical studies.  Bank-level factors: hypotheses developed by Berger and DeYoung (1997).</p>
Jakubík and Reiningger (2013)	<p>Macroeconomic and bank-level factors in 9 CESEE countries.  Macroeconomic factors: GDP growth, stock exchange index and exchange rate.  Bank-specific factors: lagged credit risk, lending growth.</p>	<p>Empirical studies (Nkusu, 2011; De Bock and Demyanets, 2012; Becket <i>et al.</i>, 2013).</p>
Laidroo and Männasoo (2014)	<p>Macroeconomic and bank-level factors in 15 CEE countries.  Macroeconomic factors: GDP growth.  Bank-specific factors: undrawn committed credit lines, lending growth, lagged loan loss reserves.</p>	<p>Financial accelerator framework (Bernanke and Gertler, 1989, Kiyotaki and Moore, 1997; Bernanke <i>et al.</i>, 1999).  Empirical studies (Keeton, 1999; Cavallo and Majnoni, 2001; Leaven and Majnoni, 2003; Bikker and Metzmakers, 2005).</p>

## Appendix B: The dataset

**Table B1** The dataset of Bulgaria

<b>Credit risk indicator</b>	<b>Definition</b>	<b>Source</b>
NPL	Doubtful and loss loans to total loans granted by Bulgarian banks.	BNB
<b>Macroeconomic variables</b>		
GDP	Real Gross Domestic Product.	NSIB
CPI	Percentage change in consumer price index (period average), over previous year.	NSIB
CA	Current account balance.	NSIB
CON	Construction production index.	NSIB
BCON	Building construction index.	NSIB
UN	Recorded official unemployment as a percentage of total labour force, average.	NSIB
REEL	Real effective exchange rate (CPI deflated).	BNB
DGDP	Total debt (both local and foreign currency) owed by government to domestic residents, foreign nationals and multilateral institutions expressed as a percentage of GDP.	NSIB
EXP	Exports of goods.	NSIB
IMP	Imports of goods.	NSIB
OILG	Oil imports to GDP.	NSIB
IPI	Industrial Production Index.	NSIB
AMW	Average monthly wage.	NSIB
<b>Monetary variables</b>		
M1	Narrow money. Comprises currency in circulation plus overnight deposits.	BNB

M2	Intermediate money. Comprises narrow money (M1) and, in addition, deposits with a maturity of up to two years and deposits redeemable at a period of notice of up to three months.	BNB
M3	Broad money. Comprises M2 plus marketable instruments issued by monetary and financial institutions.	BNB
<b>Financial markets and interest rate variables</b>		
EUR1	Euro Interbank Offered Rate (Euribor) of one month, period average (% p.a.).	Reuters
EUR3	Euro Interbank Offered Rate (Euribor) of three months, period average (% p.a.).	Reuters
SOF1	Sofia Interbank Offered Rate (Sofibor) of one month, period average (% p.a.).	BNB
SOF3	Sofia Interbank Offered Rate (Sofibor) of three months, period average (% p.a.).	BNB
SPLD	Interest rate differential between loans and time deposits of non-financial corporations and households (% p.a.).	BNB
BY10	Average interest rate of long-term Bulgarian government bond (% p.a.).	ECB
SPBG	Spread differential between Bulgarian and Greek long-term government bond yield.	ECB
EUSX50	The Dow Jones EuroStoxx 50 equity index. Indicator of economic prospects and market sentiment.	Datastream
OIL	Brent crude oil price (fob), euro per barrel.	ECB
USE	US dollar per euro, period average.	ECB
<b>Bank-specific variables</b>		
LOAN	Growth in total loans granted by Bulgarian banks (%).	BNB
CAR	Capital to assets.	BNB
LTA	Gross loans to total assets.	BNB
LDR	Loan to deposit ratio. Proxy for liquidity.	BNB

All ratios are expressed in percentage points.

**Table B2** The dataset of Romania

<b>Credit Risk indicators</b>	<b>Definition</b>	<b>Source</b>
LLP	Doubtful and loss loans provisions to total loans granted by credit institutions.	NBR
CRR	Gross exposure related to non-bank loans and interest under 'doubtful' and 'loss' to total loans and interest classified related to non-bank loans.	NBR
DDR	Number of total defaulters (legal and natural entities) to loan debtors.	NBR
<b>Macroeconomic variables</b>		
CPI	Consumer price index (% p.a.)	NISR
GDP	Real Gross Domestic Product.	NISR
CA	Current account balance.	NISR
CAG	Current Account as percentage of GDP.	NISR
CON	Construction production index.	NISR
GFCF	Gross Fixed Capital Formation. Proxies the investment expenditure.	NISR
TCON	Total consumption expenditure.	NISR
HCON	Private consumption expenditure, households.	NISR
FDIS	Stock of foreign direct investment into the country at current prices, net.	NBR
FDIF	Flow of foreign direct investment into the country at current prices, net.	NBR
TB	Imports minus exports.	NBR
UN	Recorded official unemployment as a percentage of total labour force, average.	NBR
DGDP	Total gross external debt (general government, monetary authority, banks and other sectors) expressed as a percentage of GDP.	NBR
DGGDP	Total debt (both local and foreign currency) owed by government to domestic residents, foreign nationals and multilateral institutions, expressed as a percentage of GDP.	NBR

TBGDP	Total gross external debt of banks (short and long-term) expressed as a percentage of GDP.	NBR
<b>Monetary variables</b>		
M1	Narrow money. Comprises currency in circulation plus overnight deposits.	NBR
M2	Intermediate money. Comprises M1 plus highly liquid deposits.	NBR
M3	Broad money. Comprises M2 plus marketable instruments issued by monetary and financial institutions.	NBR
<b>Financial markets and interest rate variables</b>		
ROB3	ROBOR (Bucharest Interbank Offered Rate). Reference interbank money market rate. Average 3-month interest rate on operations to place funds (% p.a.).	NBR
SPRE	Robor 3-month less Euribor 3-month.	NBR
BET	The Bucharest stock exchange (BSE) trading index. Comprises the ten most liquid companies listed on the BSE regulated market.	NBR
BETC	The Composite Index of the Bucharest stock exchange (BSE). Captures the overall performance of all companies listed on the BSE regulated market.	NBR
RAS	The RASDAQ index. Captures the over-the-counter market.	NBR
EUSX50	The Dow Jones EuroStoxx50 equity index. Indicator of economic prospects and market sentiment.	Datastream
OIL	Brent crude oil price (fob), euro per barrel.	ECB
RONE	National currency (Romanian RON) per euro, period average.	ECB
RONU	National currency (Romanian RON) per US dollar, period average.	ECB
LTBR	Average interest rate of long-term Romanian government bond (% p.a.).	NBR
SPRG	Spread differential between Romanian and German long-term government bond yield.	ECB
INTL	Average lending interest rate applied by banks to non-financial corporations and households for outstanding amounts (% p.a.).	NBR
INTD	Average deposit interest rate applied by banks to non-financial corporations and households for outstanding amounts (% p.a.).	NBR
SPLD	Interest rate differential between loans and deposits of non-financial corporations and households' time deposits (% p.a.).	NBR

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<b>Bank-specific variables</b>		
LOAN	Growth in total loans granted by Romanian banks (%).	NBR
LEV	Capital to assets. Key prudential indicator of the Romanian banking system.	NBR
LTA	Gross loans to total assets of the system. Key prudential indicator.	NBR
LIQ	Effective liquidity to required liquidity. Measures the system's liquidity. Key prudential indicator.	NBR
LDR	Loan to deposit ratio. Proxy for liquidity.	NBR

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All ratios are expressed in percentage points.

**Table B3** Greek Sovereign Crisis and Greek Banking System Distress Indicators

<b>Variable</b>	<b>Definition</b>	<b>Source</b>
LLPGR	Loss loans provisions to total loans granted by Greek credit institutions	BOG
LEV	Capital to assets ratio. Proxy of capital position - leverage	BOG
LD	Loan to deposit ratio. Proxy for liquidity	BOG
GR10Y	Secondary market yield of the 10-year Greek government bond	ECB
SPGRD	Spread differential between Greek and German long-term government bond yield.	ECB
ECBI	Ratio of emergency financing provided by ECB to total liabilities of Greek banks. A stress index, as it proxies the liquidity gap of the Greek banking system.	ECB &BOG
ASE	General Index of the Athens Stock Exchange	BOG
BASE	Banking Index Athens Stock Exchange	BOG

All ratios are expressed in percentage points.

## Appendix C: Unit root tests

### I. Results for Bulgaria

**Table C1** Unit root tests of the variables used for Bulgaria

Variables	ADF		PP		KPSS	
	Levels	First Dif.	Levels	First Dif.	Levels	First Dif.
NPL	1.523	-11.265*	1.266	-11.408*	0.286	0.135 ***
LOAN	1.578	-11.775*	1.188	-12.015*	0.223	0.166*
UN	0.165	-4.896*	1.529	-4.570*	0.270	0.209*
CON	-0.605	-3.258**	-0.406	-13.368*	0.184**	0.272*
IPI	-0.520	-14.120*	-0.785	-13.690*	0.259*	0.121***
REEL	-2.391	-7.855*	-2.034	-7.715*	0.158**	0.091**
M2	0.123	-13.650*	-0.089	-13.577	0.190**	0.195*

Notes:

- (\*), (\*\*) and (\*\*\*) imply 1%, 5% and 10% significance level.
- ADF stands for the Augmented Dickey-Fuller test, PP for the Phillips-Perron test, and KPSS for the Kwiatkowski, Phillips, Schmidt, and Shin test.

**Table C2** Unit root tests with structural breaks for Bulgaria

Variables	Perron			Zivot-Andrews		
	T <sub>B</sub>	Lag	t <sub>r</sub>	T <sub>B</sub>	Lag	t <sub>r</sub>
NPL	2008M5	3	-2.860*	2008M7	3	-2.887*
LOAN	2008M11	0	-2.948*	-	2	-2.992
UN	2008M6	3	-2.158*	2008M4	3	-2.568*
CON	2006M2	4	-3.358*	2006M3	4	-3.349*
IPI	2008M11	1	-4.869*	2008M11	3	-3.811*
REEL	2007M6	1	-4.737*	-	1	-4.593
M2	2007M7	1	-3.822*	2007M6	1	-3.839*

Note: (\*), (\*\*) and (\*\*\*) imply 1%, 5% and 10% significance level; T<sub>B</sub> denotes the estimated break date.



## II. Results for Romania

**Table C3** Unit root tests of the variables used for Romania

Variables	ADF		PP		KPSS	
	Levels	First Dif.	Levels	First Dif.	Levels	First Dif.
LLP	2.150	-3.775**	2.001	-8.849*	0.298*	0.192**
CON	-1.588	-7.846*	-1.601	-7.919*	1.102	1.023
INV	-1.418	-7.286*	-1.402	-7.407*	0.147**	0.089
DGDP	-1.113	-3.228***	-0.849	-4.942*	0.272*	0.067
UN	-2.835	-9.748*	-0.976	-9.147*	0.255	0.114*
CPI	-3.320**	-8.474*	-3.222***	-8.474*	0.287*	0.1185
M2	-2.037	-12.590*	-0.460	-12.333*	0.210	0.228*
EUR3M	-1.829	-4.180*	-1.369	-4.185*	0.157**	0.108
LOAN	-0.057	-4.480*	0.300	-7.623*	0.193**	0.243*

Notes:

- (\*), (\*\*) and (\*\*\*) imply the 1%, 5% and 10% level of significance.
- ADF stands for the Augmented Dickey-Fuller test, PP for the Phillips-Perron test, and KPSS for the Kwiatkowski, Phillips, Schmidt, and Shin test.

**Table C4** Unit root tests with structural breaks for Romania

Variables	Perron			Zivot-Andrews		
	T <sub>B</sub>	Lag	t <sub>τ</sub>	T <sub>B</sub>	Lag	t <sub>τ</sub>
LLP	2008M1	1	-3.868*	2008M2	4	-3.539*
CON	2006M8	1	-3.828*	2006M9	2	-3.867*
INV	2006M8	1	-3.988*	2006M9	1	-4.010*
DGDP	2006M12	4	-3.963*	2007M1	4	-3.973*
UN	2008M12	1	-7.393*	2008M12	1	-7.355*
CPI	2007M7	0	-2.443*	2007M7	1	-4.074*
M2	2006M11	4	-3.606*	2006M12	4	-3.633*
EUR3M	2008M10	1	-4.710*	2008M11	1	-4.690*
LOAN	2008M1	2	-3.442*	2008M2	2	-3.692*

Note: (\*), (\*\*) and (\*\*\*) imply 1%, 5% and 10% significance level; T<sub>B</sub> denotes the estimated break date.

### III. Results for the Greek crisis indicators

**Table C5** Unit root tests of the Greek crisis indicators

Variables	ADF		PP		KPSS	
	Levels	First Dif.	Levels	First Dif.	Levels	First Dif.
LLPGR	3.956	-1.266	1.617	-6.430*	0.276	0.162**
GR10Y	0.630	-1.950	1.982	-11.983*	0.257*	0.160**
SPGRD	3.668	-3.307***	1.674	-11.707*	0.238	0.146**

Notes:

- (\*), (\*\*) and (\*\*\*) imply the 1%, 5% and 10% level of significance.
- ADF stands for the Augmented Dickey-Fuller test, PP for the Phillips-Perron test, and KPSS for the Kwiatkowski, Phillips, Schmidt, and Shin test.

**Table C6** Unit root tests with structural break of the Greek crisis indicators

Variables	Perron			Zivot-Andrews		
	T <sub>B</sub>	Lag	t <sub>r</sub>	T <sub>B</sub>	Lag	t <sub>r</sub>
LLPGR	2008M8	4	-5.196*	2008M6	4	-5.012***
GR10Y	2009M6	0	-3.774*	2009M6	1	-2.596*
SPGRD	2009M7	4	-2.602*	2009M7	4	-2.337*

Notes: (\*), (\*\*) and (\*\*\*) imply 1%, 5% and 10% significance level; T<sub>B</sub> denotes the estimated break date.

## Appendix D: Results of the OLS univariate and GMM multivariate regressions

### I. Results for Bulgaria

**Table D1** Summary of the univariate regressions for Bulgaria

	Expected Sign	Regression on current factor $X_t$			Regression on lagged factor $X_{t-s}(s=1...12)$			
		Coefficient	t-statistic	R <sup>2</sup>	Coefficient	t-statistic	R <sup>2</sup>	Lags
Macroeconomic variables								
CON	-	0.000	-1.346	0.01	-0.002	-4.543	0.16	6
IPI	-	-0.001	-4.482	0.15	-0.001	-5.771	0.23	6
UN	+	0.004	4.686	0.16	0.004	4.825	0.17	3
REEL	-	0.001	-1.864	0.01	-0.001	-1.951	0.03	3
Monetary variables								
M2	-	-3.231	-2.629	0.05	-2.977	-2.445	0.05	4
Interest rate variables								
EUR	+	-0.000	-0.099	0.00	-0.003	-2.545	0.05	9
Bank-specific variables								
LOAN	+/-	-0.049	-4.751	0.16	-0.037	-3.568	0.10	6
Greek crisis variables								
LLPGR	+	0.032	1.131	0.01	0.033	1.041	0.03	3
SPGRD	+	0.069	0.862	0.10	0.101	0.563	0.02	3

Notes:

- The table presents all the statistically significant variables up to 10% level of significance, except for two proxies of the Greek crisis shown for informative purposes.
- The indicator UN is also significant at lags 9,10 and 12.

**Table D2** Serial correlation for the multivariate model of Bulgaria

Breusch-Godfrey LM Test			
F-statistic	0.938	Probability	0.395
Obs*R-squared	2.040	Probability	0.361

**Table D3** Summary of the GMM results for Bulgaria

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Dependent Variable: NPL

Method: Generalized Method of Moments

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Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.017	0.019	0.839	0.404
NPL(-1)	-0.329	0.144	-2.282	0.025
CON (-6)	-0.005	0.004	-1.081	0.283
IPI	-0.012	0.005	-2.072	0.041
UN	0.065	0.024	2.612	0.010
REEL(-3)	-0.020	0.011	-1.693	0.093
LOAN	-1.059	0.310	-3.410	0.001
DUMMY (FINANCIAL CRISIS)	0.051	0.028	1.834	0.070
DUMMY (2006)	0.042	0.019	2.132	0.036

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R-squared	0.336	Mean dependent var	0.001
Adjusted R-squared	0.292	S.D. dependent var	0.002
S.E. of regression	0.002	Sum squared resid	0.001
Durbin-Watson stat	2.493	J-statistic	5.098
Instrument rank	16	Prob(J-statistic)	0.747

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The numbers in parentheses indicate the number of lags in months of the respective variables used in the model.

## II. Results for Bulgaria

**Table D4** Summary of the univariate regressions for Romania

	Expected Sign	Regression on current factor $X_t$			Regression on lagged factor $X_{t-s}(s=1...12)$			
		Coefficient	t-statistic	R <sup>2</sup>	Coefficient	t-statistic	R <sup>2</sup>	lag(s)
Macroeconomic variables								
CON	-	-0.005	3.15	0.09	-0.004	2.58	0.06	12
INV	-	-0.005	3.13	0.09	-0.003	2.33	0.04	12
DGDP	-	-0.002	4.59	0.17	0.02	3.90	0.13	3
UN	+	-0.001	1.98	0.04	-0.001	3.75	0.13	12
TCON	-	-0.005	2.66	0.06	-0.004	2.26	0.05	1
CPI	-	-0.001	5.67	0.23	-0.001	4.86	0.19	3
TB	-	-0.001	2.64	0.06	-0.001	3.06	0.09	12
Monetary variables								
M1	-	-0.006	2.99	0.08	-0.005	2.68	0.07	3
M2	-	-0.013	2.96	0.08	-0.01	2.50	0.06	3
Interest rate variables								
EUR3	+	-0.003	3.51	0.10	-0.003	3.46	0.11	3
Bank-specific variables								
LOAN	+/-	-0.032	5.16	0.2	-0.02	4.10	0.14	3
Greek crisis variables								
LLPGR	+	0.46	2.66	0.06	0.40	2.10	0.04	3
SPGRD	+	0.01	3.24	0.09	0.01	3.00	0.08	3
GR10Y	+	0.01	2.45	0.05	0.01	3.50	0.10	1
ECB Reliance Index I	+/-	0.04	1.71	0.03	0.07	3.87	0.13	3

Notes:

- The table presents all the statistically significant variables up to 10% level of significance.
- The indicator spread SPGRD is also significant at lag 1.

**Table D5** Serial correlation test for the multivariate model of Romania

Breusch-Godfrey LM Test			
F-statistic	0.883	Probability	0.418
Obs*R-squared	1.959	Probability	0.375

**Table D6** Summary of the GMM results for Romania

Dependent Variable: LLP				
Method: Generalized Method of Moments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000	0.002	0.318	0.751
CPI	-0.000	0.000	-0.773	0.441
UN	0.001	0.000	1.993	0.050
CON	-0.001	0.000	-4.459	0.000
INV(-12)	-0.000	0.000	-0.169	0.866
DGDP (-3)	0.019	0.006	3.021	0.203
M2	-0.013	0.007	-1.839	0.069
LLPGR	0.546	0.212	2.571	0.012
SPGRD (-1)	0.003	0.001	2.362	0.020
R-squared	0.516	Mean dependent var		0.001
Adjusted R-squared	0.469	S.D. dependent var		0.002
S.E. of regression	0.001	Sum squared resid		0.000
Durbin-Watson stat	2.066	J-statistic		11.521
Instrument rank	19	Prob(J-statistic)		0.318

The numbers in parentheses indicate the number of lags in months of the respective variables used in the model.

## Appendix E: Results of the cointegration analysis

### I. Results for Bulgaria

**Table E1** The estimated ARDL(1,1,0,0,0) model for Bulgaria

Dependent Variable: NPL		
Explanatory Variable	Coefficient	t-ratio
NPL(-1)	0.836	18.944
LOAN	-0.015	-1.852
LOAN(-1)	0.023	2.996
UN	0.001	3.741
CON	0.001	-4.215
LLPGR	0.143	1.137
C	-0.185	-3.934
SHOCK	0.005	4.255
Adjusted R <sup>2</sup> =.994		F(7,98)=2489.4

Notes:

- The model was selected based on the Schwarz Bayesian Criterion.
- With the exception of LLPGR, all coefficients are significant at 1% significance level.

**Table E2** Diagnostic Tests for the ARDL(1,1,0,0,0) model for Bulgaria

Diagnostic Tests				
	LM Version Statistic	p-value	F Version Statistic	p-value
Serial Correlation	X <sup>2</sup> (12)=8.494	0.745	F(12, 86) = 0.624	0.816
Functional Form	X <sup>2</sup> (1)=1.846	0.174	F(1, 108)=1.719	0.193
Heteroskedasticity	X <sup>2</sup> (1)= 0.066	0.798	F(1, 104)=0.065	0.800

**Table E3** Summary results from Johansen cointegration (VECM) and diagnostic tests for Bulgaria.

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized	Max-Eigen	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.331	42.620	33.876	0.003
At most 1	0.190	22.375	27.584	0.201

Max-eigenvalue test indicates 1 cointegrating equation at the 0.05 level.

\* denotes rejection of the hypothesis at the 0.05 level.

\*\*MacKinnon-Haug-Michelis (1999) p-values.

Cointegrating Equation                      Log likelihood 1624.4

Normalized cointegrating coefficients (standard error in parentheses)

NPL	LLOAN	UN	CONS	LLPGR
1.000	-0.075	-0.828	0.001	-0.420
	(-5.039)	(-4.831)	(5.320)	(-0.719)

t-statistics in parentheses.

Based on the Schwarz Bayesian Criterion, the order of VAR was chosen 1.

Error Correction:	-0.156
	(0.023)
	[-6.780]
R-squared	0.590
Adj. R-squared	0.561
Sum sq. resids	0.000
S.E. equation	0.002
F-statistic	20.224
Equation Log-likelihood	529.340

Standard errors in ( ) & t-statistics in [ ].

Diagnostic Tests

	LM Version	p-value	F Version	p-value
	Statistic		Statistic	
Serial Correlation	$X^2(12)=10.419$	0.579	$F(12, 103)=0.824$	0.626
Functional Form	$X^2(1)=18.650$	0.000	$F(1, 114)=21.19$	0.000
Heteroskedasticity	$X^2(1)= 0.918$	0.338	$F(1, 117)=0.909$	0.342



## II. Results for Romania

**Table E4** The estimated ARDL (1,1,0,0) model for Romania

Dependent Variable: LLP		
Explanatory Variable	Coefficient	t-ratio
LLP(-1)	0.702	8.217
LLPGR	2.097	6.969
LLPGR(-1)	-1.246	-3.032
LM2	-0.004	3.172
LOAN	0.004	3.207
C	0.003	2.830
UN	-0.001	1.499
Adjusted R <sup>2</sup> = 0.96		F(6,79)= 911.1

Note: The model is selected based on the Schwarz Bayesian Criterion and is estimated using White's heteroskedasticity adjusted standard errors.

**Table E5** Diagnostic Tests for the ARDL (1,1,0,0) model for Romania

Diagnostic Tests				
	LM Version Statistic	p-value	F Version Statistic	p-value
Serial Correlation	X <sup>2</sup> (12)=18.151	0.111	F(12, 67) = 1.494	0.149
Functional Form	X <sup>2</sup> (1)= 0.271	0.602	F(1, 78)=0.247	0.620
Heteroskedasticity	X <sup>2</sup> (1)= 22.516	0.000	F(1, 84)= 29.793	0.000

**Table E6** Summary results from Johansen cointegration (VECM) and diagnostic tests for Romania.

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.287	35.483	27.584	0.000
At most 1	0.135	15.188	21.132	0.276

Max-eigenvalue test indicates 1 cointegrating equation at the 0.05 level.

\* denotes rejection of the hypothesis at the 0.05 level.

\*\*MacKinnon-Haug-Michelis (1999) p-values.

Cointegrating Equation                      Log likelihood 1572.0

Normalized cointegrating coefficients (standard error in parentheses)

LLP	LLPGR	M2	LOAN	UN
1.000	3.201	-0.019	0.015	-0.002
	(13.225)	(-3.591)	(5.909)	(-11.582)

t-statistics in parentheses.

Based on the Schwarz Bayesian Criterion, the order of VAR was chosen 1.

Error Correction:	-0.276
	(0.027)
	[-10.193]
R-squared	0.536
Adj. R-squared	0.530
Sum sq. resids	0.000
S.E. equation	0.002
F-statistic	103.901
Equation Log-likelihood	512.480

Standard errors in ( ) & t-statistics in [ ].

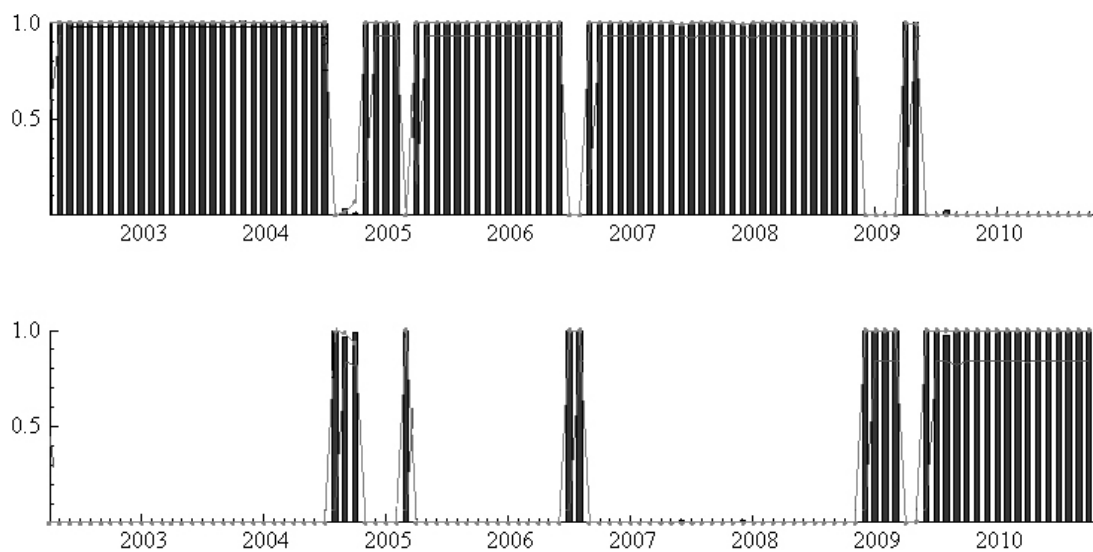
Diagnostic Tests

	LM Version Statistic	p-value	F Version Statistic	p-value
Serial Correlation	$X^2(12)=11.508$	0.486	$F(12, 78)=0.863$	0.587
Functional Form	$X^2(1)=7.176$	0.007	$F(1, 89)=7.528$	0.007
Heteroskedasticity	$X^2(1)= 2.761$	0.097	$F(1, 90)=2.784$	0.099

## Appendix F: Results of the Markov switching and the time varying SVAR models

### I. Results for Bulgaria

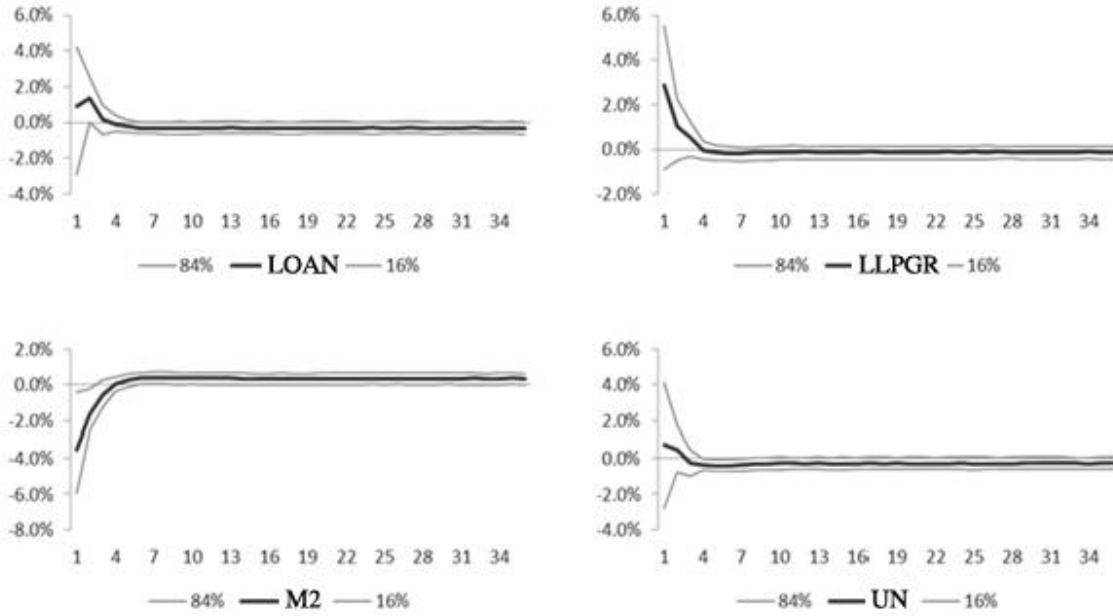
**Figure F1** Filtered Probabilities for regimes 1 and 2 in Bulgaria



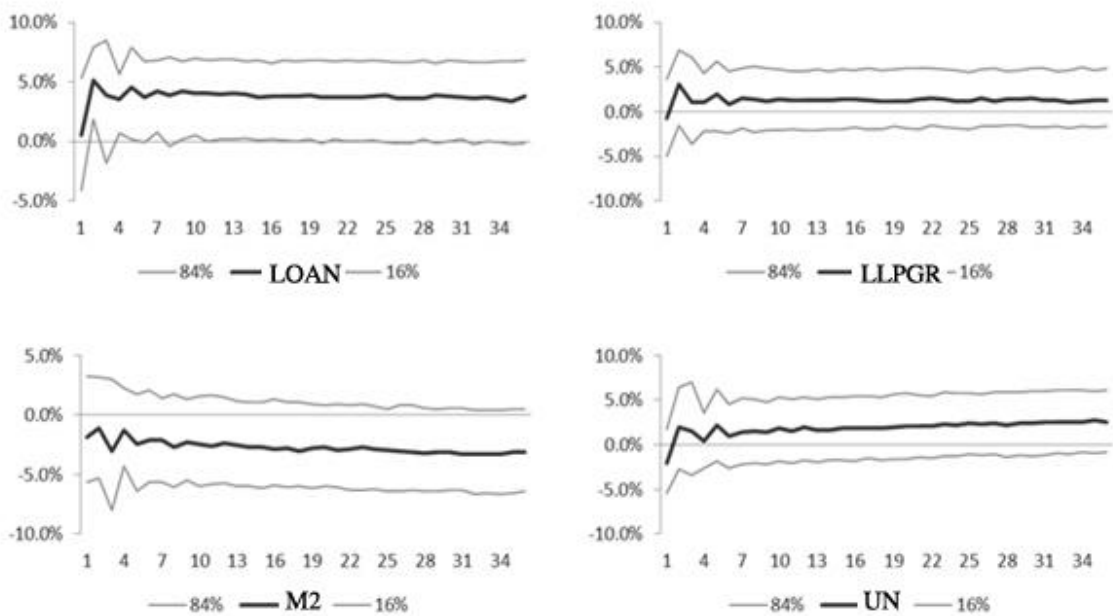
Note: The upper plot presents the filter probabilities for regime 1 (low volatility) and the one below presents the filter probabilities for regime 1 (high volatility).

**Figure F2** Impulse responses in regimes 1 and 2 of the MS-SVAR model for Bulgaria

## Regime 1



## Regime 2



**Table F3** Timing of the break dates as suggested by each of the break tests for Bulgaria

	ASC <sub>1</sub>	ASC <sub>2</sub> <sup>BT</sup>	ASC <sub>2</sub> <sup>QS</sup>	ASC <sub>2</sub> <sup>VH</sup>	KL <sub>BT</sub>	KL <sub>QS</sub>	KL <sub>VH</sub>	LMT	Adopted
NPL	-	-	-	-	-	-	-	-	2006M06
LOAN	-	-	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-	-	-
UN	2008M11	2008M11	2008M11	-	2008M11	2008M11	-	2008M11	2008M11
LLPGR	2008M11	-	2008M11	-	-	2008M11	-	2008M11	2008M11

Note: The shaded areas denote statistical significance at 5% level of significance; otherwise the statistical significance is at 1% level. The 2006M06 break date is adopted to capture the policy measures introduced by BNB.

**Table F4** Tests for the equality of mean and variance of two contiguous segments for Bulgaria

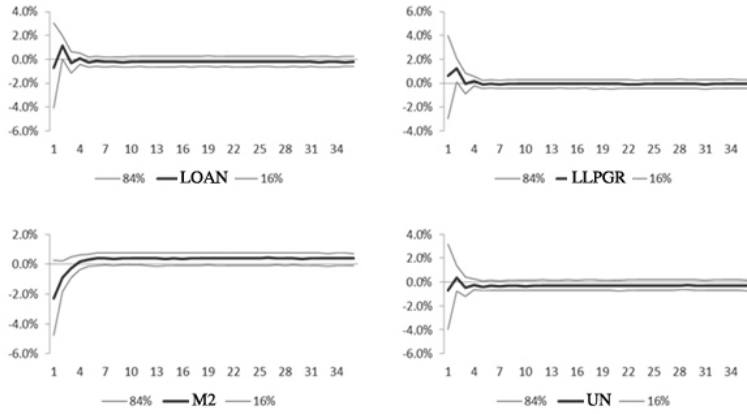
Variable	Segments	t-test	Satterthwaite-Welch t-test	F-test	Siegel-Tukey	Bartlett	Levene	Brown-Forsythe
NPL	1 & 2	-1.90*	-1,59	3.76***	2.06**	16.29***	0	0,02
NPL	2 & 3	-4.94***	-5.00***	1,37	1,17	0,59	1,86	2,1
LOAN	1 & 2	-0,61	-0,77	6.68***	0,01	23.73***	1,53	1,46
LOAN	2 & 3	11.29***	11.92***	5.53***	0,73	15.38***	25.15***	23.58***
M2	1 & 2	-0,31	-0,35	2.01**	1,07	3.90**	1,53	1,35
M2	2 & 3	2.81***	2.90***	2.41**	0,84	4.46**	2,58	2,62
UN	1 & 2	1.77*	1.79*	1,09	0,84	0,07	0,13	0,14
UN	2 & 3	-10.22***	-10.09***	1,4	0,76	0,69	0,44	0,07
LLPGR	1 & 2	1.71*	1.72*	1,03	0,07	0,01	0,04	0,03
LLPGR	2 & 3	-3.71***	-3.72***	1,13	1,11	0,09	0,27	0,17

Notes:

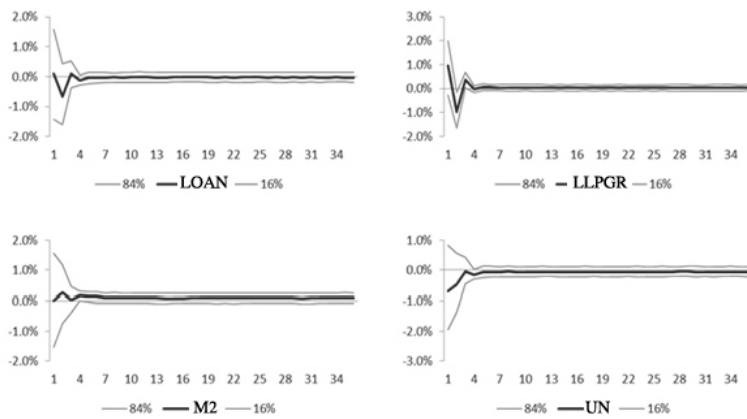
- The second column presents the contiguous segments under test.
- The third and fourth columns present the test statistics on the equality of means of the two contiguous segments on the basis of the standard t-test and the Satterthwaite-Welch t-test. The following five columns present the statistics of the tests on the equality of variances of two contiguous segments on the basis of the standard F-test, the Siegel-Tukey, the Bartlett, Levene, and the Brown-Forsythe tests.
- (\*), (\*\*) and (\*\*\*) indicate statistical significance at 10%, 5% and 1% level respectively.

**Figure F5** Impulse responses in segments 1-3 of the SVAR model for Bulgaria

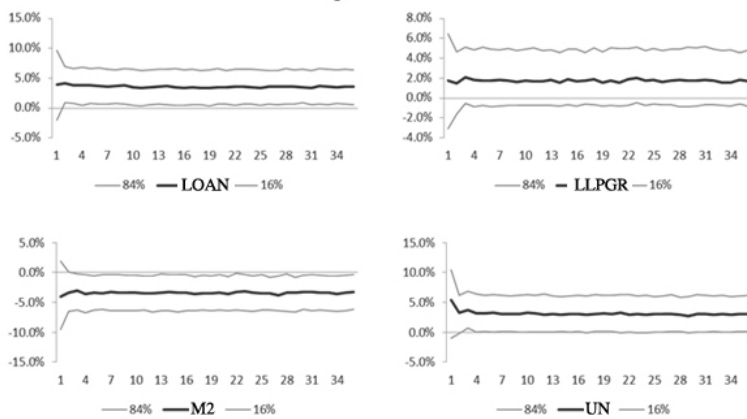
### Segment 1



### Segment 2

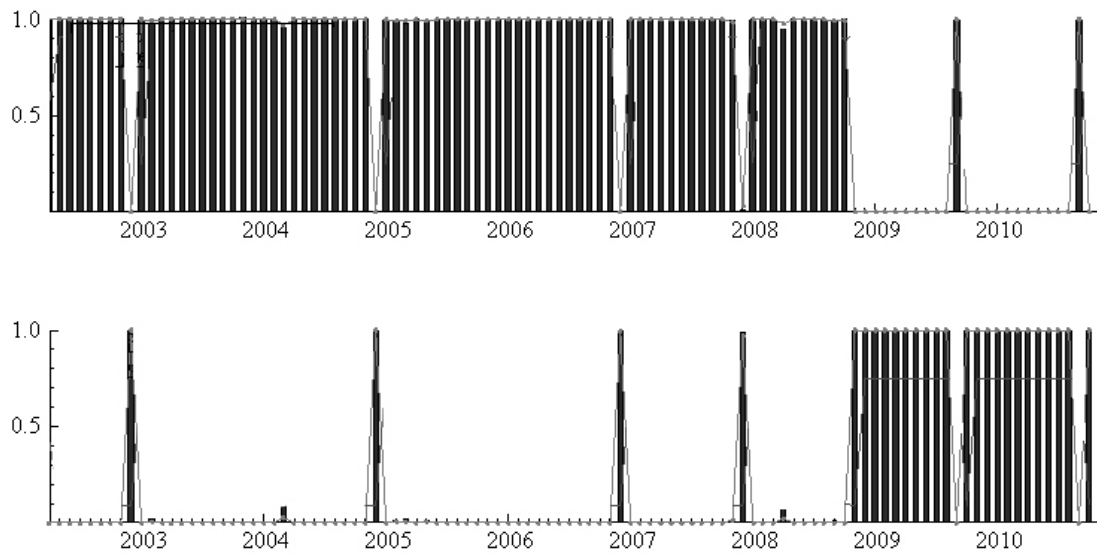


### Segment 3



## II. Results for Romania

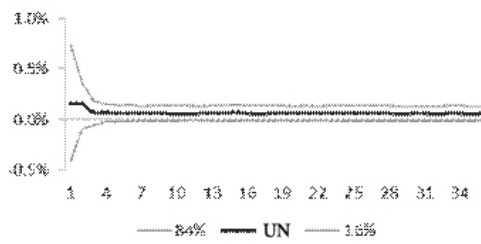
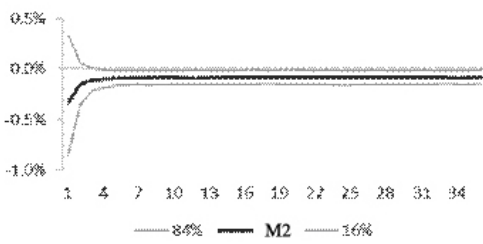
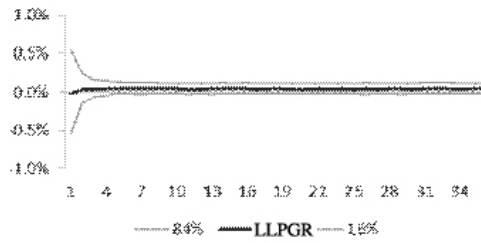
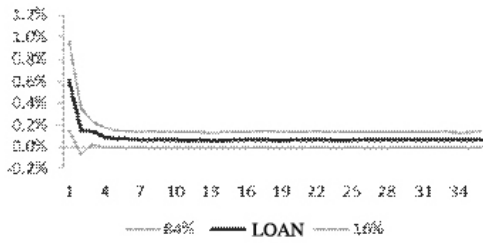
**Figure F6** Filtered Probabilities for regimes 1 and 2 in Romania



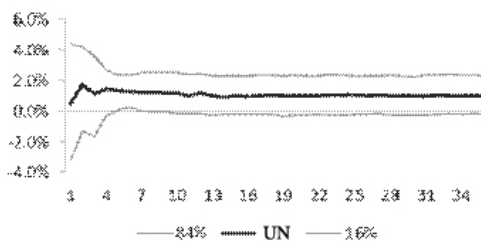
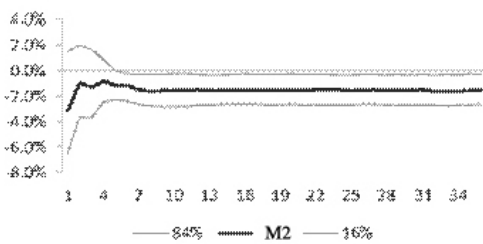
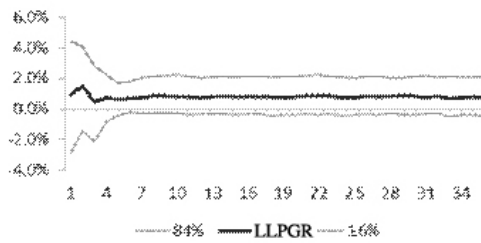
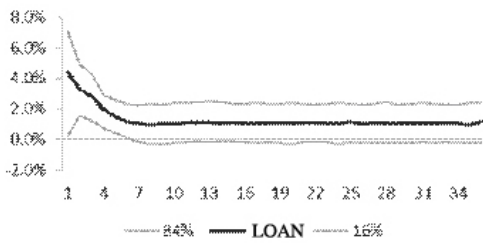
Note: The upper plot presents the filter probabilities for regime 1 (low volatility) and the one below presents the filter probabilities for regime 1 (high volatility).

**Figure F7** Impulse responses in regimes 1 and 2 of the MS-SVAR model for Romania

### Regime 1



### Regime 2





**Table F8** Timing of the break dates as suggested by each of the break tests for Romania

Variable	ASC <sub>1</sub>	ASC <sub>2</sub> <sup>BT</sup>	ASC <sub>2</sub> <sup>QS</sup>	ASC <sub>2</sub> <sup>VH</sup>	KL <sub>BT</sub>	KL <sub>QS</sub>	KL <sub>VH</sub>	LMT	Adopted
LLP	2008M11	2008M11	2008M11	-	2008M11	2008M11	-	2008M11	2008M11
LOAN	-	-	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-	-	-
UN	-	-	-	-	-	-	-	-	-
LLPGR	2008M11	-	2008M11	-	-	2008M11	-	2008M11	2008M11

Note: The shaded areas denote statistical significance at 5% level of significance; otherwise the statistical significance is at 1% level.

**Table F9** Tests for the equality of mean and variance of two contiguous segments for Romania

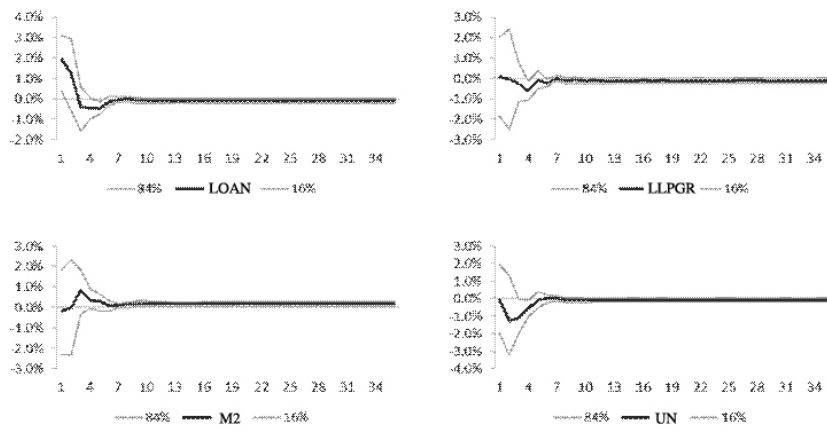
Variable	Segments	t-test	Satterthwaite-Welch t-test	F-test	Siegel-Tukey	Bartlett	Levene	Brown-Forsythe
LLP	1 & 2	-2.67***	-2.00*	2.86**	3.40***	8.22***	10.33***	8.90***
LLP	2 & 3	-10.52***	-7.39***	6.81***	4.72***	35.60***	26.38***	17.72***
LOAN	1 & 2	-2.37**	-2.48**	1,17	0,12	0,15	0,01	<0.01
LOAN	2 & 3	6.20***	6.72***	1,44	0,89	1,02	2,15	1,75
M2	1 & 2	-1.73*	-1,63	1,23	0,33	0,28	0,03	0,03
M2	2 & 3	2.84***	3.62***	3.21***	1,33	9.15***	4.53**	4.51**
UN	1 & 2	-2.59**	-2.23**	1,69	0,54	1,89	0,63	0,66
UN	2 & 3	-3.71***	-3.59***	1,16	1,55	0,18	0,02	0,03
LLPGR	1 & 2	-1.71*	-1,37	2.20*	2.13**	4.44**	4.48**	3.75*
LLPGR	2 & 3	-7.22***	-4.52***	47.15***	4.82***	130.44***	29.05***	25.70***

Notes:

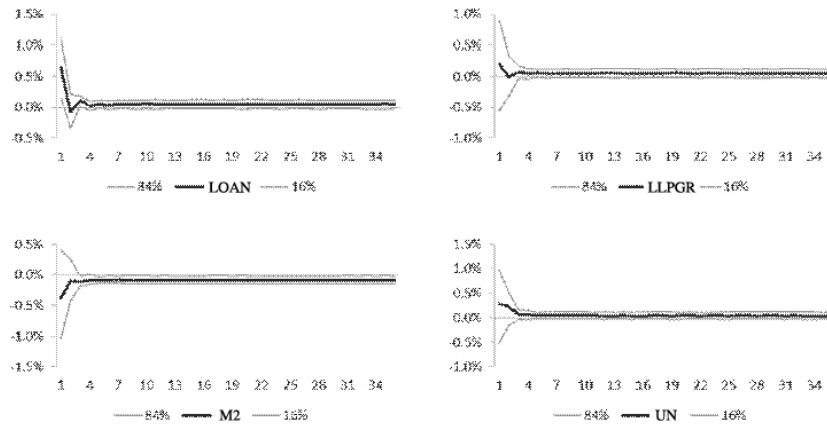
- The second column presents the contiguous segments.
- The third and fourth columns present the test statistics on the equality of means of two contiguous segments on the basis of the standard t-test and the Satterthwaite-Welch t-test. The following five columns present the statistics of the tests on the equality of variances of two contiguous segments on the basis of the standard F-test, the Siegel-Tukey, the Bartlett, Levene, and the Brown-Forsythe tests.
- (\*), (\*\*) and (\*\*\*) indicate statistical significance at 10%, 5% and 1% level respectively.

**Figure F10** Impulse responses in segments 1-3 of the SVAR model for Romania

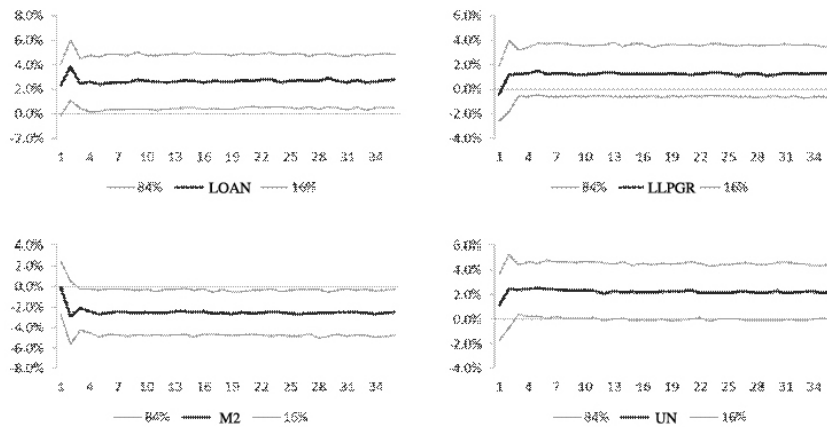
**Segment 1**



**Segment 2**



**Segment 3**



## Appendix G: List of publications and conference presentations

### 1. Chapters in monographs

Nikolaidou, E. and Vogiazas, S. (2013) Credit risk modelling in the Romanian banking system: evidence from an ARDL model. In Karasavvoglou, A. and Polychronidou, P. (eds.) *Contributions to Economics: Balkan and Eastern European Countries in the Midst of the Global Economic Crisis*. Springer.

### 2. Articles in international journals

- a. Vogiazas, S. and Nikolaidou, E. (2011) Investigating the determinants of non-performing loans in the Romanian banking system: An empirical study with reference to the Greek crisis. *Economic Research International Journal*, Vol. 2011, Article 214689, doi: 10.1155/2011/214689. Cited in *Focus on European Economic Integration Q3/13*, Austrian Central Bank (OeNB).
- b. Vogiazas, S. and Nikolaidou, E. (2012) A review on the origins of past banking crises. Are there any lessons for the Greek banks in the South East European region? *Economics and Finance Notes*, 1(1).
- c. Nikolaidou, E. and Vogiazas, S. (2014) Credit risk determinants for the Bulgarian banking system. *International Advances in Economic Research*, doi 10.1007/s11294-013-9444-x. Springer.

### 3. Articles in conference proceedings

- a. Vogiazas, S. (2010) Is there an exit strategy for Greek banks in the SEE? Preliminary evidence and lessons learnt from past banking crises. Paper presented at the 5<sup>th</sup> *South East European Doctoral Conference*, SEERC, 13-14 September, Thessaloniki, Greece.
- b. Vogiazas, S. and Nikolaidou, E. (2011) Investigating the deterministic factors of non-performing loans: Evidence from the Romanian banking system. Paper presented at the 3<sup>rd</sup> *International Conference on 'The Economies of Balkan and Eastern Europe Countries in the changed world'*, EBEEC, 5-8 May, Pitesti, Romania.
- c. Vogiazas, S. and Nikolaidou, E. (2011) Does the Greek crisis influence the Bulgarian banking system? An Empirical investigation of the factors that affect Bulgaria's non-performing loans. Paper presented at the *Conference on 'The banking system under the global financial crisis'*, VUZF University, 27<sup>th</sup> May 2011, Sofia, Bulgaria.

- d. Vogiazas, S., Nikolaidou, E, and Mouratidis, K. (2011) Investigating the determinants of non-performing loans in the Romanian banking system: an empirical study with reference to the Greek crisis. Paper presented at the *6<sup>th</sup> South East European Doctoral Conference*, SEERC, 19-20 September, Thessaloniki, Greece.
- e. Vogiazas, S. and Nikolaidou, E. (2011) Credit risk determinants in the Bulgarian banking system and the Greek twin crises. Paper presented at the *MIBES International Conference*, 16-18 September 2011, Serres, Greece.
- f. Nikolaidou, E. and Vogiazas, S. (2012) ARDL Modeling of Credit Risk in the Romanian Banking System. Paper presented in the *2<sup>nd</sup> Annual Sheffield Joint Doctoral Conference*, 22-23 May 2012, Sheffield, UK.
- g. Nikolaidou, E. and Vogiazas, S. (2012) Credit Risk Determinants in the Bulgarian Banking System. Paper presented at the *7<sup>th</sup> South East European Doctoral Conference*, SEERC, 24-25 September, Thessaloniki, Greece.
- h. Nikolaidou, E. and Vogiazas, S. (2013) Non-performing loans in the Bulgarian banking system: evidence from ARDL modelling. Paper presented at the *5<sup>th</sup> International Conference on 'The Economies of Balkan and Eastern Europe Countries in the changed world'*, EBEEC, 9-12 May, Istanbul, Turkey.