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Assessing Banking Sector Stability with Special Reference to Montenegro and Central and Eastern Europe

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Abstract

The aim of this research is to investigate the main weaknesses of the banking sector in Montenegro and, more generally, in Central and Eastern Europe. By contributing to the understanding of banking sector fragility, we seek to help regulatory authorities craft more effective regulations and policy interventions in order to minimize the costs that could arise from banking instability. The review of previous research suggests that an increase in the incidence of non-performing loans indicates increasing fragility of the banking sector and/or the lack of efficient banking supervision. Thus, the ratio of non-performing loans is taken as the key indicator of banking vulnerability. To examine the determinants of non-performing loans we use data at the individual bank level. We investigate whether in these countries the ratio of non-performing loans is driven predominantly by macroeconomic developments (i.e. similar factors to those recognized in the theory of financial crises) or by transition-specific factors, such as inadequate risk-assessments, the high risk appetite of banks' management and the high concentration in the banking sector. This empirical analysis initially focuses on the sensitivity of the ratio of non-performing loans to macroeconomic and bank-specific factors in Montenegro. Subsequently, the analysis is extended to Central and East European countries. Bearing in mind the large presence of foreign banks in these countries, a particular feature of this analysis is that non-performing loans are modelled to capture differences between banks based on ownership structure. In order to account for time persistence in the structure of non-performing loans, a dynamic panel approach is used. However, in the Montenegrin model, given that the lack of cross sectional units precludes GMM Estimators, we investigate the use of FE estimation adjusted to take account of dynamic misspecification. The empirical findings suggest that strong performance in the real economy results in a lower ratio of non-performing loans but there is also a significant positive effect of past rapid loans growth in the second year after the end of the credit boom. The latter finding suggests that aggressive lending coincides with more reckless risk taking. Moreover, the empirical evidence suggests that some bank-specific features, which reflect banks' management policies, affect the evolution of non-performing loans. The multi-national study suggests that foreign banks are likely to have lower ratios of non-performing loans. Based on our findings, regulatory authorities should expand their monitoring framework to include both macroeconomic and bank-specific indicators when assessing the stability of the banking system. In addition, regulators should be more concerned about any loosening of bank lending criteria in an upturn, since our results suggest a delayed effect of loans growth on the incidence of non-performing loans.

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List of Abbreviations

AMA	-	Advanced Measurement Approach
AMCs	-	Asset Management Companies
AR	-	Autoregressive Structure
BCBS	-	Basel Committee on Banking Supervision
BIS	-	Bank for International Settlements
CAD	-	Current Account Deficits
CAP	-	Capital Adequacy Ratio
CBM	-	Central Bank of Montenegro
CDOs	-	Collateralized Debt Obligation
CEBS	-	Committee of European Banking Supervisors
CEE	-	Central Eastern Europe
CRF	-	Common Factor Restrictions
CH	-	Switzerland
CIR	-	Cost to income ratio
CIS	-	Commonwealth of Independent States
CR	-	Credit growth rate
CRD	-	Capital Requirement Directive
DEBT	-	Public debt
DLRM	-	Dynamic Linear Regression Model
EAD	-	Exposure at default
EBA	-	EBA European Banking Authority
EBRD	-	European Bank for Reconstruction and Development
EC	-	European Commission
ECB	-	European Central Bank
EIB	-	European Investment Bank
ESRB	-	European Systemic Risk Board
EU	-	European Union
EU-15	-	Member States of the European Union as of December
EUR	-	Euro
EWS	-	Early Warning Systems
EXCR	-	Exchange rate
FDI	-	Foreign direct investment
FE	-	Fixed Effects
FSA	-	Financial Services Authority
FSAPs	-	The Financial Sector Assessment Program
FX	-	Foreign Exchange
GCC	-	Gulf Cooperation Council
GDP	-	Gross Domestic Product

GFC	-	Global Financial Crisis
GFDR	-	Global Financial Development Report
GMM	-	General Methods of Moments
IIF	-	Institute for International Finance
IMF	-	International Monetary Fund
INF	-	Inflation rate
INTER	-	Interest rate
IRB	-	Internal Rating-Based
LCR	-	Liquidity Coverage Ratio
LGD	-	Loss given default
LIBOR	-	London Interbank Offered Rate
LTCM	-	Long-Term Capital Management
LtD	-	Loans to deposit ratio
LTROs	-	Long-term refinancing operations
MFIC	-	Montenegrin Foreign Investors Council
MPBS	-	Law on Measures for Protection of the Banking System
MSHARE	-	Market Share
NPLs	-	Ratio of Non-Performing Loans to Total Gross Bank Loans
NSFR	-	Net Stable Funding Ratio
OECD	-	Organisation for Economic Co-operation and Development
OGM	-	Official Gazette Montenegro
OLS	-	Ordinary Least Squares
PCA	-	Principal Components Analysis
PD	-	Probability of default
R&D	-	Research and Development
RE	-	Random Effects
ROA	-	Return on Average Assets
ROE	-	Return on Average Equity
RU	-	Russia
RWAs	-	Risk-Weighted Assets
SCAP	-	Supervisory Capital Assessment Program
SEE	-	South-Eastern Europe
SIV	-	Structured Investment Entities
SPV	-	Special Purpose Vehicle
TR	-	Turkey
UK	-	United Kingdom
UNEMP	-	Unemployment rate
US	-	United States
USD	-	United States, Dollars
VAT	-	Value Added Tax

VI	-	Vienna Initiative
WB	-	WB World Bank
WEO	-	WEO World Economic Outlook

Acknowledgements

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CHAPTER 1: Recent Economic Development in Montenegro with Special Reference to Banking Sector Stability

Contents:

1.1 Introduction

This Chapter provides an assessment of the main characteristics and developments of the Montenegrin banking sector, which are important for the analysis of the stability of the banking sector in Montenegro. The stock and money markets are still in their infancy, thus the banking sector has a dominant role in the financial system in Montenegro. Banks are the primary source of funding for all sectors of the economy. The banking sector is mostly foreign owned. It is frequently argued that a stable and efficient banking sector helps to accelerate economic growth. Banking stability in Montenegro is necessary not only to promote internal stability but also to attract the inflow of the foreign direct investment and the development of small and medium enterprises necessary for the convergence to the EU's level of per capita GDP. Given the nature of the empirical analysis undertaken in the research programme reported in this thesis, the emphasis in this Chapter is on developments from 2004 to 2010, though more recent data is utilised when available.

The Chapter starts with a review of macroeconomic indicators of the Montenegrin economy (Section 1.2) followed by an analysis of the conditions in the money market (Section 1.3). Section 1.4 focuses on the banking sector, examining the degree of concentration and competition, the structure of banks' assets and liabilities, and their exposures to credit, liquidity and market risk. Section 1.5 analyses the role of the Montenegrin Central Bank and its influence on the Montenegrin economy. Section 1.6 examines the need for a stable banking system in Montenegro, while in Section 1.7 an initial comparison is made with banking sector developments elsewhere in Central and Eastern Europe. Finally, the Chapter concludes with section 1.8, which explains the main objectives of this research programme.

1.2 The Montenegrin Macroeconomic Environment[1]

Montenegro is a small and open economy. After a relatively low GDP growth rate in the first years of this millennium, during the three-year pre-crisis period Montenegro saw a remarkably accelerated economic growth with the average rate amounting to 8.7 per cent. The main factors that contributed to this rapid economic growth were: the introduction of the euro as official currency, privatization, trade liberalization and tax reform, the large inflows of foreign direct investment and the stable management of public finance. For example, in 2007 real GDP growth reached 10.7 per cent, the unemployment rate dropped to about 11 per cent, while average earnings increased by 30 per cent. In the same year, public spending accounted for 47 per cent of GDP, though the budget had a surplus of 6 per cent of GDP. In the same year, public debt was only about 27 per cent of GDP while the internal debt was about 14 per cent of GDP.

Table 1.1 Main macroeconomic indicators for Montenegro from 2004 to 2012

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012
Growth rate (%)	4.4	4.2	8.6	10.7	7.5	-5.7	2.5	3.2	-2.5
Inflation rate (%)	2.2	2.4	2.8	7.7	6.9	1.5	0.7	2.8	5.1
FDI Inflows (in thousand of Euro)	54,741	383,000	644,000	1,057,229	847,316	1,224,000	652,836	494,741	633,694
FDI Outflows (in thousand of Euro)	2,931	8,300	178,000	489,447	265,363	157,503	100,728	105,636	172,104
Net FDIs (in thousand of Euro)	51,810	374,700	466,000	567,782	581,952	1,066,497	552,107	389,104	461,590
Current account deficit (% of GDP)	-9.7	-9.1	31.1	-37.9	-47.7	-25.4	-20.0	-18.7	-14.7

Source: Monstat database and Central Bank of Montenegro

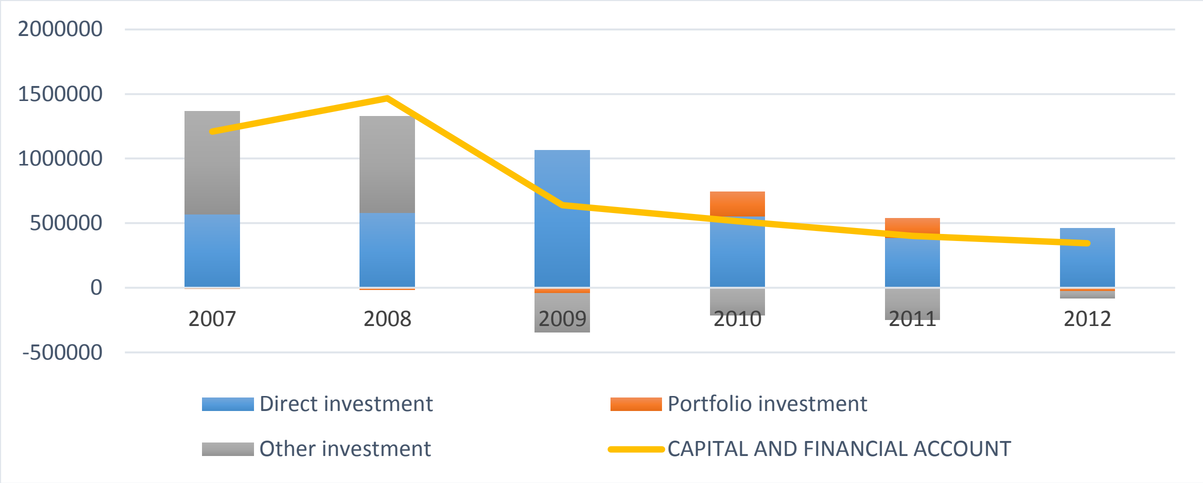
However, the crisis induced a decline in economic activity and the deterioration of almost every macroeconomic indicator. Industry is one of the branches which was most severely hit

[1] All data are provided by Statistical Office of Montenegro - MONSTAT and the Central Bank of Montenegro (CBM).

by the crisis. The crisis strongly hit the Montenegrin metal industry as well as the related mining industry. In addition to the inherited problems, these branches have faced increasing problems in placing their products in international markets.

The crisis adjustment became apparent in the behaviour of inflation which reached its record low 0.7 per cent in 2010. Namely, over the three-year pre-crisis period the inflation rate averaged almost 6 per cent, in part reflecting the high rates of economic growth. The global financial crisis induced a decrease in aggregate demand, both national and international, resulting in low rates of inflation worldwide. Substantial monetary and fiscal stimuli used globally to combat recession inevitably have affected Montenegro, so in the post-crisis period inflation in Montenegro was a result of price rises in energy and food products which Montenegro mainly imported. The inflation rate in 2006 amounted to less than 3 per cent, though in 2007 it increased to 7.7 per cent (see Table 1.1).

In 2007, Montenegro had a very high balance of payments deficit (44 per cent of GDP), which was a consequence of the faster growth in expenditure on imports compared to income from exports in the trade balance. The main causes of that large deficit in the trade balance were: accelerated economic growth and increased foreign direct investment; and, in import-dependent activities, increased openness together with weak competitive ability of the domestic economy (CBM, 2008). Namely, the accelerated economic growth meant higher FDIs, and higher FDIs stimulated a higher import of goods. The latter is explained by the fact that the most FDIs have been in tourism and real estate (construction), and those sectors required large imports of goods for their further development.



Source: CBM database

Figure 1.1 Capital and financial account in Montenegro from 2007 to 2012

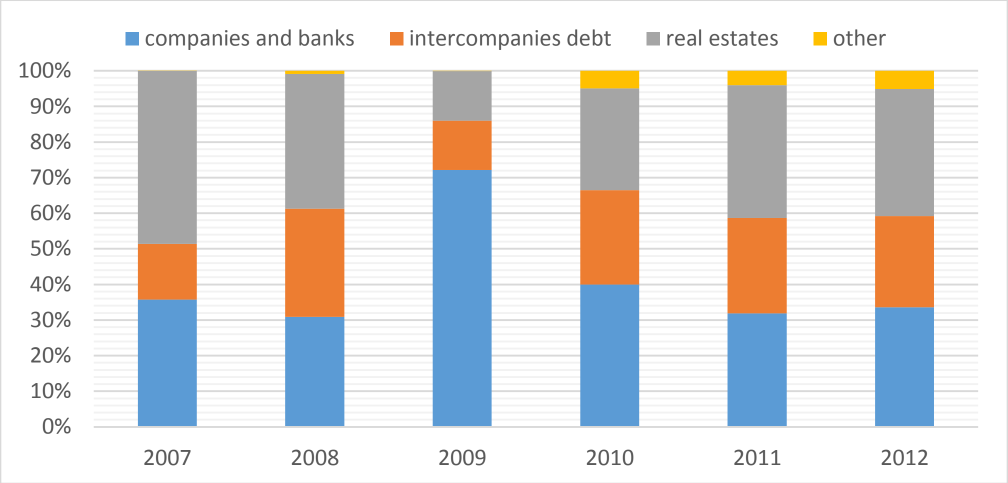
Furthermore, as shown in the Figure 1.1 in the 2007-2012 period the capital and financial account recorded net inflows as a result of net inflows of foreign direct investment sub-accounts. The portfolio sub-account recorded net outflows in all years except in 2010 and 2011, while the other investment sub-account recorded net outflows from 2009. Owing to euroization, the high level of external debt and large debt service requirements Montenegro is vulnerable to a slowdown in capital inflows and this requires the CBM to pursue a more prudent policy. Furthermore, given that Montenegro is a small country, even a relatively small shock may have a large impact on the economy. Thus, the CBM should enforce prudential norms, requiring sound capital buffers and take appropriate supervisory measures with problem banks. Bearing in mind the decline in the capital inflows and a large fall in external and domestic demand, significant external adjustment took place. Namely, the current account deficit was reduced by half between 2008 and 2010, even though imports contracted. However, in 2010 the capital account deficit was high at about 26 percent of GDP, as exports and tourism hardly recovered.

During 2006–2010, net FDI financed on average 70 per cent of the current account deficit, excluding the one-off inflows from the recapitalization and partial privatization of Montenegro's power utility in 2009. Access to capital was retained through foreign banks' increased financial support to their Montenegrin subsidiaries, which contributed to a rise in external debt. In terms of the share of FDIs in gross domestic product, which reached almost 25 per cent, Montenegro had the highest FDIs inflows in the region in 2007. Those FDIs have been concentrated in the growth-enhancing sectors of the economy. Factors which might have contributed to that high foreign direct investment inflows included privatization, the introduction of VAT at rates from 17 per cent (that was lower than in other countries of the region), low taxes on profits at only 9 per cent and reductions in other barriers to business. Those were all factors that made FDIs in Montenegro more attractive.

In 2008 the net inflow of foreign direct investment (inflow minus outflow) increased by about 8 per cent compared to the previous year, while the total FDI inflows in 2008 decreased by about 20 per cent compared to 2007, of which 99 per cent related to non-residents investing in Montenegro and 1 per cent concerned the withdrawal of assets invested abroad. Outflow of the foreign direct investment in 2008 was also reduced by 45 per cent compared to the previous year. Looking at the structure of the outflow, 63 per cent were related to real estate while the withdrawal of foreign equity shares in domestic banks and companies amounted for 10 per cent. In that period, investments of residents of Montenegro in the banks and companies were reduced and they participated in total outflow of FDI with 19 per cent. The remaining 8 per cent of total outflow of FDI was dedicated to the reduction in inter-company debt and the withdrawal of share capital invested in another domestic company. Net FDIs were increasing until 2010, when they fell by 48 per cent (see Table 1.1). Even though net FDIs had a drastic fall, there had been still a significant FDIs inflow considering that there were no major privatisations in 2010.

Analysing the structure of inflows by country of origin in 2008, inflows from the EU countries was 53.8 per cent of the total (the largest shares being from Cyprus[2] about 15.5 per cent and the UK about 8.3 per cent), while the largest investments from other countries come from the Russian Federation (15.1 per cent), Switzerland (7.9 per cent) and Serbia (5.2 per cent).

[2] Much of these inflows were suspected of being of Russian origin.



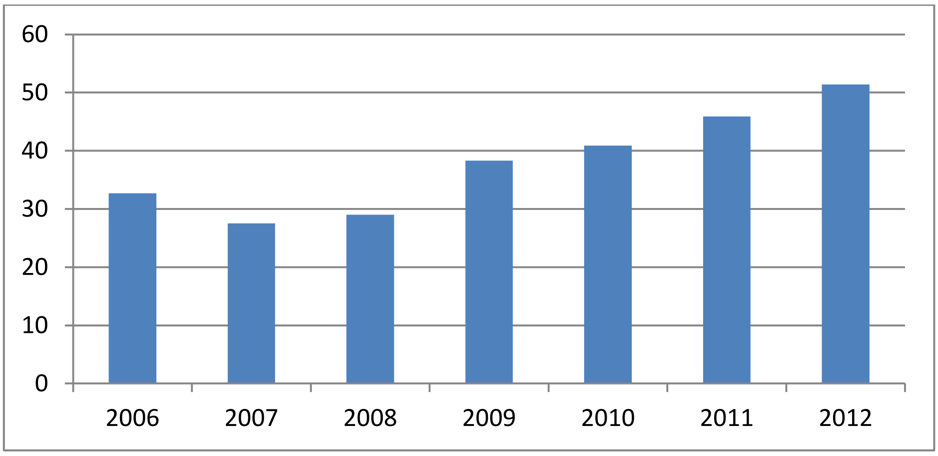
Source: CBM database

Figure 1.2 Structure of FDI inflows into Montenegro from 2008 to 2012

The structure of FDIs has improved a little from 2008. While investment in real estate has declined from 49% to 36% of total FDI, investment in companies and banks is more or less stabile (36% in 2007 and 34% in 2012). The decline of real estate in 2008 and 2009, was partly due to the smaller number of buyers from abroad, reduced supply of credit funds as a result of the crisis, and partly about the difficulties of registering land that emerged at the beginning of 2008. In addition, in 2008 foreign investments in local companies and banks amounted to 31 per cent less than the previous year. More diversified FDI has been noticed in 2010 and in later years. According to the CBM (2010) although Montenegro has not used all its potential to attract FDI, a new model of growth is required. The future development should be based on performance and competitiveness growth, international presence, and the further development of creativity and entrepreneurship.

The specificities of Montenegro, as small and open economy, indicate a large and volatile current account. For example, if any big project requires import of goods not locally produced, that may be quickly reflected in a build-up of current account deficits. The current account in the post-crisis period is lower than in the period before the crisis (see Table 1.1). However, this improvement in the balance of payments is not primarily the result of better competitiveness of the Montenegrin economy, but is rather due to global crisis and reduced domestic demand. According to the CBM (2010), the issue of competitiveness of the Montenegrin products in international market, both regarding their price and quality, remains a key problem that the economy will have to face in the future and require additional efforts to reduce the current account deficit.

Given that from 2008 the fiscal deficit increased, a fiscal adjustment has been necessary, in order to ensure macroeconomic stability. With the decrease of GDP of about five per cent in 2009, the fiscal deficit increased rapidly. In addition, fiscal revenues declined, mainly because of non-payment of taxes and the liquidity problems of mainly state owned companies. The end of the expansion phase turned budget surpluses into significant deficits, resulting in a rise in public debt, with the Government issuing Eurobonds to finance their needs. Altogether, reflecting also the Government's support for the restructuring of large enterprises in the real sector, public debt increased to 51 per cent of GDP by the end of 2012.



Source: CBM database

Figure 1.3 Public debts as a percentage of real GDP in Montenegro from 2006 to 2012

Delayed and slowly progressing structural reforms in the public sector, which started before the global financial crisis and have not yet been completed, have contributed to the rising share of public spending in GDP. This may be justified in the short term, because the supply side is not yet generating the growth and corresponding tax revenue to cover government spending. Conversely, high government spending is being used to offset the still lacklustre performance of the private sector. If the public sector debt is to be sustainable, then in the long run it may be necessary to stimulate the competitiveness of the economy by strengthening the supply side, in particular export capabilities.

Overall, the macroeconomic indicators show that Montenegro in the pre-crisis years achieved macroeconomic stability and rapid economic growth. That was particularly important given the recent political turbulence in the region (the war in former Yugoslavia, hyperinflation and economic sanctions). Comprehensive reforms and macroeconomic stability enabled the signing of a Stabilization and Association Agreement with the EU and the application for EU membership. With the highest per capita FDI in Europe and the diversified origin of that FDI, Montenegro has relied and will continue to rely on FDI as a major source of growth. Specifically, foreign investors have been interested in the implementation of capital projects in infrastructure (highway) and energy (only 18 per cent of hydropower potential has been utilized) and major tourist projects on the Adriatic coast. However, as stated by Montenegrin Foreign Investors Council (MFIC) (2013), Montenegro should continue to reduce barriers to business, particularly in terms of faster decision-making at the state and local levels, which are necessary for the implementation of development projects. At the same time, it is necessary to encourage the diversification of the economic structure through an increase in small and medium enterprises and to continue strengthening their competitive abilities (Ivanovic et al., 2010).

1.3 The Montenegrin Money Market

The money market in Montenegro is in the early stages of development. The Montenegrin money market is characterized by a limited, or more precisely a scarce, choice of instruments and a relatively modest circle of market participants. There are several reasons for the slow development of this market. Until recently there was no adequate regulation of this market. In addition full euroization meant that the central bank has no transmission function. Additional reasons for the slow development of money markets were initially a very low and later high liquidity of banks, as well as the overall low level of liquidity in the Montenegrin economy. In a period of growth in banks' liquidity, the need for the issuance of their securities did not exist. However, in that period, the banks began to appear as the most important customers of short-term bills issued by Ministry of Finance to cover budget illiquidity.

In Montenegro the most widespread instruments in the money market are short-term treasury bills, which do not have a secondary market, bank guarantees and bilateral bank loans. The Central Bank of Montenegro, as the fiscal agent of the Ministry of Finance, organizes auctions of treasury bills with maturity 28, 56, 91 and 182 days. The Central Bank of Montenegro in this process has just a technical role, and receives funding for these operations. It publishes information on the amount of sales and the achieved average weighted interest rate. All finance raised from these auctions goes to the Ministry of Finance and the independence of the Central Bank is not jeopardised by this role. The participants in the primary market of treasury short-term bills in Montenegro are: the Government (as the issuer), the Central Bank (as the fiscal agent) and, as the purchasers, banks, institutional investors (mostly insurance companies, stock exchanges, brokers and dealers), entities outside of the financial sector, as well as individuals.

Although there are inter-bank loans, they are made without an organized market, i.e. by agreement between the interested banks. Tradable deposit certificates and repurchase agreements as money market instruments did not exist until 2008, because of the high liquidity of banks. The Bank`s Law (2008) allowed banks to use these instruments based on the collateral of treasury bills with the Central Bank (repo transactions). Bank guarantees, although they exist in the form of guaranteeing the payment obligations of debtor, are not the subject of trading, and their possessor in case of an increased need for cash cannot sell them in a secondary market.

1.4 The Banking System

1.4.1 Number of Banks, Competition and Concentration of Banks

The Montenegrin banking sector is dominated by foreign banks. Namely, of the eleven banks which operate in Montenegro, nine of them are mainly foreign owned. Foreign-owned banks have around 90 per cent of total banking sector assets. Montenegrin banks have focused on the domestic market having little or no direct exposure to foreign markets. The degree of concentration in the Montenegrin banking system is very high (Table 1.2). At the end of 2010, one bank had a leading position with regard to all parameters, while the three largest banks accounted for 57 per cent of total assets and 56 per cent of deposits.

Table 1.2 Concentration ratio of the banking sector in Montenegro, end 2010

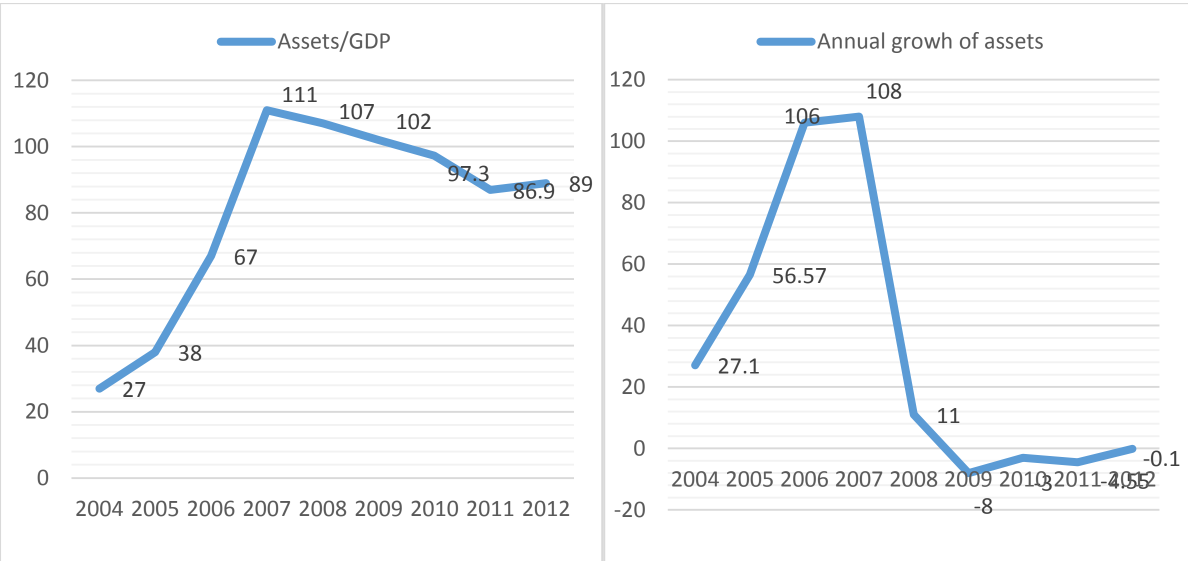
	Assets	Loans	Deposits	Capital
1 bank	24.39	22.09	31.66	15.48
3 banks	57.39	58.26	56.18	41.90
5 banks	76.87	78.33	77.13	58.45
7 banks	91.21	97.98	91.82	75.66

Source: CBM database

From 2004 to 2007, the Montenegrin banking sector expanded rapidly. The rapid growth was driven by the entry of foreign banks, along with increased domestic demand, particularly in the real estate sector (CBM, 2011). As outlined by Yildirim and Philippatos (2007), the presence of foreign banks may be beneficial for consumers by offering superior products and services, for the financial industry by increasing the quality of services and finally, for the economy by increasing efficiency. However, there may be some costs associated with the entry of foreign banks. Hellmann et al. (2000) reveal that in order to maintain or increase their market share foreign banks are inclined towards higher risk activities. These issues will be analysed further in Chapter 6. However, due to the overheated domestic demand and the impact of the global financial crisis the expansion of the banking sector halted in late 2008.

1.4.2 Structure of Assets and Liabilities

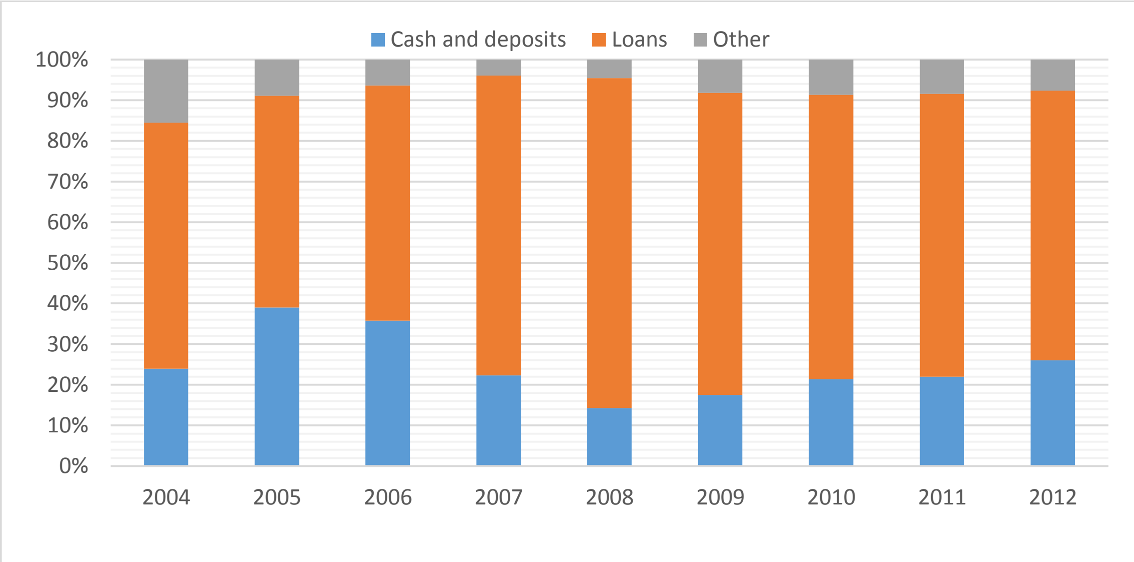
The impressive growth in the Montenegrin banking sector in the pre-crisis period, resulted in an increasing share of total banking sector assets in gross domestic product (GDP) from 26.6 per cent in 2004 to 111 per cent in 2007. Due to the influence of global financial crisis and restrictions on the credit activities of the banking sector, asset growth slowed down in 2008, increasing by 11 per cent. The asset growth stopped in 2009, declining by 8 per cent and further by 3 per cent in 2010. This decline continued until 2012.



Source: CBM database

Figure 1.4 a) Total banking sector assets/ GDP (%) b) Annual growth of assets (%) in the period 2004-2012

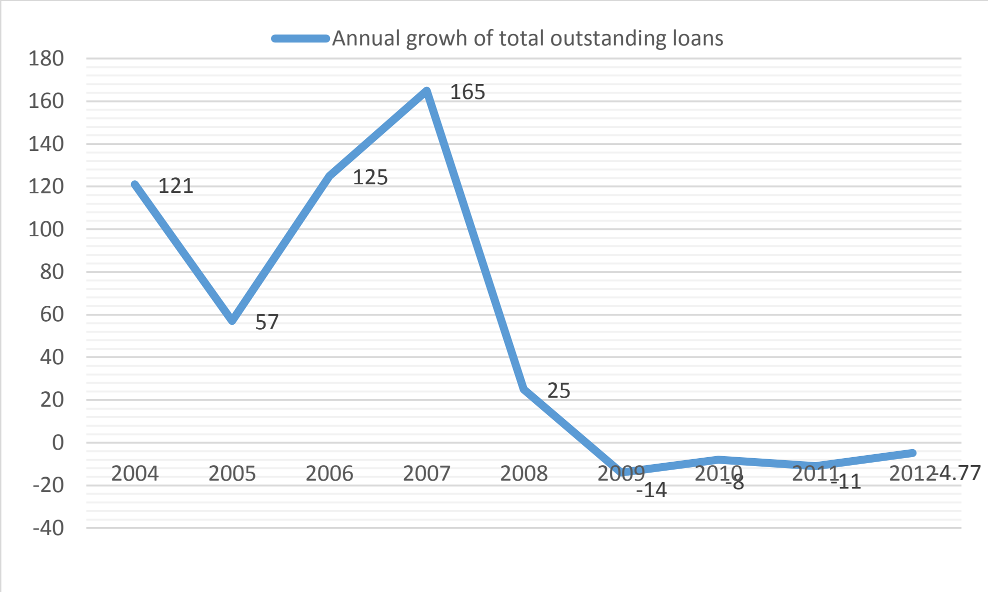
In the structure of total banking sector assets cash and cash equivalents (which include banks deposits at CBM and at other institutions abroad) and total outstanding loans are the most important elements. From 2004 to 2008, their share in total assets constantly increased. However, the fall in the share of cash and cash equivalents in total banking sector assets became particularly worrying in 2008, pointing to the problems in the reduction of total deposits and difficulties related to the non-payment of outstanding credit claims.



Source: CBM database

Figure 1.5 Structure of total assets in the period 2004-2012

The expansion of the banking assets was based on the extremely high rate of credit growth, which was one of the highest in Central and Eastern Europe. Namely, in 2006 and 2007 extremely high rates of credit growth (125 per cent and 165 per cent, respectively) were a significant factor assisting the development of the real sector. However, such high growth rates in loans were not accompanied by adequate growth rates in provisions and capital, so that the Central Bank of Montenegro, in the fourth quarter of 2007 issued a set of restrictive measures, which limited credit growth in 2008. The biggest limitations were imposed on the biggest banks since the negative consequences of excessive credit expansion of those banks would have had the greatest impact on the overall stability of the banking sector. In addition to credit growth limitations, a requirement to maintain the solvency coefficient at a minimum 10 per cent in 2008 (legal minimum amounted to 8 per cent) was prescribed. Namely, increasing the amount of banks' capital was expected to ensure adequate protection of banks' clients' interests.

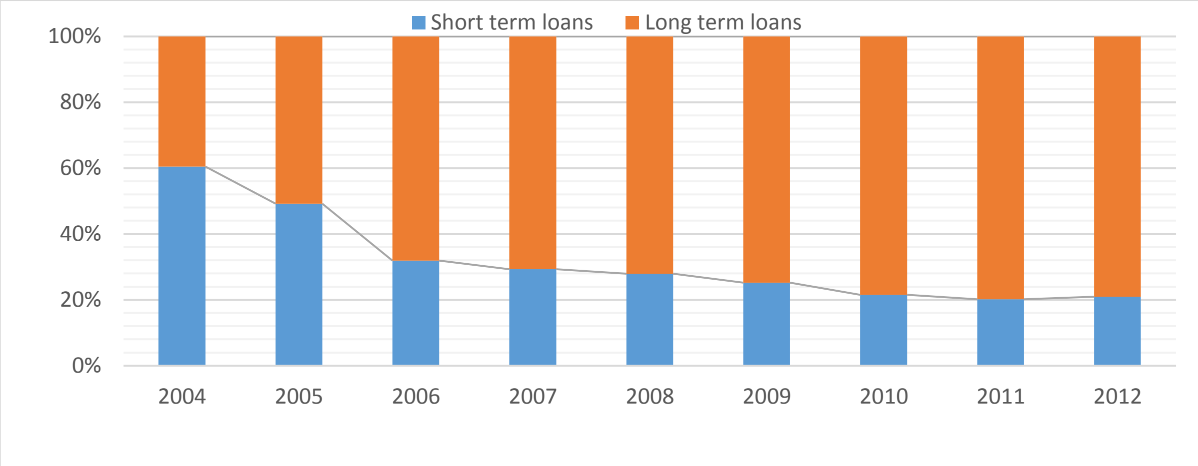


Source: CBM database

Figure 1.6 Annual growth of total outstanding loans in Montenegro, from 2004 to 2012

Lending activity began to decline in the last quarter of 2008 due to the impact of the global financial crisis, with total loans outstanding falling by about two per cent in the last quarter of 2008, as banks became concerned about their worsening liquidity situation and the ability of their parent banks to provide additional financing. That decline continued in 2009, when total outstanding loans fell by 14 per cent, mainly due to banks' deterioration of asset quality and a decline in demand for loans from the corporate sector, which was affected by the weakening situation in the real economy sector. In 2010, total outstanding loans declined by a further eight per cent. This decline continued until 2012.

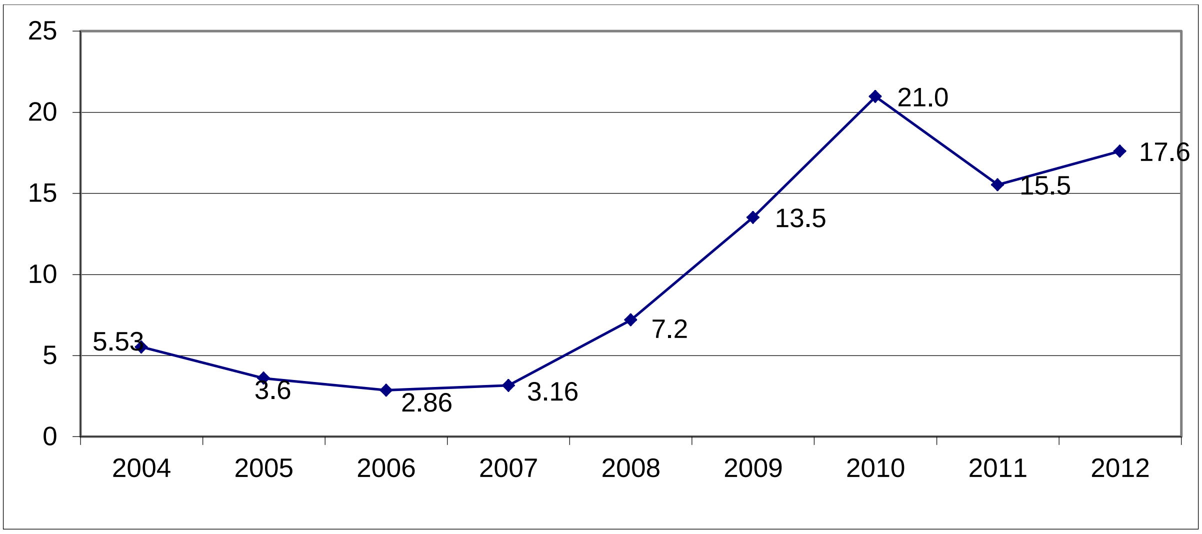
According to the Central Bank's classification of assets, loans are categorized as short term loans – approved for a period of one year and long term loans – loans approved for a period over one year. A tendency has been the growth of long-term loans in the reporting period, mainly because in the household loans there was a growth in mortgage loans, whilst loans to the private sector were mostly dedicated to the construction of tourist facilities, roads, etc.



Source: CBM database

Figure 1.7 Term structure of loans in Montenegrin banking sector from 2004 to 2012

According to the banks reports to CBM, the quality of assets deteriorated from 2008. As can be seen in Figure 1.8, there has been a dramatic increase in the ratio of non-performing loans to total gross bank loans (NPLs). According to the CBM Quarterly Report (2009, December), asset deterioration was a consequence of the excessive credit growth in previous two years, which was stimulated by banks' management motivated by quick profits, neglecting adequate and objective assessments of the financial ability of borrowers to repay loans. Thus, underestimation of assumed risks led to a deterioration in all parameters of the quality assets in the system. The high growth rates of economy motivated firms to undertake investment, leading to increased debt obligations for the business sector. Hence, the weakened economy, particularly the poor performance of the construction sector and the real estate market, contributed to a rapid increase in NPLs. This rapid increase of NPLs combined with increasing banking regulation, more stringent supervision, and the impact of those assets on banks' risk-weighted assets (RWAs) encouraged Montenegrin banks to reconsider their long-term strategies concerning their assets. Namely, banks stopped approving new loans. Thus, an increase in non-performing loan ratios might be also due to the contraction in total outstanding loans as banks ceased lending, thus as a proportion of total loans NPLs increased.



Source: CBM database

Figure 1.8 Share of non-performing loans in total loans in Montenegro, 2004 to 2012

In 2012, the reduction in lending by banks and the high burden of non-performing loans (NPLs) in banks' balance sheets, remained a challenge which could hamper economic growth.

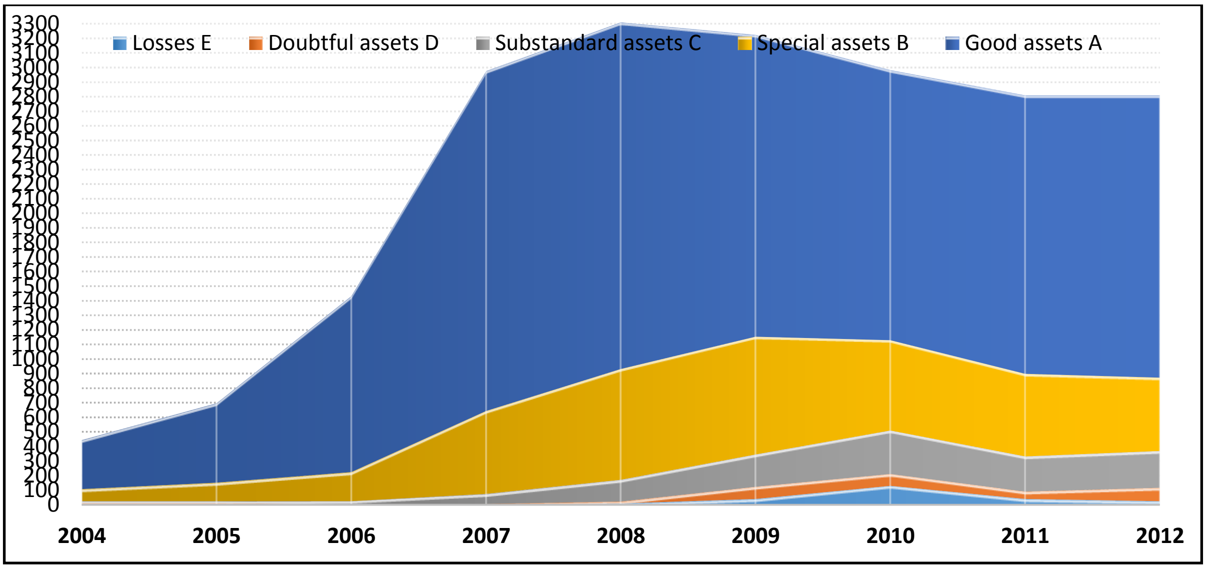
For the purpose of adequate credit risk management, banks in Montenegro are obliged, pursuant to the Decision on Minimum Standards for Credit Risk Management in Banks (OGM, 87/09), inter alia, to classify risk asset and off-balance items in five categories (A, B, C, D, and E) and to allocate appropriate loan loss provisions.

Table 1.3 The quality of banking sector's assets

Good Assets A	Classify elements of assets that are estimated to be fully charged in accordance with the agreement
Special Assets B	Classify elements of assets for which there is a low likelihood of achieving a loss, and these elements of assets require special attention of bank because a potential risk, if would not be adequately followed, could lead to weaker prospects in charged
Substandard Assets C	Classify elements of assets for which there is a high likelihood of achieving a loss, because clearly identified weaknesses
Doubtful Assets D	Classify elements where, bearing in mind the ability of the debtor's credit, the value and possibility of realization collateral, payments are unlikely to happened;
Loss E	Classify elements of assets that will be completely irrecoverable

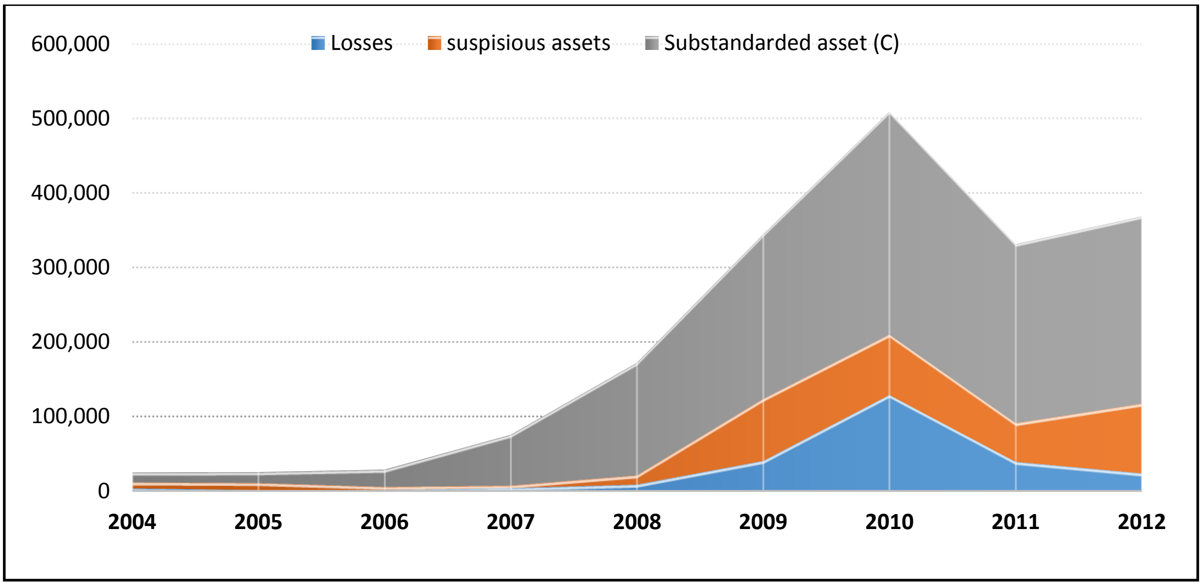
Source: The Decision on Minimum Standards for Credit Risk Management and Operations with Persons Related with the Bank

In order to have a clearer picture of the participation of non-performing assets to total assets, the following Figure 1.9 a) presents assets by categories, while the Figure 1.9 b) presents the evolution on non-performing assets by categories of substandard, doubtful assets and losses.



Source: CBM database

Figure 1.9 a) Banking sector`s asset by categories (good-A, special-B, substandard-C, doubtful assets-D and losses-E), in millions of euro

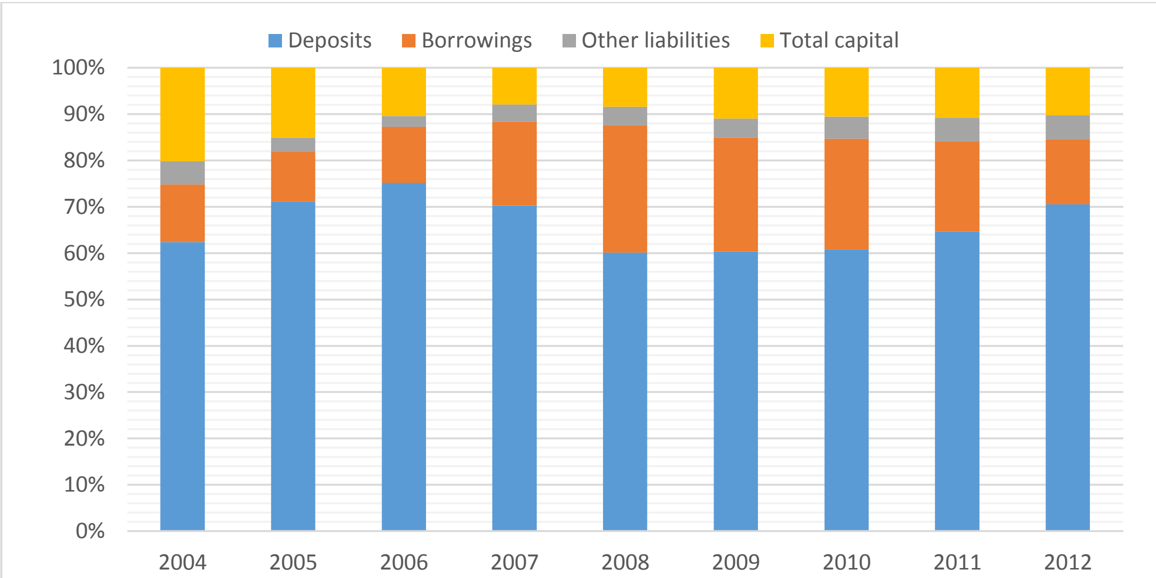


Source: CBM database

b) Non-performing assets by categories (substandard-C, doubtful assets-D and losses-E), extracted from 1.9 a), in millions of euro

In the structure of liabilities, the largest share belongs to deposits and obligations under borrowing. However, their share in total liabilities significantly changed from 2004 to 2010.

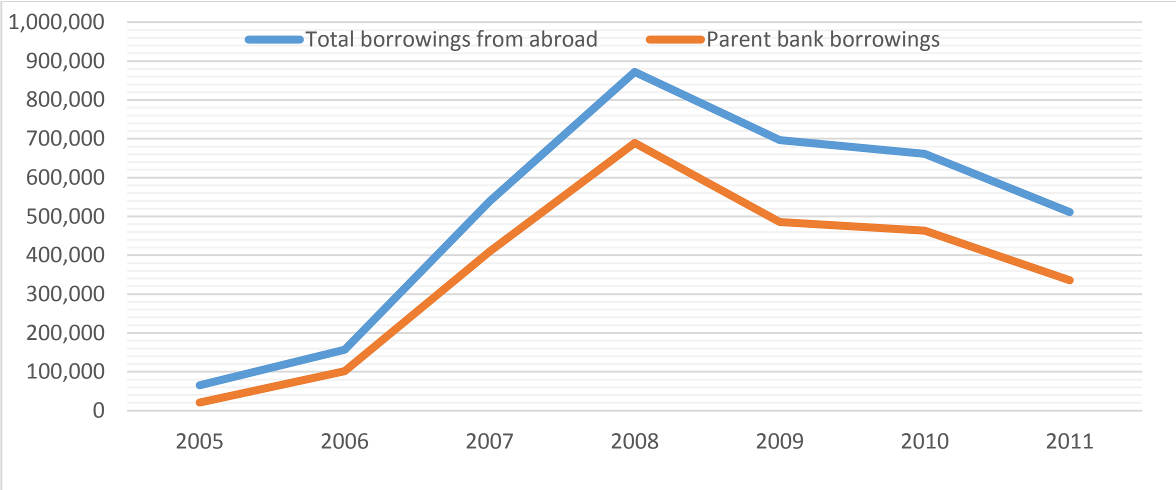
The positive trend in the share of total deposits stopped in 2007. Since that period, total deposits declined by almost 20 percentage points. The global financial crisis and loss of confidence in the banking sector caused a massive withdrawal of deposits. In addition, according to the CBM Supervision Report (March 2009) a further reason for the large reduction in total deposits, has been the case of non-payment of loans where the banks were using deposits as cash collateral. That meant that the deposits had not been withdrawn from the banks, but had been used for the payment of liabilities to banks. A massive withdrawals of deposits has been has been compensated with an increase in borrowings and credits. Looking at the Figure below, there has been a significant drop in the share of capital in total assets.



Source: CBM database

Figure 1.10 Structure of total liabilities in the period 2004-2012

The most significant share of total borrowings was borrowings from abroad. According to the banks reports to CBM, the rapid growth of loans was mainly based on borrowings from abroad. Most of the borrowings from abroad refer to the borrowing from foreign parent banks, whose subsidiaries dominate the Montenegrin banking sector (see Figure 1.11).



Source: CBM database

Figure 1.11 Banks' borrowing from abroad, in millions of euro

Funding from parent banks (borrowings from parent banks as a share of total liabilities) increased from 2005, reaching the peak in 2008. Financing from parent banks constituted 76 per cent of total borrowings at end-2008, exposing the banking sector to liquidity shocks in the case where parent banks were unable to sustain financing to their subsidiaries. However, this share decreased by 20 per cent in 2009, by 5 per cent in 2010 and a further 23 per cent in 2011.

1.4.3 Liquidity

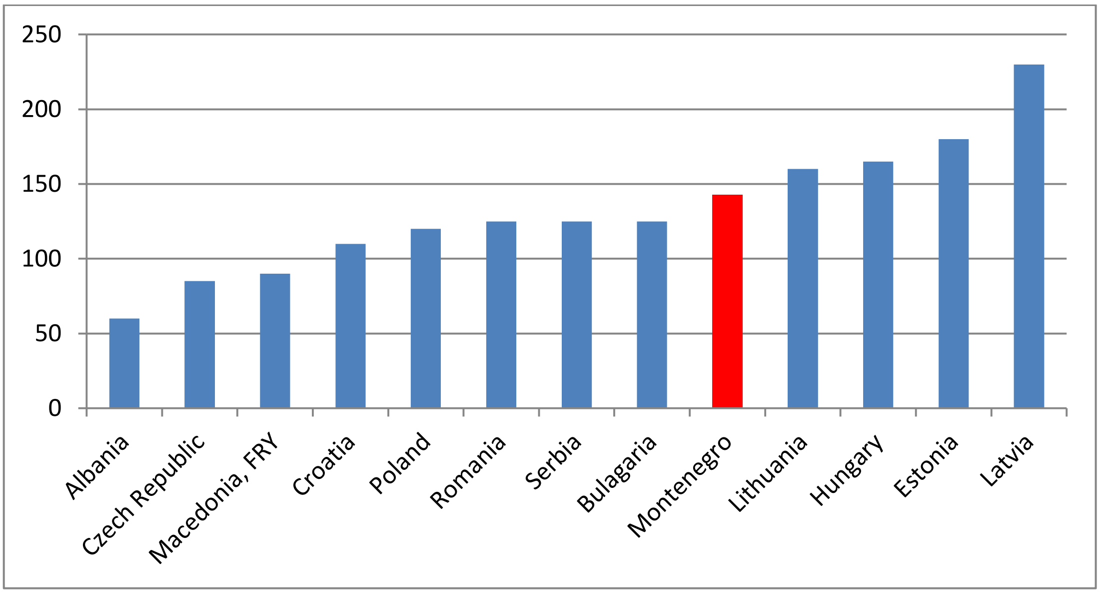
The negative effects of the global financial crisis were reflected in Montenegrin banks' liquidity. In the last quarter of 2008, there was a significant reduction in total banks` deposits. In particular, large withdrawals happened due to the panic instigated by the media and negative experiences from failed foreign currency savings from the early `90s. As noticed in the previous subsection 1.4.1, high rates of credit growth were mainly financed by foreign parent banks' lending to their Montenegrin subsidiaries, resulting in high loan-to-deposit ratios. The high loan-to-deposit ratio (LTD) exposed the banking sector to substantial liquidity shocks.

Table 1.4 Loan to deposit ratio in Montenegro from 2004-2010

	2004	2005	2006	2007	2008	2009	2010
Loan to deposit	103	77	87	121	169	154	140

Source: CBM database

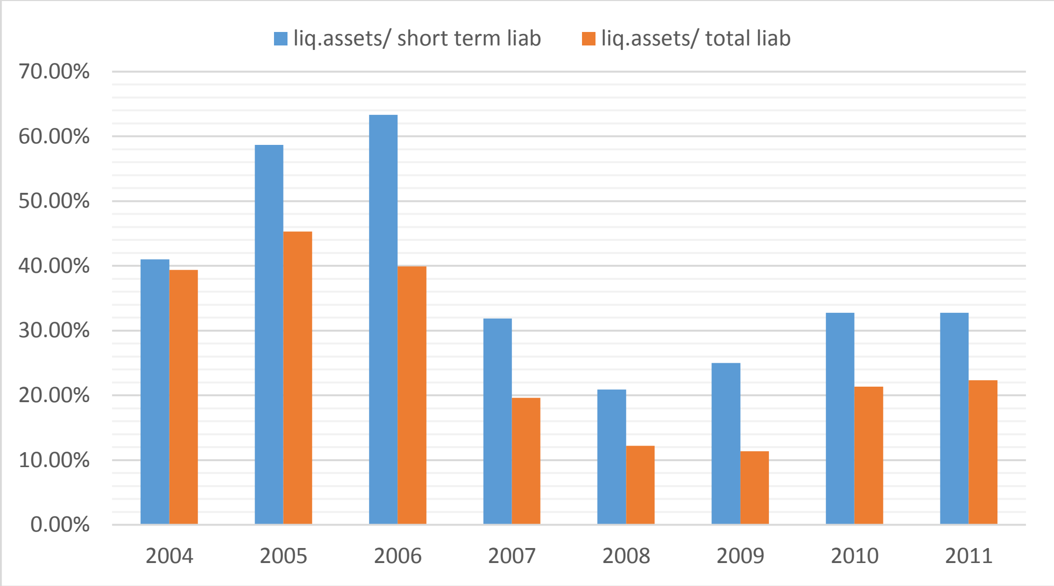
The LTD ratio that was increasing steeply until 2008, in 2009 it declined to 154 per cent, and then fell further to 140 per cent in 2010. However, those LTD ratios were extremely high. As illustrated in Figure 1.12, at the end of 2010 the LTD ratios in Montenegro were higher than in many Central and East European countries.



Source: IFS database

Figure 1.12 Loan to deposit ratio in CEE at the end of 2010

A large withdrawal of deposits severely subverted the liquidity of the banking sector in late 2008, although the situation has since improved. The system's liquid assets to short term liabilities ratio declined in 2007 and 2008 (see Figure 1.13). It is most likely that banks with extreme credit growth rates were focused on future revenues. As explained in the previous section, the increase in the proportion of loans in banks' total assets was, above all, the result of the declining share of cash, which therefore worsened the banks' liquidity position. The liquidity ratio of liquid assets to short term liabilities declined from 32 per cent at the end of 2007 to 21 per cent at the end of 2008 (see Figure 1.13). Since then, liquidity at the aggregate level improved with a liquidity ratio of 26 per cent at the end of 2009, particularly because of CBM measures to improve liquidity in the system by lowering the reserve requirement rate, as well as due to large inflows as a result of privatization of one large state company. In 2010, the liquidity ratio improved further to about 33 per cent by year end.



Source: CBM database

Figure 1.13 Movements in the ratio of liquid assets to short-term and long-term liabilities

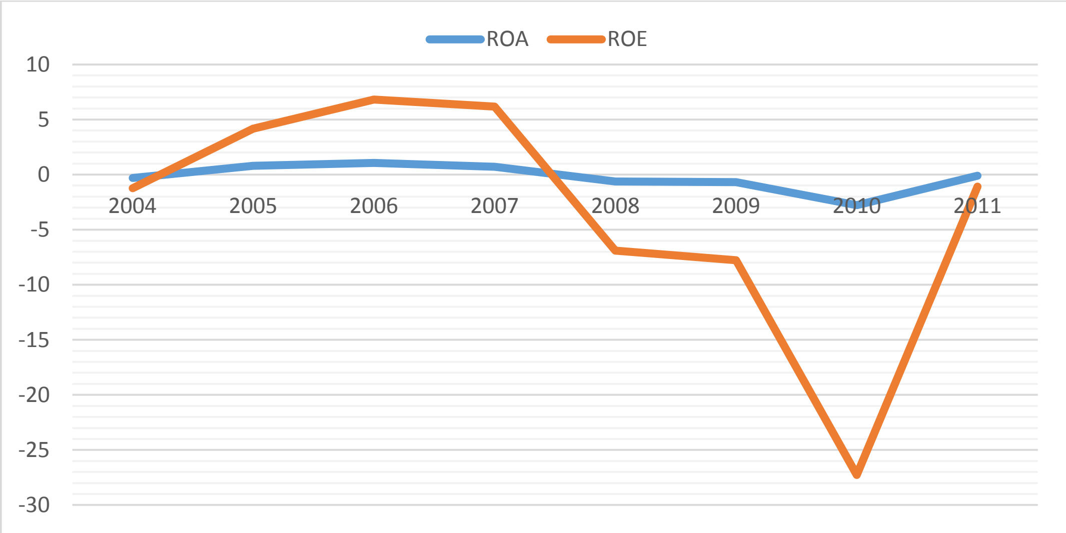
A further cause of the improvement in banking sector liquidity from 2009 was significant capital injections from the foreign parents' banks that had signed an agreement called the Vienna Initiative. The goal of that agreement was to maintain the exposure of foreign parent banks in emerging Europe and to support their subsidiaries by capital injections, bank-specific guarantees etc. The Vienna Initiative will be analysed in more details in Chapter 3. The foreign parent banks gave strong support to their subsidiary entities in Montenegro and provided them with a sufficient amount of liquid assets for the regular servicing of obligations to clients, thereby preventing capital erosion. Five banks have received subordinated debts in 2008 to 2010, while, in 2009 a few banks have been recapitalized. As a result, the capital adequacy ratio (CAP) of the system stood at 15.4 per cent at end of 2010, well above the prudential minimum requirement of 10 per cent. Subsidiaries of foreign banks also had an opportunity to manage their NPLs through transferring them to the Asset Management Companies (AMCs) of their parent banks.[3]Two Montenegrin banks have chosen to permanently remove non-performing assets from their balance sheets by transferring them to factoring companies owned by their parent bank. Those factoring entities, therefore, were not subject to consolidation at the bank level. However, domestic banks have had to maintain their NPLs on their balance sheets. Moreover, increased

[3] However, the transfer of NPLs into the Asset Management Companies (AMCs) of their parent banks does not affect our empirical analysis of NPLs presented in Chapter 5. Namely, those transfers had happened in 2011, while our empirical analysis includes developments from 2004 to 2010.

provisions for non-performing loans adversely affected the profitability of the bank, which will be discussed in the following sub-section.

1.4.4 Profitability

Profitability of the banking sector, after an upward trend from 2005 to 2007, was rapidly and drastically impaired in 2008. Analysing the profitability of the banking sector, we distinguish subjective and objective factors which had influence on the banks` profitability. Subjective weaknesses in some banks may refer at first to bad credit risk management which resulted in high levels of additional provisions being required (in accordance with the regulatory framework), high overhead costs, etc. Objective factors may be related to the prudential limits imposed on credit growth in 2008, withdrawal of deposit potential of the fourth quarter and almost complete suspension of the credit activity of banks that led to questions concerning the ability of some banks to service regularly their obligations to customers, more difficult access to external sources of funding, etc.



Source: CBM database

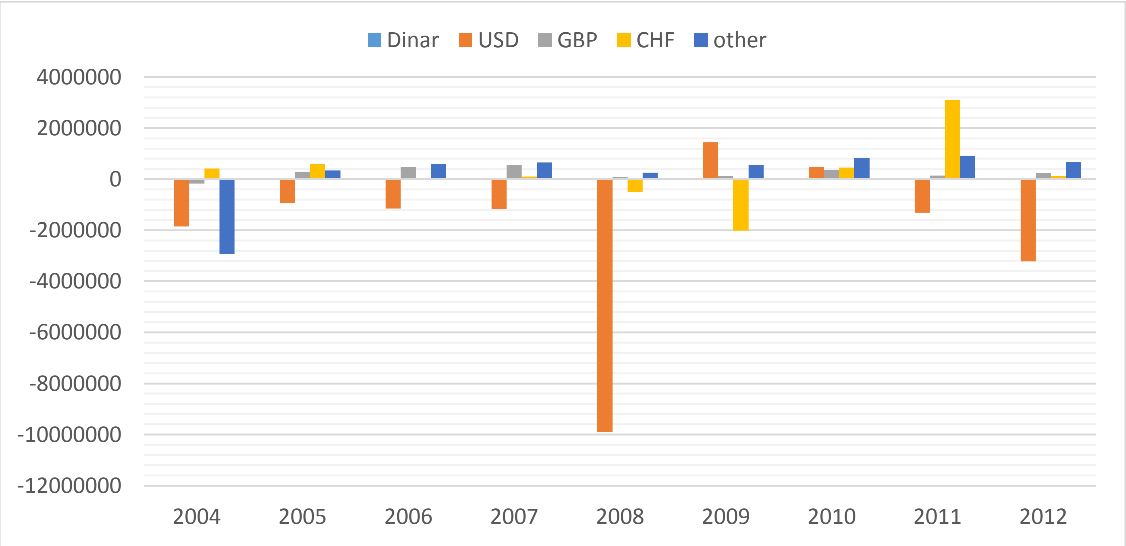
Figure 1.14 Movements of ROA and ROE at the aggregate level in the period from 2004 to 2011

These negative financial results consequently led to negative indicators of return on average assets (ROA) and return on average equity (ROE) at the aggregate level. As can be seen in Figure 1.14, the ROA decreased from -0.6 per cent in 2008 to -0.7 per cent at end-2009, to -2.8 per cent at end-2010, and improved slightly to -0.1 per cent at end 2011. The ROE declined from -6.9 per cent in 2008 to –7.8 per cent at end 2009, and declined dramatically in

2010 reaching -27 per cent at end of 2010, whilst significantly improving to -1.1 per cent at the end of 2011.

1.4.5 Market Risk

The degree of exposure of banks to market risk primarily depends on the dominant activity of the bank. That has been an important component of risk for investment banks or in banks where a large part of the activities related to the trading book. The main drivers of market risk usually are the interest rates, exchange rates, stock indexes, etc. In modern developed financial systems it is assumed that the market quickly responds to various signals through variations in the prices of securities and thereby affects the value of the portfolio of banks (Furlong and Williams, 2006). However, in the Montenegrin banking system the overall level of market risk has been low. Trading securities, derivative financial assets and securities held to maturity have a negligible share of total banks assets (about 3 per cent in 2010). These have been new instruments for Montenegrin banks starting in 2009. After the introduction of the Euro as the official currency in Montenegro, the exposure to market risk in Montenegrin banks has been very limited, according to the CBM Financial Stability Report (2011b). In addition, the level of foreign exchange risk is low. The most common alternative currency either for loans and deposits throughout the period 2004-2012 was the USD; however from 2008 the banking sector had more liabilities than assets in the US currency (Figure 1.15).



Source: CBM database

Figure 1.15 Aggregate exposure of foreign currency risk in Montenegro, in millions

At the end of 2008 the currency structure of loans was: 5.8 per cent were related to loans in foreign currency. Deposits in foreign currency consisted 2.6 per cent of total deposits and banks borrowings in foreign currency accounted for 12.2 per cent of total borrowings.

Summing up the findings of this section, it has been found that the rapid expansion of the banking sector in Montenegro stopped in late 2008, largely due to the impact of the global financial crisis on the overheated domestic economy. This growth of banking sector assets in Montenegro was led by foreign banks. Foreign banks financed excessive credit growth that affected banks` liquidity position resulting in high loan to deposit ratios. Importantly, excessive credit growth posed a threat to the Montenegrin banking sector's stability, bearing in mind that all sectors of the Montenegrin economy had a high level of debt. The weakened economy contributed to a rapid increase in non-performing loans. Finally, the crisis had a dramatic impact on banking sector profitability. The measures which the Central Bank of Montenegro introduced in order to protect the banking sector during the global financial crisis will be analysed in the following section.

1.5 The Role of the Central Bank of Montenegro

The Central Bank of Montenegro (CBM) was founded in 2001, based on the Law of the Central Bank of Montenegro which was adopted in 2000. Previously, it was a branch of the National Bank of Yugoslavia. Given the political circumstances and abuses of monetary policy in Yugoslavia, the Government of Montenegro in 1999 decided to replace the dinar (official currency of Yugoslavia) and to take over all powers in the field of monetary policy. Initially the Deutsche Mark was introduced as the official currency and later, in 2002, it was replaced by Euro. The Central Bank of Montenegro was founded as an independent institution responsible for monetary policy, establishing and maintaining a sound banking system and efficient payment system in Montenegro. Given that the monetary system of Montenegro has been based on the euro, as the official currency, and Montenegro's economy is fully euroised, the Central Bank Montenegro has no direct responsibility for issuing currency or price stability, which are the responsibilities of the ECB.

According to the Law on Central Bank, a primary objective of CBM is maintaining financial stability. The Central Bank of Montenegro is currently the only central bank that has identified financial stability as its primary objective. Other central banks have defined financial stability as an objective, but only as a secondary one. However, it should be mentioned that CBM is only in charge of the banking sector and micro-financial institutions and it does not have a responsibility for other participants in the financial system, such as insurance companies, financial leasing companies, voluntary pension fund management companies etc. This issue has been partially overcome by the Financial Stability Council being chaired by the CBM Governor. The Financial Stability Council includes members of the Ministry of Finance, the Securities and Exchange Commission, the Insurance Supervision Agency and the Central Bank.

Although the Central Bank does not have the function of issuing currency, it has some instruments of monetary policy. The most important instrument is control of banks` reserve requirements. The reserve requirements for banks have an indirect impact on money supply (monetary policy). Given the lack of public confidence in the Montenegrin banking system at the beginning of the twenty-first century, the CBM initially conducted very restrictive obligatory reserve policies. However, as the situation in the banking system improved, this instrument was partly relaxed. According to the CBM (2012), this restrictive reserves policy preserved the banking sector in the crisis period. For example, only one bank had problems and that bank in 2008 requested financial assistance from the state, that loan was repaid in 2009, but underlying asset quality problems remained. The CBM has two further instruments affecting money supply. One instrument is loans to banks and the other open market operations - buying and selling of securities. For the purpose of meeting the liquidity requirements, the Central Bank can approve certain banks to use up to 50% of their reserve requirement deposits to maintain their required daily liquidity (Decision on Detailed Conditions for Granting Liquidity Loans to Banks; OGM, 15/11). Also the Central Bank could approve intra-day credit to meet liquidity requirements; under specified terms that whole amount of credit can be collateralized by securities issued by the State of Montenegro, EU Members States and international financial institutions or other securities deemed acceptable by the Central Bank (Decision on Bank Reserve Requirement to be Held With the Central Bank of Montenegro; OGM, 35/11). The other instrument is open market operations, which the CBM uses to purchase and sell securities in order to regulate the banking sector's liquidity. Open market operations affect the interest rates, banks' lending potential and activity, and consequently the economic activity in Montenegro. When buying securities the central bank creates a currency outflow and thus decreases the interest rate. The reverse situation applies when selling securities. However, the CBM is not an issuing monetary authority and does not use open market operations to conduct traditional monetary policy. By open market operations CBM purchases and sells securities issued by Montenegro, EU Member States and international financial institutions, or other securities which are acceptable for this purpose. These operations may be performed through spot trading contracts or through direct trade with an individual bank using forward contracts (Decision on Open Market Operations, OGM 15/11).

The second objective of the CBM is to establish and maintain a sound banking system. As previously stated, the CBM is in charge of the supervision of all banks and micro financing institutions (currently 11 banks and 5 micro-financing institutions). Until 2008, the process of supervision was based on Basel I, since then there have been efforts to implement Basel II. The Basel II framework, which Kraft (2003) argued was a good example of the sustainable development of prudential ratios to meet constantly changing complex challenges, will be discussed in Chapter 4. Since 2008, with a view to maintaining banking sector stability and in order to meet Basel II requirements, the CBM has improved the regulatory framework. The CBM has adopted a new law on banks, with pertinent sub-legal legislation that has provided the legal framework for a gradual transition to Basel II, i.e. the Capital Requirement Directive (CRD). The adoption of the Law on Banks in 2008 and a set of by-laws in 2008 were largely compliant with EU directives and international standards. The CBM has implemented a prudent bank licensing policy and issuance of permissions and/or approvals to provide for the strengthening of corporate culture, competition and protection of depositors. In addition, the CBM has developed risk-based supervision with a portfolio management approach to banking supervision, with a particular emphasis on credit risk supervision. Finally, the CBM established cooperation and exchange of data with other regulatory bodies in the country with a view to strengthening consolidated supervision. Some requirements were even more stringent than the Basel II requirements. Namely, the minimum required solvency coefficient was set at 10 per cent, while according to the Basel II the minimum required amount should be 8 per cent.

To restore consumer confidence in the banking sector, the CBM adopted an emergency anti-crisis law in October 2008: the Law on Measures for Protection of the Banking System (MPBS). The provisions of this law were generally consistent with crisis responses seen in other countries, giving the government the authority to: (i) fully guarantee the deposits of all individuals and legal persons; (ii) facilitate credit guarantees for interbank loans; (iii) provide liquidity support to a bank in need of additional funds for a period of up to one year; (iv) upon a bank's request, make a prepayment of state borrowings from that bank (including loans carrying a government guarantee); and (v) provide funds for the increase of a bank's capital, with a view to protecting and ensuring the stability of the banking system. The law also provided for the CBM to: (i) approve the use of funds of the reserve requirements; and (ii) use up to 50 per cent of its capital for granting short-term loans to banks. The MPBS broadly served its intended purpose and expired at the end of 2009.

Although progress has been made in the regulations, some Basel II requirements were not followed. Namely, the main disadvantage of CBM supervision was poor knowledge of modern techniques such as early warning systems and stress testing, which should have been adopted in order to help ensure the stability of the banking sector.

The Montenegrin Central Bank is the accounting agent which processes interbank payments. The Central Bank administers the non-cash system of payments for its clients, banks and state organizations. It is responsible for establishing and maintaining an efficient system of payments: performing, regulating and controlling that system of payments. Finally, the CBM has the role of the government's fiscal agent and in managing the foreign reserves of Montenegro.

According to Vlahovic and Cerovic (2005), the CBM has a very high level of independence based on Petursson's (2000) and Cukierman's (2002) criteria. According to Petursson's (2000) criteria, the legal independence of central banks is assessed on a scale from 0.7 to 65, and the independence of the CBM is assessed at 53.55, which is relatively high, though lower than the 63.55 score for Croatia. According to these criteria the CBM cannot be awarded maximum points, given the first and last question. Specifically, the Law on the CBM does not explicitly state that the stability of prices is a goal of CBM, which is understandable given the full euroisation of the Montenegrin economy and the specific role of its central bank. Further, although the Law determined that the mandate of the Governor, five years, is longer than the electoral cycle (4 years) in this criterion CBM does not receive the highest grade (which is awarded in the event that the mandate of the governor is for 8 years or longer).

Table 1.5 The degree of independence of the CBM

Criteria	Weight	Points	Total
The charter of the central bank is clearly defined goals, expressed with a price stability goal	1	0	0
The extent to which the central bank sets policy objectives	1	10	10
The extent to which the central bank conducts compliance with monetary policy instruments	2	10	20
The extent to which government funding is allowed by the central bank	2	10	20
Length of the mandate of the Governor	0.5	7.1	3.55
Total			53.55

Source: Vlahovic and Cerovic (2005)

Measured by Cukierman's (2002) criteria, the independence of CBM is high and amounts 0.935 (on a scale from 0 to 1). Cukierman's (2002) questionnaire is used as a measure of central bank legal independence, covering information on the chief executive officer, policy formation, objectives and limitations on lending to the government. Similar to the Petursson's approach, CBM cannot be awarded maximum points on Cukierman's criteria and cannot be rated as a completely independent central bank. Namely, the CBM main limitation is its very limited capacity to conduct independent monetary policy and consequently, its inability to affect the inflation rate in Montenegro. Thus, its primary objective cannot be price stability. In addition the length of tenure of the Governor is just five years, which does not attract the highest score. In addition, the Governor is appointed by Parliament, based on the recommendation of the President of the country, which again does not attract the highest degree of independence score. However, the CBM formulates the policies and that has the highest independence score. Regarding lending to the government, according to the Law on Central Bank: "The Central Bank may not, either directly or indirectly, grant any loans to the Government, other government bodies and organisations, local self-government units or any other persons owned by or in the majority ownership of the state or local self-government units (Article 7 and 8)", which attracts the highest score by Cukierman's criteria. However, one limitation of such indices is that they measure the degree of 'de jure' independence not the 'de facto' degree. Actual independence can only be accurately measured by actions, not by legislation.

The macroeconomic policy tools available to guide the Montenegrin economy on a path of sustained convergence are, deliberately, severely constrained by unilateral euroisation. At the current juncture, the absence of a policy interest rate and the significant limitations to its lender of last resort function reduce the central bank's ability to influence bank lending and thereby to support economic growth.

1.6 The Stability of the Banking Sector in Montenegro

As stated in the previous section, maintaining financial stability has been the CBM’s primary goal. The stability of the financial system is an important component of macroeconomic stability and hence potentially contributes to economic growth, employment growth and poverty reduction. In a stable financial system, aggregate demand does not significantly deviate from the production possibilities of the real sector; the functioning of financial markets and lending are not distorted by barriers, while the value of important securities do not differ significantly from what would be their ‘fair’ prices. A stable financial system allows the efficient allocation of resources and management of financial risks and promotes price stability (Fabris, 2006). As noted above, a key driving force of economic development in Montenegro is FDI inflows, and it has been argued that the stability of the financial system is a prerequisite for attracting that key driving force (CBM, 2007).[4] The attraction of a substantial net inflow of foreign direct investment, and the resulting diversification of economic structure and strengthening of its competitive ability, requires a stable financial system (Ivanovic et al., 2010).

In line with the EU enlargement process the integration of the Montenegrin financial system in the EU has become a priority. This integration with EU certainly entails changes in the regulatory and supervisory environment. In particular, integrated markets need a unified regulatory framework. The integration and flexibility of financial systems play an essential role in promoting full convergence and supporting economic stability within the monetary policy framework of the EU (Kraft, 2003).

In Montenegro the financial system is “bankcentric”. As evidenced above in section 1.2, the banking system is the key component of the financial system, as other financial institutions

[4] This is the mainstream view. Alternative perspectives are included in the discussion in Chapter 2, such as Minsky’s theory of endogenous financial stability.

are still underdeveloped. Banks are the most important participants in the transfer of funds from domestic and foreign surplus sectors to deficient sectors. In such conditions, the stability of the banking system is a fundamental determinant of the stability of the entire financial system, and thus the achievement of macroeconomic stability and economic development. Bearing in mind the structure of the financial system in Montenegro, it is less likely that a full blown financial crisis could emerge in a segment of the system other than the banking sector (Žugić and Fabris, 2014). That was best illustrated by the Montenegrin stock exchange crunch in spring 2007, which had almost no consequences for the rest of the financial system or the real economy.

Continued stability is essential for the further development of the banking sector in Montenegro, given the experience of the last decade of the twentieth century, when there was a complete devastation of the banking system and loss of confidence in banks.[5] Banking relies on confidence, because the banks deposit function cannot be totally insured. Without the stability of the banking system there is no trust in banks, and thus no effective banking system (Fabris, 2006). Stability of the banking system can be assisted through the diversification of banking services (payment, currency conversion, some forms of insurance, custody jobs, etc...). However, the diversification of banking services can create its own risks for banks in Montenegro, especially if those banking services are out-sourced to businesses with an insufficient level of know-how.

The recent increase in foreign ownership within the banking systems of Central and Eastern Europe, including Western Balkans, significantly increased financial connections within Europe. Foreign ownership has brought great benefit to the local countries, such as an easier and faster restructuring of the banking system, improved risk-management techniques, greater access to foreign capital, and greater financial deepening (Cardenas et al., 2003). On the other hand the benefits are great also for the parent banks in relation to the generation of profits. At the same time, these growing financial connections increased susceptibility to

[5] In the early 1990s the breakdown of the former Yugoslavia, sanctions, hyperinflation, wars in the region and the deterioration of the economy completely destroyed the previous financial system. People were unable to withdraw savings (mainly in foreign-currency) which they had deposited in Yugoslav banks. As a result of the loss of confidence in the banking system in that period the general public was often keeping their savings 'under the mattress'.

negative spill overs, both in the domestic and host countries. Hence, domestic banks are exposed to the strong impact of external risks, especially now with the present trend of increasing interdependence of banks at the international level.

The key threat to financial stability in Montenegro is the relatively high level of non-performing loans (Sirtaine and Rosenberg, 2012; Žugić and Fabris, 2014). According to Žugić and Fabris (2014), referring to eventual factors that may lead to aggravating financial stability, these should primarily be sought in the banking sector as a relatively high share of non-performing loans. As mentioned in section 1.4, since the beginning of the global financial crisis, the deterioration of loans' quality has become significant. In 2010 non-performing loans in Montenegro had a leading position in the region and excessive credit risk has been identified as of importance in the Montenegrin banking sector (Dakić, 2014). In order to mitigate that problem, there has been cooperation between the World Bank, the Ministry of Finance and the CBM, in order to develop a model of voluntary financial restructuring of non-performing loans known as the "Podgorica Approach". However, that will be explained and assessed in the concluding Chapter.

The increase in non-performing loans seems to have had, as yet, no great impact such as a bank run in the Montenegrin banking sector. However, it may imply a high level of fragility of the banking sector and a lack of the efficient banking supervision. Consequently it is important to analyse the determinants of the level and behaviour of non-performing loans since they are often considered as an indicator of financial vulnerability and of future turbulence in banking sector. Thus, non-performing loans will be considered as a main indicator of banking distress in Montenegro, and great attention in this thesis will be paid to the examination of the determinants of loans` quality in order to preserve banking sector stability. Regarding Montenegro, our objective is to investigate the macroeconomic and bank-specific determinants of non-performing loans. However, since non-performing loans are a point of concern in Central and East European countries as well, we will extend our research for those countries.

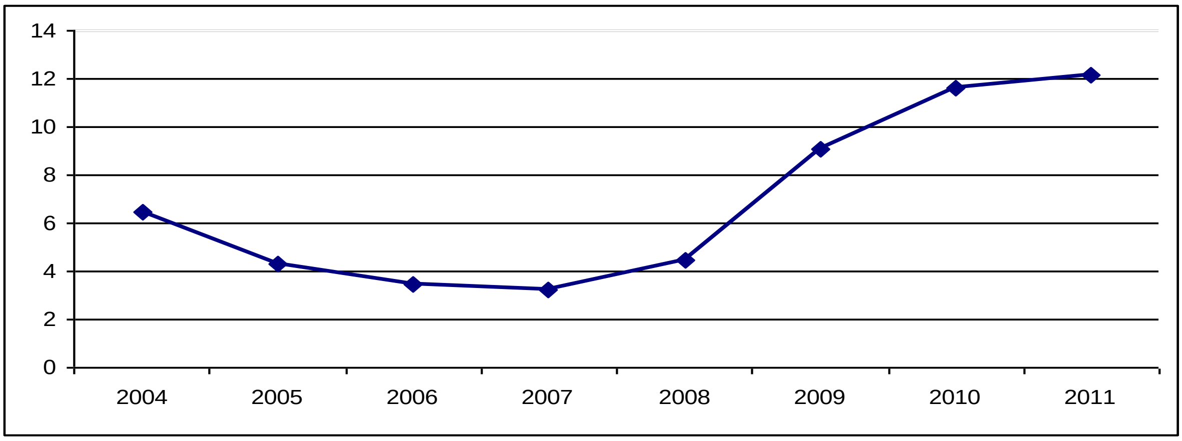
1.7 Comparative Developments in the Banking Sectors of Central and East European Economies

As in Montenegro, credit risk currently represents the main threat for financial stability elsewhere in Central and Eastern Europe (Barisitz, 2011; Jakubik and Reininger, 2013). This section will briefly examine the main recent developments in banking sectors in CEE countries; while a more detailed analysis of CEE banking sectors, in the period before and after the global financial crisis, will be presented in Chapter 3.

Although the banking sectors of CEE are based on the traditional model, approving loans and collecting deposits, they are by far the most important channels for domestic financing. In most CEE countries, banking sectors are mainly foreign owned (this will be discussed in section 3.4.1). High foreign ownership has been largely a legacy of economic transition, when banks were privatized to strategic foreign investors to quickly introduce modern banking practices and secure financial stability (IMF, 2013a). Increasing and high reliance on foreign funding emerged during the CEE region's credit boom in the mid-2000s.

The catching-up process with West European processes and practices was initially supported by increased macroeconomic stability; however, most CEE countries had become increasingly vulnerable in the wake of the Lehman Brothers' collapse. Namely, during 2002-2008, most CEE countries experienced huge credit, housing and consumption booms, and associated high current-account deficits and external-debt levels. In September 2008, previous inflows of bank funding reversed and the overheated CEE economies experienced deep recessions.

Moreover, average bank asset quality in CEE deteriorated sharply when the financial crisis hit these economies. As a result of deteriorating profitability caused by the challenging macroeconomic conditions and a decrease in aggregate demand, loans gradually, increasingly turned to non-performing. In addition, the weak macroeconomic environment put pressure on the financial position of performing enterprises.



Source: World Developed Indicators database

Figure 1.16 Non-performing loans in Central and Eastern Europe, average as a % of total loans, 2004 to 2011

Many of the rapidly approved loans of the boom years have turned problematic, pushing the average NPL ratios in the CEE region from a pre-crisis low level to worryingly high level in 2011 (see Figure 1.16). In particular, some CEE countries had ratios of over 20 per cent (see Section 3.5). Those high NPLs were likely to affect credit supply going forward (Sirtaine and Rosenberg, 2012; Klein, 2013; and IMF, 2013a). Furthermore, the associated provisioning adversely affected profits, and according to IMF (2013a) dented the long-term profitability of western banks' engagement in CEE making them more cautious to deploy capital in that region.

Strong growth in the ratio of non-performing loans was a sign of their fragile banking conditions that were exposed by the financial crisis. Namely, the rapid growth in NPLs forced most of the CEE countries to ask for financial help from the IMF, European Union and the European Central Bank since. That will be examined in section 3.5.1.

The CEE region's recent experience suggests that the banking sectors in CEE need to carefully assess recent developments in their NPLs, while anticipating adverse future movements in their NPL ratios. In order to anticipate these future movements this research programme develops, in Chapter 6, an appropriate model to estimate all determinants that have a significant influence on the incidence of NPLs in CEE countries.

1.8 Conclusion and the structure of the thesis

The recent rapid growth of banking assets in Montenegro was driven by the entry of foreign banks, which now have a dominant role in the Montenegrin banking sector. It is argued that, in 2008, ‘excessive’ credit growth, primarily financed by high external borrowing, posed a threat to banking sector stability, given that all sectors of the Montenegrin economy had a high level of debt. The strong credit growth from 2003 to 2008 led to an unsustainable boom that suddenly ended with the occurrence of the global financial crisis. Subsequently, the deep recession pointed to a number of accumulated problems, including the poor quality of many of the loans in banks` books. The boom and bust cycle in Montenegro left behind a large number of non-performing loans, which present the main current threat to banking stability. This situation has been very similar to that found elsewhere in the Central Eastern and Europe region.

Given that non-performing loans are a good indicator of banking vulnerability, the investigation of the determinants of non-performing loans is important in order to assess the prospects for future banking stability. Thus, the research in this thesis will refine the concept of banking stability with special reference to factors contributing to the incidence of non-performing loans; investigate which requirements for banking stability were disrupted in the last global financial crisis; and examine the effect of global financial crisis on Central and East European banking systems. In addition it will examine banking stability from the institutional, or more precisely, the regulator’s perspective, highlighting the weaknesses of supervisory authorities in global financial crisis. Finally, this research programme will empirically investigate the determinants of non-performing loans in Montenegro, and then in Central and Eastern Europe, and derive policy proposals to promote banking stability in these countries.

In particular, Chapter 2 develops a theoretical framework for this research programme. Throughout this Chapter we will critically review the literature on banking crises, given that banking sector fragility refers to the latent possibility of a crisis. Furthermore, Chapter 2 will explain why non-performing loans are usually considered to be a good predictor of banking sector fragility. Chapter 3 examines the nature and causes of the last global financial crisis and identifies which preconditions for a stable banking sector were disturbed. This Chapter will explain the consequences of global financial crisis, focusing on Central and East

European countries. Furthermore, the analysis investigates the contagion effects of global financial crisis, calling into question how foreign banks treated their subsidiaries in Central and Eastern Europe.

Chapter 4 provides an analysis of banking stability from the regulator's perspective, in particular demonstrating the weaknesses of supervisory authorities in the pre-global financial crisis period. This Chapter highlights the need for appropriate stress testing techniques, which should be based on both macro and microprudential perspectives. Credit risk assessment, in particular, modelling of non-performing loans, presents an important part of stress testing. Thus, in Chapters 5 and 6 we empirically investigate the determinants of non-performing loans. Chapter 5 is focused on a bank-level study of Montenegro, while Chapter 6 is focused on the banking sectors of Central and Eastern Europe. In Chapter 7, based upon the findings of the previous analyses we will suggest forward-looking central bank policies that should be adopted in order to safeguard banking sector stability.

In summary, this thesis will introduce, apply and wherever possible quantitatively assess the factors contributing to the incidence of non-performing loans and vulnerability in the banking sector of Montenegro and Central and Eastern Europe and, based on those findings, develop policy proposal for these countries.

CHAPTER 2: Banking Sector Instability: Characteristics, Mechanisms and Consequences

Contents:

2.1 Introduction

One of the conclusions of the previous Chapter highlights the need for banking sector stability in a small country such as Montenegro. Analysing the main characteristics and developments of the Montenegrin banking sector, we identified that the main threat to banking sector stability appeared to be a high incidence of non-performing loans. Thus, in this Chapter we re-examine the concept of banking sector stability with special reference to developments contributing to a rising incidence of non-performing loans. Therefore, Chapter 2 develops a theoretical framework for the analysis of banking sector stability. The banking sector serves as a major channel through which instability may be transmitted to other sectors in the economy. Thus, it is necessary to have a stable banking sector which supports the efficient allocation of resources and distribution of risks across the economy. The assessment of the stability of the banking sectors is of particular importance for regulators, depositors, investors and the general public. The importance of knowing the main factors disturbing the stability of the banking sector is discussed throughout this Chapter. In addition, in this Chapter we examine the channels transmitting financial turmoil from a crisis-country to other countries, identifying what makes a country particularly vulnerable. Therefore, this part of the Chapter will provide an introduction to the analysis presented in the following Chapter where we investigate how the recent global financial crisis was transmitted to the CEE region.

Section 2.2 starts with a discussion of the meaning of financial stability, highlighting that in most economies financial stability largely depends on the stability of the banking sector. Moreover, for an understanding of banking fragility in this section we identify the main characteristics of a stable banking system in order to understand the possible sources of instability and the mechanisms behind the occurrence of banking crises. Furthermore, given that the banking sector fragility usually refers to the possibility of a crisis, in Section 2.3, we provide a review of the literature on banking crises. The next Section 2.4 explains why macroeconomic and financial risks are likely to be closely interrelated, highlighting that macroeconomic instability may contribute to banking sector instability. The findings from the literature review in the previous two sections, suggest that the incidence of non-performing loans could be a good indicator of the degree of distress in the banking sector, thus the Section 2.5 is dedicated to examining the appropriate definition of non-performing loans and reviewing theory on the determinants of their incidences. In the next Section (2.6) we examine the nature of a financial contagion and the mechanisms by which a crisis could be spread from one country to another. The conclusions of this Chapter are presented in Section 2.7.

2.2 Financial and Banking Stability

The role of financial and banking development in the promotion of economic growth has been investigated by many researchers. Much of the initial theoretical and empirical literature suggested that a strong banking sector is important for economic growth. Schumpeter (1934) stressed the role of the banking sector as the main financier of productive investments and thus as an accelerator of economic growth. Furthermore, King and Levine (1993) found that financial services stimulate economic growth by increasing the rate of capital accumulation and by improving the efficiency with which economies use that capital. The study by Levine et al. (2000) analysing 74 countries from 1960 to 1995, reveals that the development of financial intermediaries exerts a statistically significant and economically large impact on growth even after controlling for simultaneity bias or country-specific effects. Furthermore, Mavrotas and Son (2004) find that the magnitude of the positive influence of financial sector on economic growth varies depending on the level of development. The estimation results suggest that the effect of financial sector development in developing countries is more persistent and larger than in developed countries. Hasan et al. (2009) suggest using both qualitative and quantitative measures when assessing the dependence of financial sector development on economic growth. They derive qualitative measures for the development of the banking sector, by calculating cost- and profit- efficiency and quantitative measures by credit volumes for each individual bank in 11 European countries for the period 1996-2004. Their findings suggest that an improvement in bank efficiency spurs five times more growth than does an identical increase in credit. The quality effect is stronger in developed economies, while a quantity increase is also beneficial in developing economies. Arcand et al. (2012) study whether there is a threshold above which financial development stops contributing to growth. Their results suggest that in countries with a very large financial sector the relationship between financial depth and economic growth disappears. Indeed, a ratio of total credit to the private sector above 80-100% of GDP appears to have a negative impact on economic growth. According to Arcand et al. (2012), there are two possible reasons for this negative impact: excessive credit growth could lead to high economic volatility and a rising probability of a financial crisis, and high credit volume is generally related to potential resource misallocation. Investigating particular measures of development in the financial sector, Ayadi et al. (2013) analyse the relationship between the financial sector and economic growth in the southern Mediterranean region over the 1984-2010 period. Their results indicate that credit to private sector and bank deposits are in many specifications negatively associated with growth, suggesting that there are problems in the allocation of credit and weak financial regulation and supervision in the region. Studying the real effects of financial sector growth, Cecchetti and Kharroubi (2013) also find evidence that higher growth in the financial sector reduces real growth. They argue that financial booms are not, in general, growth enhancing, probably because the financial sector competes with the rest of the economy for resources. In addition, using data by sectors, they investigate the distributional nature of this effect and find that credit booms harm what are normally thought of as a key engine of growth: the more R&D-intensive sector. They conclude that there is a pressing need to reassess the relationship between finance and real growth in modern economic systems.

In most modern economies financial stability largely depends on the stability of the banking sector. The failure of banks may cause financial vulnerability, which consequently may lead to deterioration in the economic environment. The development of financial systems may have reduced risks in markets, but the fundamental characteristics of financial intermediaries may make economies more vulnerable to financial sector turmoil than in the past (Rajan, 2005). How vulnerable that sector might be, we will investigate in the following Chapter in the context of the recent global financial crisis, which resulted in a failure of financial institutions and financial markets, and further to output declines. Furthermore, this deterioration in the economy led to a further rise in distresses in the banking sectors. Levine (2004) summarising the literature on bank-based and market-based financial systems[6], argues that a bank-based financial system can improve the (i) acquisition of information on firms, (ii) intensity with which creditors exert corporate control, (iii) provision of risk-reducing arrangements, (iv) pooling of capital, and (v) ease of making transactions. Furthermore, he notes that supporters of bank-based systems argue that there are fundamental reasons for believing that market-based systems will not do as good a job of acquiring information about firms and overseeing managers. Consequently, these limitations may hurt resource allocation and economic performance. Furthermore, Athanasoglou et al. (2008) argued that the importance of banks is more pronounced in developing countries because financial markets are usually underdeveloped and banks are typically the only major source of finance for the majority of firms and are usually the main depository of economic savings. The analysis presented in the previous Chapter indicated that these characteristics were present in the case of Montenegro and most of the Central and East European countries.

Financial stability, which includes the stability of the banking sector, plays an important role in ensuring the efficient allocation of resources. Rajan and Zingales (1998) argued that "the fundamental role played by the financial sector is to facilitate the reallocation of funds from individuals with excess capital given their investment opportunities towards firms with a shortage of funds vis a vis their investment opportunities." (p. 559). A stable financial system means that the main system components, which include financial institutions, markets and infrastructure, are capable together of absorbing foreseeable adverse disturbances. However, there is still no universally recognised definition of financial stability. Maybe the most comprehensive definition is given by ECB (2007, pp.7): *"financial stability can be defined as a condition in which the financial system – comprising financial intermediaries,*

[6] Demirgüç-Kunt and Levine (2001) explain the difference between bank and market-based financial systems using a conglomerate index of financial structure they constructed. They compare the ratio of banking sector development relative to stock market development (both measured in terms of size, activity and efficiency). Countries with larger ratios are classified as bank-based and those where the conglomerate ratio of banking sector development to stock market development is below the mean are classified as market-based.

markets and market infrastructure – is capable of withstanding shocks and the unravelling of financial imbalances, thereby mitigating the likelihood of disruptions in the financial intermediation process which are severe enough to significantly impair the allocation of savings to profitable investment opportunities".

Reviewing the literature on financial stability, two frameworks can be identified. First, where financial fragility is identified with a financial crisis and the other which makes a clear difference between financial fragility and financial instability. Minsky (1992) was the first to distinguish between the terms financial fragility and financial instability. Tymoigne (2010), following Minsky's framework, defines financial fragility as the dependence of financial positions (balance sheets, income account, cash-flow accounts) on refinancing and liquidation, while, financial instability refers to the propensity of financial fragility to affect the economic process; it ultimately materializes itself by a debt-deflation process. Namely, Minsky notes that financial fragility generates financial instability on the up and on the down side. The up side is identified with bubbles, while the down side is identified with financial crisis and debt deflation. Following this, the goal is to prevent financial instability by limiting the growth of financial fragility. Tymoigne (2010) distinguishes between two approaches to financial instability and financial fragility. First, the static approach which conceptualizes financial instability as an unfortunate by product of capitalism that results from unpredictable random forces that no one can do anything about except prepare for through adequate loss reserves, and capital and liquidation buffers. Second, the evolutionary approach conceptualizes financial instability as something that the current economic system invariably brings upon itself through internal market and nonmarket forces and that require change in financial practices rather than merely good buffers. Furthermore, he compares the two approaches in order to lay the foundation for an empirical analysis developed within the evolutionary approach. His findings suggest that with macroeconomic data, it is possible to detect financial fragility, especially Ponzi finance.[7] In particular, his methodology was applied to the residential housing sector in the U.S. and was able to capture some of the trends that are known to be sources of wider economic difficulties. The most recent period

[7] Minsky (1992) in "Financial Instability Hypothesis", described three phases of debt financing, with Ponzi finance being one of these. In particular, Ponzi finance refers to a situation where the lender expects that neither the principal nor interest will be returned.

recorded the use of Ponzi finance in housing from the second quarter of 2004 to the first quarter of 2007, after which the moving average of home prices started to decline.

The effects of banking instability on the economy can be very costly. Namely, as described by Berger et al. (2008), the banking sector serves as a major channel through which instability may be transmitted to other sectors in the economy by disrupting the interbank lending market and payments mechanism, by reducing credit availability, and by freezing deposits. Bearing in mind that banks have a central role as financial intermediates a crisis will have adverse effects on the efficient operation of the market economy. Such adverse developments, as explained by Ioannidis et al. (2009), are likely to be reflected in a reduction in investment and consumption, increases in unemployment, and disturbances to the flow of credit to individuals and firms causing an overall economic slowdown. Hence, it is important to have a sound, stable and healthy financial system to support the efficient allocation of resources and distribution of risks across the economy. Thus, assessment of the stability of the banking sectors is of importance for regulators, depositors, investors and the general public. For an understanding of banking fragility we need to identify the main characteristics of a stable banking system and to understand the possible sources of instability and the mechanisms behind the occurrence of banking crises. Thus, in the following subsections we will analyse the main components of a stable banking sector: liquidity, solvency and profitability. In order to have a stable system, banks will need to balance these three elements.

2.2.1 Liquidity

Maintaining appropriate liquidity is considered a basic prerequisite for the sustainability of a bank in financial markets. Effective liquidity risk management helps in providing a bank with the ability to cover its cash obligations, which are uncertain because they are influenced by external events and the behaviour of other participants in the economy (BCBS, 2008). Liquidity management is of, great importance, because the inadequate liquidity of a single financial institution may have an impact on the entire financial system.

Banks are characterized by balance sheets where their liabilities (deposits) are generally short-term, while many of their assets are long-term and illiquid. The fundamental role of banks, in the maturity transformation of short-term deposits to long-term loans, makes banks vulnerable to the risk of insufficient liquidity, either individually or for the banking system as a whole. Practically any financial transaction or commitment has an impact on the liquidity of the bank. The bank is obliged to pay back demand deposits at any time depositors request them. This is explained in Diamond and Dybvig's (1983) model. Instability may arise in a situation when a depositor in a particular bank withdraws his deposits, believing that other depositors are likely to withdraw their funds as well. In this situation the bank will have to call in its loans and suffer the associated losses. Unanticipated withdrawals can push a bank to liquidate some of its assets at a loss and, in the extreme case, to fail. In this case, all rational depositors will seek to withdraw their funds as quickly as possible, producing a "run" on the bank (Hendricks et al., 2006). Moreover, in this model, bank runs can be contagious. Although this Diamond and Dybvig (1983) model is simplified, it nevertheless captures the essence of past bank runs. Bank runs are a common feature of extreme crises, which will be analysed in the next section.

Croccket (2008) notes that liquidity as a concept should be considered in the light of the "procyclicality" of the financial system. He explains that as the expansionary phase of an economic cycle proceeds, asset values increase, causing collateral values to rise, and inducing additional lending by financial institutions. Those that have financed positions through leverage profit most during this positive phase. Croccket (2008) argues that these gains provide borrowers with the incentive and the means to borrow more, and provide lenders with the reassurance that their risks are acceptable. He reports that during this positive phase of the cycle, leverage tends to increase, and lending institutions take on what, with the benefit of hindsight, can be seen as more risky exposures. To sum, in this phase credit costs seem to be low, liquidity is cheap and easily available, volatility is moderate, and competitor institutions are likely to be aggressively pursuing market opportunities. However, the system is vulnerable to a sudden change in the cycle. That change, can be caused by some external shock (e.g. by sudden increase in commodity prices, unanticipated rise in interest rates, etc.) or can be endogenous, such as overlending to a particular sector, e.g. housing. Croccket (2008) concludes that when market players see declines in asset prices, they see their capital cushions shrink and seek to protect their liquidity by reducing exposures. Thus, declining prices have the further effect of raising perceived vulnerability.

Liquidity shock mechanisms can operate through the balance sheets and through asset prices when market price declines. This has been confirmed by Cifuentes et al. (2005), Adrian and Shin (2008a), and Brunnermeier and Pedersen (2008). Frank et al. (2008) summarised the mechanisms through which liquidity shocks influence various markets during the normal times and in the period of financial distress. According to their research, these mechanisms are quite different. Namely, they explained that during normal times, market illiquidity shocks are typically short-lived, as they create opportunities for traders to profit and, in doing so, provide liquidity and contribute to the price-discovery process. However, during periods of crisis, several mechanisms may amplify and propagate liquidity shocks across financial markets, creating systemic risks.

Vento and Ganga (2009) stress that liquidity risk is not an "isolated" risk like credit risk, it is rather a "consequential" risk, that can be triggered or exacerbated by other financial and operating risks within the banking business: for example, where exposure to credit risk is in terms of high concentrations of risky assets in the bank`s portfolio, a high amount of delayed bank`s receivables, or market risk exposures when the securities become illiquid due to the adverse events in the market. Here, the relationships with other risks tend to create uncertainty with regard to liquidity risk measurement and to the management of a bank's liquidity gap profile (the difference between the bank`s assets and liabilities in a certain period).

An important issue regarding banks' liquidity is how multinational banks manage liquidity across their whole banking organization. Funds circulate between parent banks and their affiliates in diverse foreign markets. However, in the wake of a funding shock parent banks may start to withdraw and redirect liquidity within their banking organizations (Düwel, 2013). In some emerging markets the large presence of foreign banks may contribute to the transmission of a crisis. Particularly, this may affect those CEE countries where foreign subsidiaries often rely on interbank and wholesale markets rather than on retail deposits for funding (see Aydin, 2008). Cetorelli and Goldberg (2011) document that U.S. global banks activated their internal capital market in order to reallocate liquidity within their banking organizations. Furthermore, they found that the funding of foreign affiliates by parent banks is mainly determined by the location of the affiliate bank as a source of funding or destination for foreign investment, and its distance from the headquarters of the parent bank. According to the authors those could be more important determinants of funding than the attractiveness of the local economic environment.

Global liquidity, which reflects the availability of low-cost funding in global financial markets (Domanski et al., 2011), is typically created by the cross-border operations of commercial banks and other financial institutions. Therefore, cross-border flows should be of particular interest for policymakers to monitor. Bruno and Shin (2014) examine global liquidity in terms of the aggregate cross-border lending through the banking sector. They find evidence for a bank leverage cycle as a determinant of the transmission of financial conditions across borders through banking sector capital flows. A distinctive prediction of their model is that local currency appreciation is associated with higher leverage of the banking sector, thus providing a conceptual bridge between exchange rate movements and financial stability.

Events at the global level in the last few years indicate an increased complexity of liquidity risk and the need for its effective management and supervision (BCBS, 2008). Before the global financial crisis, financial markets were fairly active and resources could be provided at relatively low costs. The sudden disappearance of favourable market conditions shows how liquidity can quickly deteriorate, and that illiquidity can last for quite a long time. This process will be analysed in more detail in the next Chapter.

One reason for financial fragility is the pressure to hold inefficient liquidity. If the demand for liquidity rises above the usual level, there will be a sharp fall in the price of assets. This drop in asset prices may force other banks into insolvency and exacerbate the crisis. Namely, as explained by Allen and Gale (2003), the pecuniary externalities from one set of agents forces another much larger set into bankruptcy, or in simplified way, a small shock (to liquidity demand) can have a large effect. The central bank can mitigate this situation by an appropriate injection of liquidity. However, tight regulations, such as capital controls, are another instrument that can potentially be used to intervene. These instruments will be addressed in the Chapter 4.

2.2.2 Solvency

Solvency implies that the real value of a bank’s assets is at least equal to the value of its liabilities. When the value of a bank’s assets falls short of the value of its liabilities, the bank is insolvent. The value of a bank’s assets may drop because borrowers become unable or unwilling to service their debt (Demirgüç-Kunt and Detragiache, 1998a). More precisely, a bank is insolvent if loan losses exceed a bank's compulsory and voluntary reserves together with its equity cushion.

The level at which a bank's assets exceed liabilities, is the level of bank's capitalization, which is an important indicator of the banking sector stability. The amount of capital that a bank should hold, primarily, depends on the risk level of its assets (Hardy, 1998). A higher level of capitalization is required in risky credit activities, greater market fluctuations, more variable inflation etc. The likelihood that a bank remains solvent depends on it being profitable, well managed, and sufficiently well capitalized to withstand foreseeable adverse events (Lindgren et al., 1998, p. 9). According to Hardy (1998), changes in banks' capitalization or a rapid erosion of banks' capital as they absorb mounting losses, are a signal, and a component, of the banking sector's weaknesses. Thana (2008) notes that insolvency, initiated by a high level of non-performing loans in banks, is another characterization of a banking crisis. In addition, referring to the recent subprime banking crisis, Thana (2008) argues that a solvency crisis can also be generated by losses in off-balance sheet positions arising from movements in stock market prices.

A drop in asset prices may move other banks into insolvency and exacerbate the crisis as evidenced by Bernanke and Gertler (1989, 1990), Kiyotaki and Moore (1997), Allen and Gale (1998, 2003), Diamond and Rajan (2009). Frank et al. (2008) argue that increasing financial integration and innovation can make market and funding liquidity pressures readily turn into issues of insolvency. Furthermore, they find that the interaction between market and funding illiquidity increased sharply during the global financial crisis and bank solvency became an important consideration. They explain that the subsequent write-downs and losses emanating from structured financial products required that banks raise significant amounts of new capital from other investors, such as sovereign wealth funds. Many banks following the GFC have had to strengthen their balance sheet positions through capital injections from other investors.

2.2.3 Profitability

Empirical findings suggest that bank profitability is an important predictor of financial crises (Demirgüç-Kunt and Detragiache, 1999). The literature on the bank-lending channel (Van den Heuvel, 2003) has long shown that economic activity is hampered if the commercial banks, the most prominent agents in the credit markets, cannot execute their lending function properly. Therefore, because a profitable banking sector is better able to perform its lending function, a profitable banking sector is likely to contribute significantly to the stability of the financial system (Dietricha and Wanzenriedb, 2010). However, alternatively high profitability may be itself be a cause of instability. Namely, after the global financial crisis it was noticed that excessive risks were attached to the generation of those previously high profits.

In orthodox theory profitability is usually considered to be a function of internal and external determinants. Dietrich and Wanzenriedb (2010) explained that bank profitability is usually measured by the return on average assets and is expressed as a function of internal and external determinants. The internal determinants include bank-specific variables that originate from balance sheets and/or profit and loss accounts (Themba and Tobias, 2011). In particular variables such as bank size, risk, and overhead costs are typically used as internal determinants of banking profitability. The external variables reflect environmental variables (such as GDP growth rate, inflation, etc.) that are expected to affect the profitability of financial institutions.

Summarising the internal determinants of profitability, Pasiouras and Kosmidou (2007) find a positive and significant relationship between the size and the profitability of a bank. On the other hand, Micco et al. (2007) find no correlation between the relative bank size and the return on assets, i.e., the coefficient is always positive but never statistically significant. Many empirical studies found that asset quality has a direct impact on the profitability of banks. Yuki (2006) finds that poor asset quality is the major cause of a bank's poor profitability. That might reflect the fact that banks that are exposed to high-risk loans also have a higher accumulation of unpaid loans. These loan losses lower the returns of the affected banks (Dietrich and Wanzenriedb, 2010). Berger (1995) found that banks with a high capital ratio tend to earn more profit through translating the safety advantage into profit. Empirical evidence by Demirgüç-Kunt and Huizinga (1999), Abreu and Mendes (2002), and Pasiouras and Kosmidou (2007) indicate that the best performing banks, in terms of profitability, are those who maintain a high level of equity relative to their assets. Albertazzi and Gambacorta (2006) explain that after a drop in bank profitability, if equity is sufficiently low and it is too costly to issue new shares, then a bank will usually reduce lending, otherwise they fail to meet regulatory capital requirements and that may produce contractionary real effects on consumption and investment. Another important determinant of profitability is overhead costs. Athanasoglou et al. (2008) finds that the higher the overhead costs in relation to the assets, the lower the profitability of a bank.

In order to evaluate the stability and soundness of the financial and banking sector many studies link business cycle fluctuations and banking sector profitability. A positive phase of economic activity seems to improve the profitability of the banking sector, primarily since there is a relatively high demand for loans in that phase of the business cycle, given that clients are more profitable than in the recession phase. Conversely, a recession in the economy reflects negatively on the efficiency of operations and the profitability of banks. Namely, bad economic conditions can worsen the quality of the loan portfolio, generating credit losses, which eventually reduce banks' profits. In particular, Apergis (2009) finds that there exists a procyclical relationship between bank profitability and economic conditions, with the boom phase exerting a stronger impact on bank profitability vis-à-vis the effect emanating from contractionary phases. Albertazzi and Gambacorta (2006) also find that bank profits are pro-cyclical: GDP influences both net interest income (via lending activity) and loan loss provisions (via credit portfolio quality). Controlling for macroeconomic and structural factors, in their model, banks in the United Kingdom and United States were found to make higher profits than their counterparts in the euro area. They report that this result seems at least partly related to their more flexible cost structure, which allows intermediaries belonging to these banking systems to react more quickly to exogenous shocks.

Major transformations in the economic environment can have a significant impact on banks' performance. Determinants such as the central bank's interest rate, inflation, GDP development, taxation and variables representing market characteristics (e.g. market concentration) are related to a bank's profitability. Most studies have shown a positive relationship between inflation, central bank interest rates, GDP growth, and bank profitability (e.g., Bourke, 1989; Demirgüç-Kunt and Huizinga, 1999; Athanasoglou et al., 2008). Furthermore, there is some evidence that the legal and institutional characteristics of a country matter. According to the results of Bourke (1989) a bank's concentration ratio shows a positive and statistically significant relationship with its profitability. On the other hand, the results of Demirgüç-Kunt and Huizinga (1999) and Staikouras and Wood (2004) indicate a negative but statistically insignificant relationship between bank concentration and profits.

Summing up, we can conclude that liquidity and solvency often overlap and interact with each other. Banks can fail either if they face liquidity shortages or if they are insolvent. Also, an aggregate shortage of liquidity can lead to banks becoming insolvent. Thus, it is difficult to determine the root cause of a banking crisis. Another predictor of a crisis may be, as noted above, both excessively high and low profitability, which depends on bank-specific and external (macroeconomic) determinants. In the next section we will review the literature on past banking crises in order to assess which of these requirements were disturbed in these crises.

2.3 Banking Crises

Since banking system fragility refers to the latent possibility of a banking crisis in the financial system, in this section we will provide an analysis of banking crises. In particular, in this section we will focus on banking crises before 2007, while a separate and more detailed analysis of the recent global financial crisis will be provided in the following Chapter. Banking crises have been present in the world for centuries. Reinhart and Rogoff (2008a) report that, over the past two centuries, the 66 countries they study had experienced 286 banking crisis, 105 of which have come since 1945. There are many definitions of a banking crisis. Bearing in mind Tchana's (2008) classification, a banking crisis can be identified by the lack of liquidity, a sharp reduction in the value of banks` assets, a credit crunch and insolvency. Namely, given Schwartz (1985), Miron (1986) and Wolfson (1986) research, a banking crisis refers to a lack of liquidity in the banking system, where the demand for liquidity is higher than its supply. Furthermore, for Guttentag and Herring (1984) and Manikow (1986) a banking crisis is characterized by a credit crunch. Fisher (1933), Flood and Garber (1981), and Minsky (1982) described banking crisis as a forced sale of assets because the structure of capital is not in line with market-determined asset values, causing a further decline in asset values. Therefore, according to these authors, a banking crisis begins with liquidity problems which lead to solvency problems. Monnin and Jakupii (2010) define banking instability as the probability of the banking sector becoming insolvent within the next quarter. Hence, a lower probability corresponds to greater stability and vice versa. These economists consider a banking sector to be insolvent if, at the end of the quarter, the market value of the assets owned by all the banks of a country is not sufficient to repay its total debt. This description is similar to that used by Bordo et al. (2001), who define a banking crisis as a period of "financial stress resulting in the erosion of most or all of aggregate banking system capital". A combination of above mentioned definitions of a banking crisis is offered by the Federal Reserve Bank of San Francisco (1985). They characterized a banking crisis as a sharp reduction in the value of banks` assets as well as banks` deposits, resulting either from an apparent or real insolvency of many banks or from an apparent or real liquidity problem in many banks and accompanied by some bank collapses and, possibly a credit crunch.

According to Allen et al. (2009) banking crises can be explained by two theories. According to the first, banking crises are identified with financial panics, while according to the second theory crises are fundamentals-based. Both theoretical approaches have a long history. Allen et al. (2009) argue that according to the first theory, banking crises typically occur as the consequence of a financial panic, caused by random withdrawals of deposit regardless to changes in the real economy (Kindleberg, 1978). In the research conducted by Bryant (1980) and Diamond and Dybvig (1983) bank runs are self-fulfilling prophecies. These analyses are based on multiple equilibria. Allen et al. (2009) explain that in these models, agents have uncertain needs for consumption in an environment in which long-term investments are costly to liquidate. If depositors believe that other depositors will withdraw then all agents redeem their claims and a panic occurs. Furthermore, Allen et al. (2009) note that equilibrium exists where everybody believes no panic will occur and agents withdraw their funds according to their consumption needs. However, they find that the theory is silent on which of the two equilibria will prevail and in at least one equilibrium there is a panic. They explain that the depositors' beliefs are self-fulfilling and are coordinated by "sunspots"; but "sunspots" do not have much predictive power. Thus, they conclude that since there is no real account of what triggers a crisis, it is difficult to use the theory for any policy analysis. Finally, according to this approach banking crises can be eliminated by the adoption of a deposit insurance scheme.

According to the second view, the degree of fragility of the banking sector depends solely on the phase of the real economy. Calomiris and Mason (2003) while studying four crises using a broad range of data, conclude that the first three crises were fundamental-based while the fourth was panic-based. However, this fundamental-based approach to a crisis will be discussed in the following section 2.4. A more recent, and maybe the most comprehensive definition, is provided by Laeven and Valencia (2008, p. 5), who characterise a systemic banking crisis as an event in which:

"… 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, non-performing loans increase sharply and all or most of the aggregate banking system capital is exhausted. This situation may be accompanied by depressed asset prices … sharp increases in real interest rates, and a slowdown or reversal in capital flows. In some cases, the crisis is triggered by depositor runs on banks, though in most cases it is a general realization that systematically important financial institutions are in distress."

According to Reinhart and Rogoff (2008a, p. 56), crisis is defined by "two types of events: (i) bank runs that lead to closure, merger or takeover by the public sector of one or more financial institutions; and (ii) if there are no runs, the closure, merger, takeover or large scale government assistance of an important financial institution (or group of institutions) that marks the start of a string of similar outcomes for other financial institutions".

There are several theories of crises. One part of the theory of the causes of banking crises emphasizes asymmetric information in credit contracts or in bank-depositor relations as fundamental determinants behind financial crises. Namely, asymmetric information can be defined as a situation where different parties in a financial contract do not have the same information. According to orthodox neo-classical economic theory this leads to potential adverse selection and moral hazard problems and other informational problems that may have an important impact on the financial system. One possible result is financial instability and banking crisis (Minsky, 1992). For example, as noted by Mishkin (1997) borrowers who take out loans usually have much better information about potential returns and risk associated with the investment projects they plan to undertake than lenders do. Moreover as explained by Stiglitz and Weiss (1981), borrowers with the riskiest investment projects will now be the ones most likely to take out the loans at high interest rates, since they will draw benefits and leave the losses for lenders. The result of this adverse selection is that banks ration credit, they stop lending, rather than raise interest rates further, causing the overall supply of loans to decrease (the 'credit crunch'). From the perspective of the depositor, the bank management generally has much better information about the quality of the bank's assets than the depositor has. This approach gives an explanation of bank runs and a banking panic based on the idea that depositors cannot costlessly value individual bank assets (Bordo and Wheelock, 1998). Hence, they have difficulty in monitoring the performance of banks.

It is difficult to identify and predict the exact timing of bank runs. As a result, in the literature there is still no single criterion for detecting a banking crisis. While studying the indicators of the banking crises in different countries, Caprio and Klingebiel (1996) proposed simple criteria for identifying a crisis which combines qualitative data on the state of the banking sector's assets and quantitative indicators of non-performing loans and bank solvency. Once the criteria have been established, financial experts in specific countries could make a professional assessment of whether a crisis exists or not. Demirgüç-Kunt and Detragiach (1998b, 2005) suggest the following indicators for identifying a crisis in the banking sector: when the ratio of non-performing assets to total assets in the banking system exceed 10 per cent and the cost of the rescue operation is at least 2 per cent of GDP. Disruptions in the banking sector may result in a state takeover of banks; an onslaught of depositors[8] and a deposit freeze in banks. Given that indicators of asset quality, in particular the incidence of non-performing loans, often are identified with disturbances in the banking sector, section 2.5 will be dedicated to defining non-performing loans, analysing their costs and assessing how the problems associated with a rising incidence may be addressed.

As stated in the previous section, banking crises can be very costly. According to Honohan and Klingebiel (2000), banking sector distress can frequently be attributed to crisis management measures of a particular kind adopted by the government during the early years of the crisis. They reveal that the fiscal costs are linked to a set of crisis management strategies. In particular, their results suggest that unlimited deposit guarantees, open-ended liquidity support, repeated recapitalizations, debtor bail-outs and regulatory forbearance add significantly and sizably to those costs. According to Cecchetti et al. (2009) not all of these crises have had visible real costs, but most have. In their restricted sample of 40 financial crises fully one fourth resulted in cumulative output losses of more than 25 per cent of pre-crisis GDP. And one third of the crisis-related contractions lasted for three years or more. Most, but not all, systemic banking crises in their sample coincide with a sharp contraction in output from which it takes several years to recover.

[8] A situation when a large number of customers withdraw their deposits from a bank at the same time.

2.4 Links between Banking Sector Stability and Economic Activity

The link between banking stability and economic activity has been of particular interest to policy makers in order to help them to inform their monetary policy decisions. A stable macroeconomic setting is typically viewed as one of the preconditions for financial, and hence, banking stability. Examining the relation between a stable macro economy and banking sector stability is the role of this section.

In examining the relations between banking sector stability and the real economy, the literature is mainly focused on two issues: first, on macroeconomic influence to banking sector stability; and; second, on quantifying the costs of banking sector crises in terms of real output losses. As mentioned in section 2.2, there are studies that consider that the development of the financial and banking sector acts as an important contributor to economic growth (King and Levine, 1993; Demirgüç-Kunt and Maksimovic, 1998a; Levine, et al., 2000; Mavrotas and Son, 2006; etc.). However, in this thesis we are interested in examining and assessing banking sector stability, thus we will focus on the first strand of the above mention literature. Moreover, Monnin and Jokipii (2010) summarising previous research on banking sector stability, and relying on Kaminsky and Reinhart (1999) and Demirgüç-Kunt and Detragiache (1998a) findings, note that it is difficult to separate cause and effect in the financial sector to real economy, thus it is less clear whether or not the banking sector is the main trigger of an economic slowdown.

In order to determine the banking crisis, many studies focus on the role of the macroeconomic variables and its impact on banking system. As mentioned in section 2.3. according to one strand of theory, the fundamental based approach (Gorton, 1988; and Allen and Gale, 1998, 2007), leading economic indicators could predict the onset of banking crises. Moreover, according to these authors the banking sector stability depends solely on the phase of the real economy. Basically, according to these authors, when the economy goes into recession or depression the returns on bank assets will be low. Given their fixed liabilities in the form of deposits or bonds they may unable to remain solvent. This may precipitate a run on banks. This view is consistent with the research conducted by Gorton (1988) where in the U.S. in the late nineteenth and early twentieth centuries, a leading economic indicator, the liabilities of failed businesses, could predict the occurrence of banking crises. Furthermore, Allen and Gale (1998) develop a model that is in line with the business cycle view of the origins of banking crises. They assume that depositors can observe a leading economic indicator that provides public information about future bank asset returns. If high returns are anticipated then depositors are quite willing to keep their funds in the bank. Allen and Gale (2007) explained that with real shocks, optimal risk sharing requires contingencies and, given the debt-like properties of demand deposits, crises are the only way to achieve these contingencies. In this case banking crises can be eliminated by a central bank acting as a lender of last resort.

According to Demirgüç-Kunt and Detragiatche (1998a) the emergence of systemic banking crises in developed and developing countries suggests that crises tend to erupt when the macroeconomic environment is weak, particularly when growth is low and inflation is high. Also, high real interest rates are clearly associated with systemic banking sector problems. However, they state that a weak macroeconomic environment is not the sole factor behind systemic banking sector problems. Structural characteristics of the banking sector and of the economic environment in general also play a role. Furthermore, Kaminsky and Reinhart (1999) stressed that a banking crisis may be preceded immediately by a marked slowdown in GDP growth. Hogart et al. (2001) analysing a sample of 43 banking crises find that crises have often come after a boom in developed countries but frequently occur at the peak of one in emerging market economies. In particular their findings suggest that average GDP growth in the three years before crises was above its 10-year trend in two-thirds of the emerging market countries and three-quarters of the developed countries.

Herring and Wachter (2003) found that many financial crises were the corollary of bubbles in real estate markets. That finding has been confirmed by Reinhart and Rogoff (2008a, 2008b, 2009), who found that systemic banking crises are typically preceded by credit booms and asset price bubbles. Knutsen (2012) considers that the growth in bank lending during the upswing of the business cycle and the corresponding accumulation of debt in the non-financial sector increases the banks' credit risk, and consequently financial fragility in the financial sector. This amplifies the danger of an outburst of financial crisis, and increases systemic risk. Thus, the foundation for a financial crisis is laid down during a credit fuelled boom. Examining the events which preceded the last global financial crisis, Adrian and Shin (2008b), Brunnermeier (2008), Greenlaw et al. (2008), and Taylor (2008b) considered that one cause can be found in the policies of low interest rate adopted by the Federal Reserve and other central banks after the collapse of the technology stock bubble. Those factors, as reported by Allen et al. (2009), helped fuel a dramatic increase in house prices in the U.S. and several other countries such as the U.K., Ireland and Spain. In 2006 this bubble reached its peak in the U.S. and house prices there and elsewhere started to fall. This will be discussed in more detail in Chapter 3.

Previous research suggests that a good macroeconomic environment positively affects the quality of banks` assets. However, research suggests that banks do not make enough provisions in these positive conditions, and when the conditions reverse, bad loans and loan losses emerge. Quagliarello (2007) explains that the beginning of an expansionary phase in the economy firms' profits tend to increase, asset prices rise and customers' expectations are optimistic. Expansion of aggregate demand leads to a rapid, often more than proportional, growth in bank lending and in the economy's indebtedness. During the boom banks may underestimate their risk exposures, relaxing credit standards and reducing provisions for future losses. After the peak of the cyclical upturn, customers' profitability worsens, borrowers' creditworthiness deteriorates and non-performing assets are revealed, thus causing losses in banks' balance sheets (cyclicality). Quagliarello (2007) finds that the business cycle affects non-performing loans for a large panel of Italian banks over the period 1985–2002. This discussion will be continued in the Chapter 5, where we will investigate which macroeconomic variables influence the incidence of non-performing loans.

Even though many banking crisis were preceded by macroeconomic vulnerabilities it would not be appropriate to link banking instability entirely to macroeconomic instability. Theory suggests that macroeconomic instability is a sufficient condition for banking crises to emerge. Moreover, systemic crises are also closely linked with institutional and structural factors. Regulatory changes, weaknesses in the legal framework, inadequate official supervision are frequently important elements. Importantly, banking crises often reveal existing weaknesses within the banking system. Namely, Llewellyn (1999) notes that usually the case that the seeds of the problem (e.g. over-lending; weak risk analysis and control) were sown in the earlier upswing of the cycle. Even earlier, González-Hermosillo, et al. (1996) explains that bank fragility is essentially, a function of liquidity risk, market risk and credit risk. In turn, those risks are conditioned by macroeconomic conditions and can be influenced by the overall fragility of the banking system. They suggest that bank-specific indicators explain the likelihood of a bank's failure, while macroeconomic variables largely determine the timing of failures. This analysis will be continued in Chapter 5 where we will investigate both macroeconomic and bank-specific indicators of banking sector distress.

2.5 Non-Performing Loans

Over the last two decade the literature that examines non-performing loans has expanded in line with the greater attention paid to understanding the factors responsible for financial vulnerability. This situation may be attributed to the fact that non-performing loans have an important role in assessing financial vulnerability as evidenced by the strong association between non-performing loans and banking and financial crises, as mentioned in the previous section. According to some researchers, the incidence of non-performing loans is a significant predictor of insolvency (e.g. Demirgüç-Kunt, 1989; Barr and Siems, 1994; Berger and De Young, 1997). Hou (2007) concludes that failing banking institutions always had a high level of non-performing loans prior to their failure. Greenidge and Grosvenor (2010) suggest that the incidence of non-performing loans is a key element in the initiation and progression of financial and banking crises. Louzis et al. (2010), citing Reinhart and Rogoff (2010), also indicate that rising non-performing loans can be used to mark the onset of a banking crisis. However, even if non-performing loans exceed the previous highest recorded level that does not necessarily lead to bank failure. Furthermore, Guy (2011) argues that non-performing loans have been widely used as a measure of banks' asset quality, and a high incidence is often associated with banking crises in both the developed and developing world.

Historically, there is abundant evidence that a rise in non-performing loans precede banking and financial crises in Argentina, East Asia and Sub-Saharan African Countries during the 1990s. Namely, the 1997 East Asian financial crisis left Thailand, Indonesia, South Korea and Malaysia severely affected by high non-performing loans. Namely, as documented by the Caprio and Klingebiel (1999), non- performing loans of the banking system reached 19 per cent of aggregate loans in Indonesia, 17 per cent in Thailand, and 16 per cent in Malaysia by the end of 1997. However, according to Ahmad (2002) analysing the Malaysian financial system, credit risk had already started to build-up before the onset of the 1997 Asian Financial crisis, but became more serious as NPLs increased. Similarly, Fofack (2005) found this relationship to be significant; highlighting those high costs of non-performing loans exacerbated the banking crisis. The global financial crisis was also attributed to the rapid default of sub-prime loans/mortgages. There is evidence that the level of NPLs in the US started to increase substantially in early 2006 in all sectors (Greenidge and Grosvenor, 2010). Bearing in mind this previous experience it is understandable why so much emphasis is currently given to studying the determinants of non-performing loans when assessing banking stability.

The terms bad loans or problematic loans are often used as synonyms for non-performing loans (Berger and De Young, 1997; Fofack, 2005; Bexley and Nenninger, 2012). Fofack (2005) alternately uses impaired loans for non- performing loans. According to Berger and De Young (1997), a high level of non-performing loans indicates poor management in banking institutions.[9] Generally non-performing loans are defined as loans which do not generate income for a relatively long period of time. According to Caprio and Klingebiel (1999), IMF Guide (2004a) and Guy (2011) that is the principal and/or interest on these loans has been left unpaid for at least 90 days.

According to the Institute for International Finance (IIF) and Bank for International Settlements (BIS) non-performing loans are categorized as:

- Substandard: Payment in doubt (Overdue by more than 3 months up to 6 months). Banks make 10% provision for the unsecured portion of loans.
- Doubtful: Payment improbable (Overdue by more than 6 month to 1 year). Banks make 50% provision for doubtful loans.
- Loss: Virtually uncollectable (Overdue by more than 1 year). Banks make 100% provision for loss loans.

As summarised by Barisitz (2011), national non-performing loans definitions commonly refer to three elements. The first element refers to "principal or interest 90 days or more overdue", which is in line with the IMF Financial Soundness Indicators Compilation Guide (2004). Second, the presence of underlying "well-defined weaknesses" in either the loan or the borrower. This part refers to the bank's assessment of to what extent the borrower's economic or financial standing has deteriorated (the debtor's insolvency and/or bankruptcy) which could happen before the period of 90 days overdue. And the last one refers to the frequently applied credit quality categories, where the weakest categories are "substandard", "doubtful" and "loss or write off`", proposed by IIF and BIS.

[9] This will be discussed in detail in section 5.3.

This classification is based on the IIF and BIS documents but, different countries have different approaches to classify their non-performing loans. Some countries, such as Russia[10], shorten the period for unpaid loans when they become past due. The intention in this case is to put such loans on lenders' watch lists sooner and require them to address these loans before losses start to escalate (Ernst and Young, 2004). A fuller discussion of the comparability of definitions of non-performing loans will be presented in the section 6.3.

Bearing in mind the findings of the literature on how non-performing loans may be harmful for banks, the regulatory institutions need to prescribe minimum standards for credit risk management. Dedu and Nechif (2010) argue that the basis of sound credit risk management is to identify existing and potential risks inherent in banks' lending activities. Furthermore, they proposed that measures to counter such risks should include: policies controlling the large exposures, adequate diversification, and improved monitoring of risk exposures. These policies were in line with those advocated by deServigny and Renault (2004). Further proposed measures were the appropriate classification of assets, which involves the assessment of the repayment capacity of the loan portfolio and other credit instruments, including interest incurred and not received that expose the bank to credit risk; and loss provisioning policies or establishment of an adequate provisions to absorb the expected losses in the loan portfolio and the level of assets that generates losses (Greuning and Brajovic, 2003).

In 1996 it was agreed to establish a universal international standard among banking regulators. The aim of that standard was to have a measure for how much capital a bank needed to hold in order to guard against credit, market and operational risk. That is how the first Basel Accord was created. Basel I was focused on the Cooke ratio, a ratio defined as the amount of capital divided by risk-weighted assets. Risk-weighted assets are simply the classified assets in four categories, multiplied by the risk weight, as presented in the following table.

[10] In Russia, non-performing loans for legal persons are as loans in arrears for more than 30 days, while non-performing loans for actual persons are loans in arrears for more than 60 days.

Table 2.1 Risk weights of on-balance-sheet assets

Risk weights (%)	Asset category
0%	Cash, claims on central governments and central banks denominated in national currency and funded in that currency, other claims on OECD central governments and central banks, claims collateralised by cash of OECD central-government securities or guaranteed by OECD central governments.
20%	Claims on multilateral development banks and claims guaranteed by, or collateralised by securities issued by such banks; claims on banks incorporated in the OECD and claims guaranteed by OECD incorporated banks; claims on securities firms incorporated in the OECD subject to comparable supervisory and regulatory arrangements, including in particular risk-based capital requirements, and claims guaranteed by these securities firms; claims on banks incorporated in countries outside the OECD with a residual maturity of up to one year and claims with a residual maturity of up to one year guaranteed by banks incorporated in countries outside the OECD; claims on non-domestic OECD public-sector entities, excluding central government, and claims guaranteed by or collateralised by securities issued by such entities; cash items in process of collection.
50%	Loans fully secured by mortgage on residential property that is or will be occupied by the borrower or that is rented.
100%	Claims on the private sector; claims on banks incorporated outside the OECD with a residual maturity of over one year; claims on central governments outside the OECD; Claims on commercial companies owned by the public sector; premises, plant and equipment and other fixed assets; real estate and other investments; capital instruments issued by other banks; all other assets.

Source: BCBS (1988), Annex 2.

The aggregate amount of each asset category is then multiplied by the risk weight assigned to that category. The resulting weighted values from each of the risk categories are then added together. The sum is the bank's total risk-weighted assets, which forms the denominator of the Cooke Ratio.

However, from 2004 a new more risk sensitive capital adequacy framework was adopted. Namely, according to BCBS (2004) Basel II establishes more rigorous assessment of risk and capital management requirements designed to ensure that a bank maintains capital reserves appropriate to the risk the bank exposes itself through its investment and lending practices. However, the Basel II framework allows a more flexible approach for estimating the minimum supervisory capital, emphasising the use of a standardized and internal rating-based (IRB) approach. In the standardised approach, the risk weights are based on a rating that is provided by external credit assessment institutions or other institutions accepted by national supervisors such as export credit agencies, while in the IRB approach, the rating is produced internally by a bank's risk-management system. The banks are allowed to use the ratings of more than one external credit assessment institutions but some precise rules are designed to prevent any opportunistic ('cherry-picking') behaviour (Ayadi, 2005). Therefore, banks will not be allowed to choose, for each customer, the rating source assigning the most favourable judgement (thereby reducing the total amount of regulatory capital). As argued by Ayadi (2005), it was hoped that better ratings would bring about lower weights in the computation of risk-weighted assets; moreover, as in Basel I, different categories of counterparties (from individuals to sovereign governments) will receive different sets of coefficients. In the Basel II standardised approach a bank allocates a risk weight to each of its assets and off-balance sheet positions. It then calculates a sum of risk-weighted asset values. A risk weight of 100% indicates that an exposure is included in calculation of risk weighted assets value which translates into a capital charge equal to 8% of that value, as the minimum prescribed capital ratio is 8% according to Basel II.

In addition, in order to ensure comparability across banks, the Basel II established minimum qualifying criteria for the use of internal rating-based approaches that cover the comprehensiveness and integrity of banks' internal credit risk assessment capabilities (Fofack, 2005). According to the IRB approach, credit exposure will be a function of five basic risk parameters which are presented in Table 2.2 below.

Table 2.2 Risk parameters by the IRB approach

Type of parameter	Definition of the risk parameter
Probability of default (PD)	The default probability for a borrower over a one-year period. A starting point of the measurement of PD is the definition of default. In general, the default event arises from the non-payment of principal or interest. It is commonly accepted that default occurs if payment is past due 90 days. These types of loans are characterised as 'non-performing'.
Loss given default (LGD)	The expected amount of loss on a facility provided to the borrower when s/he defaults. To determine LGD, a bank must be able to identify the borrowers who defaulted, the exposures outstanding at the time of default and the amount and timing of repayments ultimately received. In addition, private information on the borrower and the availability of collateral could serve to develop the LGD estimates.
Exposure at default (EAD)	The amount the borrower owes at the time of default. The EAD is the sum of the current utilisation expressed as a percentage of the total commitment and the loan equivalent, which is the additional utilisation as a percentage of the unused commitment.
Maturity estimate of the exposure (m)	This parameter raises the possibility that the original probability of default needs to be revised and possibly increased.
Diversification coefficient (rho)	The degree of diversification and correlation of the credit portfolio to which the exposure belongs.

Source: Ayadi (2005)

According to BCBS (2005), bank calculates the expected loss through a simple multiplication of (PD*LGD*EAD). In conjunction with the maturity estimate of the exposure (m) and the diversification coefficient (rho), these risk parameters are translated into estimates of potential future loss, thus defining the basis of minimum capital requirements (Ayadi, 2005).

The IRB approach enables estimates to be made of capital requirements for various specific exposures, such as to the corporate, sovereign or retail sectors.

Regulations and risk measurement have to be strengthened in order to prevent an accumulation of non-performing loans and avoid a possible banking crisis. However, to what extent Basel II provided such protection will be investigated in Chapter 4. Namely, in Chapter 4 we examine whether the regulations before the global financial crisis were adequate.

A high incidence of non-performing loans tends to generate economic, financial and fiscal costs to financial institutions. Firstly, non-performing loans deteriorate the banks' financial statements. Furthermore, provisions for non-performing loans and write offs which are made in banks` balance sheets in order to cover potential losses, affect banks profitability. Non – performing loans may reduce banks liquidity, credit expansion, and consequently slow down the growth of the real sector (Somoye, 2010). According to Fofack (2005), high levels of non-performing loans can produce significant economic and financial cost. He explained that these loans may negatively affect the level of private investment, increase deposit liabilities and constrain the scope of bank credit to private sector through a reduction in banks 'capital, falling saving rates as a result of runs on banks, accumulation of losses and related increased provisions to compensate for these losses. Thus, according to Fofack (2005), non-performing loans potentially reduce private consumption and in the absence of credible deposit guarantee mechanisms to protect small depositors, can be a source of economic contraction, especially when coupled with declining gross capital formation in the context of a credit crunch caused by erosion of banks' equity and assets. Caprio and Klingebiel (1999) and Laeven and Valencia (2008) summarising the evidence from systemic banking crises conclude that a high level of non-performing loans may cause significant financial costs. For example, in Macedonia in 1993-1994 70 per cent of total banking system loans were non-performing and the costs of banking system rehabilitation, obligations from assumption of external debt, liabilities regarding frozen foreign exchange, and contingent liabilities in banks were together estimated at 32% of GDP (Caprio and Klingebiel, 1999; Laeven and Valencia, 2008). Also, in 1998, non-performing loans in Romania were estimated to amount to 25-30 per cent of the total loans in six major state-owned banks. The Central Bank injected 210 million dollars in the largest state bank, which was about 0.6 per cent of GDP (Caprio and Klingebiel, 1999; Laeven and Valencia, 2008).

Given the implications of the high level of non-performing loans for investment, economic growth and the future banking and financial stability, these loans cannot be left unresolved. Non-performing loans resolution usually refers to loan restructuring and collection, in order to 'clean' balance sheets. However, in more acute situations, outright sale or securitization of problematic assets may be needed. Historically, the resolution of non-performing loans referred to the transfer of these loans from fragile financial institution by asset management companies and/or deposit insurance schemes. Dado and Klingebiel (2002) while concluding that the proper management and disposition of impaired assets are one of the most important tasks of successful and speedy financial restructuring, distinguish, citing Sheng (1996), two alternatives for asset management strategies which include setting up a government agency with the full responsibility for acquiring, restructuring and selling of the assets (the centralized approach) or letting banks and other creditors manage their own non-performing assets (the decentralized approach). Furthermore, Dado and Klingebiel (2002) analyse seven banking crises in which governments mainly relied on banks to resolve non-performing assets. Their analysis underscores that as in the case of a centralized strategy the prerequisites for a successful decentralized restructuring strategy are manifold. The successful countries were those who significantly improved the banking system's capital position enabling banks to write down loan losses; banks as well as corporations were given adequate incentives to engage in corporate restructuring; and ownership links between banks and corporations were limited or severed during crises.

According to Sirtaine and Rosenberg (2012) research in Europe and Central Asia, efforts by banks to resolve NPLs have been proceeding slowly because of a collective action problem[11] and of various obstacles in the business environment[12] which make NPL resolution difficult. Namely, they explain that individual banks have too little incentives to resolve NPL solely, thus the government or central bank may have to initiate and/or coordinate action. In addition they suggest that the collective action problem could also be overcome by direct government intervention, but this has the downside of potentially large fiscal costs or the retroactive

[11] Collective action program includes both individual banks and public sector interventions, because individual banks cannot usually resolve the problem of high non-performing loans by themselves.

[12] These obstacles mainly refer to laws and regulations that need to be amended to remove obstacles to NPL resolution. According to Papa (2012), the main barriers to fast non-performing loans resolution are shortcomings in the regulatory and accounting frameworks, the absence of well-developed corporate and insolvency framework, adverse tax incentives as well as simply overloaded court systems and too lengthy proceedings.

change of private contracts by government fiat. This, the World Bank argues, should therefore be confined to truly exceptional circumstances. With non-performing loans being unresolved in an appropriate timeframe, economies might be hampered by resources being tied to unprofitable sectors. Whilst a speedy resolution of non-performing loans is necessary, this should be conducted in a manner that contributes to overall banking stability. For example, in the case of Hungarian, Latvian and Romanian banks in 2012, a sudden write-down of loans may cause large capital shortages, with solvency ratios falling below the required minimum (UniCredit CEE Strategic Analysis, 2012).

2.6 Contagion

As explained in section 2.2, in Diamond and Dybvig`s (1983) classical model of a bank run it is rational for individual depositors to either hold funds in the bank or withdraw funds, depending on the actions of all other depositors. Thus, in a currency crisis, the process is analogous to a bank run in that there is a sudden withdrawal of funds from a country sparked by investors` fear that unless they act quickly they will be too late to claim the limited pool of foreign exchange reserves (Dornbusch et al., 2000).

When explaining contagion in financial markets, Sell (2001) differentiates between a fundamental contagion, which is caused by direct links between the country originating the crisis and the countries affected by its consequences, and a non-fundamental contagion, which could be due to a general shift in the risk perception of international investors. Kaluza (2010) referencing the World Bank provides a comprehensive definition of contagion. Namely, he provides three distinct definitions of contagion: a broad one, a restrictive one as well as a very restrictive definition. The broad definition of the contagion describes the "cross-country transmission of shocks or the general cross-country spillover effects" (p.3). This broad view of contagion views contagion as any transmission of shocks across countries. This view considers that contagion can take place both during "good" times and "bad" times, it does not need to be related to crisis, even though, contagion has been emphasized during crisis times. The restrictive definition provided by the World Bank describes contagion as the "transmission of shocks to other countries or the cross-country correlation, beyond any fundamental link among the countries and beyond common shocks" (p.4). Therefore, a crisis could spread from one country to other countries not only via fundamental channels, but also by herding behaviour of international investors. The very restrictive definition by the World

Bank describes contagion as “when cross-country correlations increase during crisis times relative to correlations during tranquil times” (p.4). Therefore, the impact of certain shocks across countries would systematically increase during crisis times.

In general, contagion includes shocks which are transmitted through trade links, competitive devaluations and financial links (Dornbusch et al., 2000; Sell, 2001). Dungey et al. (2003) consider these will produce an anticipated spillovers, and they include linkages that capture changes in market fundamentals and economic relationships between countries. However, according to Dungey et al. (2003), who are citing Masson (1999), Favero and Giazvazzi (2000) and Forbes and Rigobon (2002), there are also unanticipated spillovers. Namely, these shocks are transmitted between countries by linkages that are not transparent, and are typical in equity, currency and fixed interest markets. Dungey et al. (2003) provide an empirical analysis of the transmission of contagion in equity markets during the Russian bond default and LTCM crises in 1998. Contagion was identified as the effects of unanticipated shocks from either Russia or the United States on other global markets. Contagion from Russian bond default in 1998 was found to be important, but quantitatively smaller than contagion from LTCM crisis, and mostly affected industrial countries. There were two main channels of transmission; one was through direct exposure of U.S. banks and hedge funds and European banks to Russia. The second was an indirect channel arising from interconnections between German and European financial markets, as well as that of the United States.

Eichengreen and Rose (1999) distinguish two channels for the international transmission of speculative attacks in the foreign exchange markets. The first channel is trade links, where they consider that attacks spill-over contagiously to other countries with which the subject country trades. The second channel is macroeconomic similarities, where they consider that attacks spread to other countries where economic policies and conditions are broadly similar. Their large, quarterly panel of twenty industrial country data from 1959-1993, suggests that both the “macroeconomic” and “trade” channels of transmission are empirically relevant, however, the trade effects dominated.

Eichengreen and Rose (1999), Glick and Rose (1999), and Forbes (2001) stress trade linkages. In addition, the IMF’s World Economic Outlook (WEO) (2009) notes that the role of trade channels of transmission has increasingly become important for emerging market economies during the last two decades. Namely with a speeding up of the process of global integration, trade openness rose rapidly. However, Kaminsky and Reinhart (2003); Caramazza, et al. (2000); Fratzscher (2002); and Van Rijckeghem and Weder (2001) emphasize financial channels, whilst Forbes and Chinn (2004) attribute the main role in the transmission of financial shocks to trade, with bank lending being of increasing importance over time.

Enders and Peter (2012) investigate the transmission of the global financial crisis, of 2007-2009 via trade and financial channels. Calibrated to German data, their model predicts 95% of the observed decline in real output at the beginning of 2009. The trade channel turns out to be responsible for 70% of this movement, while the financial channel explains the remaining 30%. However, transmission via the financial channel is found to trigger a longer-lasting recession relative to the trade channel, thereby prolonging the crisis abroad. Balakrishnan et al. (2009) find evidence that financial stress, which has appeared to be a key conduit of transmission, tends to spread rapidly to emerging economies and with a high pass-through. They concluded that the unprecedented spike in financial stress in advanced economies in the third quarter of 2008 had a major effect on emerging economies and raised the financial stress index above levels seen during the Asian crisis. The origins and nature of the global financial crisis will be analysed in more detail in the following Chapter.

Finally, the transmission of a shock through these channels may affect multiple countries at the same time (a common shock) or a specific country (a country specific shock). As explained by Balakrishnan et al. (2009) the role of common factors is likely related to the increasing financial integration of the majority of emerging economies in the past decades or in other words, financial globalization. One example is common-lender effects via the blanket withdrawal of funds by highly exposed multinational financial institutions, which will be explained in the next Chapter. Beside these channels of transmission, country-specific indicators of vulnerability can make certain countries more prone to the propagation of external shocks. As suggested by the empirical literature these indicators, include current account and budget deficits, composition of capital inflows, domestic banking sector indicators, and other structural characteristics.

According to the IMF's WEO (2009), emerging economies obtain some protection against financial stress from their typically lower current account and fiscal deficits and higher foreign reserves during positive phases of the advanced economies' cycle. However, during a downswing in advanced economies, they cannot prevent its transmission, although they may limit the implications of financial stress for the real economy by utilising foreign reserves to buffer the effects of a drop in capital inflows.

The transmission of potential shocks is becoming stronger over time given that the emerging economies have increasing financial links to advanced economies. In the recent period, in European transition economies bank lending has been considered as the major channel of transmission. Namely, Aydin (2008) demonstrates that interbank market conditions in Western Europe have had an increasing impact on bank lending in Central and Eastern Europe. However, this topic will be addressed in Chapter 3.

2.7 Conclusion

In this Chapter the importance of banking stability has been explained and the main preconditions for a stable banking sector, liquidity, solvency and profitability, identified. The literature review suggests that the violation of these preconditions may lead to a banking crisis, which can be costly for the entire economy. In general, a banking crisis can be identified by the lack of liquidity, a sharp reduction in the value of banks` assets, a credit crunch and growing insolvency.

Many banking crisis were preceded by macroeconomic vulnerabilities. A stable macroeconomic environment is one of the preconditions for financial, and hence, banking stability. However, it would not be appropriate to link banking instability entirely to previous macroeconomic instability. There are other factors contributing to the banking distress, which will be addressed later in the thesis.

Banking crises are difficult to identify and predict; however, according to previous empirical studies, an increasing incidence of non-performing loans usually precedes banking and financial crises. In general, non-performing loans are loans which do not generate income for a relatively long period of time. It has been argued that the incidence of non-performing loans is affected by the macroeconomic environment and bank-specific indicators. A fuller analysis of these determinants will be provided in Chapter 5.

In this Chapter we have explained that contagion results from shocks which are transmitted through trade and financial links. Moreover, a shock transmitted through these channels may affect multiple countries at the same time. The common lender effect is an example how shocks can be transmitted to other countries, due to increased financial integration and globalization. In addition, country-specific indicators of vulnerability, such current account and budget deficits, composition of capital inflows, domestic banking sector indicators, indicate how certain countries are more prone to the external shocks.

The following Chapter will assess which of the preconditions for banking stability were disturbed in the recent global financial crisis. Furthermore, Chapter 3 will analyse how the global financial crisis spread to the CEE region, leaving a high proportion of non-performing loans in most CEE banking sectors.

CHAPTER 3: The Global Financial Crisis and Its Impact on Central and East European Economies

Contents:

3.1 Introduction

This Chapter evaluates the fundamental causes and consequences of the global financial crisis, concentrating upon the role of financial linkages. The Chapter will serve as a special case of the previous Chapter, in the sense of explaining the mechanisms behind the occurrence and severity of this particular crisis. As explained in Chapter 2, macroeconomic and financial risks are closely interrelated. Macroeconomic instability (inflation, unemployment, external imbalances, asset price bubbles and excessive credit growth) may contribute to financial instability, particularly when banks and their borrowers are exposed to significant interest rate and exchange rate risks.

By analysing the causes of the global financial crisis, we seek to identify the main macroeconomic influences at work. In addition, we consider the consequences of global financial crises in order to understand the contribution of the finance and banking sector to the contagion process, whereby the effects of the global financial crisis are transmitted from the countries where it originated to the countries of CEE and SEE. There are several linkages that are potentially able to transmit external shocks across borders. However, here, the focus is on financial linkages and on potentially moderating influences of different financial structures. This Chapter provides illustrative statistics for the pre-crisis period indicating potential macro and financial imbalances in the CEE region. The crisis was followed by rapidly multiplying credit quality problems, accompanied by a credit crunch and a high level of non-performing loans. The global crisis has called into question how parent banks treated their subsidiaries in CEE region, given the dominant ownership of foreign banking groups in region.

One of the aims of this Chapter is to demonstrate how macro structural developments contributed to the global financial crisis. This part will contribute to the analysis in Chapter 6, where we will investigate, among the others, the effect of the macro determinants on the incidence of non-performing loans which have remained high in the post-crisis period. The second objective of this Chapter is to explain the influence of financial and banking systems structures and their implications for economic performance in CEE economies in the aftermath of the GFC. In particular, we consider the implications of a high degree of foreign ownership for the contagion process.

This Chapter is organized as follows: Section 3.2 provides an analysis of the global financial crisis, explaining its causes and consequences. Section 3.3 evaluates the macro vulnerabilities in Central and Eastern Europe in the pre-crisis period, with Subsection 3.3.1 examining the phenomenon of excessive credit growth in the CEE region during this period. In the next Section, 3.4, the analysis assesses the main financial linkages in CEE. The discussion in Subsection 3.4.1 provides an overview of the pattern of bank ownership in the CEE region, while in Subsection 3.4.2 the analysis focuses on the common lender and cross border lending in the region. Section 3.5 discusses the impact of the GFC on the CEE region and subsequently analyses the actions of western parent banks in CEE during this period. The conclusions of this Chapter are presented in Section 3.6.

3.2 The Global Financial Crisis

For the first time since the 1930s, the world economy experienced a major global financial crisis in 2008. The crisis started as a "subprime" crisis in the United States in the summer of 2007, and later spread to a number of other countries through a combination of direct exposures to subprime assets, the gradual loss of confidence in a number of asset classes and the drying-up of wholesale financial markets (Merrouche and Nier, 2010). As noted by Merrouche and Nier (2010), the major Western economies faced financial imbalances, characterized by an overreliance on wholesale funding sources by their banking systems and asset bubbles in residential property markets. The GFC was accompanied by dramatic events such as the failure of major financial institutions and significant government interventions in their financial systems around the world. First, the causes of GFC will be discussed.

3.2.1 Causes of the Global Financial Crisis

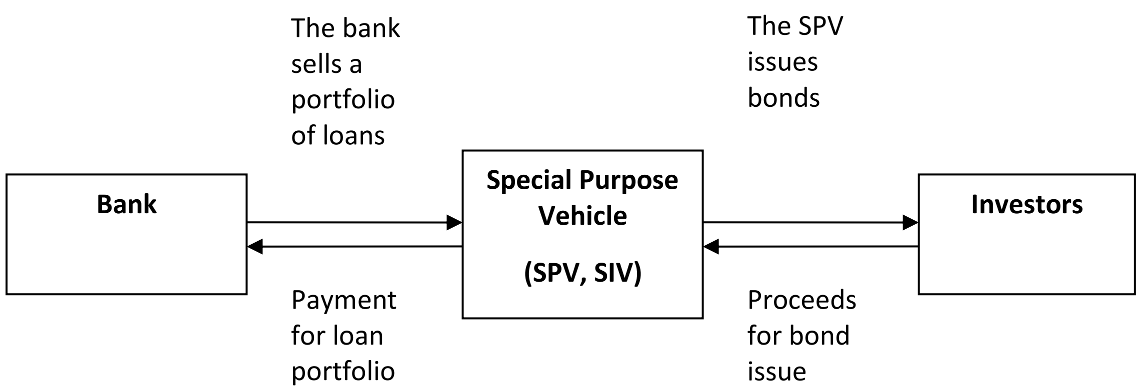
This section investigates the drivers of the global financial crisis. There is, as yet, no complete agreement on the causes of global financial imbalances. According to Taylor (2007) and White (2009), accommodative monetary policy in the US from 2001 fuelled an increase in financial imbalances. Accommodative monetary policy is usually used to stimulate consumers spending by making borrowing cheaper by lowering the interest rate. According to Adrian and Shin (2008b) low short-term rates may have reduced the cost of wholesale funding for financial institutions, leading them to increase the leverage. In addition, low interest rates provided investors with incentives to hold riskier assets, including structured products that promised higher returns (Gerlach and Moretti, 2011). Moreover, Taylor (2007) argues that low interest rates in financial markets as a whole increased the supply of and demand for mortgages, causing a surge in housing price inflation. Against this, Merrouche and Nier (2010), citing Jiménez et al. (2007) and Gambacorta (2009), reveal that lower policy rates are associated with lower risk-taking, since low short term rates increase intermediation margins and profits, which in turn can reduce the incentive for financial institutions to take risks.

According to Portes (2009), Bernanke (2009), Eichengreen (2009), Krugman (2009) and King (2010) widening global trading imbalances and associated capital flows were the key factors contributing to the global financial crisis. Borio and Disyatat (2011) explain that an excess of saving over investment in emerging market countries, as reflected in corresponding current account surpluses, eased financial conditions in major developed deficit countries and exerted significant downward pressure on world interest rates. Furthermore, they note that low interest rates fuelled a credit boom and risk-taking in major advanced economies. This is in line with King (2010) who argues that the large flows of capital into western financial markets decreased interest rates and encouraged excessive risk-taking. As summarized by Merrouche and Nier (2010), citing Bernanke (2005), high capital inflows may reduce long–term interest rates (and thus compress spreads), causing financial institutions to lever up and investors to “search for yield”. In addition, Ostry et al. (2010) note that large capital inflows may provide lower-cost financing for local banks, and they also may reduce long term interest rates. While Reinhart and Reinhart (2008) explain that, due to the large capital inflows, the total credit supply to the domestic economy may increase, causing a rise of local assets (house) prices.

There is general agreement that the supervision standards and instruments to maintain the banking stability prior to GFC were weak (this will be discussed in chapter 4), leading many to argue that it was a combination of accommodative monetary policy, growing global imbalances and weak supervision standards that caused the build-up. Maddaloni and Peydró (2010), based on Acharya and Richardson (2009), Allen et al. (2009), Rajan (2010) and Taylor (2008a), conclude that the key contributing factors were an excessive softening of lending standards due to too low levels of short-term (monetary policy) and long-term (government bond) interest rates, a concurrent widespread use of financial innovation resulting in high securitization activity, and weak supervision standards, especially for bank's capital. Acharya and Richardson (2009) explain that banks had placed problematic assets, such as securitized mortgages, in off-balance-sheet entities, so that they did not have to hold significant capital buffers against them. Maddaloni and Peydró (2010) analysing bank lending standards in Euro area and the U.S., find that low short-term interest rates softened lending standards, both for firms and households. Furthermore, they report that softening of lending standards, especially for mortgages, was amplified by high securitization activity, weak supervision of banks' capital, and too low (and for too long) monetary policy rates. In addition, they also demonstrate the costs of the softening of lending standards; namely countries with softer lending standards, related to negative Taylor-rule residuals (low monetary policy rates), and prior to the financial crisis had a worse economic performance afterwards, as measured by real, fiscal and banking variables.

The period prior to GFC was characterised by excessive borrowing, excessive lending and excessive investment, which had been fuelled by significant economic and regulatory factors. Excessive borrowing and lending were related, particularly, to the subprime mortgage market in the United States, especially during 2005 and 2006. While the excessive investment mainly resulted from the period of low interest rates globally in the wake of the onset of banking crisis in Japan at the beginning of 1990, following the bursting of the dot.com bubble in 2001 in the Unites States; and finally, from the imbalances in savings and investment between the Anglo-American economies and the rest of the world. As reported by Arner (2008), excessive borrowing and lending involving commercial real estate, corporate lending (especially for mergers and acquisitions and private equity transactions), commodities and international equities, impacted not just on the U.S. market, but also other markets. This broad-based excessive borrowing and lending were fuelled by excessive investment by investors around the world in financial institutions in the U.S. (Arner, 2008).

Excessive borrowing, lending and investment were encouraged by, as previously mentioned, the different forms of securitization. Securitization, as defined by Ashcraft and Schuermann (2008), is a process through which loans are removed from the balance sheet of lenders and transformed into debt securities purchased by investors. Securitization allows lenders (banks) of assets (such as residential mortgages) to transform a future stream of revenue (loan repayments) into a present value pool of capital, which can then be used to support further lending. Maddaloni and Peydro (2010), note that the securitization of loans initially can result in assets yielding attractive returns for investors and also enhances banks' lending capacity, especially when the capacity constraint is binding (in times of high credit growth, partially stemming from low monetary policy rates). As part of the securitization process, and in order to relocate certain assets and liabilities from the banks` balance sheet, special legal entities such as special purpose vehicle (SPV) were created. Namely, as explained by Schwarcz (1998), the bank transfers rights in current or future receivables or other financial assets to a SPV, which in turn issues securities to capital market investors and uses the proceeds from the issue to pay for the financial assets (see Figure 3.1). This was the most common structure used in the United States and in other countries.



Source: BCBS (2006)

Figure 3.1 The securitization process

Other securitization products included structured investment entities (SIV) which were used to issue commercial paper, and operate in a similar way to a SPV. Investors bought commercial paper issued by the SIV mainly because of their attractive returns. SIV exercised profits based on the difference in interest rates earned on long-term loans and paid interest rates on short-term debt. Theoretically, as summarized by Arner (2008), securitization allows the distribution of banks` credit risk to a wider range of investors, thereby reducing the cost of borrowing for ultimate borrowers and reducing the risk to lenders of defaults on underlying loans. However, the securitization products provided significant incentives to abuse, and that lay at the heart of the credit crisis. Particularly, as Arner (2008) reports, in the United States and other developed countries loans came to be made not by banks, but instead by specialists, mortgage brokers for real estate or investment banks that intended on profiting from charging to arrange loans and with little or no attention paid to the ability of the borrower to repay in the future.

Comparing the GFC with previous crises, there are some similarities. Namely, as identified in section 2.3, asset price booms are common in crises. As reported by Claessens et al. (2010) house prices increased dramatically before the crisis, in particular in the United States, the United Kingdom, Iceland, Ireland, Spain and most of the other markets that subsequently ran into problems. These booms were generally fuelled by fast rising credit, resulting in sharply increased household leverage. As seen in previous crises, the combination of rapid house prices increases and increased leverage turned out to be the most dangerous elements. The dynamics of this housing boom were similar to developments in previous banking crises. Reinhart and Rogoff (2008b) compared developments in house prices in the United States before 2007 with those in the previous "Big Five" crises (Finland, 1991; Japan, 1992; Norway, 1987; Sweden, 1991; and Spain 1977). They found an excess of 30 per cent increases in housing prices prior to financial crises and marked declines in the year of crisis and in subsequent years. They noted that the rise in U.S. house prices, prior to the 2007 crisis exceeded those prior to the "Big Five" crises.

As in earlier crises, the rapid expansion of credit played a large role in the period before the GFC. Rapid credit expansion has been noticed in the United Kingdom, Spain, Iceland, Ireland, and several Eastern European countries, often fuelling real estate booms. Credit booms generally coincide with large macroeconomic fluctuation (IMF WEO, 2004b), with real output, consumption, and investment rising above trend during the build-up phase of credit booms and falling below trend in the subsequent phase (Claessens et al. 2010). In addition, Claessens et al. (2013) noted that while aggregate credit growth was less pronounced, reflecting slower corporate credit expansion, household indebtedness in the United States rose rapidly after 2000, driven largely by increased mortgage financing, with historically low interest rates and financial innovation contributing. In spite of low interest rates, debt service relative to disposable income reached historical highs.

In many countries, particularly in Central and Eastern Europe, large portions of loans were denominated in foreign currency prior to the GFC. Those exposures had been common before, for example in the Asian financial sector before their crisis of the late 1990s. Historically, as explained by Szpunar and Głogowski (2012), one common driver of high foreign currency lending was a significant interest rate differential in favour of foreign currency loans for the clients. Namely, lower interest rates on foreign currency loans than on local currency loans often caused a strong demand for foreign currency loans, once their supply appeared. However, although the interest rates on foreign currency loans were lower the borrower's ability to service these debts depended on exchange rate stability. This implied a high default risk correlations across loans and systemic exposure to external shocks (Claessens et al., 2010).

To some extent, the GFC has many of the same characteristics as other recent banking crisis. However, the GFC had its own unique feature: excessive subprime lending which in the longer term acquired a high-risk profile and significantly increased leverage. Claessens et al. (2013) discussed that even though the subprime model seemed good for risk allocation, it turned out to undermine incentives to properly assess risks and led to a build-up of tail risks.[13] Furthermore they explained that the lack of understanding of the true value of assets in that model quickly turned a liquidity crisis into a solvency crisis. Lastly, they suggested that in countries where non-banks (including money market funds, investment banks, and special-purpose vehicles) played important roles, the risk of runs became more likely, as these institutions usually did not fall under the formal financial safety net. In addition, the regulation and supervision of new structured credit instruments and techniques was also ineffective. Increased international financial integration contributed to the GFC. Financial integration increased dramatically in the years before the crisis, involving many markets and

[13] Risk tails refers to the end portions of risk distribution curves, the bell shaped diagrams that show statistical probabilities for a variety of outcomes.

different countries. Increased financial integration enabled the US securitisation boom, which has been considered as the proximate trigger for the crisis, to expand to other countries. Lane (2012) considers that it is difficult to imagine that the growth in these credit markets would have been of a similar magnitude without the participation of foreign investors (especially foreign banks), which fuelled the accelerated growth of the asset-backed securities markets in the United States. As presented by Acharya and Schnabl (2010) and Bernanke et al. (2011), European banks were major purchasers of the asset-backed securities. In addition, these banks also obtained dollar funding in the US money markets (Shin, 2011). Therefore, the risk exposure of European parent banks grew in line with these US activities. On the other hand, financial globalisation permitted rapid growth in the balance sheets of many banks. Namely, globally-active banks grew rapidly, making it difficult for national supervisors to adequately monitor and assess their risk profiles. In addition, local banks expanded their lending by tapping international wholesale markets, which fuelled credit growth in a number of countries (Lane, 2012). Finally, financial globalisation had an important role in emerging markets, where an increased demand for low-risk debt assets from emerging-market official sources and the increased supply of equity opportunities in these countries may have added fuel to the securitisation boom (Bernanke et al. 2011).

In summary, a confluence of factors is currently thought to have produced the GFC: excessive borrowing and lending, securitizations, mispricing risk, inaccurate credit ratings, lax monetary policies and insufficient regulation. Given these factors the GFC became an unavoidable consequence.

3.2.2 Consequences of the Global Financial Crisis

The GFC produced a huge downshift in the path of economic output, consumption and financial wealth (Luttrell, et al., 2013). As Claessens et al. (2010) show, this might not have been a surprising outcome since recessions associated with financial crises tend to be unusually severe, resulting in much larger declines in real economic activity, and their recoveries tend to be slow. Similarly, globally synchronized recessions are often long and deep, and recoveries from these recessions are generally weak.

Loosening lending standards during the boom had significant consequences in most countries, but particularly so in the United States where mortgages were more likely to be packaged into securities. The trading books of investment banks and other financial institution were especially affected, since if the market price of securities fall, accounting conventions often requires that the loss is recognised immediately, which is not the case for a traditional loan portfolio. Namely, the banks' losses were concentrated in securities rather than in loans in the traditional balance sheet. In this environment, as explained by Ellis (2009), banks' perceptions of risk increased, and they started to tighten lending standards. Namely, banks became more careful, as were their borrowers experienced difficulties refinancing their loans. Projects that seemed attractive and profitable in the good times suddenly become risky.

SPVs began having difficulties issuing CDOs, as the demand for structured products dried up. In many cases, backup lines of credit for the SPVs were cancelled, creating severe liquidity problems for the SPVs. In order to protect their reputations, many banks took back assets that they had transferred to SPVs. Liquidity pressures and credit quality impairment increased, and banks started reporting major losses. In addition, banks become unwilling to lend to each other. Namely, the TED-Spread, which is a difference between interbank rates (originally 3-month LIBOR) and Treasury-EuroDollar rate, rose dramatically in summer 2007.

When banks started to face bankruptcies (see the following text box), it triggered a further increase in risk aversion. When risk aversion rises like this, the macroeconomic consequences can be severe (Ellis, 2009). The United States, most of the euro area countries and Japan were experiencing economic contractions by the first half of 2008. Ellis (2009) notes that bank regulation and behaviour might explain how a US mortgage crisis propagated into essentially a North Atlantic banking crisis, but trade and confidence effects explain why that North Atlantic banking crisis escalated into a global problem.

Text box 3.1 Bankruptcies, Acquisitions and Bank Runs

- September 17, 2008. Britain`s biggest mortgage lender HBOS is taken over by Lloyds TSB in a 12bn deal.
- September 25, 2008. In the largest bank failure in the United States, Washington Mutual, and the giant mortgage lender which had assets valued at 307bn is closed down by regulators and sold to its JP Morgan Chase.
- September 29, 2008. Wachovia, the fourth largest US bank, is bought by its Citigroup in a rescue deal backed by US authorities.

Bank Runs

- Northern Rock: September 14, 2007
  Depositors withdrew £1bn from Northern Rock in what is the biggest run on a British bank for more than a century. They continue to take out their money until the government steps in to guarantee their savings.
- Bear Stearns (investment bank): March11, 2008
  Goldman Sachs refuses to honour ``netting`` arrangements that would expose them directly to Bear Stearns. Bear Stearns`s hedge fund clients flee and they are unable to secure funding on repo market.

- April 2007. New Century Financial (specializes in sub-prime mortgages) files for Chapter 11 bankruptcy protection.
- March 17, 2008. Bear Stearns acquired by larger rival JP Morgan Chase for $240m in a deal backed by $30bn of central bank loans.
- July 13, 2008. US mortgage lender IndyMac collapses – the second-biggest bank in US history to fail
- September 15, 2008. Lehman Brothers files for Chapter 11 bankruptcy protection. Merrill Lynch taken over by Bank of America for $50bn.

Source: Brunner (2011)

The intensification of the crisis, see Text Box 3.1, led to the deterioration of most macroeconomic indicators. According to United Nations World Economic Situation and Prospects Report (2012), there was a sudden contraction in the volume of world trade and industrial production. This fall in world trade volumes in 2009 was exceptional with exports from developed economies falling by 12% and, notably, a collapse in transition economies' demand for imports of 26% (see Table 3.1).

Table 3.1 World trade: changes in volume of exports and imports, by major country groups, 2003-2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
	Volume of exports (annual % change)									
World	5.10	10.60	7.80	9.40	7.00	2.70	-9.20	12.30	6.40	4.50
Developed economies	1.90	8.20	5.80	8.50	6.10	1.90	-12.20	11.00	6.10	3.30
Economies in transition	11.40	12.90	4.00	7.00	7.40	2.00	-6.90	4.20	5.20	1.90
Developing economies	11.00	15.00	12.00	11.20	8.40	4.20	-4.40	15.30	7.00	6.40
	Volume of imports (annual % change)									
World	5.80	11.20	8.30	9.50	7.50	2.70	-10.70	13.40	6.70	4.30
Developed economies	3.80	8.80	6.40	8.10	5.00	0.30	-13.00	10.40	5.30	2.60
Economies in transition	12.50	18.20	10.50	15.70	21.80	1.50	-26.10	11.00	6.40	7.00
Developing economies	10.50	16.80	12.50	12.20	11.70	6.60	-4.50	18.70	9.00	6.80

Source: United Nations World Economic Situation and Prospects Report (2012)

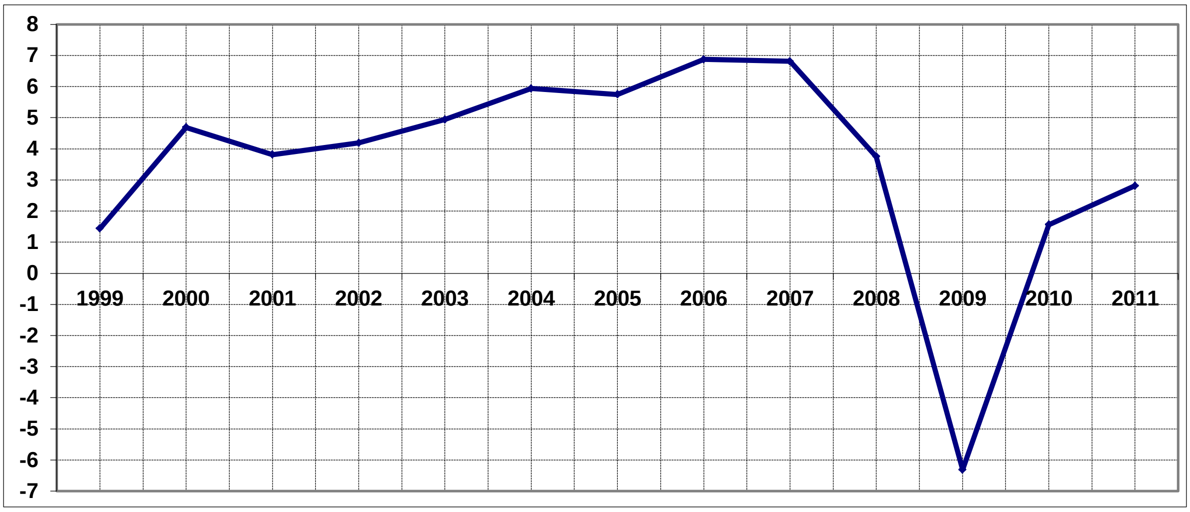
The decline in global aggregate demand was accompanied by new strains in global financial markets, in particular, increased borrowing costs and a shortage of trade credits. In response to falling domestic and external demand, industrial production also came under pressure. By early 2009, world industrial production was falling at a 27 percent annualized pace. In the second half of 2009, production began recovering, initially led by accelerating growth in China (World Bank, 2010). The financial crisis also caused a collapse in commodity prices (UN, 2010). For example, by early 2009, oil prices decreased by almost 70 per cent from their peak levels of mid-2008. During the same period, prices of metals and prices of agricultural products also declined significantly.

Since the beginning, of the GFC, the number of unemployed has risen in most economies. Namely, by 2012 the number of unemployed in the United States of America had more than doubled since the beginning of the crisis. The unemployment rates in the euro zone and Japan have also increased significantly. Unemployment rates in transition economies and developing countries also moved higher, in particular in the Commonwealth of Independent States (CIS) and Central and South-Eastern Europe (UN, 2010).

Macroeconomic shocks can feed into banks' balance sheets through the credit-risk transmission channel (Reinhart and Rogoff, 2010). Namely, a large body of research finds that a weak global macroeconomic outlook implies that borrowers have become riskier. The borrowers are likely to face greater difficulty servicing their debts. As highlighted by Claessens et al. (2013) debt servicing and repayment are likely to be vulnerable to the economic downturns and changes in monetary conditions. Furthermore, they argue that this maximized defaults correlations across loans, generating portfolios highly exposed to declines in house prices, confirmed later through the large number of non-performing loans. In general, non-performing loans rise relative to total lending when economies turn down (Keeton and Morris, 1987; Pesola, 2005; Espinoza and Prasad, 2010; Nkusu, 2011) and the GFC has been no exception to this pattern. In that environment, banking sectors were weakened in all the major economies. For the CEE region, the global financial crisis was experienced as a huge external shock. Since the CEE banking systems were not directly exposed to "toxic assets", the crisis was transmitted to the region through several indirect channels (Petreski and Lazarov, 2013), which will be discussed further in the Chapter (Section 3.5). However, primarily we will analyse the macroeconomic environment in CEE countries in the period before the GFC.

3.3 Macroeconomic Vulnerabilities in Central and Eastern Europe in the Pre-Crisis Period

The CEE countries have followed a particular model of development that was based on political integration, institutional development, trade integration, financial integration and labour mobility (Becker et al., 2010). The key features of this model, until the emergence of the global financial crisis, were solid economic growth (see Figure 3.2), that brought incomes closer to the level of developed countries and increased financial integration; remarkable net capital inflows corresponding to current-account deficits; the presence of the large western European banking groups; credit expansion; significant real exchange-rate appreciation; and lower real interest rates in most of the CEE countries. Although the catching-up process was initially supported by increased macroeconomic stability, most of these countries had become increasingly vulnerable before the crisis. In particular, they experienced huge credit, housing and consumption booms, and associated high current-account deficits and external-debt levels.

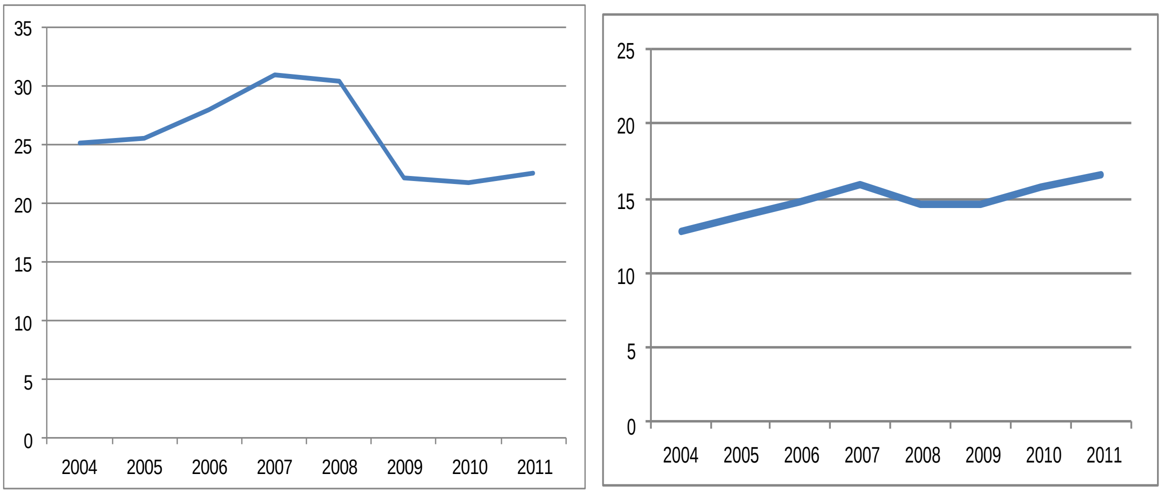


Source: World Bank database, World Development Indicators

Figure 3.2 Annual GDP [a] growth in Central and East European countries (%)

a) Unweighted average of GDP growth rate is used

Before the global financial crisis, economic growth in CEE economies was largely based on external financing. As explained by Jude (2014), foreign investors were of major interest for policy makers, in order to maximize domestic investment. Analysing FDI in CEE countries, Mileva (2008) suggests that it stimulates domestic investment, particularly in countries with weak institutional development and underdeveloped financial markets. This is in line with Gray and Jarosz's (1993) argument that in CEE the need for foreign capital and know-how to repair their economies and stimulate growth was immense. Kose et al. (2006) suggest that domestic investment can also be stimulated by the "collateral benefits" associated with FDIs. Namely, they argue that in order to attract foreign investors, governments in developing countries' are forced to set in place good macroeconomic policies and improve political and economic governance.



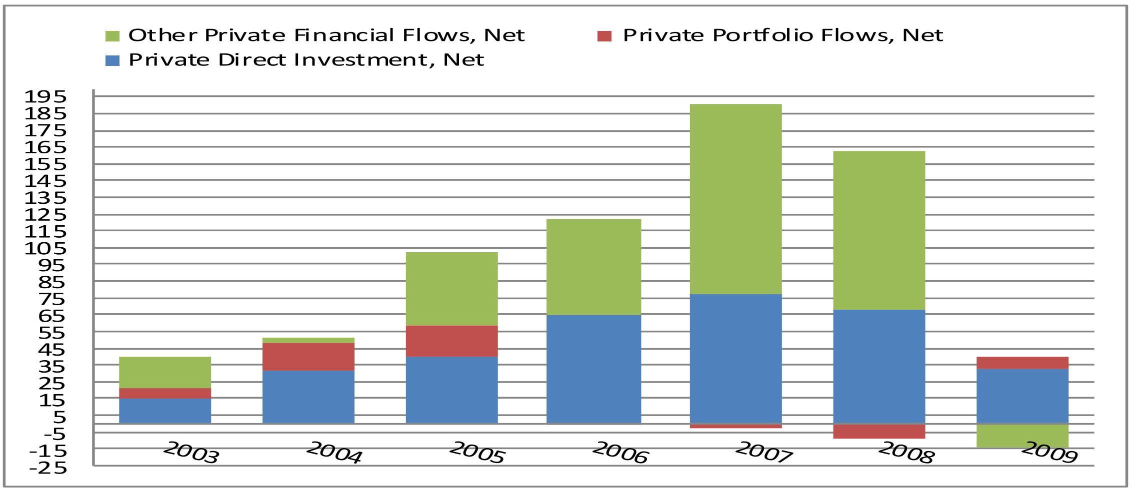
Source: World Development Indicators

Figure 3.3 a) Gross domestic investment (% of GDP) Figure 3.3b) Gross domestic savings (% of GDP) in CEE countries

Note: Based on unweighted average

Low saving rates were present in most of the CEE countries (Figure 3.3 b). Looking at Figures 3.3 a) and 3.3 b), it is noticeable that in the years 2004-08 gross domestic savings were only around 50% of gross domestic investment in the CEE countries. Bearing in mind that FDI accounts for only around a half of domestic investment, the figures suggest that at least half of all investment could not be covered by domestic savings. That, in turn, indicates the importance of inward FDI to the economic development of the CEEs. That importance of FDI is even greater if we consider the quality of investment (e.g. the extent to which investment embodies technical progress), corresponding transfers of know-how and other positive externalities. In other words, in the boom years around half of all investment was FDI and almost certainly a much larger proportion of the high-quality investment.

Total net private financial inflows to CEE were particularly high before the recent global financial crisis (Figure 3.4). These inflows took various forms, including foreign direct investment (FDI), portfolio investment and other investment flows. Looking at the composition of net capital inflows illustrated in Figure 3.4, there was a gradual and substantial increase in net FDI inflows. FDI inflows were crucial for the CEE countries during the 1990s and at the beginning of 2000s, in order to accelerate the restructuring of their economic systems. FDI flows have been argued to exert a significant impact on the catch-up rates of this region (Tondl and Vuksic, 2003). Other investment flows (mostly consists of cross-border loans) were more volatile than FDI, though interestingly, in the peak years before the crisis their magnitude even exceeded FDI inflows.

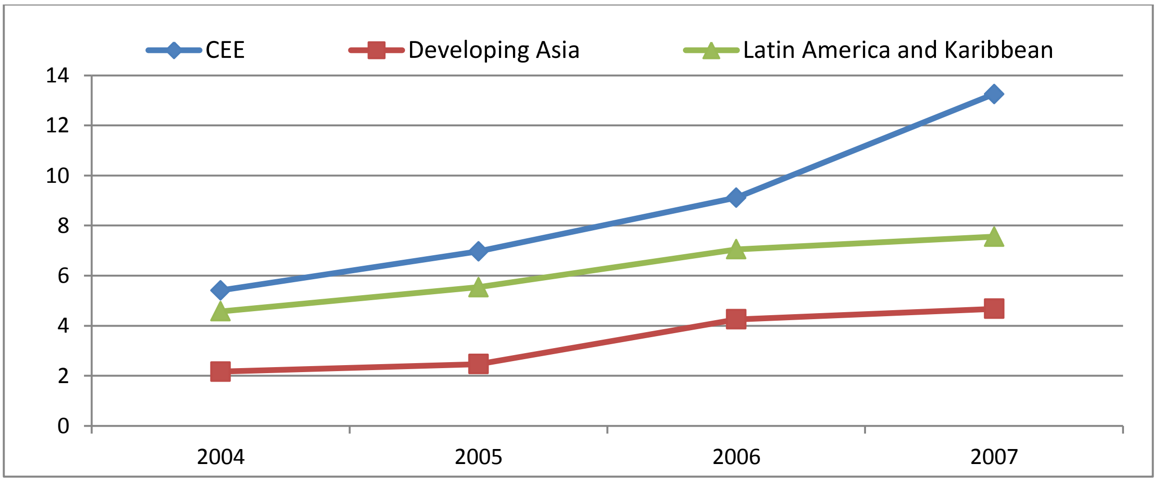


Source: IMF World Economic Outlook April 2010.

Figure 3.4 Net private financial flows in Central and Eastern Europe (% GDP), 1999-2009

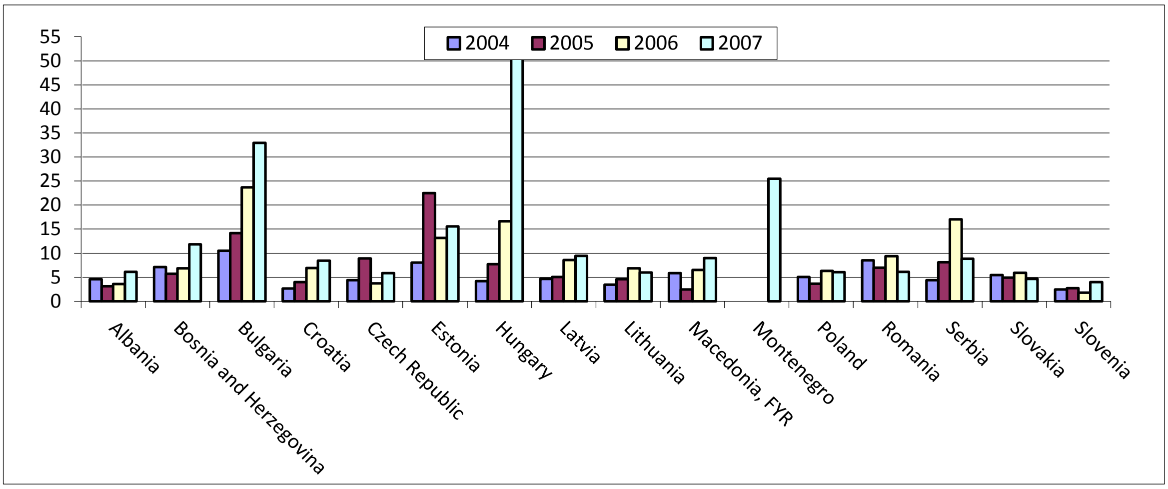
Note: Other investment mainly consists of international banking flows and parent companies lending to their subsidiaries.

FDI Inflows of capital to CEE countries exceeded corresponding inflows to any other emerging or developing region in the years before 2009. Figure 3.5 shows that net FDI inflows reached about 13 per cent of the GDP of the whole CEE region by 2007. FDI flows to CEE declined after the region was adversely affected by the propagation of financial turmoil during the 2008. Regarding net FDI inflows, the situation within the CEE region was quite diverse. For example, Hungary`s net FDI inflows reached about 52 per cent of the GDP, whereas net FDI inflows in Slovenia were just 4 per cent of GDP (Figure 3.6). One crucial explanation for these differences in inward FDI to CEE was the diversity of the respective national economy (Filippov and Kalotay, 2009).



Source: IMF World Economic Outlook April 2010.

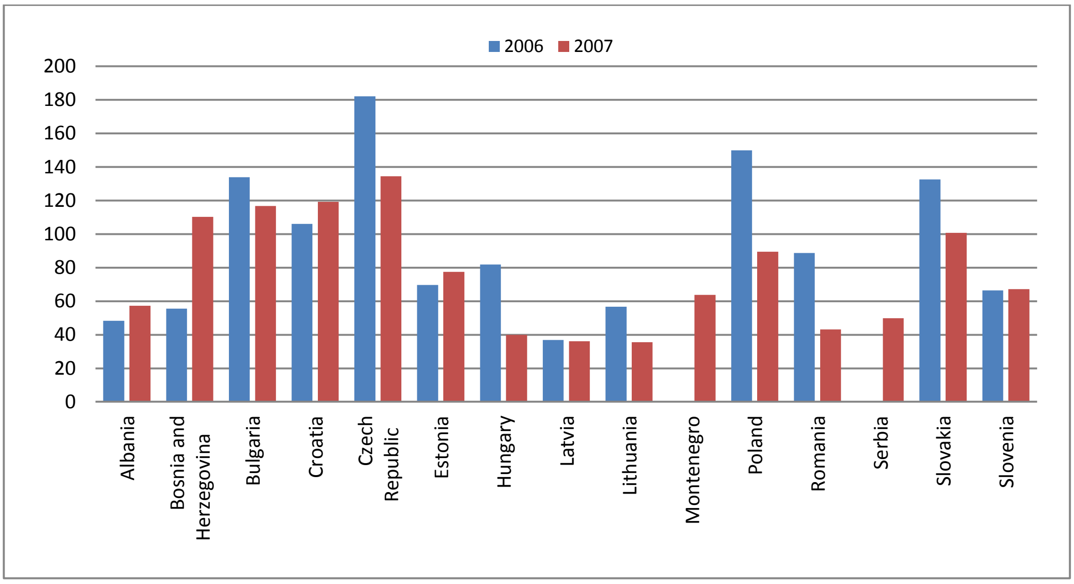
Figure 3.5 Net capital flows to emerging regions in the pre-crisis period (% of GDP)



Source: Source: World Development Indicators

Figure 3.6 Net capital flows to countries in CEE (% of GDP) from 2004-2007

An important task when analysing a country's vulnerability to the external shocks in regard to capital inflows is the extent to which FDI, which developed differently to portfolio flows during the contagion of the current crisis, is able to cover current account deficits (CAD). In general, FDI is considered to be more stable than other financial flows since investments in fixed assets may be more difficult to liquidate (compared with portfolio investments) and because direct investors tend to make long-term commitments (McGettigan, 2000). However, an important caveat is that some of the recent FDI into emerging Europe was due to privatization and, therefore this inflow of FDI may not be sustainable (Vamvakidis, 2008). Furthermore, Vamvakidis (2008) explains that foreign bank borrowing from parent banks has been financing an increasing share of the current account deficits in most countries, primarily in the Baltics and in South Eastern Europe. There were significant differences in the region in the extent to which inward FDI covered the CAD. Figure 3.7 shows the respective values varying from 135% (Czech Republic) to 36% (Lithuania) in 2007. The data implies that in the year before the crisis, the countries most vulnerable to immediate liquidity constraints in financing the CAD were Latvia and Lithuania, while Bulgaria, Croatia, the Czech Republic and Slovakia were even able to over compensate for their current account deficit by attracting large FDI.



Source: UNCTAD database

Figure 3.7 Inward FDI / CAD Ratio in CEE (2006-2007)

Large current account deficits are of concern, as they pose financing risks if the capital inflows stop. According to Vamvakidis (2008), the deterioration in the current account balances in emerging Europe was driven by an increase in investment, as high investment was expected to improve these countries' growth prospects and, then eventually, help reduce their current account deficits. By the end of 2007, these vulnerabilities were recognized. Namely, the IMF (2008, p. 15) warned that *"…the heavy dependence on foreign capital leaves the region exposed to an abrupt retrenchment of capital inflows"* and *"economies with large current account deficits or high external debt ratios would be especially vulnerable if foreign financing dried up."*

The existing monetary frameworks and open capital accounts may also have contributed to the build-up of vulnerabilities in CEE. The choice of exchange-rate regime played an important role in the catching-up process of CEE (Becker et al., 2010). Prior to the crisis, most CEE countries (except Albania, Czech Republic, Poland, Romania, Serbia, Slovakia and

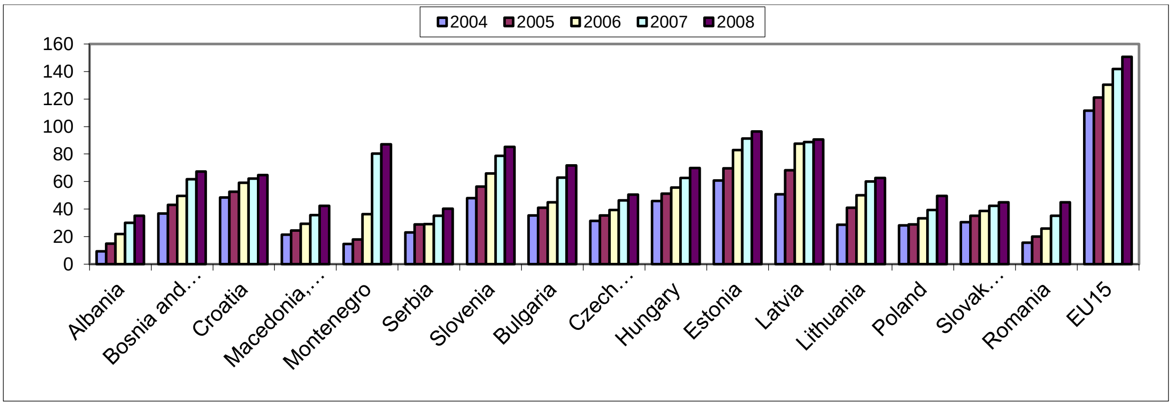
Slovenia) maintained fixed rates. According to Mishkin (1996), fixed exchange rates have been one of the causes of instability in many emerging market financial crises. A fixed exchange-rate regime fuels inflation in an economy that is catching-up (Becker et al., 2010). Namely, when a country is converging in term of GDP per capita, then price level convergence translates into higher domestic inflation. Darvas and Szapáry (2008) explain, the main risk for countries with fixed exchange rate systems is that with no room to let their nominal exchange rate appreciate to accommodate the price level convergence and with little or without risk premia, their real interest rates become excessively low due to higher inflation if the nominal rate rise less. Low interest rates may have encouraged domestic demand and led to excessive credit growth and booms in several CEE countries. Namely, Sorsa et al. (2007) note that the currency board in Bulgaria and the heavily managed float in Croatia largely subject these economies to euro interest rates that have been too low for their cyclical conditions. That situation have exacerbated credit growth. Furthermore, Sorsa et al. (2007) argue that the fixed currency regimes have desensitized economic agents and authorities to exchange rate risk, as indicated by their currency mismatches, the largest in the region, and led to the under-pricing of currency risk. Therefore, countries with fixed exchange rate systems amplified their imbalances in the boom and contributed to severe declines in the bust period.

In those countries with a floating exchange rate, the structural price-level convergence can also be accommodated by nominal exchange-rate appreciation. Becker et al. (2010) recognised that on one side, the difficulties of managing the catching-up process under inflation targeting with floating exchange rates cannot be underestimated; and on the other hand, countries with floating exchange rate regimes succeeded better than countries with fixed exchange rate regimes in maintaining macroeconomic stability. Countries with floating exchange rates had an easier time dealing with large capital inflows than countries with fixed exchange rates (Bakker and Gulde, 2010). According to IMF (2013a) 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. Furthermore, IMF (2013a) report that in countries with floating exchange rates tightened monetary conditions, by letting the nominal exchange rate appreciate, contributed to the less pronounced credit boom, lower inflation, and lower current account deficits.

In this section, we discussed the macro economic imbalances in CEE before GFC. The analysis will be continued in the following section, where another source of vulnerability, credit growth, will be discussed.

3.3.1 Credit Growth: A Key Source of Vulnerability

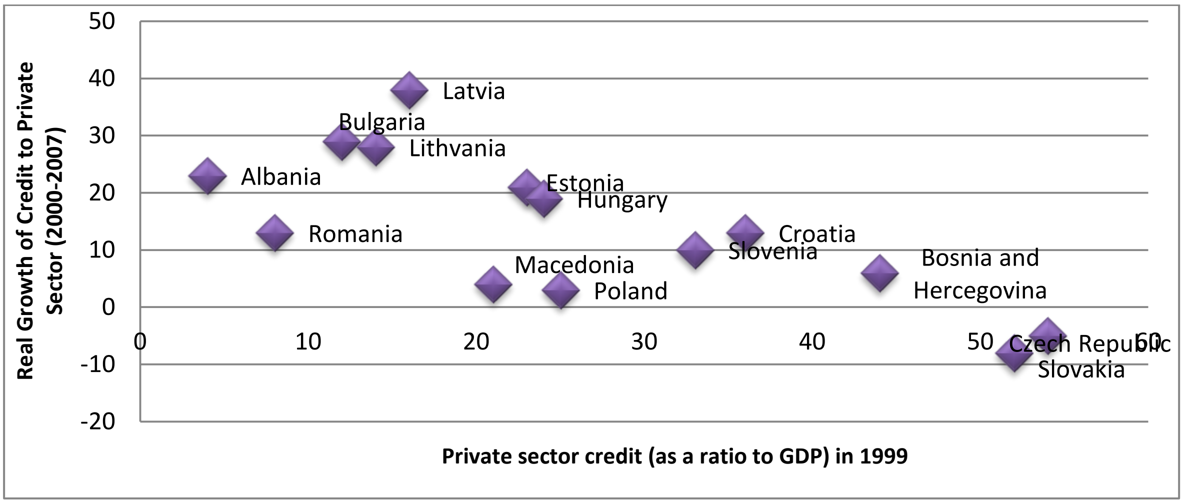
Credit expansion was an important driver of economic growth in CEE countries (Becker et al., 2010), but it is also often considered to be a key factor in their vulnerability. Namely, along with the growth of foreign investment in the financial sector and inflows of other capital, the credit to GDP ratio increased rapidly before the crisis in the CEE region (Figure 3.8), though with substantial differences across countries. The level of credit as a percentage of GDP remained below the EU15 average in the pre-crisis period (Figure 3.8) and several empirical studies (Kiss et al., 2006, Égert and Mihaljek, 2007; and World Bank, 2007) suggested that the level of credit was below equilibrium. However, Becker et al. (2010) argue that the speed at which the equilibrium level of credit is reached matters for macroeconomic stability. They explain that from the perspective of inflationary pressure, it is not the level but the rate of growth of credit that is important. The evolution of the credit-to-GDP ratio was markedly steeper in the Baltic and SEE countries. Becker et al. (2010) explain that given the extent of foreign investment in real estate and financial services which contributed to the huge pre-crisis housing booms and excessive credit booms, we cannot exclude the possibility that the resulting structural imbalance was a cause of these countries' increasing vulnerability.



Source: World Development Indicators

Figure 3.8 Credit to the private sector (% GDP, 2004-2011)

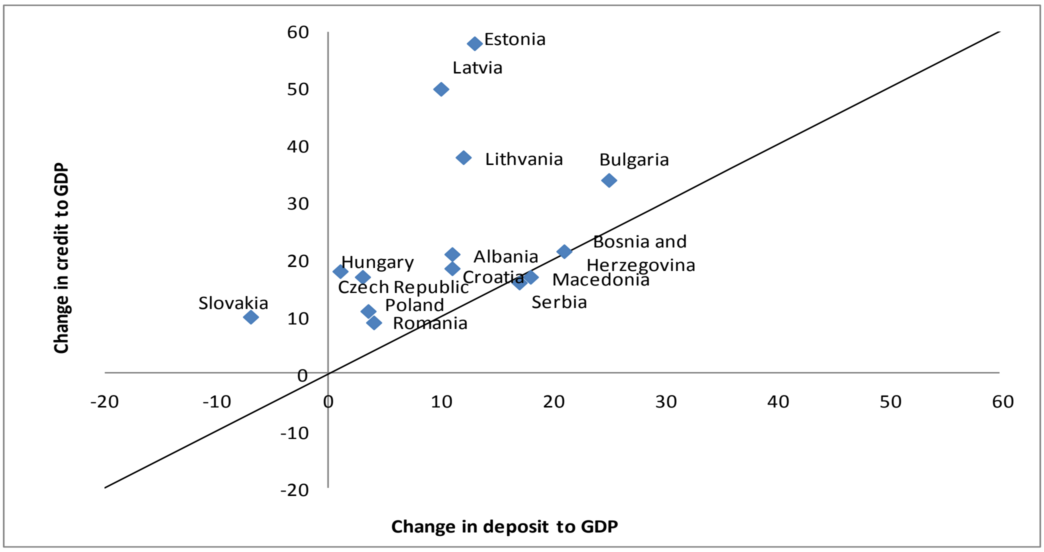
The CEE countries with low levels of financial intermediation at the beginning of the new millennium generally experienced faster credit growth compared to those CEE countries with higher credit–to–GDP ratios (Figure 3.9). According Hilbers et al. (2006), on the demand side, the credit expansion was supported by higher income expectations, often related to these countries' (prospect of) accession to the European Union. On the supply side, as explained by Hilbers et al. (2006), the credit surge was facilitated by foreign financial institutions entering these markets with the objective of rapidly increasing their market share.



Source: Hilbers et al. (2006)

Figure 3.9 The CEE Region: Catching Up from Low Levels of Intermediation

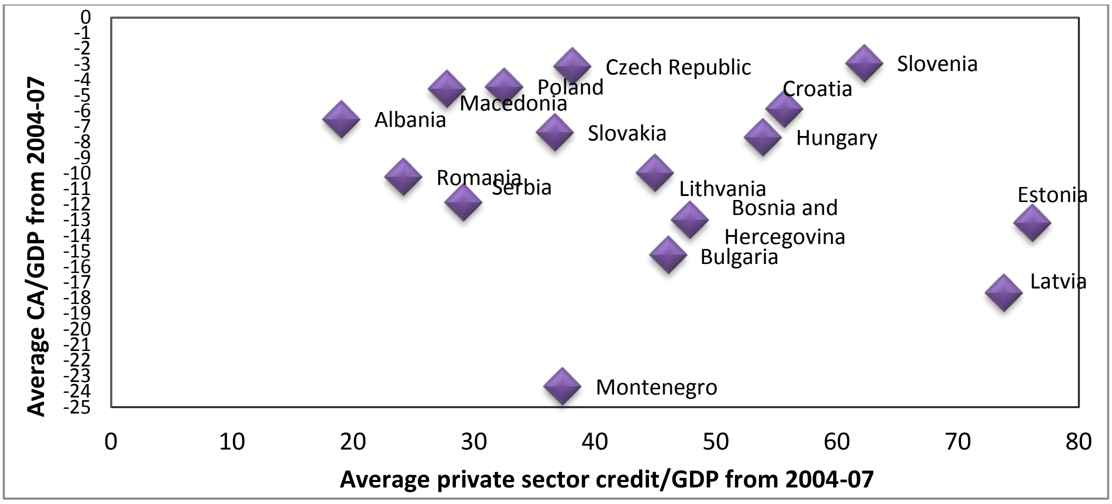
Most CEE countries experienced potentially unsustainable growth rates in private credit markets in the years before the crisis. Namely, credit growth significantly exceeded deposit growth in most CEE countries. The Loan to Deposit ratio has been relatively high and rising in all these countries, suggesting that deposits have not been able to meet loan requests in recent years. This has led to an increasing dependency on foreign funding, which has mainly been channelled through the banking sector. UniCredit CEE Banking Study (2011) reports that with leveraging on abundant international liquidity and the low cost of country risk, local banks were able to support credit growth by financing domestic lending via international capital inflows, given the context of low domestic saving rates. As can be seen in Figure 3.10, with the exception of Bosnia and Herzegovina, Macedonia and Serbia, the changes in bank credit to GDP ratios significantly exceeded those in the ratio of bank deposits to GDP. In particular, the LTDs were rising rapidly in the Baltic countries.



Source: Arvai et al. (2009)

Figure 3.10 Change in deposit and credit to GDP (2003-2007), in percentage points

As Égert and Mihaljek (2007) explain, rapid credit growth can fuel consumption, lead to sharp rises in house prices and feed inflation and wage growth. This process can erode competitiveness and contribute to current-account deficits and the build-up of external debt. The data presented in Figure 3.11 indicates a close relationship between pre-crisis credit growth and the current-account balance. As reported by ECB (2009), strong growth in housing loans and rising house prices contributed to the output boom in the construction sector, stimulating demand for particular imported goods such as white goods etc. In addition, they reported that the housing loans have raised the overall ability of households to finance consumption; thus, these loans may also have contributed to rising inflationary pressures and/or current account deficits. The two countries with the highest rise in private sector loans as a percentage of GDP are those with the largest current account imbalances in the region.



Source: World Development Indicators

Figure 3.11 The relationship between pre-crisis credit growth and current account balances

There have been growing concerns about the implications for macroeconomic and banking stability where rapid credit growth has coincided with vulnerabilities in the domestic financial systems. What was the "normal" or "satisfactory" level of credit? Was the fast credit growth just a result of the structural changes associated with mid-transition or of a catching-up process? The large increase in credit growth rates was mainly driven by the aggressive business strategies of foreign banking groups that dominate in CEE countries (which will be examined in following section). As explained by Hilberts et al. (2006), fast credit growth contributed to a rise in imports and current account deficits in most CEE countries. The low savings rates in most of the CEE countries (Figure 3.3 b) suggest they were highly dependent on foreign investors to fund these deficits.

In addition, optimism about future earnings led to a boost in asset valuations and a surge in capital inflows in almost all CEE countries that allowed firms and households to borrow and spend more (Hilberts et al., 2006). On the financial side, as mentioned in Chapter 1 (section 1.7), prudential indicators such as non-performing loans, capital adequacy ratios, and loan to deposit ratios worsened, suggesting that the banking system had significant vulnerabilities. Furthermore, Hilberts et al. (2006) argue that banks may be highly exposed to indirect foreign exchange risks, since foreign currency–denominated loans represent a substantial proportion of total loans. They also note that a sharper decline in interest margins, resulting from stronger competition, would decrease profitability and thereby increase the vulnerability of the banking system. These vulnerabilities in the financial sector will be explored further in Chapter 6.

3.4 Financial Linkages in Central and Eastern Europe

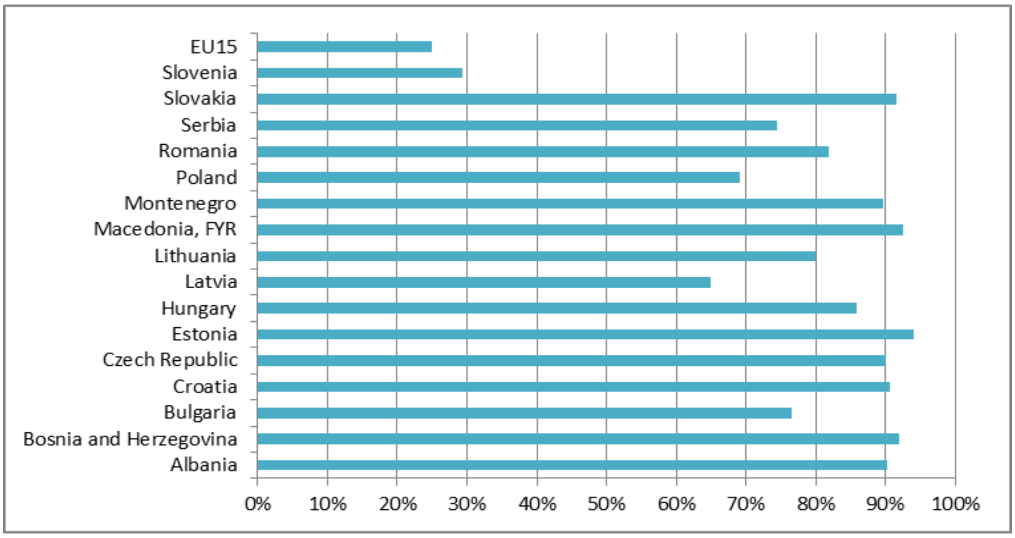
Developing countries can receive growth and investment benefits from growing trade and financial linkages with the rest of the world, but the latter also increase their exposure to costly spillovers from abroad (Moghadam et al., 2011). The aim of this section is to identify and examine those channels of transmission that played a crucial role during the recent financial crisis in CEE. As mentioned in section 2.6, the recent literature investigates the transmission of the global financial crisis of 2007-2009 via trade and financial channels. Part of the literature suggests that countries which are more integrated are more prone to be affected by external shocks. Fidrmuc and Korhonen (2009) stressed that greater synchronisation of shocks is present when there are stronger trade ties. However, as stated by Enders and Peter (2014) transmission via the trade channel leads to a relatively short recession, while the financial channel, in contrast, has longer-lasting effects. Given the focus of this thesis, we will focus on explaining the relevance of the financial linkages. Furthermore, Backé et al. (2013) note that the financial channel has traditionally dominated the trade channel in South Eastern Europe, whereas the trade channel has traditionally played a stronger role for the CIS region. In particular, we will examine the role of cross-border bank lending and the common lender channel that is likely to be one of the major channels of transmission. This appears very important bearing in mind the close banking relationships between Central and Eastern Europe and Western Europe in the years preceding the global financial crisis. A key indicator of the massive growth in financial linkages between Eastern and Western Europe is the number and systemic importance of foreign-owned banks operating in Central and Eastern Europe. In the following sub-section we will analyse the banking sectors in CEE economies, with special emphasis on their ownership structures.

3.4.1 Banking in Central and Eastern Europe — an Overview of Bank Ownership

After the fall of communism and arrival of capitalism in CEE, the need to restructure the banking system became apparent. It brought about large-scale restructuring and the introduction of many institutions that did not formerly exist. In order to stimulate competition, most CEE countries initially adopted very lax licensing and regulatory regimes, leading to a large increase in the number of banks (Barisitz, 2005). One of the main issues in many CEE countries in the early 1990s was the low quality of banking regulation and supervision, resulting from a complete neglect of this function during communist rule (Altman, 2006). Throughout the 1990s most of these countries experienced major banking crises and painful structural transformation (Altmann, 2006). However, at the turn of the millennium the environment stabilized, most CEE countries began membership talks with the EU and banking activities entered a path of sustained expansion, boosted by robust economic growth (Barisitz, 2005). The legal environment a in the financial sector, also improved with respect to laws on banks, bankruptcy laws, collateral laws, and confidence in the application of the law. In order to benefit from the region's transition process, several EU 15 banks partly shifted their business focus to Eastern European countries by entering their banking sectors (Čihák and Fonteyne, 2009). The main mode of entrance was their acquisition of newly privatized banks in CEE. As explained by Kalusa (2010) this situation heightened the contagion risk in the case of adverse developments in the host country for the domestic country's financial system. In addition, difficulties primarily occurring in the domestic banking system might easily spread to CEE and could even trigger contagion throughout the region (Arvai et al., 2009).

Although banks in European transition countries have made considerable progress in improving their performance and services since the early 1990s, as explained above, the banking sectors in these economies still do not possess the financial depth of their Western Europe counterparts nor are banking services as well developed in these countries (Bonin et al., 2008). Nonetheless, state banking structures have been replaced by privately-owned, market-oriented, generally well-capitalized banking institutions that are independent from the government and state-owned clients.

Foreign-owned banks dominate the financial systems of the CEE countries, these are mainly European banking groups attracted by these countries' growth prospects or their shorter-term investment profitability (Raiffaisen Research, 2011). In the ten years to 2008, large banks from Western Europe took strong positions in CEE countries. As summarized by Deuber and Shpilevoy (2013), from 2000 until 2008/2009 western banks increased their CEE loan books and asset base by 10 to 30 per cent per year in Euro terms. The total CEE assets of the top seven Western European banks increased from EUR 215bn in 2005 to EUR 490bn in 2011 (Deuber and Shpilevoy, 2013). Their presence improved efficiency, skills and technologies and brought fresh capital in the region. These Western European banks improved access to credit, introducing very important banking products that were largely absent during 1990s in these economies, like mortgages (Kolev and Zwart, 2013). Figure 3.12 illustrates the overwhelming presence of foreign banks in CEE countries.

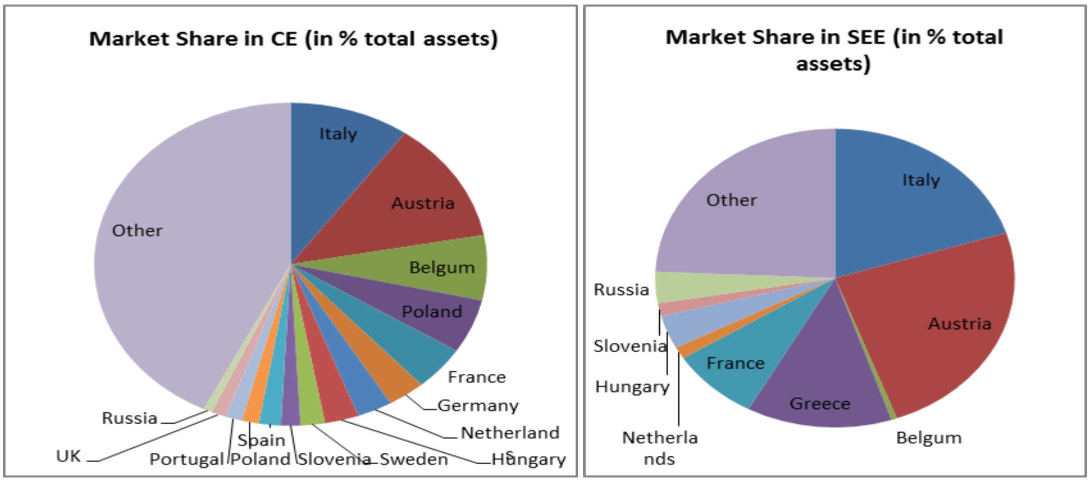


Source: EBRD Survey of Central Banks (2012), IMF (2012)

Figure 3.12 Market Shares of Assets of Foreign-Owned Banks in the CEE Countries in 2011

Foreign-owned banks control the majority of assets in the CEE banking sector and have acquired dominating competitive positions, on the basis of a 70% or more share of total assets, in all analysed countries except Slovenia, Latvia, Poland and Bulgaria. In some countries, like Slovakia, Estonia, Bosnia and Herzegovina and Macedonia, foreign-owned banks positions are completely dominant; and overall in SEE foreign-owned banks' share of total assets is particularly high. This appears to be a phenomenon specific to CEE countries when looked at from the perspective of countries in Western Europe, where foreign ownership is typically within a range of 5-15% of total assets (Raiffeisen Bank Research, 2012). However, the high share of foreign ownership in banking sectors in CEE countries should be seen in a broader emerging markets context. Raiffeisen Bank Research (2012) reports that emerging markets' superior economic and banking-sector growth outlook, compared to most advanced economies, provided the incentives for international banks to penetrate CEE fast-growing markets, leading foreign-ownership ratios there to rise over the past decade. Moreover, as presented in Raiffeisen Bank Research (2012), large foreign banks seek to smooth earnings profiles by diversifying away from their home market as a singular high concentration risk. Opportunities for large international banks to move into emerging markets arise in aftermath of a crisis. Namely, Cardenas et al. (2003) argues that: "foreign bank entry in emerging market economies has been the result of dealing with financial crises, while in mature economies foreign entry comes from competitive pressures" (p. 3). As outlined above, this is true to a large extent in CEE as well. As can be seen in Figure 3.12, the market share of foreign banks is well above the average for Western Europe in all analysed markets. In the Czech Republic, where foreign banks account for 83.1% of banks' capital and 96.1% of assets, the foreign strategic investors were credited with contributing "to overcoming the lingering financial crisis that had plagued the country since the mid-1990s" (Barisitz, 2005, p. 62).

As can be seen in Figure 3.13, these foreign banking groups are predominantly from Western Europe. The strongest foreign presences, in terms of assets, are Austrian, Italian, Belgian, German and French banks. However, in the case of Bulgaria, and to a smaller degree Serbia and Romania, the contagion risk is increased by the large presence of banks from Greece.



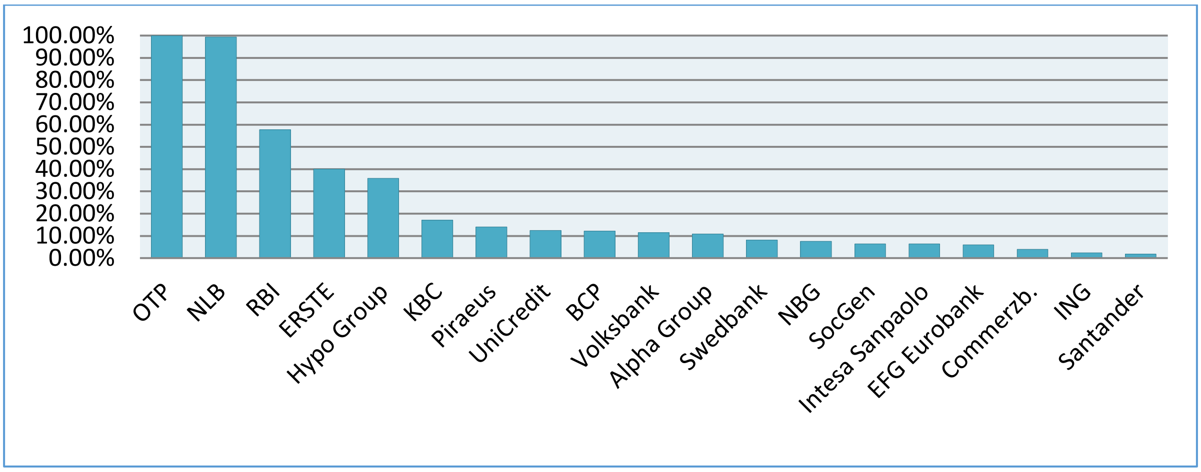
Source: Raiffaisen Research (2011) and own calculations

Figure 3.13 Market shares of foreign banks in CE and SEE countries by country of origin (in % total assets) in 2011

CE: Poland, Czech Republic, Slovakia, Slovenia, Hungary, Latvia, Lithuania, Estonia
SEE: Romania, Bulgaria, Croatia, Serbia, Montenegro, Macedonia, Albania, Bosnia and Herzegovina

In general, the presence of non- European banks in CEE is limited, the two main exceptions being Citibank and GE Capital. There exist very few large, domestically-owned banks in CEE, and the OTP of Hungary and the NLB from Slovenia have been able to become regional players. OTP, which is mainly owned by a number of domestic investors and funds, has become a strategic foreign investor in the banking markets of Slovakia, Bulgaria, Romania, Croatia and Montenegro. The Austrian banking sector is the largest investor in all countries discussed with the exception of Poland, Slovenia, and the Baltic States. In the

Baltic States, Swedish banks have taken a very dominant position, with Swedfund and SEB controlling over 60% of the total Baltic market (Bank-Austria Creditanstalt Report, 2004, p. 14).



Source: Raiffeisen Research (2011)

Figure 3.14 Share of assets of CEE subsidiaries as % of group assets

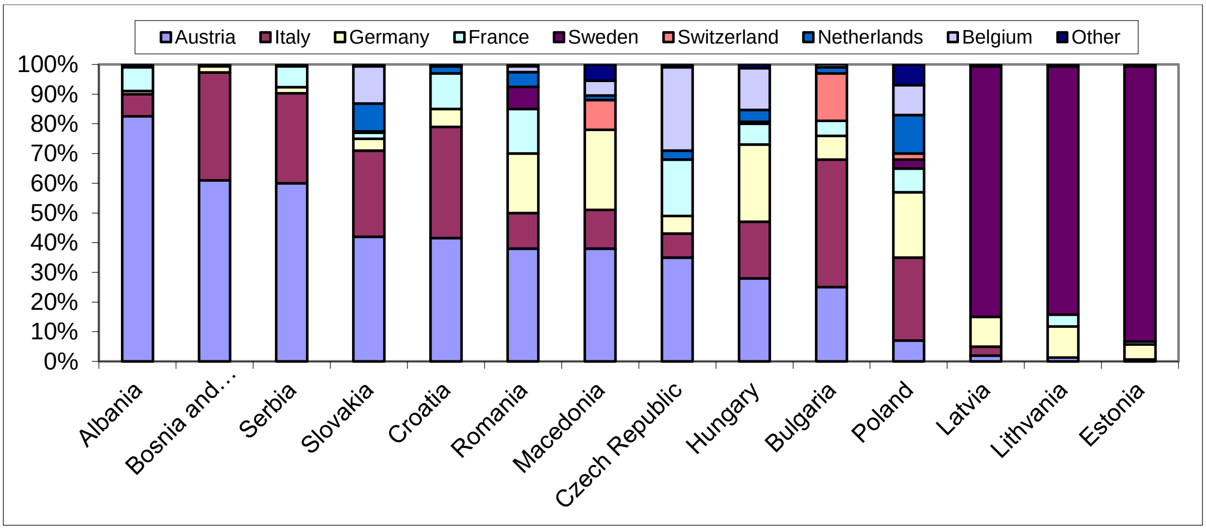
Concerning the exposure of international banking groups to the CEE market, OTP and NLB are clearly in the first position with 100% of assets in the region (see Figure 3.14). These Hungarian and Slovenian banks are followed by three Austrian banks, namely the Raiffeisen Group (58% of assets in CEE), Erste Bank (40%) and Hypo Alpe Adria (38.2%). With business models directed to the traditional lending and a strategy based on the assumption of a structural and productivity catch-up in the labour-intensive loan business, Deuber and Shpilevoy (2013) reported that the number of branches operated by leading western banks in CEE and CIS soared from 9,000 to 15,000 between 2004 and 2009.

3.4.2 "Common Lender" and Cross-Border Linkages

As explained in Chapter 2, the "common lender", as an important source of funding for a number of countries, can be considered as a channel through which financial shocks could be transmitted. Arvai et al. (2009) explain the common lender channel in the following example. When the private sectors of two countries in the region, A and B, borrow mainly from the banking system of a third country, C (the common lender); a shock affecting A may result in liquidity or solvency pressures in the banks of C, provided that the parent bank is highly exposed to A. The problems in A could then spillover to B, even though B's economy is not directly linked to A's, because of the third country, C, which is present in both A's and B's banking sector. Therefore, Arvai et al. (2009) conclude that the parent bank's presence in the region could transfer a shock from one country to other countries in the region in which the parent bank has significant operations. Sbracia and Zaghini (2001) argue that in a situation where the common lender is highly exposed to a crisis country, adjustments to restore capital adequacy or reduce risk exposure can lead to sudden cuts of credit lines in other economies. They explain that when a common lender has a rise in non-performing loans in one country; it is likely to reduce its credit risk exposure, either by choice or for regulatory reasons, in all the countries in which it operates. Furthermore, Sbracia and Zaghini (2001) noted that when the same institution is the main source of funding for several countries, the increase in non-performing loans following a financial crisis in one of the borrowing economies may induce the common lender to require early repayment of its outstanding loans elsewhere.

Unlike in Western European countries, a large share of cross-border banking in the CEE countries was in the form of local subsidiary lending rather than direct cross-border lending. Namely, in recent years the expansion of cross-border banks, particularly from Western Europe, in the CEE region accelerated to such an extent that most parts of the local banking sector are now owned by foreign affiliates, as revealed in section 3.4.1. Given the strong cross-border, inter-linkages between Western and CEE banking sectors problems in a parent bank can affect its subsidiaries in the CEE region. Namely, liquidity or solvency problems experienced by a parent bank could directly spread to its subsidiaries. In particular, as argued by Arvai et al. (2009), banks that are heavily dependent on parent bank funding to support credit growth could face a sudden shortfall of, or costly access to, credit, if the parent bank either withdraws its deposits or lending to the subsidiary or increases the interest rate on its funding.

Figure 3.15 shows the distribution of cross-border exposures between CEE and Western European banking systems.



Source: IMF: WEO April (2008)

Figure 3.15 Exposure of CEE countries to Western European countries in 2007

Note: Emerging Europe exposure to western European banks is defined as the share of the reporting banks in each western European country in the total outstanding claims on a given emerging European country (both bank and nonbank sectors).

This exposure of CEE countries could contribute to their potential vulnerabilities if they are heavily concentrated in one country. Austria, Germany, Italy and Sweden have concentrated their funding activities in Central and East European countries. Looking at South Eastern Europe, their banking systems rely mainly on parent banks in Austria, Italy, Germany and France, while in the Baltic countries foreign funding mainly originates from Swedish banks. Some countries, like Poland, Czech Republic and Hungary rely on more diversified foreign sources than the other countries in the sample. Figure 3.15 implies that adverse developments in the Swedish bank will be felt most severely in the Baltic States, while liquidity problems in Austrian banks are likely to exert significant difficulties in Albania, Bosnia and Herzegovina, Serbia, etc.

Arvai et al. (2009) provide indices of exposure to regional contagion in CESE which reveal that the larger the dependence of a country on funds from foreign country banks (directly or indirectly through the banking systems), and the larger the exposure of these home country banks to the trigger country, the higher the values of the contagion indices. They also find that the contagion indices are highest when the common lender has activities that are substantially concentrated in CESE region, whereas the indices are smaller when the common lender has large presence in, but smaller exposure to, CESE in terms of its economic size. Namely, the exposures to any country in the region are economically too small to affect the funds available to others when problems emerge in a trigger country. Their results reveal that

Austria, as the dominant "common lender", would have the largest effect in propagating shocks across a wide range of CESE countries.

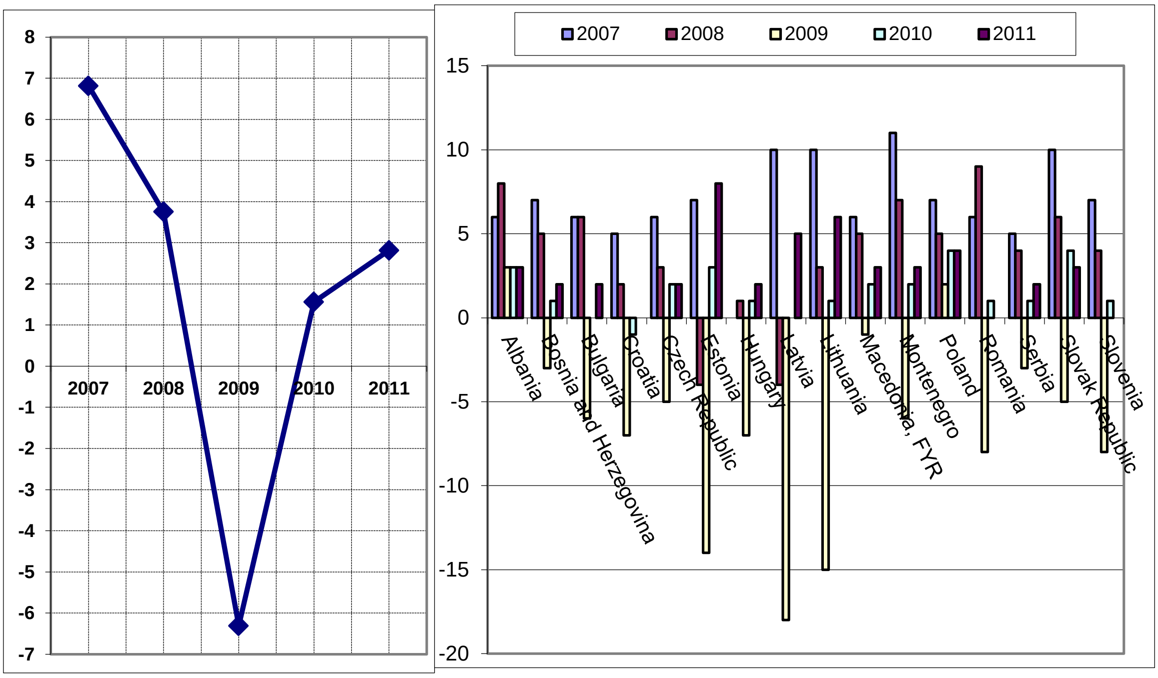
One way to check to what extent the CEE economies are vulnerable to contagion effects, is to check how those countries experienced the GFC. This is the task of the following sections.

3.5 Impact of the Global Financial Crisis on Central and Eastern Europe

The global financial crisis hit the CEE region in the fourth quarter of 2008, after the turmoil that followed the collapse of Lehman Brothers. The global financial crisis triggered concerns with respect to CEE countries because of their high economic and financial integration with the Western countries. As explained above, those concerns related to high domestic credit risk, unhedged borrowing in foreign currencies and strains related to the euro-area debt crisis. Transmission to these countries was through several channels. As previously mentioned, the two channels of transmission, that are thought to have played a crucial role were: (i) trade and foreign direct investment; (ii) financial linkages through which banks in CEE were exposed to western banks, or what ECB (2012) call "deleveraging" e.g. via a decline of external funding to local subsidiaries of western parent banks (previously termed the common lender channel). The ECB (2012) notes that transmission escalated in late 2011 when funding pressures on European banks reached a peak. Since then, the ECB's provision of long-term funding with a maturity of three years via two special longer-term refinancing operations (LTROs) in December 2011 and February 2012 significantly mitigated pressures on European banks (ECB, 2012). Although bank deleveraging, presumably associated with a reduced reliance on external funding and a decrease in lending activity to the real economy, materialised at the beginning of global financial crisis in many countries, ECB (2012) reported that there was no evidence of a retrenchment of parent bank lending to subsidiaries by the end of 2011.

The impact of the financial crisis varied across CEE countries. In some countries the liquidity shortages and the solvency problems emerged, particularly in countries where the external imbalances had grown rapidly before the crisis. As reported by Berglöf et al. (2009) emerging market risk premiums increased while the FDI flows and bank lending flows and export volumes decreased. Many countries experienced large declines in their economic activity (see

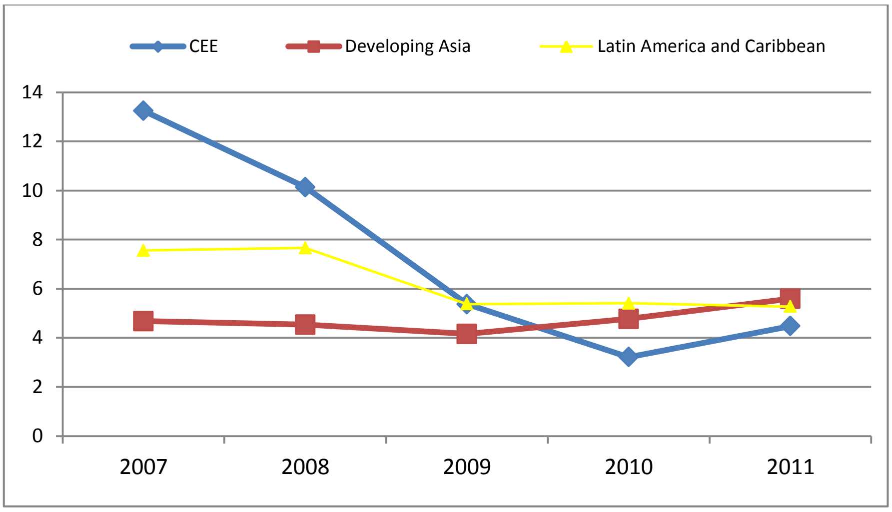
Figure 3.16) together with a credit crunch. Even though the financial crisis was severe, the worst consequences of past crises, such as a bank runs and the collapse of the systemic banks, were avoided.



Source: World Development Indicators

Figure 3.16 GDP growth rate in CEE after 2007, on average (left) and by countries (right)

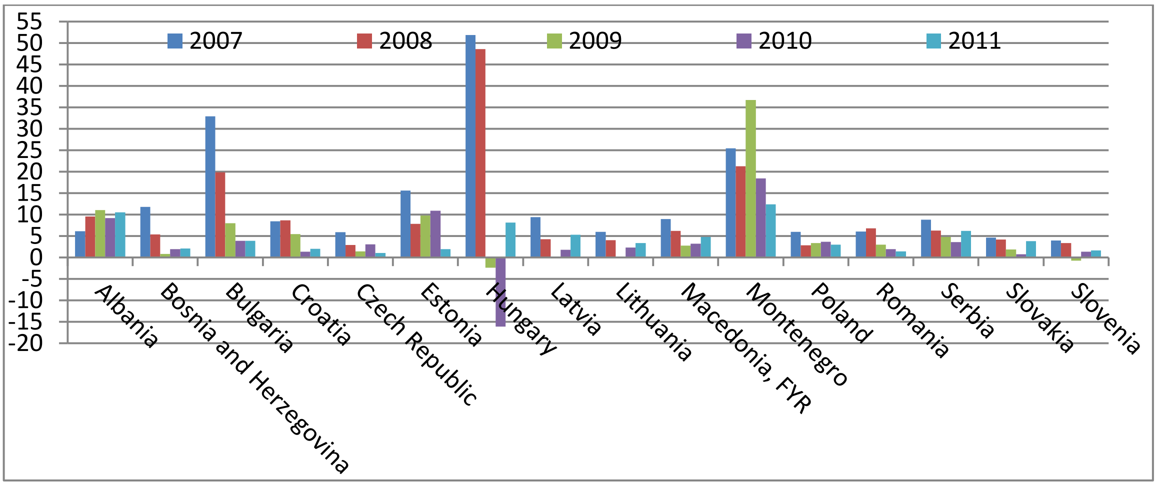
The CEE region experienced in 2008-09 a much larger fall in capital inflows than Latin America or developing Asia (Figure 3.17), with a 10 percentage of GDP decrease between 2007 and 2010. Countries in the CEE region were hit hard, especially since many of these countries are small, open, and highly sensitive to external shocks. According to (Becker et al., 2010) large reliance of CEE countries on net external funding created a systemic risk in these countries because of potentially devastating chains of corporate defaults and the related currency risk for the economy as a whole. These are likely to lead to a further increase in loan delinquencies and a further deterioration of bank loan portfolios. However, the retrenchment of parent bank lending was avoided since multilateral action was undertaken. That will be discussed in the following subsection 3.5.1.



Source: IMF World Economic Outlook April 2010.

Figure 3.17 Net capital flows to emerging regions in the post-crisis period (% of GDP)

Figure 3.18 shows the large slowdown in net capital inflows in 2008 and 2009 in most of CEE countries. However, in some countries, Albania, Montenegro, Estonia and Poland, the impact was delayed. In 2010, the sharpest decrease of capital inflow happened in Montenegro, while a net capital outflow happened in Hungary.

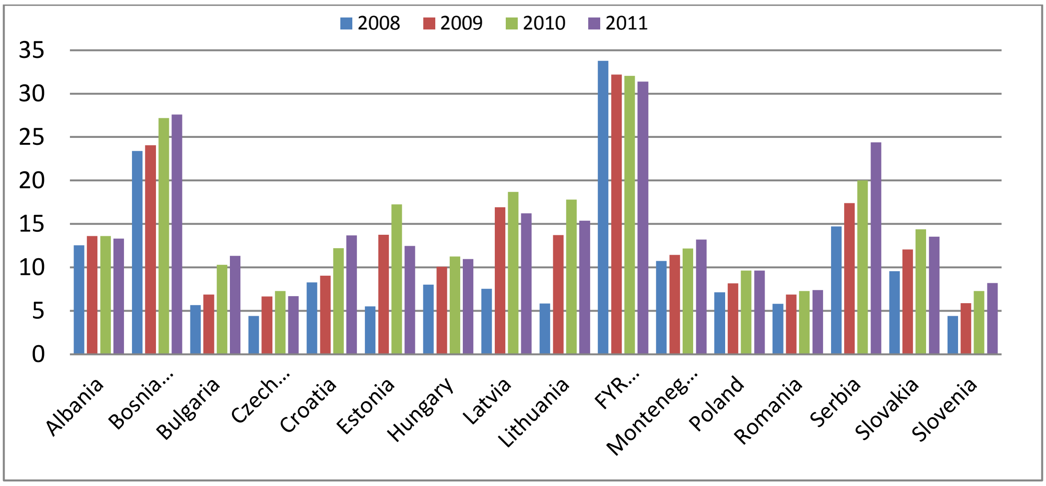


Source: World Development Indicators database

Figure 3.18 Net capital flows to countries in CEE (% of GDP) from 2007-2011

In CEE the GFC was also transmitted through trade. For the open highly internationally integrated CEE countries the reduction of exports had strong negative effects on domestic production and employment. As reported by Sprenger and Vincentz (2010), when the crisis appeared there was no way to compensate for the declining foreign demand of one country by exporting more to other countries. The strong dependence on exports did not only lead to production losses but also contributed to a loss in foreign currency earnings which in turn affected the exchange rate (Sprenger and Vincentz, 2010). The reduction of exports increased the current account deficit, which was already high before the crisis. The more export-oriented CEE countries such as the Czech Republic, Hungary and Slovakia (Raiffeisen Research Report, 2014) were the most highly exposed to reduced foreign demand.

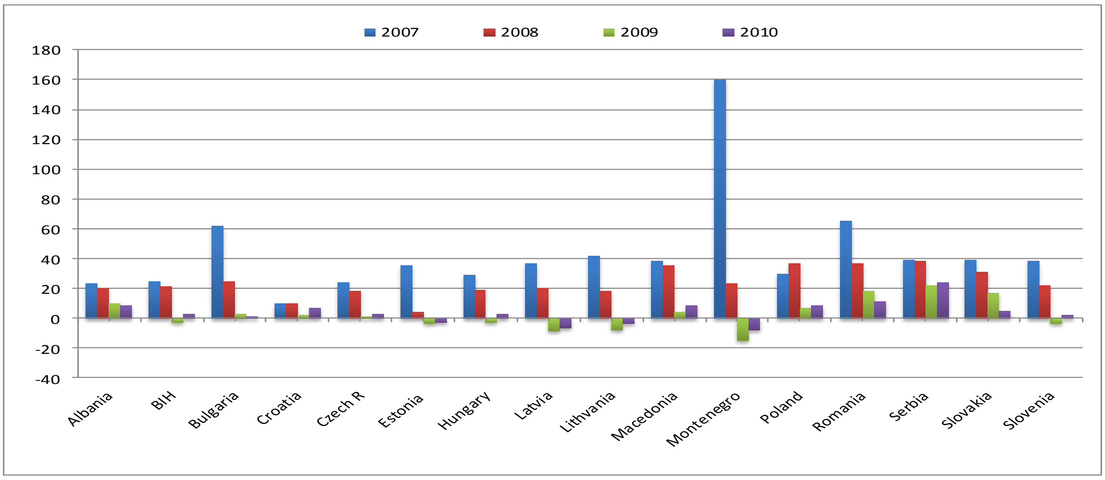
By the beginning of 2009 the crisis was felt in almost all sectors. Namely, even though the output declines had slowed and the confidence indicators stabilized, the ripple effect of the crisis began to be felt in the corporate, households and banking sectors (Berglof, 2009). There was a rise in corporate insolvencies and unemployment (see Figure 3.19), though labour market rigidities may also have played a role in the latter's rise (IMF, 2013c). Namely, in cutting wage costs, as explained by IMF (2013c), there is a trade-off between a reduction in wages and employment, thus the more wages adjust the less employment has to. Moreover, they argue that it is likely that the poorly functioning labour markets caused large adjustments in employment rather than wages. In addition, Bakker and Zeng (2013) found that the large differences among EU countries in post-crisis employment performance were to a large extent driven by the need to adjust corporate balance sheets, which had greatly deteriorated in the years of rapid growth in some countries.



Source: IMF WEO database

Figure 3.19 Unemployment rate (%) in CEE economies in the post-crisis period

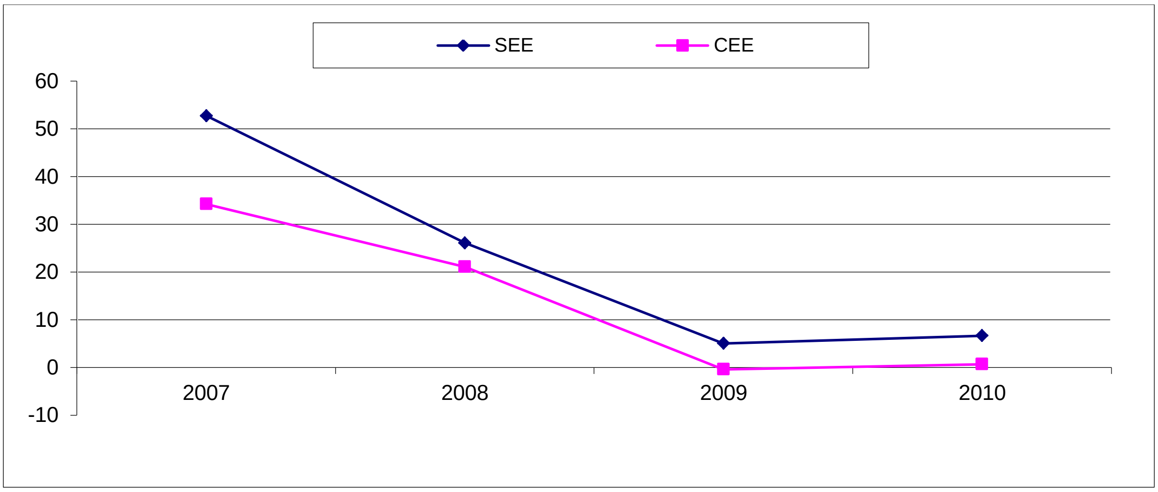
Important post-crisis issues include credit contraction, rising non-performing loans, and a strengthening of weak bank balance sheets in many countries of CEE. The crisis recovery has been credit-less, in the most problematic of the CEE and SEE countries (Latvia, Lithuania, Estonia, Hungary, Montenegro, Bosnia and Herzegovina and Slovenia, see Figure 3.16). As reported by Mucci et al. (2013), who analysed the banking sector trends in CEE, the weak demand was present at the forefront of the weak credit growth in a number of countries, with banks generally being characterized by an excess of liquidity Furthermore, they reported that the retail lending proved to be more stable during the crisis, showing growth even in 2009.



Source: Central Bank websites and financial stability reports

Figure 3.20 Growth of total loans (in % y-o-y change in Euros) in Central and East European countries

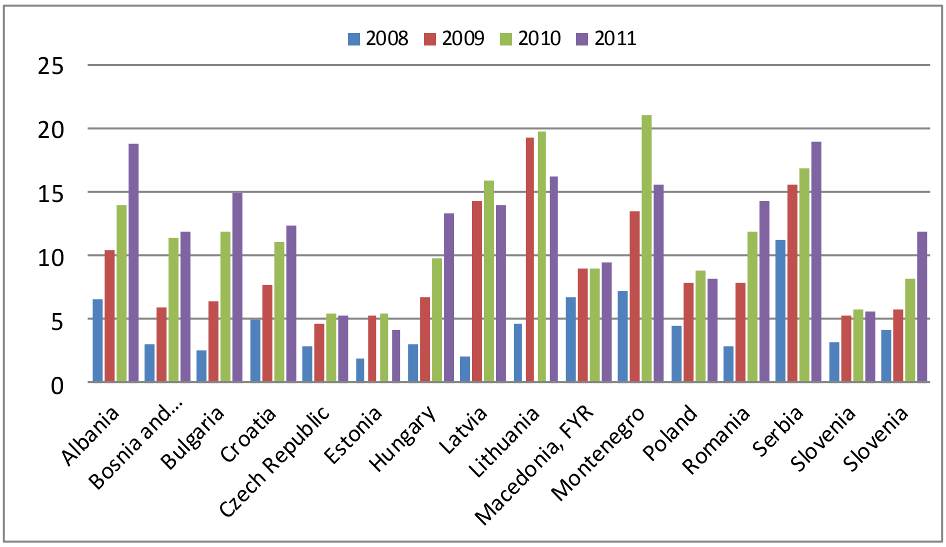
During 2010, lending activity continued to expand, most strongly for those countries in South Eastern Europe, particularly in those countries with a previously strong credit growth (Serbia and FYR Macedonia). While at the end of 2009 and during 2010 credit growth in Central Eastern Europe started gradually to dissipate on the back of continuing turmoil in the global financial markets (Figure 3.21). According to Mucci et al. (2013) growth was stimulated by the corporate segment which profited from the cyclical recovery in the economies in 2010 and the beginning of 2011, while retail lending turned more subdued, even though there have been some improvement in household financial conditions and stronger consumer confidence.



Source: Raiffeisen Research (2011)

Figure 3.21 Average growth of total loans (in % y-o-y change in Euros) in Central, East and South East European countries

According to the ECB (2009), rising unemployment, lower incomes and corporate defaults most likely lead to a further increase in loan delinquencies and a further deterioration of bank loan portfolios. In addition, as reported by EBRD (2011) the vulnerabilities arising from foreign exchange denominated borrowing by unhedged entities, the underdevelopment of local capital markets and adjustments to the new post-crisis, strengthened regulations also fuelled the rise in non-performing loans in CEE. Three years after the onset of the crisis, in 2011, the share of non-performing loans in total loans in the banking sector, in CEE countries, remained very high and worrying. However, analysing Caprio and Klingebiel (2003) findings, the highest ratios of non-performing loans in CEE countries are still lower than non-performing loans ratios in some Asian countries in late 1990 that reached 30-40 percentage. In 2011, a growth in the share of non-performing loans occurred in nine CEE countries, in particular in Albania, Serbia, Hungary, Bulgaria and Slovenia. However, in some countries the share decreased, thus relieving bank balance sheet pressures, though in countries like Lithuania, Montenegro and Latvia the share remains at high levels (see Figure 3.22).



Source: World Development Indicators

Figure 3.22 Share of non-performing loans in total loans (%) in CEE

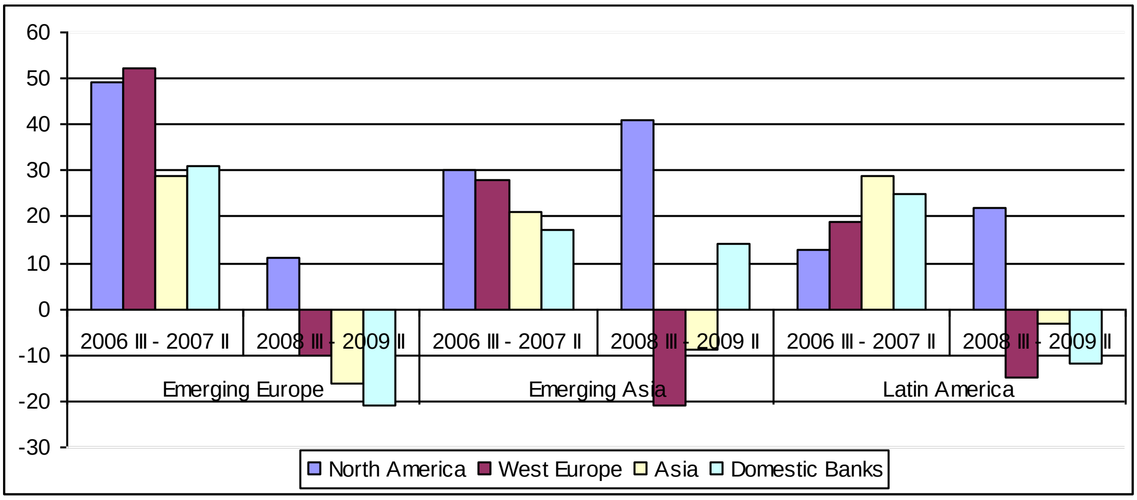
Addressing the high level of non-performing loans presents a major challenge for the CEE region. Namely, it poses the question of whether their banking sectors are able to withstand that stress without causing a failure in confidence, which could lead to the collapse of their banking sectors (see Section 2.3).

3.5.1 Actions of Parent Banks in CEE in the Period of Crisis

Given the importance of foreign-owned banks in CEE banking systems established earlier in this Chapter, we pay particular attention to the behaviour of the parent banks. As the GFC hit Western Europe it was questionable whether the parent banks would manage to support their subsidiaries and branches in CEE countries. Another disadvantage of non-euro area CEE countries was their restricted access to euro liquidity and the ECB's collateral policy. Namely, the near-paralysis of the euro-area interbank money market after the collapse of Lehman Brothers meant that commercial banks in Central and Eastern Europe were largely cut off from euro liquidity (Darvas, 2009). Finally, the possibility of contagion, i.e. intra-regional spill-overs, was also among the major fears for CEE countries. These concerns will be analysed in this sections.

As shown by Berglöf et al. (2009), Mihaljek (2009) and Takáts (2010), in the first year of global financial crisis, outflows of foreign bank loans in Central and Eastern Europe were quite resilient. In that respect, the presence of mainly foreign-owned banks, especially in smaller economies in CEE (BIS, 2009), appear to have been, less affected by the decline in cross-border loans. Indeed, Berglöf et al. (2009) find that the output drop during the crisis was smaller in countries with a higher share of foreign banks, suggesting that the impact of the crisis would have been even larger without their presence in the region. This finding is also in line with the research of De Haas and Van Lelyveld (2008). They find that "subsidiaries of multinational banks, in sharp contrast to domestic banks, do not tend to reduce their credit supply when the host country is hit by a banking crisis" (p. 27). In contrast, the larger economies of CEE where foreign bank ownership has not been dominant, e.g. Poland, have been confronted with relatively higher contractions in cross-border bank loans (BIS, 2009). Kalusa (2010) explains that the relative large withdrawal of cross-border bank loans from the Czech Republic and Poland, in late 2008, may also have been because of the relatively high level of soundness and liquidity of these countries' banking systems. However, later studies such as De Haas and Van Horen (2011) find that during the crisis banks foreign bank subsidiaries reduced their lending earlier and faster than domestic banks, whereas domestic banks were a relatively stable credit source. Also, Allen et al. (2011) note that many foreign banks were "locked in" because their local subsidiaries had given long-term loans in the host countries, which could not be recalled. In addition, Popov and Udell (2010) provide evidence that less capitalised Western European banks reduced the credit supply of their Eastern European subsidiaries during the early stages of the global financial crisis.

Comparing CEE to other global emerging regions it becomes evident that in Central and East European countries the post-Lehman decline in cross-border bank lending was relatively mild. In particular, the Western European banks, withdrew less liquidity from the CEE countries than from other regions of the emerging world (Figure 3.23).



Source: Cetorelli and Goldberg (2010), Table 1a, 1b.

Figure 3.23 Cross-border flows, % change by source in the global emerging regions in the period before and after the GFC

Notes: ***This graph indicated the growth of foreign claims (cross-border and foreign exchange claims by local subsidiaries) over the periods 2006, 3rd quarter to 2007, 2nd quarter, and 2008, 3rd quarter to 2009, 2nd quarter, from three advanced to three emerging regions, plus growth in loans by domestic banks in the respective emerging region***

McCauley et al. (2010) find that local lending by subsidiaries of large international banks was more stable than cross-border lending. This may be due to the European banks' commitment to the region and the Vienna Initiative. Also, Cetorelli and Goldberg (2010) reveal that countries covered by the Vienna Initiative appear to be associated with mitigated local lending declines. In addition, De Haas et al. (2014) show that foreign banks that participated in the Vienna Initiative were relatively stable lenders than those banks that did not participate. The Vienna Initiative, launched in January 2009, was a coordination effort that brought together international financial institutions, European institutions, regulatory and fiscal authorities and the largest banking groups operating in emerging Europe. Its main goal was to prevent a large scale withdrawal of cross-border banking groups from the region.

Bearing in mind the new circumstances and potentially new risks the Vienna Initiative has changed three times since it was launched. The Figure below presents the three phases of Vienna Initiative.

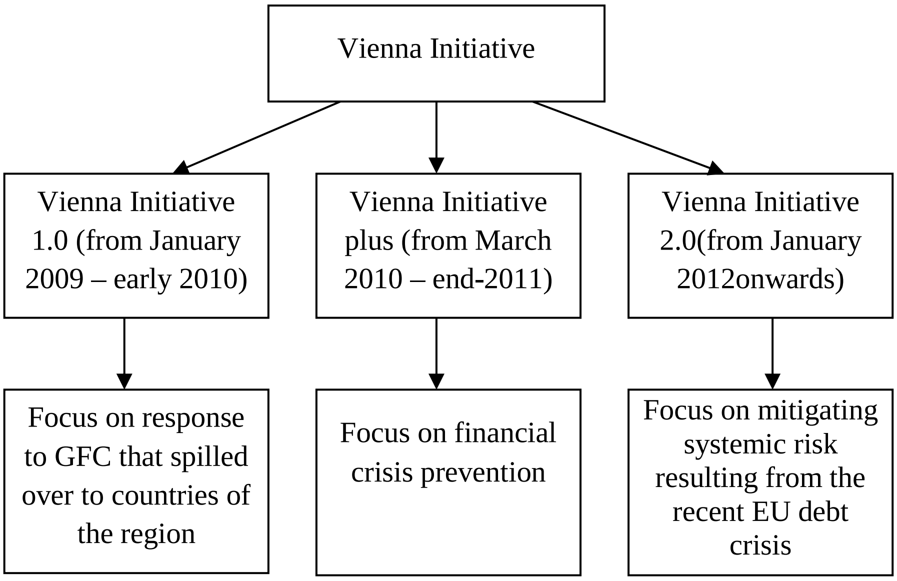


Figure 3.24 Vienna Initiative improvements

The key objective of Vienna Initiative 1.0 was to preserve financial sector stability in East European markets by maintaining adequate solvency and liquidity in the subsidiaries of western banks. Developed within the context of the “Vienna Initiative” and supported by EBRD, EIB and World Bank, the new Joint International Financial Institution (IFI) provided assistance that enabled banks to maintain their exposure to the region, meet their capital requirements and direct their lending activity to the real sector. For two years, under IFI assistance, the EBRD and World Bank committed to the provision of up to 24.5 billion of financing to financial institutions operating in the CEE and the CIS region, and made available more than €33 billion in crisis-related support for financial sectors in the region (EBRD, EIB, and WB Report, 2011). In Table 3.2 we present for each of the 16 countries of the CEE region the funding commitment, up to a total of €12, 5 billion (column "total signed") and the funding made available, in total more than €17, 5 billion (column "total approved").

Table 3.2 Delivery on EBRD's, EIB`s and World Bank`s Commitments under the Joint IFI Action Plan, up to end 2010 (in millions of Euros)

	EBRD			**EIB**			**World Bank**		
	Total approved	Total signed	Total disbursed	Total approved	Total signed	Total disbursed	Total approved	Total signed	Total disbursed
Bulgaria	449	299	181	444	424	224			
Hungary	483	467	87	1,596	1,306	851	1043	1	1
Latvia	151	104	127	518	332	147	309		
Lithuania	30	30	35	268	213	170	480	10	
Poland	585	545	407	2,494	1,918	1,392	218	14	8
Romania	799	431	282	795	700	437		168	90
Slovakia	70	55	35	564	544	363			
Slovenia	50			956	791	559			
Albania	50	29	25	35	10	0		2	2
Bosnia and Herzegovina	156	154	70	459	334	82	52	12	4
Croatia	159	159	146	913	733	305	141		
FYR Macedonia	64	57	10	120	110	75	26	26	24
Montenegro	60	38	6	130	109	56	79		
Serbia	447	301	213	664	604	335	139	139	47
Czech Republic				1,349	1,269	995		44	
Estonia				155	50	50			
Total	**3,553**	**2,669**	**1,624**	**11,460**	**9,447**	**6,041**	**2,457**	**416**	**176**

Source: Joint IFI Action Plan (2011)

The various participants in the Vienna Initiative 1.0 made different commitments. For instance, the host country authorities were responsible for appropriate macroeconomic policies, liquidity support in the local currency irrespective of bank ownership and supporting their deposit insurance schemes (De Hass et al., 2012). Parent bank groups and the home country authorities behind them were responsible for providing funding in foreign exchange and recapitalising subsidiaries where needed (EBRD, 2012). The Vienna Initiative 1.0 successfully achieved its objectives. Banking groups maintained their exposures in the region, continued lending to the production sector, and contributed to the economic recovery in 2010 and 2011.

An interim phase was the Vienna Initiative Plus. In this phase, the Initiative created a platform for public-private cooperation in order to analyse and advice on longer-term issues for future crisis prevention, such as the widespread lending in foreign currencies prevalent in the region. This phase involved group meetings of parent banks, regulators, central banks, ministries of finance and international institutions in which on-going issues were discussed, such as, NPLs, local currency and capital market development, Basel III etc.

As a response to new dangers to the CEE region, such as Eurozone sovereign debt crisis, in January 2012, the Vienna Initiative moved to a second phase. This time, the crisis affected not only banks but public finances of home countries as well. Vienna 2.0 has a different aim. Namely, instead of external assistance programs, such as Joint IFIs` assistance, the aim is to create sustainable bank business models, involving (i) the deleveraging process of banking groups through cooperation of home and host country supervisors, and (ii) greater reliance on local sources of funding (EBRD, 2012).

The CEE region has also been protected by an additional characteristic that is unique to emerging Europe. Namely, some of the observed countries are members of European Union, while some of them are candidates to European Union. Thus, these countries have developed political ties that produced financial support through European institutions. For example, Hungary, Latvia and Romania received loan packages financed by the EU and IMF. Overall, the strong international crisis response, such as the Joint IFI Action Plan of the EBRD, the EIB Group, and the World Bank Group, played an important role in the restoration of confidence in the European region (EBRD, EIB, and WB Report, 2011).

3.6 Conclusion

By considering both direct macroeconomic influences on financial instability/crisis and the influence of financial/banking structures on the subsequent contagion effects of the global financial crisis, this Chapter will inform the analysis in Chapter 6. Namely, this Chapter provides illustrative statistics and initial analysis of most of the variables that will be used in the CEE model of non-performing loans.

Overall the experience of the global financial crisis suggests that the macroeconomic developments, in particular growth rates, interest rates, exchange rates and excessive credit growth, are important in understanding the impact of the global financial crisis on countries and, correspondingly, in understanding the associated incidence of non-performing loans.

Although the GFC resulted in large declines in economic activity, a large slowdown of net capital inflows, higher unemployment and insolvencies, a credit crunch followed by credit quality problems and high ratios of non-performing loans, and bank recapitalizations, full-blown financial crisis was avoided. As noted in section 2.3, the crisis in emerging economies involved currency crises, with large overshooting of exchange rates, runs on banks, and the collapse of systemic banks. However the worst of these outcomes were avoided in the CEE region. While there was a modest credit crunch and high non-performing loans ratios in CEE countries after the GFC, these were of moderate size compared to those in other emerging markets. Namely, the data shows that CEE countries suffered less outflows of bank lending, as a share of existing bank assets, than other emerging regions, and had a share of non-performing loans well below the level seen in several recent crises.

Finally, currently the empirical literature suggests that international bank lending through local branches and subsidiaries is more stable than direct cross-border lending, and indicates that foreign bank subsidiaries reduce their lending during a financial crisis less than domestic-owned banks. That suggests that the impact of the GFC crisis would have been even larger without foreign bank presence in the region and that the same foreign banks that helped create the macroeconomic imbalances and over-indebtedness also helped reduce the impact of the resulting fragility. Those circumstances have indicated why bank lending outflows from emerging Europe were generally more moderate than from other regions (Berglöf et al., 2010). The last section also shows the benefit of private-public co-operation and the role of international financial institutions as coordination mechanisms (Vienna Initiative). This finding suggests that the structure of banking sectors in CEE countries, particularly regarding ownership, had a moderating effect on the transmission of the global financial crisis to these countries. The influence of foreign banks on the quality of loans in these economies will be investigated in Chapter 6.

Amongst researchers there is also a general agreement that the supervision standards and instruments to maintain the banking stability prior to GFC were weak, this argument will be critically assessed in the following Chapter.

CHAPTER 4: Banking Regulation and Supervision in Order to Maintain Banking Stability

Contents:

4.1 Introduction

The analysis of the causes and effects of the global financial crisis presented in the previous Chapter indicated that economic, structural and institutional weaknesses lay at the core of that crisis. As we noted, these weaknesses in the period before the global financial crisis created a lethal combination of accommodative monetary policy, growing global imbalances and weak supervision standards. In this Chapter we are interested in investigating the conditions for banking stability from the institutional, or central bank's perspective. In particular, we analyse how appropriate banking regulations and prudential techniques can enhance stability of the banking sector.

This Chapter will provide a critical assessment of the design of a regulatory and supervisory framework for maintaining banking stability (Section 4.2). A subsection, section 4.2.1, is dedicated to examining the regulatory challenges in financial systems dominated by foreign banks, including a discussion of capital flow management. The Basel arrangements and their contribution to banking stability will be assessed in Section 4.3. Section 4.4 presents an evaluation of the current switch from micro to macro prudential regulation and supervision. As noted by the IMF (2011), macroprudential policy requires a capacity to identify systemic risks early enough so that appropriate action can be taken to support financial stability. Therefore, in the Subsection 4.4.1 we will investigate the techniques used to anticipate future adverse events, in particular we will analyse early warning systems and stress tests. Lastly, the Section 4.5 contains concluding remarks.

4.2 Regulation, Supervision and Banking Stability

Bearing in mind the key role of the banking sector in an economy, banking has been one of the most regulated and monitored industries in the world (Tchana, 2008). According to the International Competition Network Antitrust Enforcement in Regulated Sectors Working Group (2005), banking regulation originates from microeconomic concerns over the ability of bank creditors (depositors) to monitor the risks originating on the lending side and from micro and macroeconomic concerns over the stability of the banking system in the case of a bank crisis. Regulation means defining the legal and organizational status of banks, defining the banking business and specifying the required proportions between the different positions in the banks' balance sheets. Barth et al. (2004) describe regulation as a set of laws and rules which are applicable to banking, while they define supervision as the monitoring process by the authorities of banks' activities and the enforcement of banking regulations. According to the World Bank Global Financial Development Report (GFDR) (2013) the key challenge of regulation is to provide a better alignment of private incentives with the public interest, without taxing or subsidizing private risk-taking, while supervision should ensure the implementation of rules and regulations.

The objectives of banking regulations have changed over time. During the 1980s, as mentioned in the previous Chapter, there were new developments and processes such as deregulation, securitization, internationalisation and growing competition between banking institutions. The new approach to banking regulation and supervision emphasised the benefits of increasing competition between the banks and between banks and non-bank financial institutions. According to Allen and Herring (2001), there are broadly four goals of banking regulations, namely: preventing systemic risk, providing protection for investors, enhancing efficiency, and improving social welfare. Summarising the literature on recent banking regulations the most common cited objective of banking regulations refers to ensuring the safety and soundness of the banking sector, by lowering the level of risk to which banks lenders and creditors are exposed by reducing systemic risk. According to Čihák and Tieman (2008), regulation should aim at supporting the efficient allocation of resources across the economy in normal times. Furthermore, they argue that the final test of a well-functioning regulatory framework is whether it contributes to the financial system's intermediation capacity, while decreasing the likelihood and costs of systemic financial crises.

In most countries, central banks organize the regulation of banking sector given their role of the lender of last resort. As seen in the Table below, this is a case in the majority of most of Central and Eastern European countries.

Table 4.1 The body/agency which regulates and supervises commercial banks

Country	Body / Agency	
Albania	Central Bank	
Bosnia and Herzegovina		Two bank supervisory agencies for two entities (Federation of Bosnia and Herzegovina and Republika Srpska)
Bulgaria	Central Bank	
Croatia	Central Bank	
Czech Republic	Central Bank	
Estonia		A single bank supervisory agency
Hungary		A single bank supervisory agency
Latvia		A single bank supervisory agency
Lithuania	Central Bank	
Macedonia, FYR	Central Bank	
Montenegro	Central Bank	
Poland		A single bank supervisory agency
Romania	Central Bank	
Serbia	Central Bank	
Slovakia	Central Bank	
Slovenia	Central Bank	

Source: World Bank GFDR (2013)

However, that was not always the case through the history (e.g. Allen and Herring, 2001). In fact, central banks were typically founded for very different purposes. Through history central banks have been focused primarily on maintaining price stability and subsequently financial stability. However, since the 1990s, the objective of financial stability began to gain greater prominence among central banks. Allen and Herring (2001) summarized that historically systemic risk was manifested by crises, thus avoiding systemic risk is the prime objective of banking regulation. Typically a central banks` surveillance is broad, starting with the financial sector, payments system, real economy, monetary and fiscal policies, as well as developments in the international economy. The ultimate products of that surveillance are recommendations for the relevant authorities to respond to unfavourable development and prevent a crisis. Since, central banks have a wide range of policies (e.g. interest rates) and instruments for safeguarding financial stability (e.g. monitoring macroeconomic variables etc.) they have vital roles in fostering the soundness of financial institutions, particularly banks, as they have the powers of supervision and regulation. However, recently some countries (such as Estonia and Hungary) have taken responsibility for bank regulation and supervision away from the central bank and placed it in a separate regulatory authority, in some cases one which encompasses securities firms or insurance companies as well as banks (Barth et al., 2004). This had happened partly because financial conglomerates have become more common and they frequently offer a variety of financial products and services that cut across different institutional regulatory lines.

There have been many attempts to classify banking sector regulations. For example, Mishkin (2000) distinguishes between: restrictions on asset holdings and activities; separation of the banking and other financial service industries; restrictions on competition; capital requirements; risk-based deposit insurance premia; disclosure requirements; bank chartering; bank examination; supervisory versus regulatory approach. More specifically, restrictions on asset holdings and activities are targeted at preventing banks from excessive risk-taking by limiting the type of assets they may hold and by restricting them from engaging in non-core business activities, which might subject the bank to too much risk. The separation of the banking and other financial service industries is designed to prevent the government's safety net being extended to other activities. Restrictions on competition are designed to combat moral hazard incentives for banks to take on more risk. In addition those restrictions include the previously mentioned separation of industries, restrictions on entry of foreign banks, restrictions on branching[14], and ceilings on rates charged on loans or on deposits. Capital requirements specify the amount of capital which banks should hold, in order to discourage excessive risk-taking. Given that deposit insurance can increase moral hazard incentives, by appropriately pricing the premia banks pay to reflect the risks undertaken, the moral hazard problem may be reduced. To ensure that depositors and the marketplace have better information on banks activities, regulators can require that banks adhere to certain standard accounting principles and disclosure of specific information. Bank chartering concerns the control of banks’ entry. A typical chartering process, as Mishkin (2000) explains, requires that the people planning to run a bank need to submit an application that shows how they plan to operate the bank. Then, the chartering authority examines whether that bank is likely to be

[14] Branching restrictions refer to the geographic limitations on the ability of individual banks to open more than one office or branch.

sound, by analysing the amount of initial capital, the quality of banks intended management, etc. Bank examination means that banks must be examined in order to check the compliance of banks with existing regulations and enforcement actions must be taken in the case of non-compliance. Finally, Mishkin (2000) differentiates between the “regulatory approach” and “supervisory approach”. In particular, he argues that the “regulatory approach” simply presents a set of regulatory rules, while the “supervisory approach” represents a shift of the regulators' action towards the monitoring of the soundness of bank managements' practices with regard to controlling risk.

A more extensive classification of existing regulation and supervision is provided by Barth et al. (2001). According to their classification, there are 12 basic types of banking regulation covering: entry into banking, ownership, capital, activities, external auditing requirements, internal managements/organizational requirements, liquidity and diversification requirements, the deposit requirements, the accounting/information disclosure requirements, the discipline/problem institutions/exit, and supervision. Most of these categories overlap with Mishkin’s (2000) classification, except that Barth et al. (2001) have included external auditing and liquidity and diversification requirements. Namely, banks should be required to obtain certified audits and/or ratings from internationally renowned rating agencies. In addition, regulations may require that banks should report their liquidity provisions and diversification positions.[15]

Tchana (2008) based on the previous classifications grouped existing banking regulations into three broad categories: regulatory measures affecting the bank’s balance sheet (capital adequacy requirements, reserve requirements, and asset holding restrictions), regulatory measures affecting the structure of the banking system (separation of the banking and other financial industries like securities, insurance, or real estate, restrictions on competition), and regulatory measures for banks’ owners and managers’ behaviour (risk-based deposit insurance premiums, disclosure requirements, bank chartering, and bank examination). Bearing in mind that in the next Chapter, we will investigate the determinants of the quality of loans, we will pay the special attention to the three measures are aimed at affecting the bank’s balance sheet: restrictions on asset holdings, capital adequacy requirements, and reserve and/or liquidity requirements. Namely, according to Giordano (2009) restrictions on

[15] For example, whether banks satisfy the minimum liquidity requirement; or whether they satisfy guidelines regarding asset diversification; are banks prohibited from making loans abroad etc.

asset holding and activities discourage banks from undertaking excessive risk taking by limiting the type of assets the banks can hold and by restraining banks from engaging in risky non-core activities. Moreover, regular bank examinations and restrictions on asset holdings indirectly help to reduce the adverse selection problem (which was discussed in section 2.3) because given fewer opportunities to take on risk, risk-prone entrepreneurs will be discouraged from entering the banking industry. Capital requirement refers to the amount of capital a bank has to hold as required by regulatory authorities and/or supervisory agencies in order to prevent the bank for future unexpected losses. According to Mishkin (2000) there are three types of bank capital requirements: the first type is based on the so-called leverage ratio, which is the amount of capital divided by the bank's total assets. The second is the Basel I Accord type where assets and off-balance sheet activities are allocated into four categories, each with a different weight to reflect the degree of credit risk, then the capital requirements are calculated as a percentage of a bank's capital to its risk-weighted assets. The third type is where capital requirement are based on the level of market risk taken by banks. Bearing in mind the importance of capital adequacy requirement in a regulatory and supervisory framework we will assess more recent Basel accords in the following subsections 4.3 and 4.3.1. Reserve and/or liquidity requirements cover the amount of funds that banks are required to keep on deposit in accounts designated for such purpose by the central bank. As explained by Thana (2008), reserve requirements are probably one of the most ancient types of banking regulation; they have been viewed as a form of taxation on banks by governments, since generally these required reserves do not bear interest.

So far, the empirical literature does not provide uniform evidence that the many types of regulation assist banking stability. There are no robust results indicating that regulations such as entry restriction, capital requirement etc. have a significant and persistent positive effect on banking sector stability. Namely, Barth et al. (2006) assessed the importance of each type of regulatory policy on the stabilization of the banking system. They found that the relationship between capital adequacy requirement and banking stability is not robust. Moreover, they find that the standard features of banking supervision and regulation do not reduce and may even increase the chance that countries experience banking crises. Also, they suggest that regulations lead to more developed banking sectors or more efficient banks. They argued that their findings do not mean that regulations which have not been proven effective have no role in strengthening the banking sector. Rather, their interpretation is that it suggested a supporting role for regulation, one in which the regulators` job is to verify that the information being disclosed by banks is accurate, and to penalize banks that disclose false, misleading or inadequate information. In a later study, Barth et al. (2008) outline the findings of a survey of bank regulations in 142 countries, which again suggest that meeting the required capital requirements does not necessarily enhance banking sector stability or efficiency. Furthermore, Demirgüç-Kunt and Detragiache (2010) using data for more than 3000 banks in 86 countries find that compliance with the Basel core principles does not affect bank risk measured by Z-scores.[16] Finally, Barth et al (2012) in their fourth survey of banking regulations make comparisons with earlier surveys since 1999 and assess the relationship between changes in bank regulations and banking system performance. Their data indicates that many countries made capital regulations more stringent and granted greater discretionary power to official supervisory agencies over the past 12 years, but most countries have not enhanced the ability and incentives of private investors to monitor banks rigorously and several have even weakened such private monitoring incentives. In addition their analysis suggests that many countries are making counterproductive changes to their bank regulations by not enhancing the ability of and incentives for private investors to monitor banks.

In contrast, De Nicolò et al. (2012) analysing the impact of capital regulation, liquidity requirements and taxation find that mild capital requirements[17] increase bank lending, bank efficiency and social welfare relative to an unregulated banking system. In addition, their findings indicate that liquidity requirements reduce bank lending, efficiency and social welfare significantly. However, Dobravolskas and Seiranov (2011) while investigating the causes of the last financial crisis, find that the deterioration of financial stability was a result of deregulation processes in major financial markets since 1980s and the inadequacy of national micro-prudential[18] regulators. Namely, in the period before the global financial crisis, in many countries, a progressive deregulation of various aspects of the functioning of financial institutions was present. As noted by Sinha (2012), the process of deregulation had included removal of overall policy constraints on banks' ability to perform their core

[16] They define the Z-score as (average return on assets +equity/assets)/(standard deviation of the return on assets) over [t, t-4]. They interpret the Z-score as the number of standard deviations by which returns would have to fall from the mean to wipe out all equity in the bank (Boyd and Runkle, 1993).

[17] De Nicolò et al. (2012) put a benchmark of core capital ratio at 4%. According them, when the capital ratio equals 4% a bank is operating under "mild" capital requirements. In their analysis the capital ratio can increase up to 12%.

[18] Microprudential regulations aim to prevent the failure of particular individual financial institutions. A discussion of the microprudential approach will be provided in Section 4.4.

functions; encouraging universal banking; permitting non-bank financial institutions to undertake financial intermediation; placing greater emphasis on financial markets to allocate resources and increased integration of financial markets. In addition, as we argued in Chapter 3, new financial products, financial derivatives, were loosely regulated and this weakening of regulation was a contributory cause of the global financial crisis.

As seen in the previous Chapter, the banks in CEE countries are increasingly merging and creating strong cross-border banking groups. Consequently, the banking sectors in these countries are now dominated by foreign banks. At the same time, banking regulation, in terms of supervision, and responsibility for financial stability, remains predominantly national. This imposes additional challenges for financial regulators. Namely, as Čihák and Tieman (2008) noted, financial globalization has made individual country financial systems much more linked, and substantial differences in regulatory and supervisory quality can become exposed in a cross-border crisis. In their investigation of countries around the world, they find that: (i) on average, countries' regulatory frameworks score one notch below full compliance with the internationally accepted standards[19] (on a 4-notch scale); (ii) per capita income is significantly linked to cross-country differences in regulatory quality; (iii) higher regulatory quality in banking is correlated with better banking sector performance over the 2002-2006 period; and (iv) there are substantial differences in regulatory quality across regions, some but not all of which can be explained by differences in the level of economic development. Their findings suggest that high-income countries are characterized by better supervisory structures, given that these countries have more developed financial systems. However, the last global financial crisis has shown that the quality of supervisory systems in high-income countries was insufficient given the complexity of their financial systems.

As Caprio (1996) noted, the success of financial reform and the stability of financial systems depend particularly on developing an effective regulatory framework that rewards prudent risk-taking and is attuned to both financial institutions and the structure of the economy. Such a framework should be developed whilst participants the financial system are adjusting to changes in incentives. Namely, Caprio (1996) highlights the importance of reshaping the regulatory environment promptly, at the same time as permitting non-bank financial institutions to participate in financial intermediation and as new financial products, financial

[19] These standards included the Basel Core Principles for Effective Banking Supervision; the Insurance Core Principles, issued by the International Association of Insurance Supervisors; and the International Organization of Securities Commission's Objectives and Principles of Securities Regulation.

derivatives are introduced. Ingves (2006) stresses that efficient banking regulation is needed both to reduce the risk that banks run into problems and to minimize the externalities that arise if banks actually fail. As explained by Tymoigne (2009), traditionally the regulatory financial framework has been organized in order to detect frauds and "imprudent" risk management, and to make sure that economic incentives are set "properly" to promote smooth economic growth. However, the recent global financial crisis has shown that the previous framework was not appropriate; but this will be later discussed. Caruana (2010) explains that the currently emerging framework for financial stability favours a macroprudential[20] orientation of regulation and supervision to address systemic risk. Furthermore, he highlights that the institutional framework needs to be adjusted at national level to pay more attention to the monitoring and control of systemic risks and internationally to ensure cooperation and consistency across borders.

It is now widely accepted that banking sector regulations that prevailed in the period before the crisis must undergo significant changes (Demirgüç-Kunt et al., 2010; Sinha, 2012; De Nicolò et al., 2012; Barth et al., 2013; Caprio, 2013). The recent global financial crisis further highlighted weaknesses in the financial regulations and supervisions. One of them was the lack of system wide, now popularly called macro-prudential regulations and supervision which led to the failure of some financial institutions. This will be analysed in Section 4.4, but initially we will discuss Basel regulations (Section 4.3). Namely, the Basel capital regulations represent an important driving force behind the regulatory and supervisory improvements which should be implemented. After the period of financial liberalization in the 1980s, the most important type of regulations that had emerged was the Basel Accord with its capital requirement and its supervision practices. This new regulatory framework has contributed to an international convergence of banks' risk management standards, whilst improving these standards in many countries.

However, given the ownership structure of banking sectors in CEE there is a need to examine the specific regulatory challenges facing these banking sectors, particularly as these are the dominant intermediators for the large capitals flows in the CEE region.

[20] Macroprudential regulation aims to maintain stability of the overall financial system. The macroprudential approach will be assessed in section 4.4.

4.2.1 Regulatory Challenges in Financial Systems Dominated by Foreign Banks

In this section we will discuss the regulatory challenges in financial systems dominated by foreign banks, with a specific mention of the special case of unilaterally euroised or dollarized countries. More broadly we will tackle the challenges of liquidity management faced by central banks in these countries, including a consideration of capital flow management from a macroprudential perspective.

The presence of foreign-owned banks poses potential risks for Central and East European countries. Many foreign-owned banks in CEE relied heavily on external funding from their parent banks to support rapid credit growth. The financial soundness of the foreign bank can influence the volume of lending by these banks through its subsidiaries as well as through cross-border transactions. As mentioned earlier in Chapters 2 and 3, liquidity or solvency problems of foreign banks may be transmitted through both their internal capital markets and their cross-border lending to domestically owned banks. However, these banks also played a critical role in post-GFC stabilization, through specific commitments on debt rollovers and recapitalization (under the European Bank Coordination—"Vienna"—Initiative). Though the Financial Stability Board (2011) reported that during the last financial crisis, there had been worries amongst national authorities in CEE that the problems experienced outside the region could affect the availability of credit and even the viability of the operations of foreign banks throughout the region. Furthermore, they noted that the cross-border supervision did not provide sufficient powers and rights to information to the host country in some cases, which complicated management of the risks associated with foreign financial institutions. Prasad (2010) suggests of three types of regulatory responses in regions where foreign financial institutions increase their presence and where the institutions from within the region increase the scale of their foreign operations: greater oversight by national regulators of the international operations of their domestic financial institutions, better coordination with regulators from outside the region, and greater coordination among regulators in the region.

Regarding the predominant foreign ownership of banks in CEE, the GFC highlighted the importance of developing mechanisms to curb the effects of large and volatile capital inflows in these countries. Namely, capital flows between countries are of huge interest for determining financial conditions especially those capital flows which are intermediated by the banking sector (Allen et al., 2011; Borio and Disyatat, 2011; Obstfeld, 2012a, b;

Gourinchas and Obstfeld; 2012; Lane and Pels, 2012). Bruno and Shin (2012) noted that banking sector capital flows were associated with a leverage cycle in the banking sector, mainly through the supply and demand of wholesale bank funding. As explained by Allen et al. (2011) and Lane and Pels (2012), credit expansions were mainly financed by capital flows through the banking sector. Thus, the procyclicality of banking sector capital flows poses challenges in setting policy and regulatory responses. The cross-border spillovers associated with banking sector flows have also highlighted the importance of international coordination in banking regulation and in monetary policy. However, such coordination is not easy to implement, even when the interests of the relevant countries coincide. Moreover, even when coordination is globally beneficial, it might still generate tensions with national governance.

Large capital inflows may present a difficult task for economic policymakers. Lipsky (2010) notes that in the absence of an adequate policy and institutional framework capital inflows can complicate macroeconomic management, reduce the effectiveness of monetary policy, and create systemic stress. In order to prevent large capital flows one of policy responses is to tighten monetary policy in order to reduce incentives for capital inflows. In addition, fiscal policy should also be tight, as it reduces currency appreciation pressures (Cardarelli, et al., 2007). Cardarelli, et al. (2007) identify that during periods of large capital inflows fiscal restraint can help limit real currency appreciation and foster better growth outcomes in the aftermath of such episodes. When large capital flows fuel credit booms and where ineffective microprudential regulation is present, Ostry et al. (2010) reveal two policy choices: monetary easing or direct interventions in currency markets. Von Hagen and Siedschlag (2008) explained that with a fixed exchange rate, capital inflows then lead to a rapid increase in international reserves. The central bank may try to sterilize their impact on the money supply, but as Von Hagen and Siedschlag (2008) noted in practice this may be costly and bring only limited success. Inflationary pressures then result in a real appreciation, a loss in international competitiveness, and a widening current account deficit. On the other hand, they explained that under a flexible exchange rate, the central bank may be more successful in keeping inflation low, but at the cost of a nominal appreciation of the currency, with the same effect on competitiveness and the current account. However, when such economic policies are not sufficient then capital controls, recently propagated by IMF, may be useful as an additional policy tool.

The intensity of capital controls is measured in the literature in many different ways (Habermeier et al., 2011). Some studies use a binary variable indicating the existence of a specific measure, and some use combination of a few binary variables (Clements and Kamil, 2009; Coelho and Gallagher, 2010). There are studies on capital controls which count the number of regulation changes (Cardoso and Goldfajn, 1998), while others calculate tax equivalent intensity (De Gregorio et al., 2000). Some empirical studies find no effect of controls on the overall volume of inflows (De Gregorio et al., 2000; Binici et al., 2009), while others do (Campion and Neumann, 2004; Coelho and Gallagher, 2010). Gabor (2011) argues that IMF's proposal for capital controls offers a formulaic solution which neglects the institutional make-up of money and currency markets. She argues that it is asymmetric in its emphasis on the upturn of the liquidity cycle and sanctions capital-controls only as a last-resort solution. She stresses that the IMF approach can have perverse impacts, increasing vulnerability where banks play an important role in the intermediation of capital inflows.

However, the introduction of capital controls may be beneficiary for euroised/dollarized economies, such as Montenegro. Namely, as we presented in Chapter 1, the significant foreign investment in Montenegrin real estate might have been a way to move funds offshore and avoid capital controls, since in Montenegro there are no capital controls. Furthermore, the country's euroization, high level of external debt and large debt service requirements render the Montenegrin financial sector vulnerable to a slowdown in capital inflows and call for more prudent fiscal policy, as domestic monetary policy is limited. As already mentioned in Chapter 1, the soundness of the banking system is necessary to bolster the resilience of the economy and promote private sector-led growth. Thus, reinforcement of the legal and prudential frameworks and stronger supervisory practices are essential. Given that full euroization limits the ability of the central bank to provide liquidity support to banks, conservative capital and liquidity requirements for banks may be required. In particular, the CBM should assess whether banks have enough capital to cover potential losses and NPLs, in order to escape the build-up of huge NPLs, which would subsequently be sold to factoring companies. Factoring contracts may be a good way to save the capital of banks that have problems with debt collection. However, factoring contracts like other financing agreements should be regulated. A lack of regulation and monitoring of these contracts in practice carries the risk of abuse, which creates legal uncertainty and limits the development of the factoring industry. It is important that all parties are aware of their rights and obligations under the contract of factoring, thus it may be necessary to regulate this industry and make these contracts more transparent. These factoring companies are regulated by national lows in some CEE countries (Serbia, Latvia, and Croatia), but in Montenegro they are not yet regulated and leave a room for abuses.

To sum up, implementation of an appropriate approach to manage capital flows is likely to require a holistic approach. Some countries, like Montenegro where economic growth is mainly led by investment still needs large capital flows. Thus, that holistic approach in managing capital flows should consider the economic priorities of the country and the need for responsible monetary and fiscal policies, as well as the institutional characteristics of the country.

4.3 Review of the Basel Arrangements

In Section 2.5 we argued that improvements in the international regulatory framework for banking were necessary to ensure that risk management policies prevented excessive risk accumulations. In that context we started assessing the Basel Arrangements, focusing on minimum capital requirements according to the Basel I and later adapted in Basel II. In this Section we will expand our analysis of the Basel II arrangements bearing in mind their importance and significance to the banking industry and the overall macroeconomic needs of countries. The IMF (2005) argued that the effective risk-based banking supervision provided by the Basel arrangements was necessary for a strong financial infrastructure, financial stability and economic development. This section will provide a discussion of the critical issues concerning the development and implementation of the Basel Accords among developed and developing countries, in particular focusing on CEE countries. The Basel II Accord on capital standards was implemented in 2007 in a large number of countries, but excluding some transitional countries of CEE. The delay in the implementation of the Basel arrangements in some CEE countries, mainly Western Balkan countries (such as Albania, Bosnia and Hezegovina, etc.; see Table 4.2) was partly due to these countries' historical legacy and circumstances related to their transition process.

These countries had to make major changes to processes and practice in their financial sectors in order to meet Basel requirements, starting from their legal framework. In particular, they had to adopt and implement new laws on banking, with pertinent sub-legal legislation in accordance to EU Directives[21] in order to provide the legal framework for a gradual transition to Basel II.

Table 4.2 The regulatory capital adequacy regimes the countries used as of end of 2010

	Albania	Bosnia and Herzegovina	Bulgaria	Croatia	Czech Republic	Estonia	Hungary	Latvia	Lithvania	Macedonia, FYR	Montenegro	Poland	Romania	Serbia	Slovakia	Slovenia
The regulatory capital adequacy regimes the countries used as of end of 2010																
a. Basel I	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No
b. Basel II	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
The risks covered by the current regulatory minimum capital requirements																
a. Credit risk	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
b. Market risk	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
c. Operational risk	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
d. Other risks (explaination)	No	No	Yes	No	-	No	Yes	No	No	Yes	Yes	Yes	No	No	Yes	Yes
		---	All risks covered under Pillar II of Basel II.	---		---	liquidity risk and concentration risk.	---	---	liquidity risk	Country risk	Settlement risk, delivery risk and counterparty	---	---		
Basel II regime (if applicable)	Will be applcable from 2011	Will be applcable from 2018												Will be applcable from 2011		
a. Simplified standardized approach (SSA)	---	---	No	No	No	No	No	No	No	No	No	No	No	---	Yes	No
b. Standardized approach (SA)	---	---	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	---	Yes	Yes
c. Foundation internal ratings-based approach (F-IRB)	---	---	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	---	Yes	Yes
d. Advanced internal ratings-based approach (A-IRB)	---	---	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	---	Yes	Yes

Source: GFDR (2011)

The implementation of Basel II requires the adoption of an extremely sophisticated and expensive process, which took several years of implementation in some countries of CEE (Albania, Bosnia and Herzegovina and Serbia). This implementation requires significant investments in banks' personal and technological capacities. Majnoni et al. (2004) commenting on the Basel implementation in emerging countries, reported that the penetration

[21] On the 30th of June 2006 the European Commission published the Capital Requirements Directive (CRD) which reflects the Basel II rules on capital measurement and capital standards. That new European framework consists of two directives: the Directive 2006/48/EC relating to the taking up and pursuit of the business of credit institutions and the Directive 2006/49/EC on the capital adequacy of investment firms and credit institutions.

of external ratings agencies in these countries is typically low and that the majority of banks' portfolios are un-rated. Hence, they concluded that the standardized approach would not properly contribute to assessing regulatory capital. In addition, they argue that the set of procedures embedded in the IRB approach might be difficult to implement in emerging economies. In particular, they explain that the IRB approach provides a certain degree of autonomy to banks, since they are allowed to employ their own rating methodologies and their own mappings of their ratings to default probabilities. It further requires bank supervisors control that process, without considering the available numbers and level of expertise of the supervisors. Helmreich and Jäger (2008) noted that like in many other CEE countries where the banking sector is characterized by the presence of many foreign banks, in South Eastern Europe the international banks have many advantages over local banks, and were likely to implement the more advanced techniques. An additional problem is that in some countries there is no appropriate data series for some of the more sophisticated models, such as the advanced IRB approaches. Thus, as concluded by the IMF (2005) based on the BCBS guidelines: "Basel II may not be a first priority for all non-G 10 supervisory authorities in terms of what is needed to strengthen their banking supervision, and (they) should adopt Basel II only in a timeframe consistent with national priorities and capacities (paragraph 19.)".

The implications of Basel II, its various approaches, its rationale and design, and its impacts on banks and the macroeconomy have been discussed by many researchers (Hahn, 2003; Heid, 2003; IMF, 2005; Rochet, 2008; etc.). The Basel Committee defined their scope of activities as follows: first, the improved exchange of information; second, increasing the efficiency of techniques for the control of banks that operate internationally; and third, setting the minimum standards that were required. In the following Table we present the main pillars of Basel II.

Table 4.3 Components of Basel II

BASEL II		
Pillar I	**Pillar II**	**Pillar III**
Minimum capital requirements	**Supervisory review process**	**Market discipline**

Source: BCBS (2004)

Demirgüç-Kunt et al. (2010) noted that the more demanding minimum capital requirements (in Basel II) should restrain incentives for excessive risk-taking created by limited liability and amplified by deposit insurance and bailout expectations. They would force bank owners to have some like they said “skin in the game”[22] in order to achieve a stable system. We have previously explained the minimum capital requirements according to the Basel I and later adopted Basel II. As mentioned in section 2.5, the Basel II standard brought three particularly important changes. First, besides credit and market risk, operational risk is now introduced. Namely, Basel II outlines a spectrum of simpler-to more-complex approaches for measuring operational risk. At the most complex is the “advanced measurement approach” (AMA), designed specifically for internationally active banks, which are likely to have significant operational risk exposure (BCBS, 2006). Second, in the standardized approach an important place is given to external credit agencies whose outputs are used to classify all the companies in the portfolio of the bank, which ultimately affects the level of capital requirements. Third, Basel II enables banks to create their owned models for measuring risk in their business and in accordance with the results to set aside the necessary capital. Importantly, Basel II not only brought changes to the regulatory capital measurement, but also introduced fundamental principles and best practices for banks` supervision and transparent disclosures in banking practices.

The supervisory review process (Pillar II) is intended not only to ensure that banks have adequate capital to support all the risks in their business, but also to encourage banks to develop and use better risk management techniques in monitoring and managing their risks (BCBS, 2006). Stress testing, to be assessed later in this Chapter, is an important element of capital adequacy assessments under Pillar II. Under Pillar II, banks are required to undertake capital planning in a stress situation. Namely, the first principle in Pillar II says that “banks should have a process for assessing their overall capital adequacy in relation to their risk profile and a strategy for maintaining their capital levels” (BCBS, 2001 p. 3). Then supervisors should evaluate bank’s capital assessment and strategies, as well as their ability to ensure full compliance with regulatory capital requirements (BCBS, 2001, 2006). According to the Financial Services Authority (2009), firms should develop a range of stress scenarios relevant to their risk profile. Those scenarios should include a severe economic downturn based on forward-looking hypothetical events that are calibrated against the most adverse

[22] "Skin in the game" refers to the proposition that minimum capital requirements should curb incentives for excessive risk taking, amplified by deposit insurance and high expectations.

movements in individual risk drivers experienced over a long historical period. In addition, supervisory authorities might recommend scenarios to banks, to run stress tests as part of their Pillar II capital planning. That recommended scenario should reflect supervisory views on the worst, but still plausible, macroeconomic scenario through which a bank might go, whilst still be able to satisfy the minimum prescribe capital coefficient. Supervisors may ask banks to run that scenario directly as an input in bank`s internal capital adequacy planning. Namely, this scenario can serve banks as an 'anchor' scenario to help them develop their own scenarios. However, supervisors may also use that scenario to run their own supervisory stress testing at the aggregate level to assess banking sector's overall resilience.

Finally, the purpose the last component of Basel II is to complement the operation of minimum capital requirements and the supervisory review process (BCBS, 2001). With this component the capital adequacy requirement is not just the subject of supervisory and regulatory authorities, namely, it becomes available to all market participants. In particular, Pillar III refers to a set of disclosure recommendations (and requirements) which allow market participants to assess key pieces of information on the scope of application[23], capital, risk exposures, risk assessment and management processes, and hence the capital adequacy of the bank (BCBS, 2001).

The main criticisms of Basel II refer to the lack of emphasis placed on the second and third pillars as compared to the first pillar and the lack of analysis of the connections existing between the supervisory process and market discipline (Rochet, 2004; Van Hoose, 2007; Luberti, 2007; etc.). That the three pillars of Basel II were not given equal importance was noticed by Rochet (2004), who highlighted the need for rebalancing the three pillars to ensure the effectiveness of these regulations. Van Hoose (2007) examines the market-discipline and supervisory-process "pillars" of the Basel II framework. His conclusion on Pillar III is that the market disclosure features are likely to have significant positive spillovers for bank safety

[23] Pillar 3 applies to the top consolidated level of the banking group. Disclosures related to individual banks within the groups require the disclosure of Total and Tier 1 Capital Ratios, in order to recognise the need for these subsidiaries to comply with this Framework and other applicable limitations on the transfer of funds or capital within the group. The scope of application includes: the name of the top corporate entity in the group to which this Framework applies; an outline of differences in the basis of consolidation for accounting and regulatory purposes, with a brief description of the entities; any restrictions on transfer of funds or regulatory capital within the group; the aggregate amount of surplus capital of subsidiaries included in the capital of the consolidated group and the aggregate amount of capital deficiencies in all subsidiaries not included in the consolidation (BCBS, 2006).

and soundness only in developing countries. However, this pillar of Basel II falls short of promoting effective market monitoring by private investors or encouraging the utilization of market signals by both investors and bank regulators in developed countries. In addition, he considers that the Basel II supervisory-process pillar is completely misguided in its reliance on regulatory discretion, so that implementation of this pillar could potentially have counterproductive safety-and-soundness impacts. Namely, in his view the supervisory process included in Pillar II just delegate discretionary powers to banks without any consideration of a rules-based approach to banking regulation. Overall Van Hoose's (2007) analysis of Basel II is that the market-discipline pillar does not go far enough in the direction suggested by academic research and the supervisory-process pillar actually goes in the wrong direction.

Most of the criticisms of the implementation of the Basel II Accord have been related to the significant divergence in implementation across different countries. Namely, harmonized policies might not work the same in different institutional environments, which might be one reason why cross-country empirical studies cannot find any consistent effect of tighter capital regulations or increased supervisory powers (Barth, et al., 2006). As summarised by Bruce (2010), different countries are adopting different capital leverage ratios and allowing capital levels to change to their own satisfaction as long as they are meeting the minimum capital standards. This has the effects of encouraging banks to move into particular territories with favourable capital requirements or engaging in cross border mergers with other banks, thereby through such circumventive innovations igniting regional regulatory arbitrage. Luberti (2007) argues that the Basel II Accord presents a compromise between two very heterogeneous supervisory systems and juridical-administrative contexts, the US system, on the one side, and continental Europe, on the other. He explains that the main difference between the two systems lies in the role played by market discipline and in the reliance on that mechanism. Furthermore, he notes that the US model, seeks to address both market and regulatory failures and to ensure effective supervisory action by entrusting the supervisory authority with the task of mirroring controls typical of market discipline, when these cannot work as a consequence of the peculiarities of the banking industry. However, the European model takes market failures as a fundamental rationale for public controls and considers supervisory discretion instrumental to the structural role played by regulation. Luberti (2007) analysing the Italian banking supervisory system notes that corrective supervisory actions are likely to come too late, because of difficulties in identifying actual risk conditions and interfering with the entrepreneurial autonomy of banks. He considers that the “wait and see” attitude of banking supervision, can cause deposit guarantee schemes to be expensive for taxpayers and may also have a negative impact on the reputation of the supervisory authorities themselves. Using the crisis that started in August 2007 as an unexpected negative shock, Demirgüç-Kunt et al. (2010) explore whether market participants in 12 countries from 2005-2009, perceived different capital definitions to be effective measures of banks’ ability to withstand stress. They find that before the crisis, differences in initial capital – whether risk-adjusted or not, however defined – did not consistently affect subsequent bank stock returns. However, they show that the importance of capital becomes evident during the crisis period, particularly for the largest banks in sample they examined. Their results suggest that during the crisis stock returns of large banks were more sensitive to the leverage ratio than the risk-adjusted capital ratio. They explained that the market participants viewed the risk-adjustment under Basel rules as subject to manipulation or not reflective of true risk in the case of large banks.

Čihák et al. (2013) analyse the bank regulation and supervision after the global financial crisis, notes that the Basel capital adequacy measures considerably misrepresented the solvency of the banks. They, citing Haldane (2011), conclude that during the crisis the major failures occurred in banks that were compliant with the current regulatory capital requirements. They explain that the reasons for that were the use of risk weights that underestimated the true riskiness of assets such as mortgages and sovereign debts, the different treatment under the Basel rules of assets held in the banking book and those held in the trading book, and the definition of capital.[24] According the Čihák et al. (2013), the Basel Committee had neglected the endogeneity of risk, its attempts to level the competitive field for banks had increased the covariance of banks’ exposures, which should be anathema to bank regulators but instead has received little attention.

Basel II has also been criticized for procyclicality, as it requires that banks increase their capital ratios when they meet larger risks. That may require them to reduce lending during a bad times or even credit crunch, which could aggravate the downturn. Namely, many authors

[24] Čihák et al. (2013) note that many banks, especially in advanced economies, held a relatively small part of capital as equity, with the remainder being in capital with weak loss absorbing characteristics that had little value during the crisis. Bearing in mind the differences in the definition of capital, it was hard to assess and compare the adequacy of capital across institutions.

have argued that Basel II requirements tend to reinforce business cycle fluctuations. Kashyap and Stein's (2004) simulations suggest that the new Basel II capital requirements have the potential to create an amount of additional cyclicality in capital charges. This Accord is believed to exacerbate business cycle fluctuations by forcing a bank in an economic downturn to hold more capital against its current loan portfolio, given that its existing (non-defaulted) borrowers will be downgraded by the relevant credit-risk models. To the extent that it is difficult or costly for the bank to raise fresh external capital in bad times, it will be forced to cut back on its lending activity, thereby contributing to a worsening of the initial downturn. The authors examine the cyclicality aspects of Basel II by developing a conceptual framework questioning the optimality of the proposed regulations. Basel II is found to be sub-optimal by having a single time-invariant risk curve rather than a family of risk curves with the capital charge being reduced when economy-wide bank capital is scarce relative to lending opportunities. Simulations are then conducted supporting the theoretical reasoning. These findings are in line with other studies that have examined the pro-cyclicality of Basel II (e.g. Heid, 2003; Taylor and Goodhart, 2006). Goodhart and Persaud (2008) point to the lack of counter-cyclical control mechanisms or instruments in Basel II, in particular they note that the Basel regime of capital adequacy does nothing to constrain credit booms, instead it is likely to deepen them.

However, Cannata and Quagliermo (2009) suggests that it is not appropriate to attribute the last global financial crisis solely to the Basel II Accord and that some of the main drivers of the crisis cannot be entirely ascribed to the new regulation. They have argued that some of the 'regulatory failures' that have been highlighted (inadequate growth of banks' capital, proliferation of off-balance-sheet exposures) are failures of Basel I, rather than of the new Framework, though in other cases, they are indeed related to Basel II. Finally, they claim that other issues which have been criticized such fair-value assessment[25] have nothing to do with prudential regulation. They have also loudly reminded critics that the Basel II rules were not applied in most major countries when the crisis erupted. In Europe most banks started to

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[25] Basel II introduced 'fair-value accounting' for trading book assets. Those assets are to be marked-to market, if there is an active market or marked-to-model otherwise, i.e. at a value deriving from the application of pricing models.

apply the new rules only in 2008, whilst in the US the regulatory agencies decided to postpone its implementation to 2010.

The recent financial crisis demonstrated that bank regulation and supervision in its design or its implementation, were inadequate to prevent a panic in the financial sector. Many authors have strongly criticized the Basel II framework for banks' capital adequacy, suggesting that it was a major contributor to the global financial crisis. In addition, many regulated banks tried to circumvent the complex Basel requirements through financial innovations. Thus, the Basel Committee on Banking Supervision issued new guidelines in the form of the Basel III regulation framework, with the aim of improving the stability of the banking sectors. The Basel III regulation framework will be discussed in the following subsection.

4.3.1 Basel III

The widespread underestimation of risk, which started back in the period of Basel I and continued under Basel II, has led to many concluding that the regulatory instruments need to be revised again in order to have better capitalized financial system (Gorton, 2009; Janson, 2009; Caprio, 2013). Two years after the beginning of the global financial crises, the Basel Committee on Banking Supervision issued new guidelines in the form of the Basel III regulation framework, with the aim to improve the ability of the banking sector to absorb shocks arising from financial and banking pressures (thus reducing the risk of their transfer to the real sector), improve risk management and general management in banks, as well as to increase the transparency of bank operations. Miu et al. (2010), citing the Basel Committee on Banking Supervision (BCBS, 2009a), explain that special attention in Basel III is dedicated to the definition of available capital (i.e. the supply of capital) that is narrowed to raise the quality of capital; the level of risk capital (i.e. the demand of capital) that is increased via "bottom-of-the-cycle" calibration, so that throughout the cycle capital demand stays at its maximum; and discretionary distributions of earnings that are restricted to prevent capital reduction during stress periods. In addition Basel III, proposed enhancements to the measurement of risks related to securitization and trading book exposures (BCBS, 2009b).

It has been claimed that these new Basel III rules should significantly increase the quality and level of capital that banks will hold (BCBS, 2011). Higher quality capital means a greater capacity to absorb losses. The new Basel framework introduces a Tier 1 ratio that will increase to 6 percent from 4 percent, while the total risk-adjusted capital requirement will remain unchanged at the existing 8 percent level (Table 4.4).

Table 4.4 Basel II and Basel III capital requirements

	Basel II			Basel III		
	Common Equity Tier 1	Tier 1 Capital	Total Capital	Common Equity Tier 1	Tier 1 Capital	Total Capital
Minimum	2%	4%	8%	4.5%	6%	8%
Conservation buffer	Not applicable			2.5%		
Minimum plus conservation buffer				7%	8.5%	10.5%
Countercyclical buffer range				0-2.5%		

Source: BCBS (2011) and authors own calculations

The key element in this new definition of capital is greater focus on the core (or common equity Tier 1) capital. The bank's core capital is the most effective type of capital, given it is used directly to cover losses. The minimum requirement for core capital rose from the 2%, under Basel II, to 4.5% in the new regulatory framework (Table 4.2). In addition, the minimum amount of core capital will be supplement with another "protective amount" of core capital of 2.5% of risk weighted assets, which raises the overall regulatory requirement for core capital that banks will have to hold at 7%. The purpose of these additional capital requirements is to ensure that banks maintain the amount of capital that can be used to absorb losses during periods of financial and economic pressures. Banks will be allowed a drawn down conservation buffer or "protective amount" in stressful periods.[26] Also, if the level of banks` capital is close to the minimum requirement, the greater are the restrictions placed on the distribution of income (less money available for the payment of dividends, bonuses and other compensation). This helps to ensure the availability of capital to support the operations of banks during periods of stress, which reinforces the goal of strong supervision and bank governance and intends to solve the problem of excessive bonus payments and dividends in times of deteriorating capital positions of banks. The minimum requirement for Tier 1 ratio, which includes core capital and other financial instruments, whose involvement is based on

[26] According to Basel III, when buffers have been drawn down, one way banks should look to rebuild them is through reducing discretionary distributions of earnings. That may include reducing dividend payments, share-backs and staff bonus payments. In addition, banks may choose to raise new capital from the private sector as an alternative to conserving internally generated capital (BCBS, 2011, p. 54).

more stringent criteria, increases from 4% to 6% (before turning on the "protected amount"). In the case where these amounts are not sufficient, the Basel Committee on Banking Supervision provides a third, countercyclical amount in the range of 0 to 2.5% of risk-weighted assets. Its purpose is to achieve a wider macroprudentional goal of protecting the banking sector in periods of excessive credit growth. This amount is to be used if there is excessive credit growth[27], which can result in increasing the system-wide risk and represents a supplement to the regulatory requirements for the core capital of 7%. In particular, according Basel III, the requirement to address excess credit growth is set at zero (no added capital buffers) in normal times and only increases during periods of excessive credit availability. However, in Basel III it is also explained that even in the absence of a credit bubble, supervisors should expect the banking sector to build a buffer above the minimum in order to protect it against plausibly severe shocks (BCBS, 2011).

Basel III has introduced two new harmonised liquidity standards to safeguard the banks from liquidity risk, which had become more prevalent in the global financial crisis. Namely, besides difficulty in achieving adequate capital levels a bank may experience difficulties in providing liquidity. As already mentioned in the previous two Chapters, pre-GFC asset markets were buoyant and funding sources were available at very low costs. However, the rapid reversal in market conditions showed how quickly liquidity can evaporate and that illiquidity can last for an extended period of time (BCBS, 2011). To cope with such a situation banks will have to maintain a buffer of highly liquid securities measured by the Liquidity Coverage Ratio (LCR). This ratio, high-quality liquid assets to offset the net cash outflows, intends to promote short-term resilience to potential liquidity risk over one month, by ensuring that a bank has sufficient high quality liquid resources to overcome a stress scenario. The second liquidity risk measure, the Net Stable Funding Ratio (NSFR), requires a minimum amount of stable sources of funding at a bank relative to the liquidity profiles of the assets, as well as the potential for contingent liquidity needs arising from off-balance sheet commitments, over a one-year horizon (BCBS, 2011). The intention of this ratio is to limit over-reliance on short-term wholesale funding during times of buoyant market liquidity and to encourage better assessment of liquidity risk across all on- and off-balance sheet items (BCBS, 2011).

[27] Basel III highlights that countries that experience excessive credit growth during the transition period should consider accelerating the build-up of the capital conservation buffer and the countercyclical buffer (BCBS, 2011).

Recent events have shown that banks may be more exposed to risk at times when they are not able to make an additional capitalization due to deteriorating market conditions. Therefore, these rules of Basel III were to be introduced gradually in order to provide banks enough time to adapt to stricter requirements and in order not to jeopardize the economic recovery from the global financial crisis, due to a credit crunch which might come if the weaker bank stop lending in order to meet the new guidelines. The implementation of Basel III started in 2013, and the new rules are planned to be fully completed by 2019.

Demirgüç-Kunt et al. (2010) note that as a bank's capital helps to absorb potential losses and to curb bank's risk-taking incentives, it is expected that, when a large, unexpected negative shock to a bank's value materializes (such as in the GFC), equity market participants would judge better capitalized banks to be in a better position to withstand the shock, and the stock price of these banks would not fall as much as that of poorly capitalized banks. However, in order to safeguard the system as a whole, macro-prudential regulation, that seeks to control the social costs associated with a decrease in capital adequacy on the part of multiple financial institutions hit with a common shock, should not be neglected. Even though Basel III enhances the microprudential regulations and should contribute to making individual banks/banking groups much safer, the novel feature of Basel III is the recognition of the need to address systemic risk, which it does through macroprudential policies (Sinha, 2012). Macroprudential regulation will be critically evaluated in the following section where we will present an evaluation of the shift from micro to macro prudential regulation and supervision.

4.4 From Micro to Macro-Prudential Regulation and Supervision

Many practitioners and theorists argued that the regulatory framework before the global financial crisis was inadequate because it was largely "microprudential" in nature (Kashyap et al., 2008; Brunnermeier et al., 2009). Hirtle et al. (2009), citing Goodhart (2004), make a comparison between a recent crisis in Japan and the subprime crisis. Namely, Goodhart (2004) argued that Japan in the 1990s was an example of a system where banks were individually strong but systemically weak in response to real estate shocks. Similarly, as noted by Hirtle et al. (2009), the recent subprime crisis shows the adverse, systemic impact of common exposures and positions that accumulate across firms that seemed ex ante to be individually well capitalised.

The prime aim of microprudentional regulation and supervision is prevention of failure of individual financial institutions. As noted by Hirtle et al. (2009), microprudential regulation and supervision takes the economy as given and thus exogenous to the supervisory decision-making process. The main concern of microprudential supervision is whether the individual financial institution has enough capital in the wake of losses to protect consumers and taxpayers, and to take immediate steps to restore its capital ratio. Chang-Lok (2006) notes that microprudential supervision typically acts according to the Basel II regulation, disregarding any unique characteristics of individual financial institutions and is applied as a "one size fits all" system. In particular, he notes that under microprudential supervision, economic conditions are treated merely as exogenous variables with no relevance to the business operation by individual financial institutions. Hanson et al. (2010) argue that the main critique of microprudential regulation is that when a regulator pushes a troubled bank to restore its capital ratio, the regulator did not care whether the bank adjusted by raising new capital or shrinking assets. In both ways, the probability of banks` failure is reduced, which is most important from a microprudential supervisor's viewpoint. This method of adjustment can be justified if we are considering a single bank that is in trouble for idiosyncratic reasons; however, if a large fraction of the financial system is in difficulty, a simultaneous attempt by many institutions to shrink their assets is likely to be more damaging to the system and the overall economy. Therefore, Hanson et al. (2010) suggest that we need a system of financial regulation which would internalise the social costs associated with excessive balance-sheet shrinkage on the part of multiple financial institutions hit with a common shock. This provides the basis for the adoption of macroprudential regulatory policy. As noted in the previous sub-section, macroprudential elements were introduced in Basel III. Namely, summarized by Sinha (2012) macroprudential elements in the form of the capital conservation buffer, countercyclical capital buffer and leverage ratio are the hallmark of Basel III. The aim of these elements was to reduce the procyclicality of capital regulations and control the build-up of systemic risk.

Caruana (2010) considers that the objective of macroprudential policy is to "to reduce systemic risk by explicitly addressing the interlinkages between and common exposures of, all financial institutions, and the procyclicality of the financial system". According to Brunnermeier and Sannikov (2009) a financial system is prone to instability even when the level of aggregate risk is low, thus they argued that macroprudential regulation encourages financial institutions to retain earnings and build up capital buffers in good times and then relaxes constraints in downturns. As summarized Galati and Moessner (2011), macroprudential policy aims to contribute to financial stability, in terms of increasing the robustness of the financial system to external shocks. Moreover, according to them, macroprudential policy also aims to ensure greater resilience to shocks originating within the financial system (e.g. Schinasi, 2004; Borio and Drehman, 2009).

Regulatory reform requires recognition of the linkages between the macro and microprudential approaches. Both the macro and microprudential perspectives should be considered since they are both important and overlap with substantial complementarities (see Table 4.5). The ability to comprehensively aggregate positions and exposures across banks in a consistent way helps supervisors to identify industry-level trends and improve the macroprudential perspective. That micro and macro perspectives might work together is illustrated by the stress tests which are the main part of Supervisory Capital Assessment Program (SCAP).[28] Hirtle et al. (2009) identify the adoption of stress tests as one example of how the macro- and microprudential perspectives can be combined to create a stronger supervisory framework that addresses a wider range of supervisory objectives. Stress test techniques will be critically evaluated in the next section, as a part of the macroprudential tools used in central banks for the purpose of maintaining banking stability.

Table 4.5 Comparison between Microprudential and Macroprudential Supervision

	Microprudential Supervision	Macroprudential Supervision
Objective	• Maintain soundness of individual institution	• Maintain stability of the overall financial system
Method	• Present standardized supervision criteria for various risk factors • Evaluate management performance and make timely adjustments	• Run market-responsive supervision standards • Analyse risk factors according to changes in macro-financial environment
Recognition of economic conditions	• Exogenous variables with no relevance to business operation by financial institutions	• Endogenous variables influenced by collective business operation by individual financial institutions.

Source: Chang-Lok (2006) p. 3.

[28] In early 2009, the Federal Reserve System prepared a financial stress test to assess the capital buffers of U.S. banking organizations during financial crisis 2008-2009. The specifications and results of those stress test were published in The Supervisory Capital Assessment Program.

An efficient macro-prudential supervision may significantly complement micro-prudential supervision at the national level, as well as cross-border context. In order for better identification of potential risks and to confront them, many countries have in the years after the GFC been working on establishing a framework of macro-prudential policy. When it comes to the European Union, the European Systemic Risk Board (ESRB) is responsible for macro-prudential oversight at EU level (IMF, 2011; IMF, 2013).

Gopinath (2011) suggests that we need to acknowledge that the macroprudential policy needs to be used with other policies to be effective. Namely, he notes that the macroprudential measures enhance the resilience of the financial system, but cannot by themselves manage economic cycles or target asset prices. Gopinath (2011) suggest that a synergy between monetary and macroprudential policies is necessary, which may not be possible if banking supervision is separated from central banks. In that context, Gopinath (2011) considers that the involvement of central banks becomes critical. Thus, in the following section we will provide an analysis of analytical models and tools that are used by central banks and supervisory agencies to assess financial sector vulnerabilities to severe but plausible scenarios of widespread shocks. However, the last crisis highlighted some weaknesses in those models and tools. Thus, a key lesson from the last crisis is that central banks and supervisory agencies should assign much more importance to development of more accurate models and tools for macroprudential analysis.

4.4.1 The Instruments Used to Assess Banking Sector Stability

In this Section we will analyse the techniques used to preserve banking sector stability. In particular, the intention is to investigate the relative strengths and weaknesses of the instruments used pre-global financial crisis to assess banking sector stability. In practice, quantitative methodologies, such as early warning systems (EWS) and stress testing are used together with expert judgment and a wealth of institutional and legal circumstance, to assess financial system stability (Worrell, 2004). EWS were developed with the aim to identify economic weaknesses and vulnerabilities among markets and ultimately to anticipate those vulnerabilities (Bussiere and Fratzscher, 2002). From the financial supervisor's point of view, EWS, which generate specific indicators in order to assess new developments to identify risk build - up and vulnerabilities, are important elements of macroprudential supervision. Namely, the EWS were created to monitor cross sectorial and system wide developments, to pick up signals, connect the dots, identify vulnerabilities and identify aspects that may need policy response (IMF, 2010). The literature (Gonzales-Hemonsillo, 1999; Barrell et al., 2009) describes EWS as an ex ante approach to regulation designed to highlight severe conditions which had happened in the past crises. Thus, EWS can have substantial value to policy-makers by prompting them to take pre-emptive steps to reduce the risk of experiencing a crisis (Bussiere and Fratzscher, 2002).

Demirgüç-Kunt and Detragiache (1998a) used the multivariate logit technique to relate the probabilities of systemic banking crises to a vector of explanatory variables. In their model the dependent variable, banking crisis, is represented by a binary banking crisis dummy which is defined in terms of observable stresses to a countries' banking system (when the ratio of non-performing loans to total banking system assets exceeds 10%). In the early warning systems` literature there is an increasing recognition of the relevance of the macroeconomic environment, and the health of the financial system in the performance of the individual indicators of individual bank soundness (Gaytán and Johnson, 2002). Those indicators that the economic literature suggests should capture sources of vulnerability to widespread financial crisis (Worrell, 2004). According to Worrell (2004) they include macroeconomic variables that have a direct impact on the balance sheets and profit and loss of financial institutions, such as interest rate changes; macroeconomic variables that have an indirect effect, for example by reducing borrowers' ability to service their obligations to banks; prudential indicators of the adequacy of bank capital, such as the quality of bank assets, the efficiency of management, the robustness of earnings, the adequacy of liquidity, and the coverage of market risk; measures of exposure to interbank contagion; and measures of exposure to contagion from abroad. Männasoo and Mayes (2005) using panel data at the bank level, suggest that is possible to find bank-specific and macro-economic variables that are able to predict vulnerabilities in the CEE countries' banking sector over the period 1996-2002. They find that macro-economic variables tend to perform better in predicting a couple of years ahead, as they are more persistent compared to the more volatile financial variables. However, the financial variables have more to say about the crisis pattern, explaining how both the causes and the reactions contribute to a crisis or its avoidance. In addition they conclude that both types of indicators are inter-related and while individual factors may be weakly determined their joint effect is clear.

The GFC raised the question of why the EWS failed to predict that crisis. Davis and Karim (2008) note that most of the EWS were based on previous experiences with banking crises.

Namely they followed a "check list approach"[29] of indicators based on history. These did not capture recent financial innovations, in particular securitization and subprime lending. According to them, the previous approach highlighted vulnerability but needed supplementing in respect of possible triggers of a crisis by more accurate early warning models and detailed macroprudential analysis. However, the trigger(s) of a crisis depend on the type of economy (and its stage of development as well) and the nature of the banking system as suggested by Barrell et al (2009). According to Barrell et al. (2009), focusing on a certain type of economy and selecting explanatory variables that are relevant to their specific banking structures and lending behaviour might improve EWS design. They justify this with the example of advanced economies where the level of banking intermediation is high, shocks related to trade are less important crisis triggers than property price bubbles. Furthermore, Barrell et al. (2009) argue that previous EWSs failed to incorporate balance sheet variables as explicit banking crisis predictors, probably because of a lack of foresight on the part of regulators. Namely, as they note, capital adequacy and liquidity ratios were monitored in a way to limit financial instability, suggesting that those variables were at least used implicitly as EWSs. They also consider that EWS design never evolved in this direction possibly because banking crises in developed economies were viewed as highly unlikely events. In this context forward looking supervision become important or, as Gramlich et al. (2010) concluded, forward-looking supervisory instruments are important as they should provide the basis for ex ante policy action and consequently reduce the need for ex post regulation.

In addition to EWS, testing the resistance of the financial system to extreme shocks, has become an integral part of the regular financial reports published by many central banks and regulators, and reports of The Financial Sector Assessment Program (FSAPs) published by IMF and World Bank. In order to investigate the resistance to adverse shocks, stress tests can be used from both a microprudential perspective, where financial institutions are analysed individually; and from a macroprudential perspective, where the whole financial system is

[29] Davis and Karim (2008) identify certain common features which might be useful in anticipating a crisis. These include the following aspects: regime shifts, first to laxity (such as deregulation) which provokes a credit cycle, later to rigour (e.g. monetary tightening) that triggers a crisis; easing of entry conditions to financial markets, leading to heightened competition and risk taking; debt accumulation and asset price booms, generating vulnerable balance sheets in the financial and non-financial sectors; innovation in financial markets, which increases uncertainty during the crisis; and risk concentration and lower capital adequacy for banks, which reduces robustness to shocks.

analysed. Namely, Blaschke, et al. (2001) argue that the focus of the stress test could be at the macroeconomic level when trying to understand the possible impact of major changes in the economic environment on the financial system, and at the microeconomic when stress tests are used as a tool for managing credit, market and liquidity risk in banks. The outcome of these tests should suggest whether a financial institution (or system) can continue with their regular activities due to adverse events and continue to settle its obligations, whether the funds available are sufficient or financial institution should find additional sources of financing. As noted by Varotto (2011), regulators have recently re-emphasized the need to couple standard risk measurement tools with stress tests designed to capture severe but plausible events (Basel Committee on Banking Supervision (BCBS) 2009c; Committee of European Banking Supervisors (CEBS) 2010, and Financial Services Authority (FSA) 2009).

Worell (2004) describes stress tests as tools designed to explore vulnerabilities to events which have a low probability of occurrence, but which, should they occur, could prove extremely costly. In addition, Worell (2004) notes that stress tests might be helpful for contingencies whose probability of occurrence is difficult to estimate, and that they complement analyses which deal with vulnerabilities which are highly probable, for which expected losses are small, unless the financial system is on the brink of a crisis. Melecky and Podpiera (2010) identify stress tests as the main practical tools of macroprudential oversight.

Reviewing the literature on stress test methodologies, Sorge (2004) explained that the implementation of macro stress-tests involves the following steps: defining the scope of the analysis in terms of the relevant set of institutions and portfolios; constricting a macroeconomic stress scenario; quantifying the direct impact of the simulated scenario on the balance sheet of the financial sector (e.g., expected loss, capital adequacy ratio); interpreting the results to evaluate the overall risk-bearing capacity of the financial system; accounting for potential feedback effects both within the financial system and from the financial sector onto the real economy. Melecky and Podpiera (2010) concluded that there are two distinctive approaches employed in the construction of scenarios: the judgmental approach and the model-consistent approach. The first one sets the relevant economic variables according to experts' judgments, while the second approach builds the macro scenario based on a model, which accounts for the inter-linkages among macroeconomic variables, and financial sectors specific variables.

The IMF (2012) explained that macro stress tests have traditionally been designed to assess how the financial system would react to a macroeconomic shock drawn from a tail of the underlying probability distribution. However, given that stress scenarios should be constructed to deal with tail events[30], or the adverse events that unlikely to happen, macro stress tests have to include nonlinear behaviour in times of stress (Kliti and Shijaku, 2011). CEBS (2010) argue that there is a significant difference between the establishment of a minimum regulatory capital under Pillar 1, whose purpose was to provide enough capital in case of unexpected loss, and the assessment of risk in a stress testing practices. Namely, as they noted, in Pillar I capital against unexpected tail events is set to a specific confidence level, which might be interpreted as a measure of regulatory solvency. However, stress testing, particularly in reference to testing under Pillar 2, should examine what happens to a bank's ability to meet its internal capital requirements when external conditions change for the worse over a period of time. Most stress testing before the GFC ignored this requirement. The High Level Group on Financial Supervision in the EU, chaired by Larosier (2009), concludes that stress test scenarios were too mild or even wrong, given that model-based risk assessments underestimated the exposure to common shocks and tail risks. Also, as highlighted by Cecchetti et al. (2009), "economic behaviour is inherently nonlinear, so the linear approximation of existing empirical models is likely to be very inaccurate" (p.3).[31] However, this discussion is related to the macroeconomic and financial variables which are frequently modelled as a multivariate t copula.[32] Foglia (2009) summarized the advantages and disadvantages of this approach. According to her, the advantages are that the marginal distributions can be different from the multivariate distribution that characterizes the joint behaviour of the variables; and the co-dependence between the macro-financial variables displays tail dependence (i.e. "correlation" increases under stress scenarios). Melecky and Podpiera (2010) have also confirmed these models' benefits of working with marginal distributions which capture the higher moments' dependence among the macro-financial

[30] Refers to an event more extreme than most observations in a normal distribution.

[31] They explain that with linear approximation all models have the same path, or "they all go through the mean of the data" (p.3). That implies that they are most accurate when they have the same path, and in other cases they are not reliable.

[32] T-copula refers to a multivariate probability distribution. The Oesterreichische Nationalbank (OeNB) has used a multivariate t-copula model for macroeconomic and financial variables in their Systemic Risk Monitor (SRM). Foglia (2009) explains that the OeNB's SRM multivariate t-copula approach is used to draw risk-factor changes randomly according to their estimated multivariate distribution. During that simulation, as Foglia (2009) explains, one or more of the factor changes are set to a fixed value according to the given shock; changes for all other (non-stressed) risk factors are drawn from the conditional distribution given the stress scenario.

variables. However, Foglia (2009) argues that these models are not good for policy analysis, as they do not recognize the key transmission channels that link the shock with its effect on the degree of credit risk.

In countries like Montenegro where the conditions do not enable complex structural macroeconomic models to be constructed (such as those used by the central bank for forecasts), particular risk models such as credit risk model could be useful for prudential analysis. Namely, Foglia (2009) stresses the usage of credit risk models which should map external shocks into banks' asset quality shocks. In these credit-quality regression models, loan performance measures (such as NPLs) are typically related to macroeconomic measures (such as the nominal interest rate, inflation rate and change in real GDP) and some financial variables that according to theory and empirical evidence affect credit risk. These models can be estimated using data for individual banks and even individual borrowers.

After the global financial crisis, it was generally agreed that previous stress tests were not informative enough and did not generate an adequate policy response (Čihák, 2007; Haldane, 2009; Cecchetti et al., 2009; Galati and Moessner, 2011). Alfaro and Drehmann (2009) examining the reasons for the poor performance of stress tests, note that over a third of countries implemented macro stress testing results as part of an IMF Financial Sector Assessment Program in 2005, 2006 or the first half of 2007 and the majority concluded that their banking systems were robust even in the face of very severe adverse scenarios. In those counties where stress tests were conducted the structural assumptions underlying the stress models did not match the behaviour of output in many previous crises.[33] The IMF (2012) suggested that the main reasons for the failure of stress tests pre-GFC were that the stress scenarios were not severe enough and important new risks were missed. Alfaro and Drehmann (2009) suggest for stress tests to be useful, their underlying structure has to be improved in order to better capture crisis dynamics, and future research on stress test should incorporate more risk factors, such as international inter-linkages and bank-specific factors. According to the BCBS (2009c) banks should consider more risk factors such as previously undetected correlations between market and credit risks, as well as between those risks and liquidity risk; excessive concentrations in off-balance sheet exposure, etc. Moreover, IMF (2012) suggests including sovereign risk in stress testing through analysing interlinked risk

[33] In nearly 50% of the analysed crises, the evolution of GDP growth does not seem to be in line with the structural assumptions of the, then, current stress testing models.

exposures between the government and financial sector. IMF (2012) concludes that banks are now expected to manage enterprise-wide risks, which cover broad ranges of risk exposures, including risks of different business lines.

Analysing Central and Eastern Europe macroprudential stress-testing practices Melecky and Podpiera (2010) note that in many CEEs the limited availability of both current and historical data, the delays involved in accessing financial data, and the inconsistencies between various data sources reduce the scope of stress tests. This is a particular problem for Montenegro, given that there are only short series for both macroeconomic and bank-specific data. Moreover, most of the bank do not use internal risk-based approaches thus it is not possible to estimate their future probabilities of default. Furthermore, Melecky and Podpiera (2010) note that the main challenges for these countries involve the need to develop quantitative microprudential indicators (corresponding to bank specific risks) in macroprudential stress tests and the explicit incorporation of dynamics in stress tests to include reaction functions of banks and macroprudential policy. Namely, stress test in almost all CEE countries are currently static, where the effect of an adverse scenario is directly mapped into the banks' financial statements and accordingly it is concluded which banks are undercapitalized and whether there is a need for re-capitalization. However, this methodology does not consider that some risk factors (such as the direct effect of the interest rate risk or the exchange rate risk) propagate at a much higher pace than other risk factors, for example credit risk. Furthermore, they suggest that an effective macroprudential policy should comprise of: the usage of stress-tests, better communication between banks and supervisory authorities, full cooperation between macroprudential and microprudential supervisors and fuller information exchanges for better cross-border supervision of international banking groups.

Buncic and Melecky (2012) proposed a methodology for macroprudential stress testing which includes the direct linking of systemic credit risk to macroeconomic conditions based on cross-country experience that can be further tailored to country specific conditions, and that allows for the credit risk sensitivity to changing macroeconomic conditions to increase during crisis times. Furthermore the bank-specific, idiosyncratic component of credit risk should be based on the different underwriting standards across individual banks and their aggressiveness in lending, including the assumption of indirect credit risk from foreign currency lending to unhedged borrowers. In addition, according to them, the concentration of a bank's lending within individual asset classes and the extent of the performed maturity transformation should be allowed to play an important role in bank specific capital charge calculations, eliminating some of the drawbacks of the capital charge calculation based on the Basel II methodology identified above. According, Buncic and Melecky (2012) all these above mentioned suggestions should be prudently combined to produce a more relevant outcome indicator measuring bank resilience to macroeconomic and bank-specific shocks.

In this section, we draw attention to some important tools for macroprudential policy. The analysis of early warning systems and stress tests identified their main deficiencies which had become evident in the global financial crisis. This section also provided some useful insights for developing countries such as Montenegro, where these tools are still in a primitive form, mainly being based on a judgmental analysis approach.

4.5 Conclusion

The global financial crisis has revealed serious shortcomings in the regulation and supervision of financial institutions. Namely, regulations and supervision were focused only on standard financial instruments. Moreover, important deficiencies were manifest in the Basel I and II prudential rules for capital and liquidity. Based on the review presented above, the regulations prevailing in the period before the global financial crisis were in need of significant changes. The recently created Basel III rules should significantly increase the quality and level of capital that banks will hold. Furthermore, given that liquidity risk became pivotal in the global financial crisis, Basel III introduces new standards for banks' liquidity.

As the legal and institutional frameworks governing central banks throughout the world have undergone significant changes over the last decade, in this Chapter we have assessed the new objectives for central bank and supervisory agencies. The current literature concludes that authorities should adopt a more macroprudentional perspective in regulation and supervision. However, microprudentional perspective should not be neglected. Indeed, the recent crisis has highlighted the importance of complementing the microprudential approach to regulation and supervision with a macroprudential perspective. Techniques currently used to assess banking stability, early warning systems and stress testing techniques, illustrate how the macro- and microprudential perspectives can be joined to create a stronger supervisory framework that addresses a wider range of supervisory objectives. Though central banks and international financial institutions made extensive use of stress tests prior to the crisis, these frequently ignored or under-estimated important vulnerabilities in the system. After, the global financial crisis there has been a general consensus that stress tests should better capture crisis dynamics, and should consider more risk factors, such as international inter-linkages and bank-specific factors.

In the following Chapter we will research the econometric relations in the Montenegrin banking system which can be used for stress testing purposes by the supervisory authorities. The regression coefficients on the macroeconomic variables and bank-specific variables can be used in a credit risk model (proposed by Foglia, 2009) which can be used as a baseline model for stress testing in Montenegro. The main contribution is the parameterisation of the impact of macroeconomic and bank specific factors on loan quality in the Montenegrin banking sector. Based on the evolution of the dependent variables, we can anticipate future NPLs and assess whether they present a threat to financial stability.

CHAPTER 5: *Estimation of Macroeconomic and Bank-Specific Determinants of the Quality of Loans in Montenegro*

Contents:

5.1 Introduction

In Chapter 1 we identified the incidence of non-performing loans as the key indicator of the degree of banking distress in Montenegro. Namely, the overall situation in the real sector, the severe illiquidity of the economy in the post-crisis period, difficulties in the repayment of debts, increasing unemployment and indebtedness of households suggested growing problems with the quality of bank loans. Furthermore, in Chapter 2 we discussed how the high and rising non-performing loans ratios are often considered as an indicator of financial vulnerability and of future turbulence in the banking sector. Indeed, the origins of the GFC were attributed to the rapid default of sub-prime loans/mortgages in the United States. Lastly, in Chapter 4 we concluded that in order to improve macroprudential policy it would be useful to have a credit risk model which could serve as a baseline model for stress testing techniques.

Summarising the findings from the previous chapters, it would be useful to derive a model to help understanding of the determinants of the incidence of non-performing loans. Thus, the intention of this Chapter is to consider the joint role of macro-economic and bank-specific factors in explaining the occurrence of banking distresses in Montenegro from 2004 to 2010. Using data at the individual bank level, we plan to examine to what extent is the degree of banking distress a function of macroeconomic developments (meaning does Montenegrin evidence display similar factors to those recognized in the theory of financial crises) or whether these distresses primarily reflect the unique difficulties of banking in transition, such as previously inadequate risk-assessments, the high risk appetite of banks' management and the high level of concentration in the banking system.

Previous research suggests that credit risk, as reflected in the proportion of NPLs, seems to be primarily driven by macroeconomic developments as the business cycle literature has suggested (Williamson, 1985; Demirgüc-Kunt and Detragiache, 1998a; Hardy and Pazarbasioglu, 1999; Mueller, 2000; Anderson and Sundaresan, 2000; Collin-Dufresne and Goldstein, 2001; Diamond and Rajan, 2005; Pesola, 2005; Quagliarello, 2007; Espinosa and Prasad, 2010). However, another strand of the empirical literature has focused on the effect of bank-specific characteristics such as the quality of management, policy choices, size and market power on the incidence of problem loans (Hughes et al., 1995; Berger and DeYoung, 1997; Keeton, 1999; Salas and Saurina, 2002; Pain, 2003; Rajan and Dhal, 2003; Jimenez and Saurina, 2005; Dash and Kabra, 2010; Louzis et al., 2010). This Chapter aims to provide a synthesis of these two approaches, with the explanatory power of both macroeconomic and bank-specific variables being investigated.

This Chapter is organized as follows. Section 5.2 reviews the theoretical and empirical literature on the determinants of non-performing loans and formulates a number of hypotheses regarding the impact of macro and bank-specific variables on the proportion of non-performing loans. Section 5.3 introduces the data and provides descriptive statistics for the variables which will be used in the model. Section 5.4 investigates the appropriate econometric strategy for modelling macro and bank specific determinants of NPLs and Section 5.5 provides a discussion of the empirical results. The conclusions of this Chapter are presented in Section 5.6.

5.2 Determinants of Non-performing Loans

In Section 2.4 we started discussion of the macroeconomic influences on banking sector stability. Based on the empirical literature we found that the macroeconomic environment affects the components of banks` financial variables which may then contribute to banking crises. Another part of the literature suggests that high or rising non-performing loans could be used to mark the onset of a crisis. In addition, we have noticed that some banks in the boom phase of the cycle underestimate their risk exposures, which in the later phases may cause high non-performing loans and losses in their balance sheets. However, we argued that bank-specific factors should not be neglected when assessing the banking distresses.

Our focus in this Section will be to investigate the determinants of the incidence of NPLs. In general, shocks to the banking sector may emanate from firm (bank) specific factors or from macroeconomic imbalances. The research on the major economies which has indicated that macroeconomic environment is important when analysing credit risk, will be examined in Section 5.2.1. Later, in Section 5.2.2, we will investigate the bank-specific variables that may also be a cause of risky lending. Subsequently, in Section 5.4 we will test the influence of macro and bank-specific variables on the incidence of non-performing loans.

5.2.1 Macro Determinants of Non-performing Loans

The empirical literature which investigates the relations between the macroeconomic environment and loan quality is basically grounded in theoretical models. In general, theoretical business cycle models with an explicit role for financial intermediation offer a suitable starting point for modelling NPLs as they highlight the counter-cyclicality of credit risk and business failures (Williamson, 1985). The macroeconomic environment influences borrowers' balance sheets and their debt servicing capacity. The set of macroeconomic variables used varies across studies, but includes broad indicators of macroeconomic performance, such as GDP growth, nominal interest rate, inflation rate and unemployment as determinants of the incidence of NPLs.

One of the earliest studies on the macroeconomic determinants of the quality of banks' loans was by Keeton and Morris (1987). They found, for over 2400 commercial banks in the U.S. between 1979 and 1985, that local economic conditions explained all of the variation in loan losses recorded by banks. Pesola (2005) examining banking fragility in Northern Europe also confirms a link between the phase of the cycle and credit defaults. Jimenez and Saurina (2005) while examining the Spanish banking sector in the period from1984 to 2003, find that a rising incidence of non-performing loans is determined by lower GDP growth, high real interest rates and previous loose credit conditions. Furthermore, Dash and Kabra (2010) interpret their findings to mean that an improvement in the real economy is likely to see an instantaneous reduction in the non-performing loan portfolio of commercial banks, though the absence of a lag in the adjustment process is surprising. Finally, Bofondi and Ropele

(2011) find that the changes in macroeconomic conditions generally have significantly affected banks' loan quality in Italy in the past twenty years.

There are some studies which indicate that although risks tended to be realized during the contractionary phase of the business cycle, the origins of those risks actually peaked at the top of the cycle. For instance, Kent and D'Arcy (2000) while examining the relationship between the cyclical lending behaviour of banks in Australia, argue that, the potential for banks to experience substantial losses on their loan portfolios increases towards the peak of the expansionary phase of the cycle. Notwithstanding that towards the top of the cycle, banks appear to be relatively healthy, with low rates of non-performing loans and high profits, reflecting that even the riskiest of borrowers tend to benefit from buoyant economic conditions. According to them, while the risk inherent in banks' lending portfolios peaks at the top of the cycle, this risk tends only to be realized during the contractionary phase of the business cycle. At this time, banks' non-performing loans would increase, profits would decline and substantial losses to capital may become apparent. As Fernández de Lis et al. (2000) explain, the "excessive" accumulation of debt occurs when the economy is booming, when borrowers appear able to bear higher levels of expenditure and debt. However, that "excess" is then corrected during recessions through increased risks, deflation and finally, economic crisis. This is in line with the previously discussed findings of Quagliarello (2007) and Knutsen (2012) in Section 2.4.

Similarly, Salas and Saurina (2002) analyse the relation between problem loans and the economic cycle in Spain over the period 1985-1997. They find that during economic booms banks tend to expand their lending activity in order to increase their market share; this often results in increased lending to borrowers of lower credit quality. They also report that bad loans increase in recessionary phases and that a contraction has an immediate effect on the incidence of NPLs, concluding that macroeconomic shocks are quickly transmitted to banks' balance sheets. Summarizing these empirical studies it is evident that there is a need to model the effect of the past period of output growth and rapid credit growth on the future behaviour of non-performing loans. This relationship has been neglected in the empirical literature so far and this will be further discussed in Section 5.4.

Empirical studies have also suggested that aside from GDP growth, variables such as unemployment, interest rates and inflation may provide additional information regarding the impact of macroeconomic conditions on non-performing loans. The change in the unemployment rate is usually not considered as a leading indicator; however, it influences the income of households and, in turn, their debt servicing ability. It should be mentioned that the unemployment rate might also proxy the financial standing of companies, which influences their decisions on the optimal level of employment. Gambera (2000) assesses the impact of state and nation-wide macroeconomic variables on the quality of different types of loans (agricultural, commercial, industrial and residential) using US quarterly data for 1987–1999. The author reports that the unemployment rate is one of the significant predictors of bank asset quality. Furthermore, Babouček and Jančar (2005) quantify the effects of macroeconomic shocks on the loan quality of the Czech banking sector for the period 1993–2006 and report evidence of a positive effect of a rising unemployment rate and consumer price inflation on the incidence of non-performing loans. Louzis et al. (2010) used dynamic panel data methods to examine the determinants of non-performing loans in the Greek financial sector. They found that macroeconomic variables, specifically the real GDP growth rate, the unemployment rate and the real lending rates have a strong effect on the level of NPLs. In addition, they find evidence that firms cut their labour costs before they face credit repayment problems. The hypothesis for the use of unemployment rate might also be justified with the expected positive association with bad debts, confirming that unemployment affects borrowers' disposable income and, in turn, their ability to pay back the debt. According to Glogowski (2008) an increase in the unemployment rate precedes an increase in loan losses. Since it takes time for banks to downgrade their assets this transmission mechanism is not instantaneous. Hence, it might be reasonable to consider inclusion of lagged values of this variable in the model.

Previous empirical research also provides evidence that inflation may be included as an indicator of the state of the macroeconomic and financial environment that affects loan quality. Inflation may affect borrowers' debt servicing capacity through several channels and its impact on the proportion of NPLs can be positive or negative. Higher inflation can make debt servicing easier by reducing the real value of outstanding loans. However, it can also weaken some borrowers' ability to service debt by reducing real income when wages and prices are sticky. In addition, when loan rates are variable, inflation is likely to reduce borrowers' loan servicing capacity as lenders adjust rates to maintain their real returns or simply to pass on increases in policy rates resulting from monetary policy actions to combat inflation (Nkusu, 2011). Against this background, the relationship between NPLs and inflation can be positive or negative. Fofack (2005) finds that inflationary pressures contribute to the high level of impaired loans in a number of Sub-Saharan African countries. According to this research, higher inflation is responsible for the rapid erosion of commercial banks' equity and consequently higher credit risk in the banking sectors of these African countries. Hoggarth et al. (2005) employ UK quarterly data for the period 1988–2004 to evaluate the dynamics between banks' write-off to loan ratio and several macroeconomic variables. In general, they find that both banks' total and corporate write-offs are significantly related to deviations of output from potential. Namely, following an adverse output shock, total and corporate write-off ratios increase. Banks' write-off ratio also rises after increases in retail price inflation and nominal interest rates. In contrast, Shu (2002) find that the ratio of bad loans to performing loans in Hong Kong decreases with a higher consumer price inflation rate. Also, Dash and Kabra (2010) analysing the determinants of non-performing loans in India have found a negative association between inflation and the ratio of NPLs to total loans. They explain this situation by the common indexation of wages in India. Therefore, it seems that the influence of inflation is mediated by what is happening to real wages and by the institutional context.

Interest rates were also found to be significant in several studies. A hike in both real and nominal interest rates typically weakens borrowers' debt servicing capacity, especially in the case of floating rate loans (Louzis et al., 2010). This implies that the proportion of NPLs is expected to be positively related to interest rates. Shu (2002) found that the ratio of bad loans to performing loans in Hong Kong falls with higher real gross domestic product growth, higher consumer price inflation rate and higher property prices growth, whereas it rises with increases in nominal interest rates. Fuentes and Maquieira (2003) found, looking at Chilean banks, that interest rate changes had a greater effect on NPLs than the business cycle. Furthermore, Espinosa and Prasad (2010) examining a sample of 80 banks in the Gulf Cooperation Council (GCC) region find that the NPLs ratio worsens as economic growth weakens and nominal interest rates increase. Jimenez and Saurina (2005) examine the Spanish banking sector from 1984 to 2003 and provide evidence that the acceleration of GDP as well as a decline in real interest rates brings about a decline in problem loans. They also find that the impact of changes in real interest rates is much more rapid than that of economic activity. Furthermore, Dash and Kabra (2010) found a significant positive contemporaneous association between the real interest rate and the level of NPLs.

The majority of empirical studies do not elaborate precisely which interest rate should be taken as a determinant of NPLs, or why nominal interest rates are used instead of real interest rate and vice versa. After testing for both unrestricted and restricted versions of including interest rate and inflation, looking from an economic perspective it was decided to use a restricted version: real interest rates. Namely, including the nominal interest rate and inflation separately is the same as including the real interest rate but with the implied restriction:

$NPL = \beta_1 i + \beta 2 \pi$
i=nominal interest rate
π= inflation

Implied restriction is: $\beta_{1} = -\beta_2$
$NPL = \beta (i - \pi)$
real interest rate = $i - \pi$

To summarize, one of the hypotheses formulated in previous empirical studies is that a growing economy is characterized by a relatively low proportion of NPLs, as most debtors have a sufficient stream of income and revenues to service their debts. However, in the boom phase of the cycle credit is likely to be extended to lower-quality debtors, and subsequently, when the recession phase sets in, the proportion of NPLs in total loans increases. As summarized by Louzis et al. (2010), the inability of lower-quality debtors to service their loans during a recession might be caused by a decrease in asset values which serve as collateral and the subsequent contraction of credit as banks become more risk-averse. Our empirical estimation will use real GDP growth and the unemployment rate as indicators of macroeconomic performance. According to previous empirical research real GDP growth is negatively associated with NPLs. Conversely, unemployment is positively related with NPLs. In addition to these indicators of macroeconomic performance we are going to use the real interest rate: that is the difference between the weighted average lending rate and the inflation rate of the period. Higher real interest rates weaken borrowers' debt servicing capacity and the incidence of NPLs is expected to be positively associated with increases in real interest rates. The relevance and expected signs of the relationships between NPLs and the selected macroeconomic variables are presented in Table 5.1.

Table 5.1 Macroeconomic determinants of non- performing loans

Name of the variable	Definition	Expected sign	Data Source
GGDP growth rate *(GGDP)**	The quarterly growth in real GDP at time *t* computed as follows: $GGDP_t = GDP_t - GDP_{t-1} / GDP_{t-1} * 100$	(-)	Central Bank of Montenegro (CBM)
Unemployment rate *(UNEMP)*	Quarterly unemployment rate	(+)	Montenegrin Employment Agency
Real interest rate *(INTR)*	The difference between the weighted average lending rate and the inflation rate of bank *i* at time *t* . $INTR_t = NIR_t - INF_t$, where *NIR refers to nominal interest rate*	(+)	Central Bank of Montenegro (CBM)

* Quarterly data of GGDP are derived using standard techniques for interpolation.

We will analyse the influence of these three macroeconomic variables. It may be argued that, for the analysis of non-performing loans in Montenegro, it would be desirable to consider the composition of capital flows. As presented in section 1.2, before the crisis a significant part of foreign direct investment was in real estate and these large investments caused the rapid rise in prices in the real estate market. Additionally, given the unrealistic valuation of collateral for many of these loans they subsequently deteriorated the overall quality of loans in Montenegro. Therefore, it would be desirable to examine how the composition of capital flows impact on the loans quality in Montenegro. However, the data for composition of capital flows is available only from 2007. As we already have a small sample (from 2004 to 2010, quarterly), losing twelve observations for all eleven banks would not be the appropriate empirical strategy.

An important consideration is to address the problem of potential endogeneity between these variables. Endogeneity has been usually ignored in the literature, though some recent empirical studies have used different approaches to deal with this problem. The use of lagged explanatory variables might alleviate potential endogeneity problems. There are studies that aim to overcome the bias associated with the potential endogeneity of explanatory variables using either the fixed effects or the GMM system estimator (Jimenez and Saurina, 2005; Quagliarello, 2007; Espinoza and Prasad, 2010; Louzis, et. al. 2010).

Formally, endogeneity is the statistical condition where the error term in the “true" model is correlated with the regressors. Since standard regression techniques assume the error term to be uncorrelated and force the underlying residuals to be orthogonal to the regressors, the standard approach will produce estimates which are biased. From a practical standpoint this means that, when estimating the effect of economic phenomenon which may be jointly determined, isolating the sources of variation becomes extremely important. In addressing these concerns, it is useful to precisely identify the sources of endogeneity. In applied econometrics, Wooldridge (2002) indicates that endogeneity usually arises in one of three ways: omitted variables which should appear when controlling for additional variables but due to data unavailability one cannot include them in the regression model; measurement error is the case of measuring the (partial) effect of a variable observed only by an imperfect measure of it; and simultaneity which occurs when at least one of the explanatory variables is determined mutually with the dependent variable.

In our model bias may stem from the possible simultaneity of the macroeconomic environment and the quality of loans, which is described by the NPLs ratio. Namely, the theory suggests that the macroeconomic environment affects the quality of loans, however there might the feedback between the quality of loans and its macroeconomic determinants. Namely, some of the current macroeconomic variables might be endogenous, since banking system performance variables are likely to have second round effects on the real economy. To tackle this issue, the inclusion of lagged explanatory variables will be considered. This will be further discussed in Section 5.3.

5.2.2 Micro Determinants of Non-performing Loans

In addition to macroeconomic indicators, another branch of the literature has been focused on the effect of bank-specific characteristics such as the quality of management, strategy choices and size and market power on the incidence of problem loans. For instance, Rajan and Dhal (2003) use a panel regression analysis to report that bank-specific factors such as maturity, cost and terms of credit, bank size and credit policy orientation impact significantly on the incidence of NPLs of commercial banks in India. Similarly, Dash and Kabra (2010) find that management quality, in terms of aggressive lending policies, inefficiency and moral hazard, have impacted the loan portfolios of commercial banks in India.

Analysing the determinants of the risk-taking behaviour of banks has been of particular importance in the banking empirical literature. According to Espinoza and Prasad (2010) banks' risk-taking may be affected by a number of factors, including, moral hazard, agency problems, ownership structure and regulatory actions. Namely, they noticed that moral hazard may be induced by deposit insurance schemes, thus the banks may increase their risk positions while their capital is declining. However, risk taking driven by moral hazard should be limited by appropriate regulatory and supervisory activities, which we have considered in Section 4.2.

As mentioned in Section 5.2.1, growth in a bank's lending might be a signal of positive phase of the business cycle if it is led by expansion of aggregate demand when firms' profits tend to increase, asset prices rise and customers' expectations are optimistic. In this situation credit growth may have a negative effect on the incidence of NPLs (an improvement) (Quagliariello, 2007). However, the empirical literature which uses bank level data (Keeton and Morris, 1985; Sinkey and Greenwalt, 1991; Keeton, 1999; Salas and Saurina, 2002 and Jimenez and Saurina, 2005) suggests that in boom phases of the business cycle banks lend over aggressively which coincides with more reckless risk-taking. Thus, this aggressive lending would suggest a positive effect on the incidence of NPLs (i.e. a deterioration). Therefore, excessive lending by commercial banks is often identified as an important determinant of the incidence of NPLs.

Fernández de Lis et al. (2000) explain the following possible "mistakes" in banks expansive credit policy: disaster myopia, herding behaviour, perverse incentives and principal-agent problems. They explain that principal-agent problems could stimulate credit expansion because bank managers are willing to increase risk in order to maximise their profits and banks' market share, particularly when they are poorly monitored by their shareholders. In these situations banks` managers often disregard relevant information concerning the increasing level of risk, which indicates their myopia and tendency to follow other lenders' behaviour. They noticed that banks could be forced into excessive credit expansion as a result of an informational externality that makes bank credit policies interdependent. Namely, they noticed that bank managers often act according to the belief that the market is more forgiving if mistakes are made by many players at the same time. That explains the herding behaviour of banks managers, which drives the market into an excessive expansion of credit that will increase borrowers' debt levels and may result in an increase in non-performing loans. Similar conclusions are drawn by Jimenez and Saurina (2005). Namely, they report that short-term and reputational objectives of bank managers might explain why banks are prepared to finance uncertain "high risk" projects during expansions that, later on, will become non-performing loans. Their findings are in line with Rajan (1994) who emphasizes that bank managers have short-term decision horizons, because their reputations are strongly influenced by other banks' perceptions of their performance.

A typical scenario for credit expansion is the situations where loans are approved with collateral which is insufficient to cover the value of the approved loan (Rajan 1994, Weinberg, 1995; Jimenez and Saurina, 2005). Namely, supply-side explanations of the (excessive) expansion of bank loans frequently suggest a relaxation of underwriting standards, whereas loan contractions are said to suggest a tightening of standards (O'Keefe, 2010). This is confirmed by Jimenez and Saurina (2005) as they find that in boom periods collateral requirements are relaxed while the opposite happens in recessions, which they take as evidence of looser credit standards during expansions. This is in line with the findings of Weinberg (1995), as his model suggests that banks change their lending standards with the new market conditions, in order to try to smooth overall lending risk. Moreover, Rajan and Dhal (2003) analysing Indian banks found that lenient credit conditions affect the occurrence of non-performing loans.

Different empirical studies report different conclusions on when the effect of past rapid credit growth becomes evident, implying emerging problems in loans quality. Fernández de Lis, et al. (2000) find that in a context of strong competitive pressures, there is a tendency for loose credit standards and low provisions in an upturn in view of the low level of contemporaneous non-performing loans. That may contribute to an overextension of credit. They stressed that the low quality of these loans will only become apparent with the ex post emergence of problem loans, which will tend to appear during downturns, with an estimated lag of approximately three years in the case of Spain. Furthermore, Salas and Saurina (2002) find that credit growth has a negative effect on the incidence of NPLs when current values are considered and positive when one year lagged values are used. Jimenez and Saurina (2005) pay particular attention to the influence of loan growth on NPLs. In their empirical study, an increase in the loan growth rate worsens loan quality with a four-year lag. They also find that higher loan growth at bank level (compared to the average for the sector) is an additional factor influencing loan quality. In addition, Kraft and Jankov (2005) find that in Croatia, rapid loan growth increased the probability of credit quality deteriorating.

There are also additional bank characteristics which are likely to be correlated with credit risk. For instance, Espinoza and Prasad (2010), citing Hughes et al. (1995), link risk taking to banks' operating efficiency. Namely, they consider that it may be possible that risk-averse managers are willing to trade-off reduced earnings for reduced risk, especially when their own wealth depends on the performance of the bank. Thus, in order to improve loan quality, they are likely to increase monitoring and incur higher costs, affecting the measure of operating efficiency. In that case, seemingly more inefficient banks might in fact hold a lower risk portfolio. Conversely, Pain (2003) find that inefficient banks may be tempted to engage in riskier lending. The costs-to-income ratio is a commonly used indicator of banks' efficiency. Quagliariello (2007) finds that banks with higher values of this ratio are expected to be also less effective in the selection of borrowers and, in turn, make higher provisions. Keeton (1999) highlighted the relationship between capital and credit risk and its interaction with operational efficiency. He investigated the causality between loan quality, cost efficiency and bank capital using a sample of U.S. commercial banks for the period 1985-1994. He found that low cost efficiency is positively associated with increases in future non-performing loans. Additionally, he found that a low capitalization of banks leads to an increase in non-performing loans. Similar findings, that operating efficiency also helped to explain the incidence of NPLs were reported by Bercoff et al. (2002). The study of Louzis et al. (2010) which covered Greece's nine largest banks for the period 2003–2009 found that management quality and macroeconomic fundamentals largely explain the incidence of NPLs. Besides a positive relationship between the incidence of NPLs and the real lending rates, they find that management inefficiency, proxied by a higher ratio of operating expenses-to-operating income, is positively associated with the proportion of NPLs. Similar results have been reported by Espinosa and Prasad (2010).

According to previous empirical studies and with special reference to Berger and DeYoung (1997), Salas and Saurina (2002) and Louzis et al. (2010), we will test the following hypotheses concerning bank specific factors. Although following the practice adopted by these previous studies we acknowledge that the available bank-specific variables included are not always close proxies for those identified in the underlying theorised relationships.

"Procyclical credit policy" hypothesis - As previously mentioned banks may adopt an overly expansive credit policy during the boom phase of the cycle and a tight policy in the contraction phase.

"Bad Management" hypothesis - According to Berger and DeYoung (1997) cost inefficiency is positively associated with increases in future non-performing loans. The proposed justification links ″bad″ management with poor skills in credit scoring, appraisal of pledged collaterals and monitoring borrowers. Godlewski (2004) using the return on assets (ROA) as a proxy for performance, finds that banks' profitability negatively impacts on the level of NPLs ratio. In addition, Louzis et al. (2010) considered past performance measured by ROA and ROE as a proxy for management quality. Namely, the rationale for this hypothesis is that worse past performance may be a proxy for a lower quality of skills with respect to lending activities.

"Moral Hazard" hypothesis - A low capitalization of banks has been argued to lead to an increase in the ratio of non-performing loans in the future. The link is to be found in the moral hazard incentives on the part of bank managers who increase the riskiness of their loan portfolio when their banks are thinly capitalized (Berger and DeYoung, 1997). Ahmad and Ariff (2007) analysing credit risk in Australian and Indian banks confirm that under-capitalized banks take more risks. Banks' capital resources, measured by the solvency ratio, will be included to account for the possibility of such "moral hazard" behaviour. Lagged values rather than contemporaneous values of the solvency ratio will be used in the models in order to reduce bias from the potential endogeneity problems that may rise from reverse causality.

"Good Monitoring" hypothesis - According to this view, there exists a trade-off between allocating resources for underwriting and monitoring loans and measured cost efficiency (Louzis et al., 2010). Namely, banks which devote less effort to ensure higher loan quality will seem to be more cost-efficient; however, on average there will be a higher proportion of NPLs in the long run. To test the this hypothesis the cost-income ratio will be used, calculated as operating expenses relative to operating income.

"Market Power" hypothesis - considers the relative market share of the assets of each commercial bank in relation to total aggregate banking assets. The size distribution of banks is of interest to policy makers given that size is likely to influence a bank's risk taking behaviour (Demsetz and Strahan, 1997), credit availability (Peek and Rosengren, 1998), lending relationships (Stein, 2002; Berger et al., 2005) and lending specialization (Delgado et al., 2007). Salas and Saurina (2002) reveal that market power, calculated as the ratio of the relative market share of each bank's assets, explains some of the variation in the incidence of NPLs. In addition, they find that the large banks seem to have a lower proportion of NPLs. Hu et al. (2006) while analysing the relationship between the proportion of NPLs and the ownership structure of commercial banks in Taiwan also find that bank size is negatively related to the incidence of the NPLs. The theoretical rationale for this hypothesis is that the larger banks have more resources to build-up know how and technologies for high-quality risk management.

Table 5.2 provides a summary of the bank-specific determinants of NPLs which will form the basis for the following empirical work.

Table 5.2 Bank-specific determinants of NPLs (in %)

Variable	***Definition***	***Hypothesis tested***	***Expected sign***
Return on Assets	ROA_{it} = $Profits_{it}$ / Total $Assets_{it}$	″Bad Management″	(-)
Return on Equity	ROE_{it} = $Profits_{it}$ / Total $Equity_{it}$	″Bad Management″	(-)
Capital adequacy ratio	CAP_{it} = Owned $Capital_{it}$ / Total $Assets_{it}$	″Moral Hazard″, ″Bad Management″	(+)
Loans to Deposit Ratio	LtD_{it} = $Loans_{it}$ / $Deposit_{it}$	″Moral Hazard″	(+)
Inefficiency	CIR_{it} = Operating $Expenses_{it}$ / Operating $Income_{it}$	″Bad Management″, ″Good monitoring″	(+) (-)
Credit growth[34]	$CR_{it} = (Loans_{it} - Loans_{it-1}) / Loans_{it-1}$	″Procyclical credit policy″	(-) (+)
Market share	$Mshare_{it}$ = Total $Assets_{it}$ / $\sum_{i=1}^{11}$ Total $Assets_{it}$	″Market power″	(-) (+)

Note: All ratios are expressed in percentage points

Before an explanation of the variables is provided, it is necessary to mention that some variables do not uniquely identify the proposed concepts. Namely, from the Table above it is seen that for one hypothesis there are several identified variables. Although following the practice adopted by the previous studies, we also acknowledge that the bank-specific variables included are not always close proxies for those identified in the underlying theorised relationships.

[34] In Section 5.4 we will explain the empirical strategy for calculating the effect of this variable.

Explanation of variables

Return on assets (ROA) and Return on equity (ROE) will be used to test the “Bad Management” hypothesis. ROA is usually used as a measure of overall bank performance from an accounting perspective (Sinkey, 1992, p. 43). It is used as primary indicator of managerial efficiency. ROA indicates how a bank’s management has been converting the bank’s assets into net earnings. ROE measures approximately the net benefit that the stockholders have received from investing their capital (Rose and Hudgins, 2006, p. 151). However, using ROA and ROE as independent variables in determining the incidence of NPLs raises endogeneity concerns. The source of endogeneity in this case would be reverse causality. Since a change in NPLs can drive a change in bank performance, the effect of an independent change in bank performance on NPLs is likely to be incorrectly measured. Following the practice of several previous studies (Jimenez and Saurina, 2005; Głogowski, 2008; Louzis, et al., 2010; etc.), we use lagged explanatory variables to overcome, or at least to reduce, endogeneity problems.

A bank’s capital resources, measured by the solvency ratio, will be included to account for the possibility of “Moral Hazard” behaviour. **The Capital adequacy ratio or solvency ratio (CAP)** indicates the capital strength of a bank, indicating whether the bank has enough capital to meet the potential losses which can occur. As required by the Central Bank of Montenegro, banks have to maintain a minimum CAP equal to 10%. The Central Bank of Montenegro also requires that capital funds consist of capital inclusive of Tier-1 and Tier-2 capital, i.e. core capital and supplementary capital respectively. Tier 1 capital consists of paid-up capital and disclosed reserves such as capital reserves and the previous year’s after-tax profit. The Tier-2 capital comprises of undisclosed reserves, revaluation reserves, general provisions, hybrid instruments and subordinated term debt.

Lagged values rather than contemporaneous values of the solvency ratio will be used in the models in order to reduce bias, namely the potential endogeneity problems that may rise from reverse causality. In addition, since the hypothesis is that the low capitalization of banks leads to an increase in the ratio of non-performing loans in the future, it is appropriate that lagged values of the solvency ratio will be used.

The loan to deposit ratio (LtD) is the variable used to test banks’ risk attitude. LtD is a measure of a bank’s liquidity, indicating the extent to which deposits are used to meet loan requests. LtD serves as an indicator which shows the extent to which a bank is intermediating, connecting the excess fund-holders and the borrowers in their economic activities. Banks have to maintain sufficient level of LtDs so that their function as an intermediary is fulfilled. Generally, as banks borrow short and lend long, they have a constant need to refinance long-term assets as their short-term funding expires. However, this might be problematic in a crisis period, when the sources of funding are usually limited, and then banks may face significant funding gaps. If a bank has trouble funding itself, then it cannot grow and, indeed, must actually shrink its balance sheet. The "Moral Hazard" hypothesis predicts that the bigger the loan portfolio relative to deposit size the higher should be the ratio of NPLs. Ahmad and Ariff (2007) find that the LtD ratio is a significant positive determinant of credit risk in Malaysia, the U.S. and France.

To test the hypothesis of “Bad Management” and “Good Monitoring” we will use the cost-income ratio, which is calculated as **operating expenses relative to operating income (CIR)**. Theory provides mixed predictions on the sign of the expected coefficient of this variable. On the one hand, high cost inefficiency, as a characteristic of bad management, is expected to be positively associated with the increase in the proportion of NPLs. On the other hand, extensive screening and monitoring of borrowers requires higher operating costs, which could also consequently result in an increase in the cost to income ratio but a lowering of the incidence of non-performing loans.

The variable **CR** will be included to measure the growth rate of banks’ total loans. As mentioned above, the growth in a bank’s lending might be a signal of a positive phase of the business cycle if it is led by expansion of aggregate demand, in which case NPLs are low. However, we have also discussed that in that phase there may be incentives for bank managers to take on more risk. Thus, since aggressive lending is likely to coincide with reckless risk taking, the rate of non-performing loans is likely to increases in the next phase of the business cycle. Therefore we have created an interaction term which will consider the effect of past rapid credit growth on the incidence of non-performing loans. The strategy of how to model this effect of past rapid loans growth on future non-performing loans will be explained in Section 5.4.

Finally, we include the variable **Mshare**, the relative market share of the assets of each commercial bank in total aggregate banking assets. The empirical evidence relating to the impact of market share on NPLs is mixed. For instance, some studies report a negative impact of the market share on the incidence of non-performing loans (see Rajan and Dhal, 2003; Salas and Saurina, 2002; Hu et al., 2006; Louzis, et. al. 2010). According to these studies, the inverse relationship means that large banks have better risk management strategies that usually translate into superior loan portfolios vis-à-vis their smaller counterparts. It is interesting that Galloway et al. (1997) find that size (measured by market value of equity) was significantly positively related to risk during a well regulatory period of the cycle but was significantly negative during a deregulatory regime when restrictions were imposed on banks following the failure of too-big to fail policy.

5.3 Data Analysis

Bearing in mind that the Montenegrin banking sector has been in its current form for just eight years, there are many unresolved issues with regards to the determinants of NPLs. This Chapter focuses on the period from 2004 to 2010, using quarterly data and uses a panel data set of the 11 banks operating in Montenegro. During this period the Montenegrin banking system could be characterized as a sector which was responding to global market changes. In addition, this period encompasses part of a boom period and also of the Global Financial Crisis, originating from the US subprime mortgages market. Thus, in the time period examined contrasting phases of the business cycle are represented.

In order to learn which sectors are likely to experience higher NPLs and to examine the determinants of NPLs for each type of loan portfolio, it would be useful to have the sectoral breakdown of non-performing loans. However, these data are not available for Montenegro. The macroeconomic data, such as GDP growth and real interest lending rate, are provided by Central Bank of Montenegro (CBM), while the unemployment rate[35] is provided by the Montenegrin Employment Agency. In particular, GDP quarterly data are determined using the standard techniques for interpolation by the Statistics Department of the CBM, since during the sample period quarterly GDP data were not reported by the Montenegrin Statistical Agency. The bank-specific data are collected from the Supervision Department

[35] Registered unemployment rate is the proportion of registered unemployed in the labour force within the 'official' working age (typically, from 15 or 16 to retirement age, which can be different for men and women; in Montenegro it is 65 for both genders).

database of the CBM.[36]Since in Chapter 1 we discussed the main macroeconomic and bank-specific developments in Montenegro, this Section will be dedicated to summary statistics of the main variables. These are presented in Table 5.3.

Table 5.3 Descriptive statistics for macro and bank-specific variables in Montenegro (in %)

Variable name	Variable label	N.Obs.	Mean	Std. Dev.	Min	Max
Non-performing loans	NPL	281	8.740	8.763	0.120	48.070
GDP growth rate	GGDP	308	1.029	0.032	0.943	1.075
Real lending interest rate	INTR	242	9.909	1.068	9.030	12.570
Unemployment rate	UNEMP	308	15.358	4.930	10.260	27.420
Return of assets	ROA	283	-0.295	6.398	-30.240	50.000
Return of equity	ROE	283	-2.589	31.690	-188.84	54.000
Solvency Ratio	CAP	283	34.589	30.943	6.540	196.910
Loan To Deposit Ratio	LtD	283	143.986	114.800	37.410	790.460
Inefficiency ratio	CIR	283	139.125	457.494	35.190	6882.120
Credit growth	CR	282	11.145	23.019	-45.450	171.680
Market share	Mshare	283	9.718	9.704	0.040	46.000

The relatively large values of some variables (CAP, LtD, CIR, CR) are mainly related to two new banks that started to operate in the observed period. The profitability measures, ROA and ROE, after the crisis became negative because some banks experienced large losses. As presented in Chapter 1, section 1.4.4, the ROE at the aggregate level in 2010 reached -27%. Regarding unemployment data, it is worth mentioning that there is an issue of particular concern to the accuracy of an unemployment measure based upon registrants given that a high level of undeclared work has been present in Montenegro. According to the ISSP Labour Force Survey 2007 data, close to 50,000 or 22.6% of the total number of employed

[36] These data are handled through a confidentiality agreement with the Central Bank of Montenegro. According to that agreement the names of banks cannot be mentioned.

persons are employed in the informal sector or hold informal employment in formal sector companies (informal employees) (European Commission, 2010).

The correlation matrix (in Appendix 5.1) shows that the size of correlation between NPL and other variables is not very high, except for the relation between NPL and ROE (51.66%).

5.4 Econometric Specification

Most previous studies of the determinants of NPL ratio estimate a static FE model (Rajan and Dhal, 2003; Gerlach, et al., 2005; Głogowski, 2008; Khemraj, and Pasha, 2009; Dash and Kabra; 2010). However, upon investigation we have found that static FE specifications are seriously misspecified with respect to serial correlation.[37] This suggests respecifying the model as a dynamic linear regression model. Interestingly, several recent studies use a dynamic specification in order to account for time persistence in the determinants of non-performing loans (Louzis, et. al., 2010; Espinoza and Prasad; 2010). The main feature of a dynamic panel data specification is the inclusion of a lagged dependent variable in the set of regressors. However, given that the lack of cross sectional units precludes GMM Estimators, we will investigate the use of FE estimation adjusted to take account of dynamic misspecification (which may be possible given the time series depth of our data). Namely, there is a possibility that the dynamics are unobservable and therefore contained within the residuals. To overcome this problem we check whether the common factor restrictions (CFRs) hold (Hlivnjak, 2010). First of all, a dynamic linear regression model of order one (DLRM (1)) will be specified and estimated. Using one independent variable, the form of the DLRM (1) is:

$$\mathrm{NPL}_t = \alpha_0 + \alpha_1 \mathrm{NPL}_{t-1} + \beta_0 \mathrm{GGDP}_t + \beta_1 \mathrm{GGDP}_{t-1} + \varepsilon_t \qquad t = 1, 2, \ldots, T. \qquad (5.1)$$

The dynamic linear model is misspecified in the panel context (Wooldridge, 2002). Accordingly, two approaches are used to estimate the first order dynamic panel model and to test the CFRs: OLS in which the coefficient on the lagged dependent variable is subject to maximum upward bias and a fixed effect estimation in which the coefficient on the lagged dependant variable is subject to maximum downward bias. Therefore, all possible dynamic misspecifications are encompassed (Bond, 2002). By checking whether the CFRs hold in

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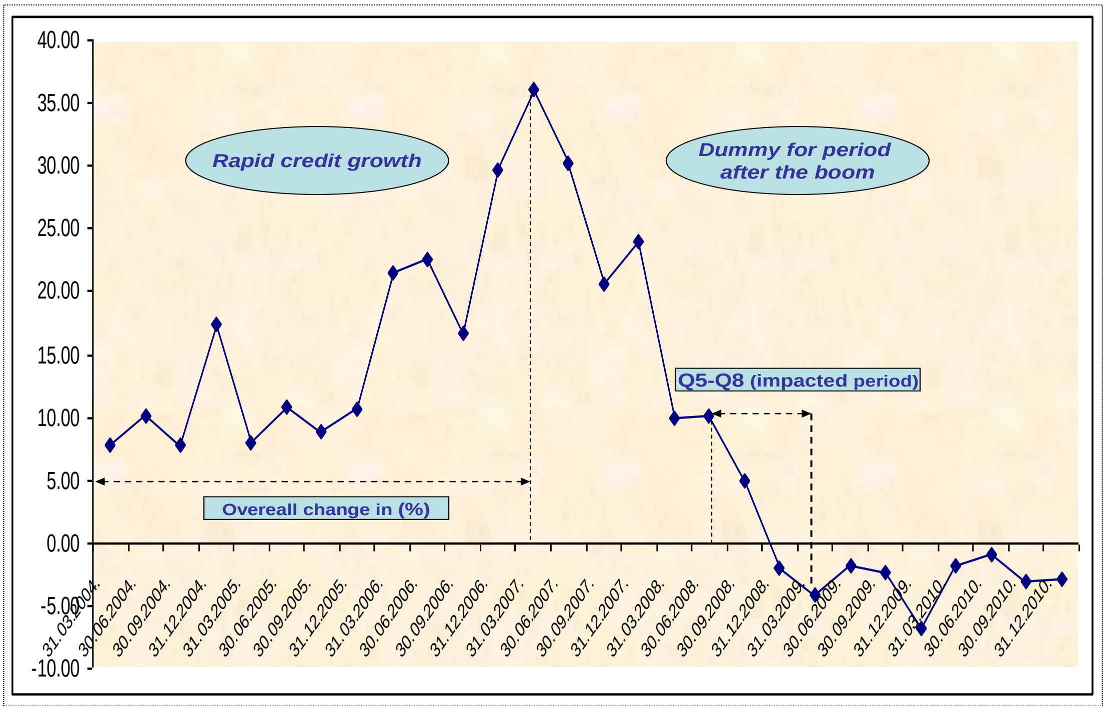
[37] The Wooldridge (2002) test - implemented in Stata by xtserial - rejects the null hypothesis of no serial correlation (p=0.000).

both OLS and fixed effects estimation, greater confidence can be placed in the approach to estimation and, hence, in the validity of the results.

The CFR is tested for each continuous variable (McGuirk and Spanos, 2004). The CFR indicates that something may be missing in our specification, namely that there may be dynamics in the model but it is not known from which variables the dynamics arise. If they are not accounted for in the model then they are in the residual, in which case the hypothesised CFRs cannot be rejected. Since it was found that the CFRs cannot be rejected (see Appendix 5.2) in both the OLS and FE estimations, an unobserved components model is the preferred empirical strategy for estimation (McGuirk and Spanos, 2004).

In the model we have included potential macroeconomic determinants of credit risk (i.e. common shocks to all banks) through the real rate of growth of the gross domestic product (GGDP), the unemployment rate (UNEMP) and the real lending interest rate (INTR). As mentioned in Section 5.2.1, an important consideration is to address the problem of potential endogeneity between these variables and NPLs. Even though endogeneity has typically been neglected in the literature, recently some empirical studies have used different approaches to deal with this problem. In our model, as noted above, bias might stem from the simultaneity - mutual causation - of macroeconomic variables on the right-hand side of the model and the NPLs ratio. As noted in Section 5.2.1, even though theory suggests that the macroeconomic environment affects the quality of loans, there might be feedback between the quality of loans and macroeconomic determinants. Namely, in this case, some of the current macroeconomic variables might be considered as endogenous, since banking system performance variables are likely to have a second round effect on the real economy. To tackle this issue the GGDP growth rate and UNEMP are included as lagged one quarter indicators capturing borrowers' response to expected macroeconomic environment and business prospects. Additionally, the bank specific variables: ROA, ROE and CAP are also used in a form of lagged value to avoid potential endogeneity, as discussed in Section 5.2.2. Considering that 90 day past due loans are characterized as non-performing loans, one quarter lagged ROA, ROE and CAP give an even longer lag in the model.

As mentioned previously, during booms banks tend to expand their lending activity to try to increase their market share, which, on average, is likely to result in increased lending to borrowers of lower credit quality. Hence, the credit risk increases in the boom periods although it only appears as NPLs during bad times. Bearing in mind the empirical literature, it was necessary to implement a strategy to model the effect of past rapid loans growth on future non-performing loans. This required that the period of fast past rapid loans growth is interacted with a period after the peak of loans growth. The following Figure helps to explain how we have implemented this strategy.



Source: CBM data

Figure 5.1 The growth of loans in Montenegro (aggregate data) and its lagged effect on the incidence of NPLs

Note: Vertical axis refers to loans growth (in %)

The existing literature gives the general proposition that present developments in credit give rise to future deterioration of loans quality. However, previous studies do not provide precise guidance on the timing of the lagged effect of past credit growth on the incidence of non-performing loans, which might be expected to vary across time and place. In order to determine the timing of this effect - if any- we proceeded as follows. For each bank, we created dummy variables for various periods after the peak of its loans growth[38], each one of which was interacted with a variable which captures its loans growth from the beginning of the sample period to the peak of its loans growth. After some experimentation it was

[38] The peak of loan growth was different for different banks.The peak of loan growth varies from the first quarter of 2006 to the last quarter of 2008. On average, as seen in Figure 5.1 the peak of loans growth was in 2007.

concluded that the effect of past peak loan growth on the incidence of NPLs became most evident in the second year (from the fifth to the eighth quarter) after the peak of loans growth (see Figure 5.1 which displays this procedure using aggregate rather than individual bank data).

The equation below presents a linear regression function with an AR (I) error term that seeks to explain the ratio of NPLs to total loans through the behaviour of key macroeconomic and bank specific variables.

$$\mathrm{NPL}_{i,t} = \beta_{0i} + \hat{\beta}_1\mathrm{GGDP}_{t-1} + \hat{\beta}_2\mathrm{UNEMP}_{t-1} + \hat{\beta}_3\mathrm{INTR}_t + \hat{\beta}_4\mathrm{ROA}_{i,t-1} + \hat{\beta}_5\mathrm{ROE}_{i,t-1} + \hat{\beta}_6\mathrm{CAP}_{i,t-1} + \hat{\beta}_7\mathrm{CIR}_{i,t} + \hat{\beta}_8\mathrm{LtD}_{i,t} + \hat{\beta}_9\mathrm{CR}_{i,t} + \hat{\beta}_{10}\mathrm{D2YGLOANS}_{i,t} + \hat{\beta}_{11}\mathrm{D2Y}_i + \hat{\beta}_{12}\mathrm{mshare}_{i,t} + \lambda_t + \varepsilon_{i,t} \qquad (5.2)$$

$$\text{where: } \varepsilon_{i,t}=\rho\varepsilon_{i,t-1} + \upsilon_t \qquad i = 1, \dots \mathrm{N}, t = 1, \dots \mathrm{T}$$

where: $\mathrm{NPL}_{i,t}$ represents the ratio of non-performing loans to total loans for bank i in quarter t; $\Delta\mathrm{GDP}_{t-1}$ represents the quarterly growth in real GGDP at time t-1; UNEMP_{t-1} denotes the quarterly unemployment rate at time t-1; INTR_t represents the quarterly real weighted average lending rate at time t ; $\mathrm{ROA}_{i,t-1}$ is the return on assets for bank i at time t-1; $\mathrm{ROE}_{i,t-1}$ represents the return on equity for bank i at time t-1; $\mathrm{CAP}_{i,t-1}$ is the solvency ratio for bank i in quarter t-1; $\mathrm{CIR}_{i,t}$ represents the cost to income ratio for bank i in quarter t; $\mathrm{LtD}_{i,t}$ represents the loans to deposit ratio for bank i in time t; $\mathrm{CR}_{i,t}$ represent the growth in loans for bank i in quarter t; $\mathrm{D2Y}_i$ is a dummy variable which equals 1 for the period of the second year (or for the 5th to 8th quarter) after the peak of loans growth for each bank, and zero otherwise; $\mathrm{D2YGLOANS}_{i,t}$ represents the interaction term calculated as the overall percentage change in loans growth from the beginning of the sample period to the peak of loans growth for each individual bank multiplied by the dummy for period after the peak; $\mathrm{Mshare}_{i,t}$ is the ratio that captures the market share of the bank i at time t; and a set of time dummies (λ_t). In this model, the fixed effects β_{0i} capture the effect of time invariant, unobserved bank-specific, variables that are otherwise omitted from the model; $\varepsilon_{i,t}$ is the idiosyncratic error term (since we do not know where it comes from) which represents the unexplained part of dependent variable for each observation, in other words for each bank for each quarter; ρ is the autoregressive coefficient and υ_t represents a white noise component.

There are two important reasons for specifying with a full set of time dummies (of course omitting the 1st period). Firstly, to model group-specific invariant but time-specific influences otherwise omitted from the model. This is particularly important to model the effects of global financial crisis, which affected all banks in our sample. Namely, a part of the model specification is to control for quarter by quarter changes in the global economic environment. Secondly, including time dummies allows us to address a developing concern in the econometric literature on panel analysis, and on dynamic panel analysis in particular: cross-group residual correlation. This is a serious issue largely neglected by applied researchers. Yet failure to address cross-group correlation may invalidate statistical inference (specifically standard errors are likely to be underestimated). The recommended strategy to remove, or at least to minimize, cross group correlation is to include a full set of time dummies (Wooldridge, 2008). Inclusion of time dummies was neglected in the previous empirical studies.

5.5 Estimation Results

Non-rejection of the CFRs (see Appendix 5.2) transforms the DLRM into an unobserved components model, which is static in the observables but dynamic in the unobservables (as in equation 5.2). This model requires a non-linear numerical estimator and it is implemented in its FE version as explained above (equation 5.2). This estimator is legitimate only, indeed if and only if, the CFRs cannot be rejected. In its essentials, the estimator proceeds by estimating the beta (β) coefficients in equation 5.1, then estimating the autoregressive coefficient ρ in equation 5.2, then re-estimating the β coefficients conditional on ρ, re-estimating ρ conditional upon the β coefficients and so on until iteration to stable estimates of both β and ρ is achieved.

By applying a panel AR (1) estimator, the errors are assumed to follow a first order autoregressive process. The diagnostic check for first-order serial correlation in the residuals (ρ= 0.71, substantially above the rule of thumb threshold of 0.3) suggests that taking into account the AR structure of the residuals should improve the estimation results significantly. The results from the fixed effects linear model with an AR (1) disturbance are presented in the following Table.

Table 5.4 Fixed effects linear model with AR (1) disturbance

VARIABLE NAME	ABBREVIATIONS	COEFFICIENT	t	p>|t|	HYPOTHESIS

Growth rate	GGDP L1.	-40.050	-1.56	0.122	Credit risk is pro-cyclical
Unemployment rate	UNEMP L1.	0.507	0.35	0.728	Deteriorates debtors capacity of repayment
Real weighted average lending rate	INTR	-8.614	-0.74	0.462	Affects the difficulty in servicing debt
Return on Assets	ROA L1.	0.009	0.18	0.856	"Bad Management"
Return on Equity	ROE L1.	-0.007	-0.52	0.604	"Bad Management"
Solvency Ratio	CAP L1.	0.060*	1.90	0.059	"Moral Hazard"
Loans to Deposit Ratio	LtD	-0.004	-0.57	0.570	"Moral Hazard"
Inefficiency	CIR	0.003**	2.19	0.030	"Bad Management"
Credit growth	CR	-0.012	-0.72	0.474	"Procyclical credit policy"
Dummy for 2nd year after the peak	D2Y	-0.053	0.06	0.954	"Procyclical credit policy"
Interaction	D2YGLOANS	0.078*	1.83	0.070	"Procyclical credit policy"
Market Power	Mshare	-0.344**	-2.12	0.035	"Market power"
Time dummies included but not reported					

Note: ** significant at 5%; * significant at 10%

Note: Time dummies are reported in Appendix 5.3

Looking at the estimation results, there is evidence of a substantial negative effect of GDP growth[39] on the incidence of non-performing loans in Montenegro, albeit approaches significance at the 10 per cent level (p=0.122). The lack of precision of this estimate may first and foremost be explained by the low number of observations on GGDP and the other macroeconomic variables (t=28 with no variation between banks`). Furthermore, as mentioned previously, the quarterly data for GDP growth rate were interpolated and thus might not accurately measure the actual changes in the GDP growth rate. Finally, the lack of precision of the estimate may also reflect multicollinearity between GGDP observations (derived from annual data) and time dummies. Evidence for this is provided by estimation without time dummies where the GDP growth coefficient is now marginally significant at the 10% level. According the these results, an increase of one percentage point in the GDP growth rate during the first quarter, leads to a decrease of 13.7 percentage points in the NPL ratio during the second quarter. All but one of the other variables had similar coefficients to

[39] However, considering that one standard deviation change in the growth rate of GDP (0.032) is associated with a marginal effect of GDP growth rate on the incidence of NPLs, the marginal effect of GDP growth has a plausible size.

those in the preferred model. The results of estimation without period times are provided in Appendix 5.4.

The other two macroeconomic indicators presented in Table 5.4, lagged unemployment rate and real lending interest rates are found to be statistically insignificant. One reason why the unemployment rate is statistically insignificant may be due to the inaccurate measuring of unemployment due to the registrant measure used and the large informal economy in Montenegro.

Focusing on bank-specific coefficients, the results partly comply with expectations with respect to the relationship between management quality and non-performing loans. Namely, one of the variables, CIR, used to test for the hypothesis of "Bad Management" is found to be statistically significant. In particular, using this variable in the model we have assumed that the quality of banks` management may be also reflected through the cost efficiency. Our results provide evidence that the inefficiency index, measured as a ratio of operating costs to operating income, has a positive and statistically significant influence on the incidence of NPLs. Specifically, an increase of one percentage point in the ratio of operating costs to operating income, at 5% significance level, leads to a slight increase of 0.003 percentage point in the NPL ratio during the first quarter. The other three variables (ROA, ROE, LtD) which were used to test the hypothesis of "Bad Management", are not significant. However, banks' risk attitude, seen through the solvency ratio, seems to have a positive and statistically significant influence on the incidence of NPLs. An increase of one percentage point in the solvency ratio in the first quarter leads to an increase in 0.06 percentage points in the NPL ratio in the second quarter, at the 10% significance level,. Thus, the "Moral Hazard" hypothesis cannot be rejected for the Montenegrin banking system. Finally, the variable Mshare, which represents the market share of the bank, has a negative, statistically significant impact on the incidence of NPLs. This finding, which is consistent with the "Market Power" hypothesis, can be interpreted to mean that relatively large banks might be more careful in approving loans and screening loan customers. Large banks might have more resources to build-up know how and technologies for high quality risk management. Hence, they may attract and/or select less risky borrowers.

In this Chapter, we paid special attention to modelling the effect of rapid past loans growth on the incidence of NPLs, implying that short sightedness amongst bank managers was present in Montenegro and that the aggressive lending coincides with more reckless risk taking. In particular, we were interested to investigate at which point this effect of past rapid loans growth might become evident. Thus, observing the interaction between the overall percentage change in loans growth from the beginning of the sample period to the peak of loans growth for each individual bank and the dummy for period after the peak (D2YGLOANS), the result suggests a positive and significant influence of past loans growth on the incidence of NPLs in the second year after the peak of loans growth. More precisely, at the 10% significance level, an increase of one percentage point in loans growth, prior to the peak (measured for each particular bank), leads to an increase in the ratio of NPLs of 0.08 percentage points, during the period five to eight quarters after the peak of loans growth. It is noteworthy that we find no contemporaneous effect of loans growth on NPLs. Yet, if we estimate in the absence of period dummies, we do find a statistically significant negative effect (see Appendix 5.4). This may suggest that this finding in previous studies reflects model misspecification arising from the omission of period dummies (Ranjan and Dhal, 2003; Dash and Kabra, 2010; Louzis et al., 2010; Nkusu, 2011; Beck et al., 2013).

While the main purpose of time dummies is to control for omitted group invariant, time specific effects and to address possible cross-group residual correlation, in this model they do have a plausible economic interpretation. The signs of the time dummies after the crisis period are uniformly positive and jointly significant, suggesting that the crisis has a positive influence on the incidence of NPLs, while the time dummies before the crisis are not jointly significant (see Appendix 5.3).

We have reported the results from a model which did not consider period dummies, in order to demonstrate how previous empirical studies not considering time dummies might be misspecified and most probably report spurious results. For example, the variable ROE is not statistically significant in our model specified with period dummies (equation 5.2), while it appears statistically significant in the misspecified model (Appendix 5.4). However, our variable of interest, the delayed effect of loans growth on NPLs, which becomes evident in the 5th to 8th quarter, has an even stronger effect when we include time dummies in the model.

5.6 Conclusion

In this Chapter we use a dynamic panel approach to investigate the determinants of the incidence of non-performing loans (NPLs) in the Montenegrin banking sector. In particular, we specify a dynamic linear regression model and test the common factor restrictions (CFRs). The non-rejection of the CFRs suggests estimation of a dynamic linear regression model in the form of an unobservable components model with fixed effects, which is static in the observables but dynamic in unobservables and which is estimated by a non-linear iterative procedure. Using data at the individual bank level we examine whether our proxy for the degree of banking distress is a function of macroeconomic developments and/or the unique difficulties of transition such as inadequate risk-assessment, excessive risk-taking or the high concentration of the banking system.

The empirical findings suggest that, ceteris paribus, a strong performance in the real economy results in a lower ratio of non-performing loans, albeit with borderline statistical significance. Bearing in mind the lack of precision of the estimate and the substantial size of the GDP estimate, which probably reflects not only the small number of observations on macroeconomic variables but also multicollinearity between GDP observations (derived from annual data) and time dummies, we cannot determine the precise size of the GDP effect on the incidence of non-performing loans.

The empirical results also indicate a delayed effect of credit growth on the incidence of non-performing loans. In particular, the results suggest a significant positive effect of past rapid loans growth on the incidence of NPLs that becomes evident in the second year after the credit boom, implying that persistent short-sightedness of banks` managers was present in Montenegro and that the aggressive lending during the boom phase coincides with more reckless risk taking. Furthermore, the Montenegrin bank-specific variables, such as cost inefficiency and solvency ratio, which are used to describe the quality of banks` management and their risk attitude, are found to have significant influence on the of NPLs.

Our findings have several implications for policy and regulation, these are more fully outlined in Chapter 7 but we briefly summarise them here. The supervisory authority should expand its monitoring framework to include both macroeconomic prudential and bank-specific indicators when assessing the stability of the banking system. In addition, regulators should become more concerned with a loosening of bank credit conditions in an upturn since our results suggest a delayed effect of loans growth on non-performing loans. Based on our findings, the supervisory authority could use the regression coefficients on the macroeconomic variables and bank-specific variables in their development of a credit risk model that can be used in Montenegro. This is of major importance, given that there is still no credit risk model for stress testing that links both macro and bank-specific variables in the Central Bank of Montenegro. Furthermore, based on the evolution of the dependent variables, we can anticipate the future behaviour of the NPL ratios and assess whether they present a threat to financial stability.

CHAPTER 6: Assessing the Determinants of the Quality of Loans in Central and East European Countries

Contents:

6.1 Introduction

In recent years, there have been a few multi-country studies of the determinants of bank credit risk (Espinoza and Prasad, 2010; Nkusu, 2011; Makri et al., 2011) but only one relating specifically to Central and Eastern Europe (Klein, 2013).[40] Most studies of bank credit have been for a single country, with attention being directed at banks in developed countries. This chapter will present a study of the factors contributing to the determinants of credit risk of commercial banks in a multi-country setting. The intention of this chapter is to provide a better insight into financial weaknesses in the economies of the CEE countries and hence to help design monitoring processes and systems which minimize the costs that could arise from banking instability. Since high NPLs are generally a source of concern for financial stability, an increase in their incidence can cause deterioration in the economic outlook for the region.

As seen in Chapter 3, the global financial crisis has left a legacy of high NPLs in many CEE countries, which, according to the Sirtaine and Rosenberg (2012) and Raiffeisen Research (2014), are a threat to the region's economic recovery. The purpose of this chapter is to investigate the factors affecting the non-performing loans ratios, as a measure of the quality of loans, in 16 countries of Central and Eastern Europe, from 1999 to 2011, which is the most recent period for which the data is available. Based on the existing literature, reviewed in Chapter 5, both bank-specific and macroeconomic factors are included as independent variables in the estimation of the determinants of the ratio of non-performing loans in CEE

[40] This study became available during the course of writing this Chapter.

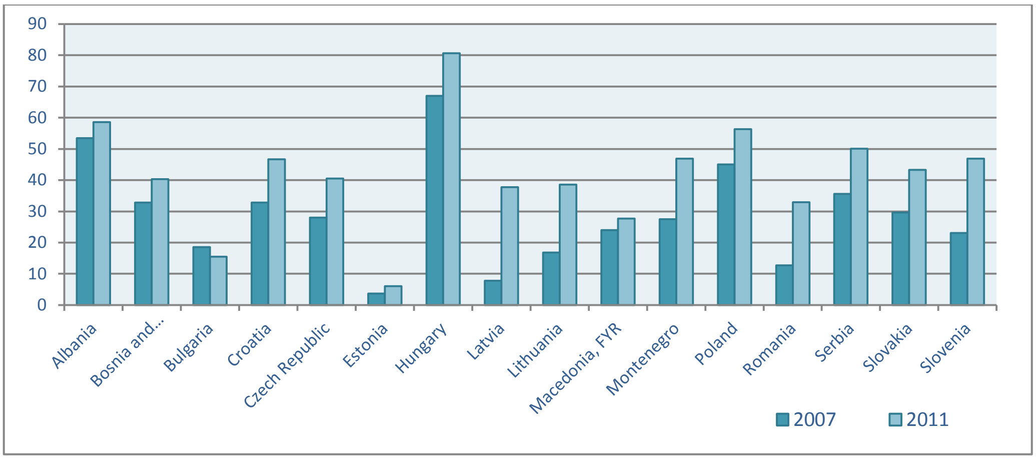
banks. Since we investigate the model for 16 countries, the previous chapter's model specification will be extended to control for variables that in the context of CEE countries may be expected to affect the incidence of non-performing loans. Such contextual variables can be included in a multicounty study but not in a single country study. Those additional variables are the exchange rate and level of public debt. Furthermore, our analysis in Chapter 3, suggests that the structure of banking sectors in CEE countries, particularly regarding ownership, had a moderating effect on the transmission of the global financial crisis to these countries. Thus, in this Chapter we investigate whether the foreign ownership of a bank has an impact on the incidence of non-performing loans. Thus, non-performing loans will be modelled to capture any differences between banks based on their ownership structure. Apart from information on ownership status, the characteristics of the home country of the parent bank may also affect the non-performing loans of a foreign-owned bank, therefore the origin of parent banks will be considered in modelling non-performing loans in CEE countries.

This chapter is organized as follows. Section 6.2 presents the methodology for modelling non-performing loans in CEE and extends the presentation of the macroeconomic and bank-specific indicators in CEE countries, which was introduced in Chapter 3. Section 6.3 provides explanation of the data used, descriptive statistics and an examination of the quality of the data. Section 6.4 investigates the appropriate econometric strategy for modelling macro and bank specific determinants of NPLs, followed in Sections 6.5 and 6.6 by a discussion of the empirical results. In Section 6.7 the results from the previous two sections are compared with Klein's (2013) findings. Subsequently, in Section 6.8 a model that applies the same empirical strategy as Klein for proxying the excessive lending effect on non-performing loans ratios will be presented. In the following Section, 6.9, we exclude the variables that Klein (2013) did not consider, in order to check whether that explains the differences in findings. In Section 6.10, we check whether our findings are biased by the unobserved propensity to report non-performing loans ratios. Finally, the conclusions of this Chapter are presented in Section 6.11.

6.2 Methodology and Empirical Consideration

From the theoretical perspective analysed in Sections 5.2.1 and 5.2.2 there are two sets of indicators that are commonly thought to explain the evolution of non-performing loans. First, the proportion of non-performing loans in total loans seems to be driven by macroeconomic developments that are likely to affect the borrowers' capacity to repay their loans. In order to capture the macroeconomic developments prevailing in CEE countries from 1999 to 2011, and how they affect loans quality, the GDP growth rate, the unemployment rate, the annual inflation rate and the nominal interest rate will be considered in the estimation process. As shown in Chapter 5 (see section 5.2.1), the NPL ratio is typically countercyclical, falling in business cycle upturns and rising in recessions. As also explained in section 5.2.1, the relationship between the ratio of NPLs with unemployment is expected to be positive and negative with real GDP growth. Furthermore, inflation may affect borrowers' debt servicing capacity through several channels and its impact on the proportion of NPLs can be positive or negative. Higher inflation can make debt servicing easier by reducing the real value of outstanding loans. However, when loan rates are variable, inflation is likely to reduce borrowers' loan servicing capacity as lenders adjust rates to maintain their real returns or simply to pass on increases in policy rates resulting from monetary policy actions to combat inflation (see section 5.2.1). Finally, in the case of nominal interest rates, the channel to non-performing loans is likely to work through a rise of debt service costs of borrowers, particularly if loan rates are variable (Louzis et al., 2010), which is the case in most of the CEE countries (Beck et al., 2013). Therefore, interest rates are expected to be positively related to the incidence of NPLs. Most of these macroeconomic developments have been presented in Chapter 3.

Bearing in mind that in this Chapter we investigate the model for 16 countries, the Montenegrin model specification will be extended to control for variables that in the context of CEE countries may be expected to affect the incidence of non-performing loans. In particular, we will consider the public debt and exchange rate. As expected in the period of crisis, most of the countries engaged in fiscal stimulus to alleviate the downturn. As a result, in 2011, the public debt is much higher than before the crisis. For instance, public sector debt exceeded 50 per cent of GDP in Albania, Poland, and Hungary in 2011 (see Figure 6.1).



Source: IMF WEO (October 2012)

Figure 6.1 Public debt as a % of GDP in CEE countries

The problem of over-indebtedness can be reflected in the banking sector by an increasing number of bad loans, as noted by Impavido et al. (2012). Makri et al. (2011, 2014) investigating NPLs in the Euro zone countries, stressed that fiscal problems in countries of the Euro zone might lead to a significant rise in problem loans. Indeed, they reported that outstanding public debt in the previous year has a positive influence on the NPL index in the current year. To a lesser extent, high public debt may adversely affect borrowers' wealth or income, thereby raising the likelihood that they would run into debt servicing problems (Nkusu, 2011). Namely, Guy and Lowe (2011) find that high public debt caused the Barbadian government to raise taxes, which is likely to reducing disposable income for its citizens and placing them in a worse debtor position. Bearing in mind the conditions of increased indebtedness in CEE and these recent studies, we will test for an effect of public debt on the incidence of NPLs in CEE.

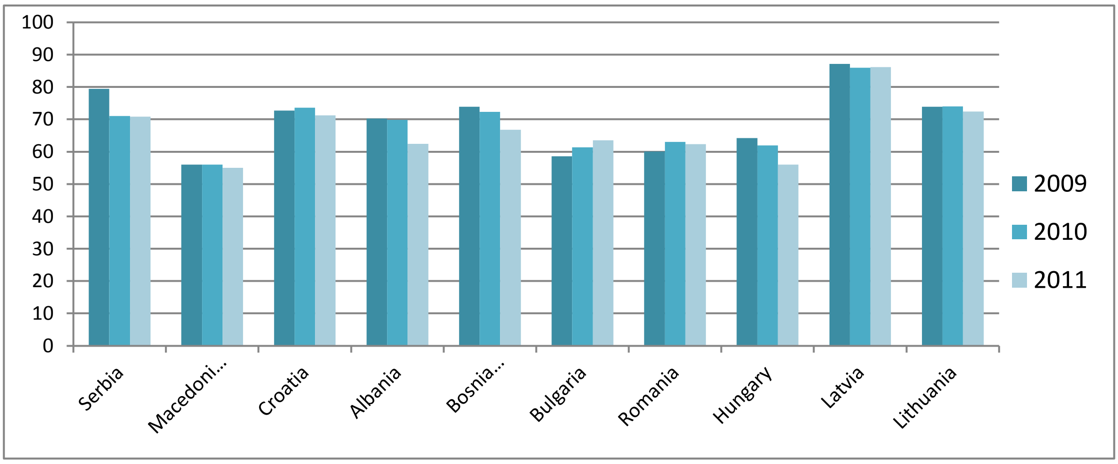
In addition to economic activity the exchange rate will be considered. The exchange rate will be included in order to capture any effect that a depreciation of the national currency (against the euro) had on the dynamics of NPLs in the CEE region. If the national currency depreciates the borrowers which have loans in foreign currency will have higher debt servicing costs, this can lead them to default and their loans classified as non-performing. In order to escape misunderstanding the depreciation is defined as an increase in exchange rate: namely, more units of domestic currency are required to purchase a given basket of foreign currencies. To avoid exchange rate fluctuations, most of CEE countries have fixed exchange rate systems or manage the float of their national currencies against the euro or US dollar. The exchange rate systems in CEE are presented in Table 6.1.

Table 6.1 Exchange Rate Systems in CEE at the end of 2010

Country	**Exchange Rate Arrangements**
Albania	De facto crawling band around US dollar
Bosnia and Herzegovina	Currency board/Peg to euro
Bulgaria	Currency board/Peg to euro
Croatia	De facto band around euro
Czech Republic	De facto crawling band around euro
Estonia*	Peg to euro/Currency board
Hungary	Crawling peg system
Latvia	De jure peg to euro
Lithuania	De facto band around the euro.
Macedonia	Managed float
Poland	Managed floating/de facto band around euro
Romania	Managed float/ De facto band around the euro.
Serbia	Managed float/De facto band around euro
Slovakia	Currency Union
Slovenia	Currency Union

* Euro starting January 2011.
Source: IMF official classification

According to the ECB (2011), exchange rate depreciation might have a negative impact on asset quality, particularly in countries with a large amount of lending in foreign currency to un-hedged borrowers. FX-denominated loans had been one of the drivers of fast lending expansion before the crisis (EBRD, 2010). As can be seen in Figure 6.2, in 2011 more than 70 per cent of total loans in Latvia, Lithuania and Serbia were denominated in a foreign currency. The share of FX loans also exceeds that of domestic currency loans in Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Macedonia and Romania.



Source: IMF Country Specific Reports

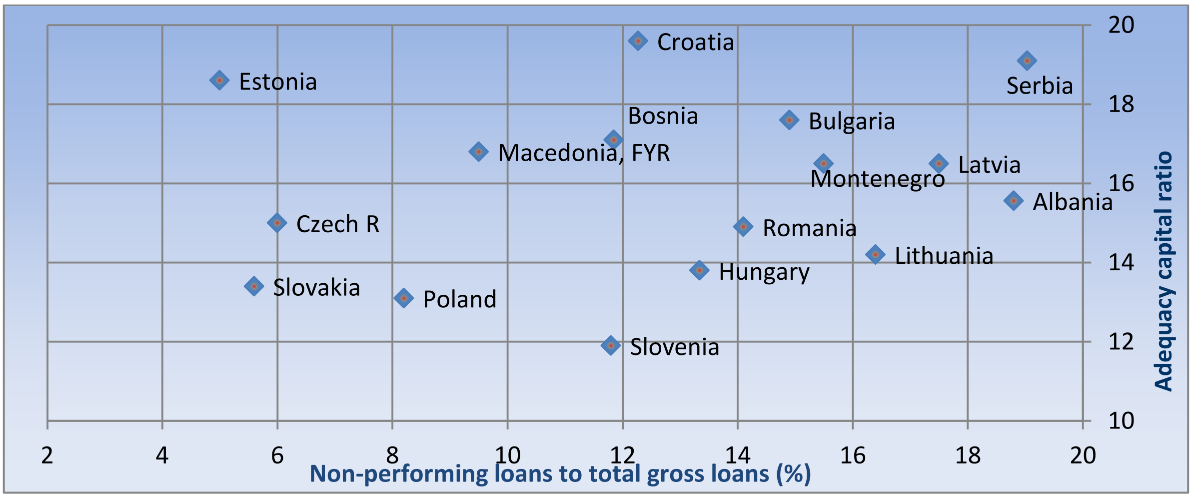
Figure 6.2 Foreign currency loans as a % of total loans in selected CEE countries from 2009-2011

According to the PFS research (2012) of foreign currency lending in CEE countries, lending in foreign currency may be advantageous to borrowers as the interest rates are generally much lower, however these loans carry increased repayment risks for both banks and borrowers. In particular, they find that the risks of FX-lending appeared to rise in 2008 and 2009 because the exchange rates in CEE countries moved in favour of the foreign currencies. Loan repayments, while stable in the foreign currency, grew in terms of local currency equivalents. Consequently, both banks and borrowers have suffered from these exchange rate movements. Since borrowers might not be able to repay their debts, banks might be exposed to a higher number of NPLs. Fofack (2005) reveals that changes in the real effective exchange rate had a positive impact on NPLs of commercial banks that operate in some Sub-Saharan African countries with fixed exchange rate regimes. The author argues that this result is due to the large concentration of loans to the export-oriented agriculture sector, which was adversely affected by the appreciation in the currency of these countries during the 1980s and early 1990s. Similarly, Khemraj and Pasha (2009) found that the exchange rate has a strong positive association with the levels of NPLs reported by commercial banks, suggesting that whenever there is a deterioration in the international competitiveness of the domestic economy (as reflected by an appreciation in the exchange rate) this translates into higher NPLs. So, currency movements may have opposing effects on NPLs, via currency mismatch and trade effects. If so the overall effect might turn out not significant.

Following the practice prevalent in the empirical literature, we did not include the composition of capital flows in our model specification, but we do not exclude the possibility of including them in future work. In this phase we have concentrated on examining the influence of the GDP growth rate, inflation rate, unemployment rate, nominal short-term interest rate, exchange rate and public debt, on the incidence of NPLs. Namely, using GDP growth rate in our model specification we test for the aggregate influences of the economy on the incidence of NPLs. Furthermore, we include the leading economic indicators (inflation rate, unemployment rate, exchange rate, etc.) which are commonly used by policymakers to predict the economy's future.

A second strand of the literature focuses on indicators, such as the quality of management and operational decisions, attributing the level of non-performing loans to bank-level factors. Similar to the Montenegrin model, the following bank-specific variables will be included in the CEE model: return on assets, return on equity, capital adequacy ratio, loans to deposit ratio, cost to income ratio, credit growth and market share of banks` assets. Respectively, these are used to test the hypothesis of "Bad Management", "Moral Hazard", "Good Monitoring", "Procyclical Credit Policy" and "Market Share". An explanation of these variables was presented in section 5.2.2 and in section 6.4 we will analyse the recent developments of some bank-specific variables in CEECs which will be used to test the above mentioned hypothesis.

As mentioned in section 5.2.2, high NPLs ratios may give rise to financial stress, especially if banks' provisioning is inadequate, their capital buffers are low, and further NPL rises are in the offing. Outright losses can arise that weaken banks' capital base, potentially giving rise to insolvency or illiquidity. However, a comparison of capital adequacy ratios with the share of NPLs to total loans in the CEE context, see Figure 6.3, suggests that banks have provided a sufficient amount of capital to cover possible losses. Banks capital adequacy ratios in the CEE region were substantially higher compared to the minimum required by their countries' regulators (that is approximately 10%). However, the capital adequacy ratios were not always higher than NPLs in some CEE countries (e.g. Albania).

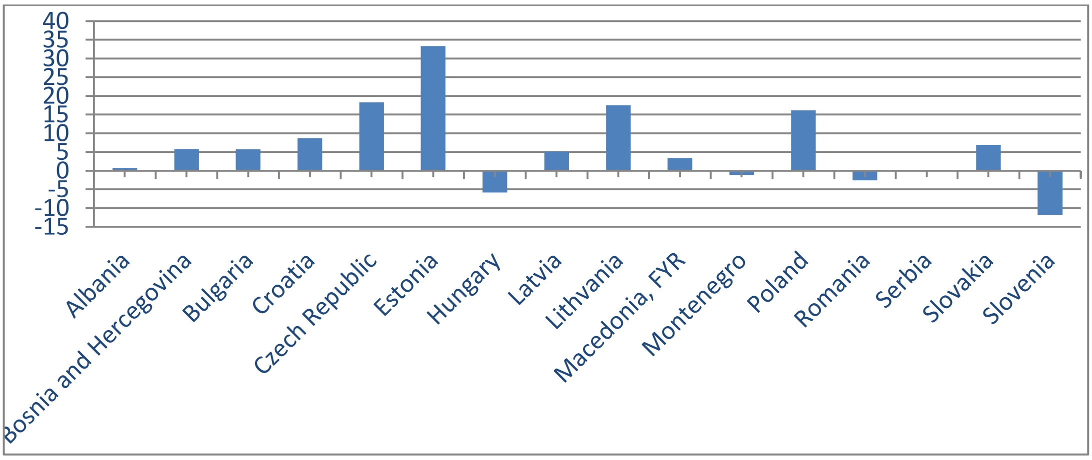


Source: IMF, Financial Soundness Indicators (2012)

Figure 6.3 Non-performing loans and adequacy capital ratios for CEE countries in 2011

While relatively high bank capitalization in CEE countries provides considerable buffers, according to Sirtaine and Rosenberg (2012) the high level of NPLs may still present an obstacle to economic recovery and a considerable stress on the financial sector, particularly if economic growth remains weak or these economies slip back into recession.

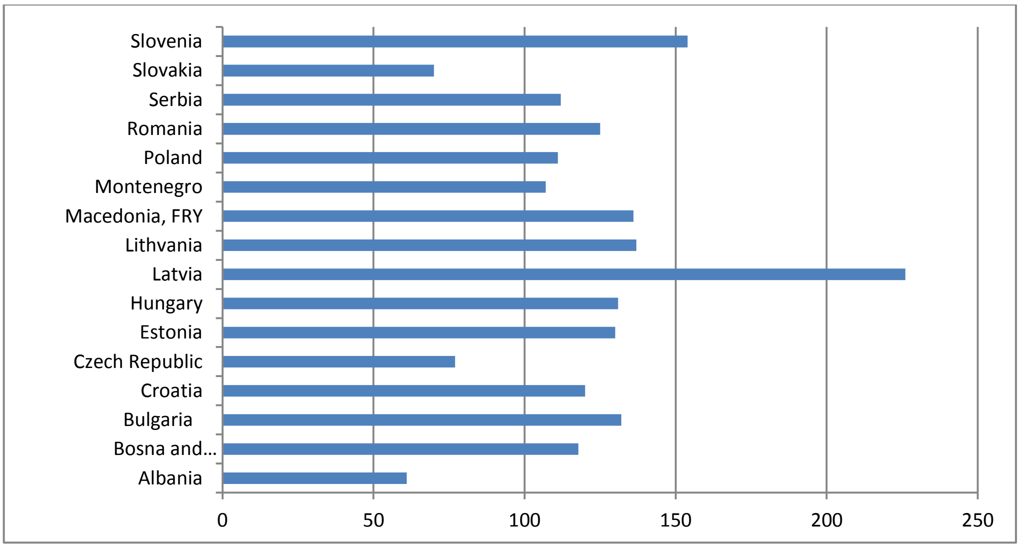
With the global financial crisis, the overall bank profitability has fallen in the CEE region. The return-on-equity declined from an average of 16 per cent in 2007-2008 to almost 10 per cent in 2011 (Mucci et al., 2013). However, there were large differences between countries, and the banking sector in Hungary, Montenegro, Romania and Slovenia reported overall negative returns on their equity (see Figure 6.4). SEE countries emerge on average with a much lower profitability, having a return-on-equity below 5 per cent.



Source: IMF, Financial Soundness Indicators (2012)

Figure 6.4 Return on equity (ROE) in CEE countries in 2011

As mentioned in section 5.2.2, an important factor determining the stability of a country's banking sector is the relation between loans and deposits. In general, if the ratio is below 100% it means that credits are financed from domestic savings. A ratio of above 100% responds to an increase in funding uncertainty (Ritz, 2010), suggesting that the new additional loans will probably be financed by borrowing money from abroad. However, that makes them extremely vulnerable to the situation in the global financial markets and creates a major risk for a country's banking sector in the case of increased global turmoil. The banking sector's situation may be assessed from that point of view as relatively resilient only in the case of Albania, the Czech Republic and Slovakia, and – to a certain degree – in Montenegro, Poland and Serbia (Figure 6.5). In contrast, the loans to deposits ratio remained dangerously high in Latvia and Slovenia.



Source: EBDR and central banks of the mentioned countries

Figure 6.5 Loans to deposit ratio in CEE banking systems at the end of 2011 (%)

In addition to macroeconomic and bank-specific indicators, the ownership structure of banking sectors will be considered in the CEE model of NPLs. Namely, non-performing loans will be modelled to capture any differences between banks based on their ownership structure. In order to distinguish between foreign and domestic owned banks we have created the dummy variable "Foreign", which takes the values of 1 if the bank is foreign owned (foreign-owned banks are defined as those with foreign ownership exceeding 50% in year t) and 0 otherwise. As discussed in Chapter 3, foreign banks in the CEE region helped to create macroeconomic imbalances and over-indebtedness but also in the crisis supported their subsidiaries with capital infusions, especially through the private-public co-operation and the international financial institutions' coordination mechanisms (such as the Vienna Initiative).

Since the crisis started, the debate about the effects of foreign bank ownership has become more nuanced as foreign banks can transmit home-country shocks. These developments have led to an increased demand among policy makers and interest among academics for more analyses of the pros and cons of banks foreign ownership. According to one strand of the literature, foreign ownership has been accepted as an important driver in improving bank performance and reducing risk taking. Levine (1996) argues that foreign shareholding leads to improved financial services and easier access to international financial markets. The presence of foreign banks may also contribute to a country's attractiveness to foreign direct investments (Brealey and Kaplanis, 1996). Moreover, foreign banks can contribute to alleviating some of the problems associated with underdeveloped markets, increasing credit availability to the private sector. In particular, De Haas and Van Lelyveld (2002) analysing banks ownership in ten CEE countries, find a positive relationship between the market share of foreign banks[41] and private sector credit growth. Empirically, various studies reported a beneficial impact of foreign ownership on banks' outcomes: non-performing loans; bank performance and efficiency. Accordingly, Boudriga et al. (2010) analysing 46 banks in 12 countries over the period 2002-2006 find that, among bank specific factors, the degree of foreign participation from developed countries reduces the non-performing level. Micco et al. (2004), Lensink and Hermes (2004) and Bonin et al. (2005) argue that foreign bank entry to less developed markets is important in improving efficiency, skills and technologies and bank performance; therefore it leads to a lower number of non-performing loans.

However, some economists identify possible adverse effects of such foreign participation. More recently, the financial crisis that originated in high-income economies, and which has spread rapidly to developing economies through investment, has put into question the desirability of foreign banks dominating the banking system in the latter countries. Martinez-Peria et al. (2002) analysing claims from seven "lender" countries on ten "borrower" countries in Latin America, argue that an economic downturn in the country of the foreign bank may cause a bank to reduce its operations in other countries. Although, De Haas and Lelyveld (2002) find a positive relationship between foreign banks and private sector credit growth in Central and East European countries', they find that foreign banks reduce their credit activity in the host countries if their home country experiences a crisis. Furthermore, Popov and Udell (2010) suggest that foreign banks may transmit a large portion of financial shocks from their origin countries to host countries in CEE. Claessens and Van Horen (2012) analyse the risks associated with cross-border banking and foreign banks presence. They report that during the global crisis foreign banks reduced credit by more when compared to domestic banks, except when they dominated the host banking systems. Namely, they explain when a foreign bank is dominant in one country, that bank tends to focus on maintaining its dominant position and does not, disproportionately, reduce credit.

As mentioned earlier the macroeconomic environment of the country of the parent bank may affect the performance of foreign banks. Claessens and Van Horen (2009) found that foreign banks performed better (in term of efficiency and profitability) than domestic banks, if their parent bank was from a more developed country. They also reported that foreign bank have

[41] They consider a foreign bank a bank where foreign shareholders own a majority of outstanding shares.

better performance if the geographical, cultural and institutional distance to their origin is small. Furthermore, De Haas and Van Lelyveld (2010) find that foreign banks are not adversely hit by systemic banking crises in the host countries, because these banks have a different structure of assets and liabilities than domestic banks. Thus, apart from information on ownership status, the specific origin or home country of the parent bank may also affect the profitability and efficiency of its subsidiaries, as suggested by Sturm and Williams (2008), Havrylchyk and Jurzyk (2011) and Claessens and van Horen (2009, 2012). In order to check whether the country of origin of the parent bank has an impact on the quality of loans of their subsidiary bank, foreign-owned banks are in the analysis presented below divided into sub-samples of banks originating from the EU12 countries[42], the countries of the "Southern Enlargement"[43], the US and Switzerland, CEE countries, Russia and Turkey. The reason for this classification was to differentiate between parent banks from countries with different levels of development and that have suffered differently from their exposure to the global financial crisis.

6.3 Data Analysis

A large number of studies have examined loans quality in groups of countries using aggregate data (for example Boudriga et al., 2010; Espinoza and Prasad, 2010; Nkusu et al., 2011; Makri et al., 2011). A certain number of studies examine individual banks from a particular country (for example Fernandez de Lis et al., 2000; Jimenez and Saurina, 2005; Louzis et al., 2010; Cotugno et al., 2010). However, there are few studies that use individual bank data from several countries. The objective in this chapter was to collect bank level data and macro data from 16 countries in Central and Eastern Europe for the longest possible period. The countries considered are: Albania, Bosnia and Herzegovina, Bulgaria, Czech Republic, Croatia, Estonia, Hungary, Latvia, Lithuania, Montenegro, FYR of Macedonia, Poland, Romania, Serbia, Slovenia and Slovakia. In this context, as presented in Table 6.2, the sample consisted of a panel of 334 banks for the period 1999-2011. To be included in the final

[42]The EU 12 includes the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Sweden and the United Kingdom.

[43] Since the debt crisis in Southern European Eurozone members (Spain, Portugal and Greece) had been aggravated over the last few years, there is a greater risk that banks coming from these countries may become insolvent.

sample, a bank had to be classified as a commercial bank and data for all the variables had to be available for that year.

Table 6.2 Number of commercial banks by countries in the sample

Country	**Number of banks**	**Country**	**Number of banks**
Albania	11	Lithuania	10
Bosnia and Herzegovina	20	FYR Macedonia	15
Bulgaria	22	Montenegro	11
Croatia	36	Poland	43
Czech Republic	24	Romania	28
Estonia	7	Serbia	31
Hungary	17	Slovak Republic	15
Latvia	25	Slovenia	19
		Total	**334**

Source: Bankscope data set

In Table 6.3 we record how many banks reported their NPLs by country and year. We notice that many banks avoided reporting NPLs, in particular in the first year of our sample period. This potential problem will be discussed in more details in section 6.10.

Table 6.3 Number of dependent variable observations by country and year

Country/Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Albania	1	1	1	1	3	4	2	2	7	7	8	8	8	53
Bosna and Herzegovina	5	5	4	4	7	6	6	8	8	10	12	14	13	102
Bulgaria	1	1	1	3	3	3	4	11	14	16	18	17	14	106
Croatia	11	13	13	10	11	13	17	15	20	19	20	18	17	197
Czech Republic	7	7	7	7	8	13	15	13	14	15	14	13	13	146
Estonia	0	1	2	2	2	3	4	5	4	5	5	4	4	41
Hungary	4	6	5	5	6	6	7	7	5	7	7	9	9	83
Latvia	5	5	4	4	5	5	7	9	11	16	17	16	16	120
Lithuania	3	3	3	3	4	3	5	7	8	8	8	9	8	72
Macedonia, FYR	3	3	3	2	2	2	2	2	10	13	11	9	8	70
Montenegro	0	0	0	0	0	9	9	9	10	11	11	11	11	81
Poland	11	12	9	10	11	15	16	16	16	21	24	23	22	206
Romania	5	8	6	5	5	4	4	10	15	15	17	18	15	127
Serbia	3	4	2	5	10	8	5	6	4	8	11	8	6	80
Slovakia	5	5	7	7	7	7	6	8	11	13	11	8	7	102
Slovenia	7	7	8	6	5	4	9	11	11	14	14	13	14	123
Total	71	81	75	74	89	105	118	139	168	198	208	198	185	1,709

Source: Bankscope dataset

The macro data (GDP growth rate, inflation rate, unemployment rate and public debt) used in this study was collected from the World Economic Outlook (WEO) and the World Bank database, while data for the exchange rate against the euro and nominal short-term interest rates were collected from International Financial Statistics (IFS) and from central banks` websites (for the missing countries in the IFS database). The bank specific data was collected from Bankscope.[44]

The correlation matrix (in Appendix 6.1) shows that the size of correlation between NPL and other variables is not very high. The ratio of NPLs exhibits a positive correlation with the rate of unemployment, public debt, interest rate, capital adequacy ratio, loan to deposit ratio and cost to income ratio, while being negatively correlated with real GDP growth, the exchange rate, return on assets, and return on equity, credit growth and market share. In contrast to the initial expectations, the inflation rate is negatively correlated with the ratio of NPLs.

The CEE region is characterised by substantial heterogeneity. For example, some CEE countries may be regarded as advanced economies, such as the Czech Republic, Slovakia and other EU members, fairly close to the conditions prevailing in more mature economies, while others, such as Western Balkan countries are more typical of emerging markets (see Raiffeisen Research, 2012). To control for such country-specific effects, in particular for the cultural and institutional characteristics, country dummies will be included in the estimation. The inclusion of these dummy variables in the model should enable efficient estimation of the parameters. Furthermore, in order to control for time-specific effects the model specification will include time dummies.

Macroeconomic variables show high variability across time and countries, as can be seen in Table 6.4. For instance, as reported by Klein (2013), high double-digit levels of inflation were recorded in Serbia and Romania in late 1990s and early 2000s, while deflation rates were evident in the period of crisis (Bosnia and Herzegovina, Estonia, and Latvia).

[44] Bankscope is the best available dataset, providing bank level data for many countries around the world. Bankscope collects annual reports and financial statements from individual financial institutions and due to the maintenance of a uniform accounting convention provides globally comparable indicators. It is widely used within the business community and, more recently, by academic scholars.

Table 6.4 Descriptive statistics for macro variables (in %)

Variable	Variable Label	Observations	Mean	Std. Dev.	Min	Max
GDP growth rate	GDP	2939	3.445	4.249	-17.729	11.154
Inflation rate	INF	2933	5.893	8.522	-1.224	80.601
Unemployment rate	UNEMP	2930	13.902	7.787	4.298	37.251
Public debt (% of GDP)	DEBT	2832	36.655	20.054	3.685	241.653
Exchange rate (against Euro)	EXCR	2941	31.151	62.227	0.559	280.331
Interest rate	INTR	2926	7.659	8.252	0.548	74.208

Source: Bankscope dataset

The descriptive statistics for the bank specific variables used in this empirical analysis are presented in Table 6.5.

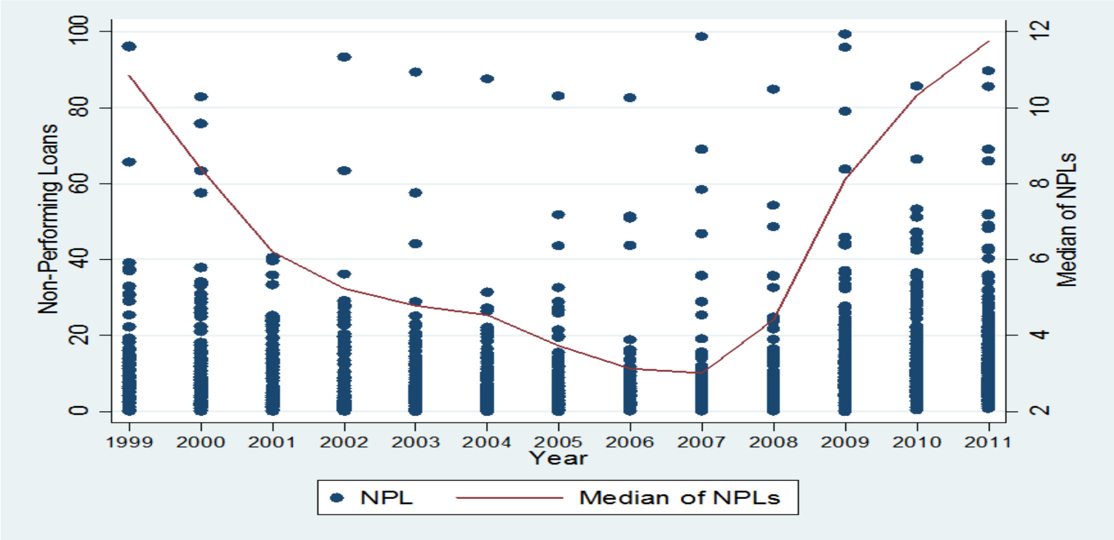
Table 6.5 Descriptive statistics for bank-specific variables (in %)

Variable	Variable Label	Observation	Mean	Std. Dev.	Min	Max
Non-performing loans in total loans	NPL	1709	10.353	12.867	0	99.470
Return on assets	ROA	2917	0.695	3.124	-29.010	36.520
Return on equity	ROE	2917	5.871	31.215	-351.060	570.171
Credit growth rate	CR	2724	29.953	60.403	-100.000	850.000
Capital adequacy ratio	CAP	1985	21.281	21.269	0.990	393.850
Loans to deposit ratio	LTD	2844	122.470	111.536	0.000	988.800
Cost to income ratio	CIR	2910	72.477	45.775	0.000	1165.510
Market share	Marketshare	2889	6.794	10.097	0.017	80.149

Source: Bankscope dataset

The number of observations of the dependent variable, NPL, is smaller than those for the other variables. As mentioned earlier, some banks used to avoid presenting their data on asset quality in Bankscope. The potential bias that can arise from the self-selection of banks into our sample will be addressed in Section 6.10. Looking at the dependent variable, a large disparity between countries is present. Regarding the indicators of profitability, the minimum value of both the ROA and the ROE displays a negative sign, while the ROE records a relatively high disparity between countries.

The evolution of the NPLs ratios, presented in Figure 6.6, indicate that they varied significantly over time and between banks. The left-hand axis measures the percentage of NPLs for each bank. The right-hand axis measures the median percentage of NPL for all 334 banks in the data set. Each dot/year represent a bank/year.



Source: Bankscope

Figure 6.6 Evolution of banks` non-performing loans from 1999-2011

Figure 6.6 also shows that deterioration in the banks' assets quality has occurred since the beginning of the financial crisis in the balance sheets of most of the banks (see the median line).

The quality of NPL Data

As mentioned in Chapters 2 and 5, NPLs data are difficult to interpret, since there is no internationally accepted definition of a non-performing loan. The definitions differ by country, since national supervisors follow different definitions for classifying loans (Laurin and Majnoni, 2003; Moody's Investor Service, 2003; and Barisitz, 2011). There is, however, some convergence of opinion on this issue. The definition of non-performing loans, summarized from paragraphs 4.84-4.85 of the IMF's Compilation Guide on Financial Soundness Indicators 2004 (Guide) is:

A loan is non-performing when payments of interest and/or principal are past due by 90 days or more, or interest payments equal to 90 days or more have been capitalized, refinanced, or delayed by agreement, or payments are less than 90 days overdue, but there are other good reasons—such as a debtor filing for bankruptcy—to doubt that payments will be made in full.

According to Impavido et al.'s (2012) survey, all but one of the countries in our sample (Lithuania) apply the 90-day overdue threshold and report the total amount of defaulted loans as non-performing, though practices regarding the treatment of collateral, restructured loans, criteria other than the overdue period, and multiple loans by the same defaulted borrower vary widely.

Bankscope, a commercial provider of data from bank statements, provides the level of "impaired loans" as a proxy for non-performing loans. It should be mentioned that "impaired loans" may be different than the official classification of non-performing loans. Namely, "impaired loans" is an accounting term[45], which reflects cases in which it is probable that the creditor will not be able to collect the full amount that is specified in the loan agreement, while NPL is a regulatory concept, which primarily reflects loans that are more than 90 days past due. International Accounting Standard 39 (paragraphs 58-70) specifies that objective evidence is required for a loan to be impaired and that the total amount of loan value should be reduced for impairment losses. When a loan is impaired, it should be placed on non-accrual status, i.e. interest should not be accrued on such loans in the income statement of the lender. Impaired loans might be a better measure of asset quality than non-performing loans, as they are more comparable between countries and less prone to regulatory discretion. Acknowledging these differences, "impaired loans" are used as a proxy with NPLs in the following analysis.

6.4 Estimation Procedure

As previously mentioned, a panel approach will be used. Combining time series and cross-section observations, panel data provides data that are more informative, possess more variability, more degrees of freedom, less collinearity among variables and more efficiency (Gujarati, 2004). Following the discussion in section 6.2, we base our empirical analysis on the following equation

$$\begin{aligned} NPL_{i,t} = {} & \beta_{0i} + \hat{\beta}_1 GDP_{i,t} + \hat{\beta}_2 INF_{i,t} + \hat{\beta}_3 UNEMP_{i,t} + \hat{\beta}_4 DEBT_{i,t} + \hat{\beta}_5 EXCR_{i,t} + \hat{\beta}_6 INTR_{i,t} + \hat{\beta}_7 ROE_{i,t} \\ & + \hat{\beta}_8 ROE_{i,t} + \hat{\beta}_9 CR_{i,t} + \hat{\beta}_{10} CAP_{i,t} + \hat{\beta}_{11} LTD_{i,t} + \hat{\beta}_{12} CIR_{i,t} + \hat{\beta}_{13} Marketshare_{i,t} + \hat{\beta}_{14} Foreign_{i,t} \\ & + \hat{\beta}_{15} Dummy\_EU12_{i,t} + \hat{\beta}_{16} Dummy\_SouthernEnlarg_{i,t} + \hat{\beta}_{17} Dummy\_CEE_{i,t} \\ & + \hat{\beta}_{18} Dummy\_USAandCH_{i,t} + \hat{\beta}_{19} Dummy\_RU_{i,t} + \hat{\beta}_{20} Dummy\_TR_{i,t} + \lambda_t + C_i + \eta_i \\ & + \varepsilon_{it} \quad (6.1) \end{aligned}$$

[45] Impairment is a specific term used in the International Accounting Standard 39 and by the Basel Committee on Banking Supervision.

Where $NPL_{i,t}$ is the ratio of non-performing loans to total gross loans. $GDP_{i,t}$ is the annual percentage growth rate of $GDP_{i,t}$, $INF_{i,t}$ is the annual average inflation rate, $UNEMP_{i,t}$ is the unemployment rate, $DEBT_{i,t}$ is the public debt to GDP ratio, $EXCR_{i,t}$ is exchange rate and $INTR_{i,t}$ is short term interest rate. Looking at bank-specific variables: $ROA_{i,t}$ is the return on assets, $ROE_{i,t}$ is the return on equity, $CR_{i,t}$ is the credit growth, $CAP_{i,t}$ is the capital adequacy ratio, $LtD_{i,t}$ is the loans to deposit ratio and $CIR_{i,t}$ represents the cost to income ratio. $MarketShare_{i,t}$ represents a share of a bank`s assets in the total banking assets of the country. $Foreign_{i,t}$ is a dummy variable where a value of 1 represents a 51% or more foreign-owned banks and value 0 represents majority domestic-owned banks. As explained in Section 6.2, the $Dummy\_EU12_{i,t}$ is a dummy variable where a value of 1 indicates that the origin of the parent bank is within the EU12, Similarly the $Dummy\_SouthernEnlargement_{i,t}$ indicates that the origin of the parent bank is in a "SouthernEnlargement" country: $Dummy\_CEE_{i,t}$ that the parent bank is in CEE; $Dummy\_USAandCH_{i,t}$ the parent bank is from USA or CH; $Dummy\_RU_{i,t}$ the parent bank is from Russia and, $Dummy\_TR_{i,t}$ from Turkey.[46] The equation also includes a set of time (λ_t) and country (C_i) dummies and where η_i are the unobserved individual bank effects; and ε_{it} are the error terms. Note that i=1…n denotes the individual bank and t=1…T the year.

As a starting point, we investigate a static model that takes advantage of asymptotic theory (see Appendix 6.2.1). In addition, we estimate a static fixed effects model in first differences, intended to capture short-run movements in the NPL ratio. However, the diagnostic tests reveal that our static model is misspecified. In particular, we find evidence of pronounced serial correlation (see Appendix 6.2.1). Consequently, the analysis is extended to a dynamic setting. In addition, bearing in mind previous empirical studies (e.g. see Salas and Saurina, 2002; Louzis et al., 2010; Espinoza and Prasad, 2010; Blanco and Gimeno, 2012; Beck et al. 2013), it is expected that some degree of persistence may exist in the evolution of NPLs. Therefore, the static model is misspecified due to the omitted dynamics that would result in biased and inconsistent estimates. Furthermore, the dynamic specification is suitable for testing the hypotheses formulated in section 6.2 regarding the bank-specific determinants of NPLs.

[46]The rational for the inclusion of these dummies is explained in Section 6.2.

The main feature of a dynamic panel data specification is the inclusion of a lagged dependent variable in the set of regressors, as shown below:

$$y_{it} = \hat{\alpha} y_{i,t-1} + \hat{\beta} x'_{it} + \eta_i + \varepsilon_{it}, \quad \alpha < 1, \quad i = 1, \ldots, N, \quad t = 1, \ldots, T \qquad (6.2)$$

where each observation is indexed over i cross-section groups (banks) and t time periods (13 years), $y_{i,t-1}$ is the first lag of the NPLs, x'_{it} is $k \times 1$ vector of explanatory variables other than $y_{i,t-1}$, and the error term is composed of the η_i, which are the unobserved bank specific effects, and the ε_{it}, which are the observation specific – idiosyncratic - error terms. $\hat{\alpha}$ is a coefficient to be estimated and $\hat{\beta}$ a $1 \times k$ vector of coefficients to be estimated. The lagged dependent variable, y_{it-1} is correlated with the compound disturbance, ($\eta_i + \varepsilon_{it}$), because the same bank-specific effect, η_i, enters the equation for every observation in group i (Greene, 2003, p. 308). Hence, in order to calculate consistent estimates in the presence of lags of the dependent variable, we employ the Generalized Method of Moments (GMM) "system" approach as proposed by Arellano-Bover (1995) and Blundell and Bond (1998) and operationalised as a programme for Stata (xtabond2) by Roodman (2006). Roodman (2006) notes this is the proper approach for situations with "small T, large N" panels, meaning few time periods and many individuals; with independent variables that are not strictly exogenous, meaning correlated with past and possibly current realizations of the error; with fixed effects; and with heteroskedasticity and autocorrelation within individuals" (p.1). A main advantage of all GMM dynamic panel models is that the procedure for handling the endogeneity of the lagged dependent variable may be applied to all potentially endogenous variables in the model: in GMM dynamic panel estimators "predetermined or endogenous variables are handled analogous to the dependent variable" (StataCorp, 2007, p.83).

The reason for usage of the Arellano and Bover (1995) and Blundell and Bond (1998) model, (Roodman, 2005) can be explained as follows. A problem with the original Arellano and Bond (1991) estimator is that lagged levels are often poor instruments for first differences, especially for variables that are close to a random walk. Arellano and Bover (1995) described how, if the original equation in levels were added to the system, ***additional moment conditions*** could be brought to bear to increase efficiency. In these equations, predetermined and endogenous variables in levels are instrumented with suitable lags of their own first differences. The Arellano and Bover (1995) estimator thus uses more moment conditions: ***both*** predetermined and endogenous variables in first differences instrumented with suitable lags of their own levels (used by Arellano and Bond, 1991); ***and*** predetermined and endogenous variables in levels instrumented with suitable lags of their own first differences.

With more moments, more information is used in estimation with consequent increase in efficiency (Bond, 2002, p.17). Furthermore, Roodman (2006, p. 30) explains that differencing within groups must remove all variables that are constant. In that case "system" GMM estimation has an advantage in that it can include time invariant regressors, which disappear in the "difference" GMM approach developed by Arellano and Bond (1991). Even though time invariant regressors are differenced out of the differenced (transformed) equations in the system, they remain in the levels (untransformed) equations in the system. Finally, with system GMM we obtain more valid instruments in the presence of random-walk processes. Roodman (2006, p.28) explains that for random walk-like variables, past changes may indeed be more predictive of current levels than past levels are of current changes, so the new instruments are more relevant. Bearing in mind the incidence of random walk statistical generating mechanisms in macroeconomic variables, this is likely to be a significant advantage of the system over the difference GMM estimator.

To implement the system GMM model we will use ***xtabond2*** that "make available a finite-sample correction to the two-step covariance matrix derived by Windmeijer". Allowing for dynamics in the model seems to be important for getting consistent estimates. Therefore, we proceed with a dynamic NPLs model (see Appendix 6.2.2). Applying GMM we account for potential endogeneity arising from the lagged dependent variable and the weakly exogenous variables. Using appropriate instruments for the endogenous variables one can overcome the endogeneity problem. Under this approach, the lagged bank-level variables were modelled as pre-determined (thus instrumented GMM-style in the same way as the lagged dependent variable), while the macroeconomic variables were treated as strictly exogenous (instrumented by themselves as "IV style" instruments; see Roodman 2009a). However, a model with one or more lags of the dependent variable together with several endogenous variables will generate a large number of instruments (see Appendix 6.2.2.1). It is worth mentioning that with increases in the number of lags of the dependent variable and in the number of potentially endogenous variables to be instrumented in "gmmstyle", the sign and statistical significance of the variables of interest in the NPLs model do not change substantially and the diagnostic tests are still valid.

Too many instruments can overfit endogenous variables and fail to expunge their endogenous components. Moreover, ***xtabond2*** issues a warning when the number of instruments may be large relative to the number of observations, in which case the instruments may be invalid. In addition, in all our model specifications the diagnostic test m2 indicates that there is no second order serial correlation among the differenced residuals and the heteroskedasticity-robust Hansen test of the over-identifying restrictions suggests that the instruments are valid. The t statistic is greater than 0.25 and does not approach 1.0, which correspond to the guidelines suggested by Roodman (2009a). Therefore, the H0: the restrictions are sufficiently close to zero cannot be rejected, since the test statistics are smaller than the chi-square critical values at all levels of significance in all ours specifications.

According Roodman (2009b) and Mehrhoff (2009), there are three ways to limit the instruments count while minimizing loss of identifying information. First, it is suggested to r*estrict the lag ranges* that are used in generating these instrument sets. The second way to limit the instruments is to use the “collapse” command available in ***xtabond2***. In the “Help” manual the collapse command is explained as follows:

> *The collapse suboption of gmmstyle() specifies that xtabond2 should create one instrument for each variable and lag distance, rather than one for each time period, variable, and lag distance.*

The GMM instrument matrix includes “one column for each time period and lag available to that time period” (Roodman, 2009a, p.108). Conversely, when using “collapse” to reduce the instrument set, we do not create a whole matrix of instruments but, instead, a single column vector of instruments, which means that there is only one instrument for all time periods. Consequently, with the instrument set “collapsed”, there is only one moment condition.

The third way is to apply Factor Analysis or Principal Components Analysis (PCA) to the "GMM"-style instruments. Technically, PCA is applied to de-meaned variables. However, ***xtabond2*** computes the retained components as linear combinations of the original instruments, not the de-meaned ones. This is because de-meaning subtracts a constant from an instrument. If the constant is itself an instrument, this does no harm, but it might not be, in which case the identifying assumptions would be materially changed. When using PCA in System GMM, Roodman (2012) recommends using "gmm(X, eq(diff)) gmm(X, eq(lev))" instead of "gmm(X)". Namely, Arellano and Bover 1995, gmm(X) will generate the quadratically-numerous-in-T, "exploded" set of instruments based on X for the differenced equation, but only generate a linearly numerous set of instruments for the levels equation (those for the shortest lag depth used). It could generate the full, exploded set for the levels equation too, but the additional instruments would be mathematically redundant, containing no new identifying information. However, they would not be formally collinear with the normally retained instruments. Therefore, Roodman suggests when doing PCA it is better to start with a symmetric instrument set, and let the PCA algorithm pare it down from there.

All three of the suggested ways to reduce the number of instruments have been used (see Appendix 6.2.3). In order to yield more acceptable diagnostics from a reduced number of instruments, we experimented, with lag levels, the collapse command, and the PCA approach. As yet, there is no consensus as to how to achieve the optimum instrument set. The results are reported in the following section.

6.5 Model 1- Results

In order to avoid a misunderstanding of the independent variable influences on the incidence of NPLs, here and throughout the rest of this Chapter, a negative sign on the independent variable suggests improvement in loans quality (reduces NPLs), while a positive sign of independent variable deteriorates loans quality (increases NPLs). Variables: ROA, ROE, CR, CAP, LtD and CIR are treated as endogenous and the pattern of instrumentation in each case is recorded in Appendix 6.2.3.

Looking at the results presented in Table 6.6, it may be observed that the estimated coefficients have signs that are compatible with economic intuition and the theoretical arguments presented in section 6.2. Among the macroeconomic variables, it has been suggested that inflationary pressures contribute to the high non-performing loan ratios in Central and East European countries, which is indicated by a positive and statistically significant coefficient, albeit only at the 10% significance level, on the inflation rate variable. Namely, an increase in the inflation rate by 1 percentage point causes the ratio of NPLs to increase by 0.27 percentage points, suggesting that inflation makes it more expensive to service debts. In this context our results are in line with Fofack’s (2005) and Niksu’s (2011) findings. Apart from the inflation rate, the results suggest that the degree of indebtedness of a country contributes to the evolution of NPLs among CEE banks, as the variable public debt is positive and statistically significant. In this context, an increase of the public debt by 1 percentage point causes NPLs to increase by 0.28 percentage points. These results agree with the findings of Ali and Daly (2010) and Makri et al. (2011). Other macroeconomic indicators were not found to have a significant impact on the incidence of NPLs.

Table 6.6 Dynamic Panel System GMM estimations results from model 1

Dependent variable		Non-performing loans (%)		
	Variables name	Label	Coefficient	p-values
	Lag dependent variable	NPL	0.742***	0.000
Macro variables	GDP growth rate	GDP	-0.091	0.480
	Inflation rate	INF	0.272*	0.066
	Interest rate	INTR	-0.142	0.394
	Exchange rate	EXCR	0.007	0.379
	Unemployment rate	UNEMP	0.009	0.963
	Public debt (% of GDP)	DEBT	0.277**	0.024
Bank-specific variables	Return on assets	ROA	-2.153***	0.012
	Return on equity	ROE	0.073	0.309
	Credit growth rate	CR	0.003	0.954
	Capital adequacy ratio	CAP	-0.271 [a)]	0.108
	Loans to deposit ratio	LtD	0.014	0.242
	Cost to income ratio	CIR	-0.004	0.913
	Market Share	Mshare	-0.033	0.397
Ownership variables	Foreign bank	Foreign	-2.647 **	0.018
	Dummy_CEE	CEE	3.046*	0.061
	Dummy_USAandCH	USandCH	2.608	0.127
	Dummy_SouthernEnlargement	SouthEnl	0.236	0.854
	Dummy_RU	RU	4.118	0.247
	Dummy_TR	TR	5.497	0.333
Time dummies [b)]	Included in the model	Yes		
Country dummies [c)]	Included in the model	Yes		
	Number of observations			1052
	Number of groups			226
	Number of instruments			64
	Wald Test			Wald chi2(46) = 10001.37 Prob > chi2 = 0.000
	Hansen test p value			0.499
	A-B AR(1) or m1 test p-values			0.009
	A-B AR(2) or m2 test p-values			0.184

Significance level: ***significant at 1%; ** significant at 5%, *significant at 10%.

a) On the borderline of 10% significance level
b) Time dummies reported in full in Appendix 6.2.3
c) Country dummies reported in full in Appendix 6.2.3

The Wald test establishes that the estimated coefficients are jointly significant; i.e. that the model has explanatory power. As required the m1 test rejects the null hypothesis of no autocorrelation in the first differenced residuals (p=0.009), while the m2 test - crutually - does not reject the null of no autocorrelation in the second-difference residuals (p=0.184). This combination supports the validity of instruments (Rodman, 2009a). The Hansen test does not reject the null of overidentifying restrictions at any conventional level of significance (p=0.499); hence, it is an indication that the model has valid instrumentation. In Table 6.7 we compare the system-GMM estimate of the lagged dependent variable with the FE (which is the most downward biased estimator) and OLS ones (which is the most upward biased estimator). Our system-GMM estimate is within the range given by FE and OLS estimators (Bond, 2002; Roodman, 2006) which supports its validity.

Table 6.7 Comparison statistics of System-GMM with OLS and FE in terms of the estimated coefficient on the lagged dependent variable

	FE	**OLS**	**System-GMM**
NPL (-1)	0.495	0.746	**0.742**

The dynamic specification affirms the presence of a high and significant persistence effect, as indicated by the significant positive coefficient on the first lag of the dependent variable. It captures the partial adjustment of banks` non-performing loan ratios, suggesting that a shock to the ratio of NPLs is likely to have a prolonged effect on the banking system, which is in line with findings of Klein (2013). Thus, the obtained results would suggest that ceteris paribus, a 1 percentage point increase in the non-performing loans ratio in the previous year contributes a 0.74 percentage point increase to the non-performing loans ratio in the current year.

Looking to the other bank-specific variables, the estimations show that a higher return on assets ratio leads to decrease in banks` NPLs ratios, therefore suggesting that better managed banks have, on average, a better quality of loans (corroborating the "Bad Management" hypothesis). More precisely, a 1 percentage point increase in return on asset variable leads to a 2.15 percentage point decrease in the non-performing loans ratio. Banks' risk attitude, as reflected in the capital adequacy ratio, appears to be a relevant indicator of banks` loans quality in the context of the CEE banks. Namely, a decrease in banks` capitalization by 1 percentage point leads to a 0.27 percentage point increase in NPLs, at the borderline of the 10% level of significance. This link is consistent with moral hazard incentives on the part of banks' managers who increase the riskiness of their loan portfolio when their banks are thinly capitalized. Unlike in the other studies reviewed earlier, additional bank-level indicators, such as the credit growth, the loan to deposit ratio, cost-to-income ratio and market share were not found to have a significant impact.

The results confirm that both bank-level and macroeconomic factors play a role in affecting the banks' asset quality. In addition, this analysis emphasizes the impact that the presence of foreign-owned banks had on the quality of loans during this period. Foreign ownership appears to positively influence financial stability in CEE countries. This suggests that most foreign banks have remained committed to the region, notwithstanding the global financial crisis. This suggests that, on average, those banks with a foreign owner have a lower NPLs ratio than those domestically owned. Quantitatively, the corresponding estimate suggests that the NPL ratio is 2.65 percentage points lower for foreign-owned banks than for domestically-owned banks, ceteris paribus.

As mentioned in section 6.2, with the aim of investigating whether the differences in NPLs between foreign and domestic banks can be attributed to the country of origin of the foreign bank, we added dummy variables for the country of origin being in "Southern Enlargement" countries, CEE countries; United States or Switzerland, Russia and Turkey. The estimated effect of dummy for foreign ownership indicates an overall benign effect on NPLs. However, the additional dummies suggest a more differentiated effect, with CEE-owned foreign banks having a higher incidence of NPLs; the NPLs ratio is 3.05 percentage points higher for banks whose parent banks are coming from CEE region.

The year dummy variables, which are included to control for period effects that influence all the banks in the sample in much the same way, appeared statistically insignificant. Turning to the country dummies, Estonia, Hungary and Poland specific dummy variable are the country dummies that reflect the NPLs data (see Appendix 6.2.3) .The coefficients of country dummies for Hungary and Poland reflect the presence of strong exogenous factors negatively affecting banks' NPLs ratios. Poland has proved to be a particularly attractive market thanks to its relatively strong economic performance and large internal market (Deloitte Centre for Financial Services' Research, 2012). The Polish economy recorded a solid growth performance during the entire period of the global financial crisis. The main reasons behind the continuous GDP growth were: the relatively low level of dependence on exports, the moderate indebtedness, the strong banking sector, and the strong fiscal stimulus financed partly through EU structural funds. The Polish banking sector stands out in CEE as the largest and that which recorded the fastest growth (Deloitte Centre for Financial Services' Research, 2012). Asset quality remained resilient between 2009 and 2011, especially when considered in a regional context, as the Polish banking sector has the one of the lowest share of non-performing loans. Regarding Hungary, our findings are in line with Raiffaisen Research (2012) where NPLs ratios in Hungary have a significant negative impact on the NPLs ratio of the region In addition, it is important to note that Hungary and Poland have strengthened their macroprudential oversight in recent years, a development which might be considered as positive. In addition, Poland (and Romania as well) have introduced or tightened regulations supporting prudent lending practices, which should help to avoid excessive private sector indebtedness.

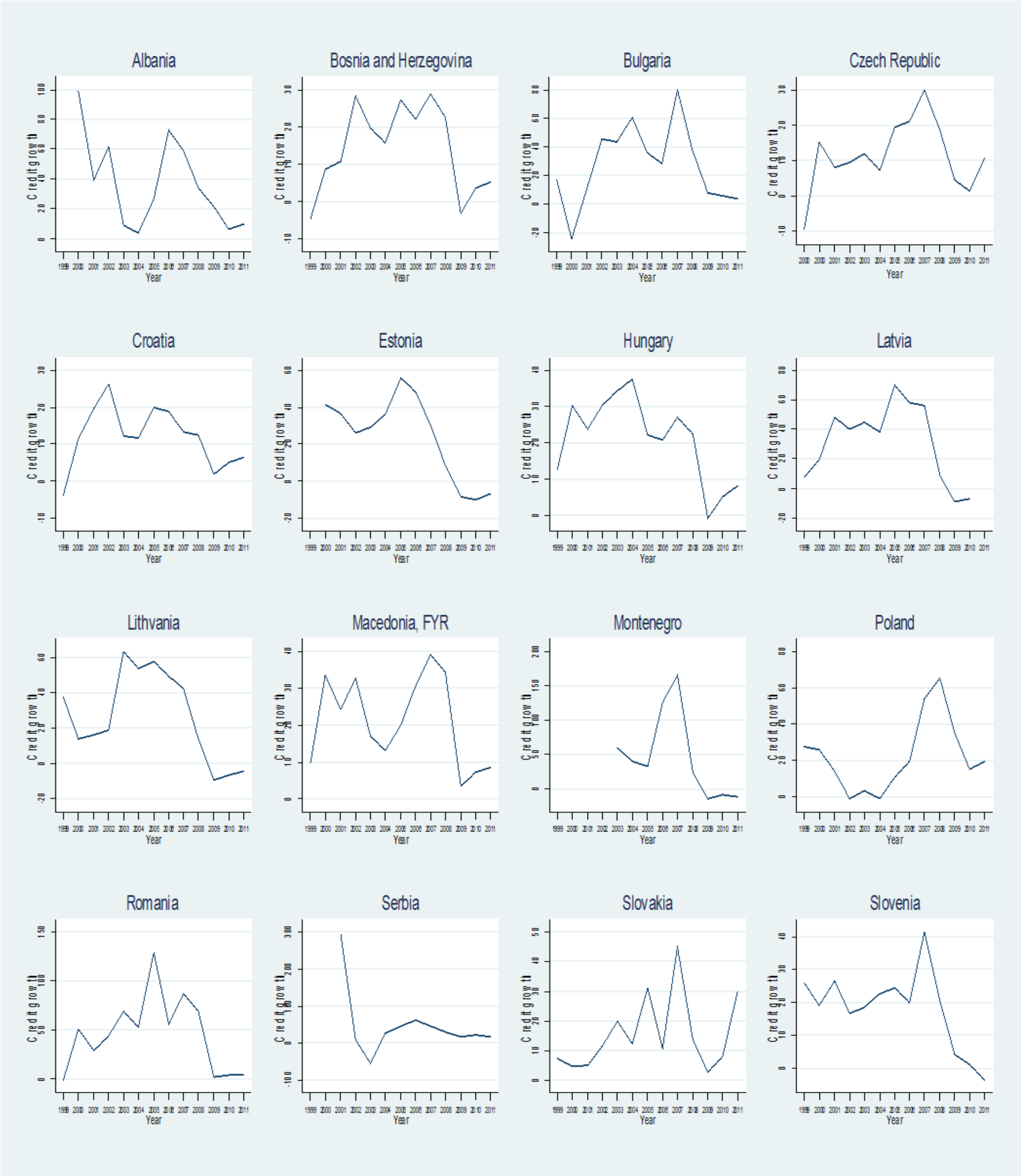
In contrast, the country dummy for Estonia reflects factors positively affecting the NPLs ratios. Estonia suffered a fallout from the bursting of its real estate bubble (OECD, 2011). The situation in the mortgage market was expected to deteriorate the quality of bank's assets. Particularly, the non-performing ratios of loans to the construction sector are rising. Most of the banks were sitting on growing inventories of real estate collateral that were difficult to liquidate in the current environment (OECD, 2011).

We have tested for potential long-run effects on banks` NPL ratios of changes in all of the independent variables. However, we find that they were not statistically significant at conventional levels. They are reported in Appendix 6.2.3.

6.6 Model 2 - Results

Model 2 is an augmented version of model 1. Namely, model 1 is expanded by the addition of the interaction of the credit growth during the boom period and a dummy variable for the period after the end of the credit boom. Since there are growing concerns (mentioned in section 5.2.2) about the implications of rapid credit growth for macroeconomic and financial stability, the intention of this section is to find an appropriate empirical strategy to capture the effects of the phenomenon of rapid growth in banks` lending, which has been particularly prominent in many Central and East European countries. In order to understand developments in the loans market in the context of transition economies, it is useful to recall that in the financial systems of these countries around 85% of financial assets are bank assets. Namely, capital markets, especially the corporate bond and stock market segments, are not well developed. Rapid and persistent credit expansion in many of these countries has been identified as posing an increased risk of a deterioration in asset quality (Borio and Lowe, 2002; Salas and Saurina, 2002; Jimenez and Saurina, 2005; Borio and Drehmann, 2009). Hence, the credit expansions during the last decade pose the question as to whether the quality of loans granted during that period was evaluated accurately by the banking system. Recent experience has suggested that banks in an economic growth phase have over-optimistic expectations about borrowers' future ability to repay their debts and thus they often may over-lend to risky borrowers. As noted in section 5.2.2, Jimenez and Saurina (2005) find that in boom periods collateral requirements are relaxed while the opposite happens in recessions, which they take as evidence of looser credit standards during expansions. Therefore in the downward phase of the credit cycle, bad loans, approved in an upward phase, become more evident. Moreover, fast FX-denominated credit growth exposes lenders and borrowers to risks because of the increase in unhedged foreign currency lending. If the domestic currency depreciates, debt-servicing costs go up, and foreign exchange risk turns into credit risk. Thus, as noted by Steiner (2011), in many cases, regulatory measures to contain credit growth were targeted primarily at reducing growth in foreign currency loans. Furthermore, if a domestic credit boom is financed from foreign sources, as was the case in several CEE countries, the risk of the domestic banking sector having insufficient balance-sheet liquidity (roll-over risk) increases.

In this section, in particular, we are interested to investigate at which point the effect of past rapid loans growth might become evident. Consistent with the approach developed in section 5.4, the period of past fast credit growth is interacted with a dummy variable for the period after the peak of credit growth. The peak of credit growth is observed for each CEE country individually. Figure 6.7 illustrates the credit growth in all CEE countries that are considered in the model. The Baltic countries experienced their highest rates of credit growth in 2004 and 2005, while in most of the other CEE countries the peak was in 2007, just before the onset of the global financial crisis.



Source: Central bank sites (Financial Stability Reports), IMF, Author's own calculation

Figure 6.7 Credit growth in CEE countries

Following the approach developed in section 5.4, the growth of credit during the period of past fast credit growth is interacted with an indicator variable for the period after the peak of credit growth. Looking at the graphs above, the peak of credit growth is observed for each country individually. In this augmented model specification, we include a dummy variable that represents the period after the peak of credit growth and the interaction term, calculated as this dummy variable multiplied by the overall percentage change in credit growth, for each country, from the beginning of the sample period to the peak of credit growth. However, we do not obtain results that provide evidence of a positive effect of credit growth on NPLs ratio when using these country-specific peaks of credit boom. Indeed, the results, when the past credit growth is interacted with the period after the peak of credit growth for each CEE country individually, suggested a statistically significant negative overall effect of previous credit growth on the post-peak incidence of NPLs ratios, other things being equal. These findings do not coincide with the results obtained by Saurina et al. (2008) and Klein (2013), who suggest that excessive lending leads to a higher percentage of NPLs. In this context we continue to experiment with the interaction of the past credit growth and the period after the peak of credit growth. Since consideration of the peak of credit growth by each CEE country individually did not generate the results expected, the peak of credit growth is considered at the aggregate level for our data set. Namely, if we observe the total lending activity in the CEE and SEE region (see graph 3.20) we conclude that the peak of loans growth was in 2007, the year when the global financial crisis started. The argument for considering the peak of the credit boom on a regional, i.e. aggregate, level is that from the perspective of each individual bank the GFC was a huge exogenous shock, changing the trading environment for all banks in a similar way. Furthermore, foreign banks' behaviour is likely to be determined by behaviour across the whole region not by events in a single country. Moreover, this common shock was met in CEE by a common response, aided by international institutional coordination. Namely, as already mentioned, the Vienna Initiative was created as a coordination platform for multinational banks, their home and host country supervisors, fiscal authorities, the IMF, and development institutions to protect and secure a continued commitment of parent banks to their subsidiaries and to guarantee macroeconomic stability in emerging Europe.

Therefore, the model in equation 6.1 will be expanded by the inclusion of Interactioncreditgr2009, an interaction term calculated as the period dummy 2009 multiplied by the overall percentage change in credit growth from the beginning of the sample period to the peak of credit growth. As noted in section 6.4, the bank specific variables are treated as potentially endogenous. Hence, if credit growth is correlated with unobserved effects in the error term then the interaction with the post crisis period will itself be correlated with unobserved country specific effects in the error term; therefore, it should be treated as a potentially endogenous as well. Moreover, when the period of past credit growth is interacted with the period after the peak of credit growth the results suggest a positive and significant influence of past credit growth on the incidence of NPLs in the second year (in 2009) after the peak of credit growth. The results of this augmented model are presented in Table 6.8.

Table 6.8 Dynamic Panel System GMM estimations results from the model 2

Dependent variable		Non-performing loans (%)		
	Variables name		Coefficient	p-values
	Lag dependent variable	NPL	0.639***	0.000
Macro variable	GDP growth rate	GDP	-0.307*	0.059
	Inflation rate	INF	0.006	0.215
	Interest rate	INTR	-0.051	0.746
	Exchange rate	EXCR	-0.113	0.312
	Unemployment rate	UNEMP	-0.272	0.975
	Public debt (% of GDP)	DEBT	0.236*	0.077
Bank-specific variables	Return on assets	ROA	-1.167	0.137
	Return on equity	ROE	0.034	0.637
	Credit growth rate	CR	-0.132 **	0.035
	Capital adequacy ratio	CAP	-0.122	0.377
	Loans to deposit ratio	LtD	0.007	0.874
	Cost to income ratio	CIR	0.008	0.680
	Market share	Mshare	-0.037	0.442
	Interactioncreditgr2009	Int 2009	0.179 *	0.066
Ownership variables	Foreign bank	Foreign	-2.166**	0.045
	Dummy_CEE	CEE	3.954**	0.027
	Dummy_USAandCH	USandCH	1.232	0.287
	Dummy_SouthernEnlargement	SouthEnl	0.497	0.765
	Dummy_RU	RU	4.214	0.623
	Dummy_TR	TR	-2.594	0.165
Time dummies [a)]	Included in the model	Yes		
Country dummies [b)]	Included in the model	Yes		
	Number of observations			1052
	Number of groups			226
	Number of instruments			64
	Hansen test p value			0.495
	A-B AR(1) or m1 test p-values			0.008
	A-B AR(2) or m2 test p-values			0.751

Significance level: ***significant at 1%; ** significant at 5% *significant at 10%.

a) Time dummies reported in full Appendix 6.3
b) Country dummies reported in full Appendix 6.3

The m1 test rejects the null hypothesis of no autocorrelation in the first differenced residuals (p=0.008), while the m2 test - crucially - does not reject the null of no autocorrelation in the second-difference residuals (p=0.751). This combination supports the validity of the instruments (Rodman, 2009a). Moreover, the Hansen test does not reject the null of the validity overidentifying restrictions at any conventional level of significance (p=0.495). The coefficient on the lagged dependent variable is within the range established by FE and OLS and this supports its validity (see Table 6.9).

Table 6.9 Comparison statistics of System-GMM with OLS and FE in terms of the estimated coefficient on the lagged dependent variable – model 2

	FE	**OLS**	**System-GMM**
NPL (-1)	0.495	0.746	**0.639**

The results summarized, in Table 6.8, suggest that, *ceteris paribus*, an increase of one percentage point in loan growth, prior to the aggregate peak (2007), leads to an increase in the ratio of NPLs of 0.05 percentage point two years after the peak of loans growth (the combined effect of the effect of credit growth overall, -0.132, which is significant at the 5%; and in the aftermath of the global financial crisis, 0.179, which is significant at the 10%). This finding is in line with the procyclical credit-growth hypothesis (see 5.2.2), implying that excessive lending coincides with reckless risk-taking. Most interestingly, the estimated effect of the credit growth rate suggests that credit growth alone has a negative and statistically significant effect on the incidence of NPLs. However, bearing in mind our data span, this trend might be viewed as a positive consequence of the deepening and restructuring of the financial system in these countries, given that most of these countries were, and some of them still are, in a transition phase.

Table 6.10 The combined coefficient of credit growth variable and Interaction2009

```
------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |    .046581   .0601011     0.78   0.438    -.0712149     .164377
------------------------------------------------------------------------------
```

Both the credit growth rate and the interaction term are statistically significant; however, the combined coefficient is not significant (see Table 6.10). Non-significance may be expected, since the estimates have different signs with similar absolute values; hence, they more or less cancel out leaving a small combined coefficient that is not easily distinguishable from zero.

Looking at the effect of other variables on the ratio of NPLs, the GDP growth rate appears significant but only at the 10% level, suggesting that the NPLs ratios may be negatively affected by a higher GDP growth rate. Namely, an increase of one percentage point of GDP, ceteris paribus, leads to a decrease of 0.30 percentage points in the banks` NPLs ratio. This finding is in line with the hypothesis that NPLs ratios are countercyclical, falling in business cycle upturns and rising in recessions (see 5.2.1). As found in model 1, the public debt variable is positive and statistically significant but again only at the 10% level, implying that, other things being equal, an increase of the public debt by 1 percentage point causes NPLs to increase by 0.24 percentage points. Similar to the results shown in Table 6.6, the obtained result on the lagged dependent variable suggests that, ceteris paribus, a 1 percentage point increase in the non-performing loans ratio in the previous year contributes a 0.64 percentage point increase to the non-performing loans ratio in the current year. Similar to our initial findings, models 2's results confirm that the NPLs ratio is 2.2 percentage points lower for foreign-owned banks than for domestically-owned banks. Moreover, as in the previous model the results suggest that the NPLs ratio is 3.95 percentage points higher for banks whose parent banks are coming from the CEE region than for those banks whose parent banks are from EU12 countries.

The period dummies, which are used to control for period effects that influence all the banks in the sample in much the same way, appeared statistically insignificant. The augmented model 2 reveals more country specific effects that have an influence on the incidence of NPLs, and which are indicated by positive and statistically significant coefficients. Here, the coefficients for Bosnia and Herzegovina, Bulgaria, Estonia, Latvia, Macedonia and Romania reflect unobserved time invariant influences specific to these countries that increase NPLs ratios (see Appendix 6.3).

These large persistence effects suggest that the long-run effects on NPLs of changes in the independent variables are considerably larger than the estimated short-run effects reported in Table 6.8. The long run coefficients are presented in the following Table.

Table 6.11 Long-run coefficients for the variables

Variables	Coefficient	p-value
Credit growth rate	-0.366**	0.012
Interaction 2009	0.495*	0.069
Public debt (% of GDP)	0.655*	0.091

Significance level: ***significant at 1%; ** significant at 5% *significant at 10%.
Note: The long run coefficients on other variable are reported in Appendix 6.3.

Furthermore, these results suggest that past credit growth can account for a substantial part of non-performing loans, especially in the aftermath of the global financial crisis. Taken literally, and allowing for a non-marginal change, the mean of credit growth (30% - see Table 6.5), the long-run coefficient suggests an effect considerably larger than the mean NPLs in 2009 (see Figure 6.6). Whereas the estimated short-run coefficient measures the current impact, the long-run coefficient measures the entire effect from the current impact up to infinity. From a policy perspective the importance of the long-run coefficient is in the insight that the effect of economic causes cumulate over time. The short-run coefficient (0.179) suggest that an increase in credit growth of 10 percentage point causes an increase in NPLs of 1.79%. The long run coefficient reminds us that this effect cumulates over time and is thus larger in the long-run. Taking even an estimative of 0.2 or 0.25 suggests that previous credit growth can have a substantial impact on future NPLs.

There are some modest improvements in explanatory power compared to the previous model. The specification of the model is somewhat improved by inclusion of the interaction term representing the overall percentage change in credit growth from the beginning of the sample period to the aggregate peak of credit growth, pointing to a delayed effect of fast credit growth on the incidence of NPLs ratios. That delayed effect of credit growth becomes evident in the second year after the peak. These findings are in line with Klein (2013). However, he uses a different empirical strategy to model the effect of past credit growth. Klein's investigation of the determinants of the NPLs in CEE region will be critically reviewed in the following section. This comparison is expected to be revealing since Klein (2013) and our models have slightly different specifications and are used to analyse somewhat different datasets, and, in the main, come to similar conclusions. In the next section, we highlight the difference with respect to modelling of the potentially delayed impact of rapid credit growth on NPLs.

6.7 Comparison with Klein (2013)

In this Section, we compare our key results with those obtained by Klein (2013). Given the same dependent variable, similar structure of the independent variables and econometric procedures in these two studies, a comparison of results should provide useful insights. Initially we will summarize Klein's (2013) model, data used and main findings. Klein's study evaluates the determinants of non-performing loans in CESEE economies, looking at both bank-level data and macroeconomic indicators between 1998 and 2011.

The analysis uses panel data of individual banks' balance sheets from Bankscope as well as macroeconomic indicators from the Haver Analytics dataset and World Economic Outlook (WEO) datasets, the latter are different from the sources used for our sample. Data is based on annual frequency and covers the ten largest banks (commercial, savings, cooperate, and real estate & mortgage) in each of the 16 countries[47] covered in the analysis. The dependent variable is again the ratio of non-performing loans in total loans. As macro or country-specific indicators, Klein included inflation, the change in exchange rate vis-à-vis the euro and the change in the unemployment rate. He has also considered two 'global' variables: the Euro zone's GDP growth and the global risk aversion captured by the volatility of Standard & Poor's 500 stock market index. Turning to the bank level data, Klein's main model specification includes four explanatory bank-level variables: the equity-to-assets ratio; the return on equity; the loan-to-assets ratio; and the growth rate of loans. Overall, the data on NPLs includes 976 observations, which are divided into, in order to evaluate the effect of the financial crisis: the pre-crisis period (1998–2007) and the "post-crisis" period (2008-11).

Klein considers three alternative estimation techniques. The first one is a fixed effects model, which allows controlling for unobserved heterogeneity across banks. Second, they apply the "difference GMM" method of Arellano and Bond (1991), which transforms the data to first differences to remove the fixed effect element and uses the lagged levels of the right hand-

[47] Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Russia, Ukraine, Serbia, Slovakia and Slovenia.

side variables as instruments. However, Klein (2013) notes one drawback of this approach; that, in samples with a limited time dimension (small T) and high persistence, the estimation has low precision (Blundell and Bond, 1998). Finally, they also estimate a “system GMM” model, an approach developed by Arellano and Bover (1995) and Blundell and Bond (1998), which addresses this concern.

The results suggest that NPLs ratios are indeed affected by both macroeconomic and bank-level factors. Among the macroeconomic determinants, the results suggest that an increase in the unemployment rate, exchange rate depreciation (against the euro) and higher inflation contribute to higher NPLs ratios, while higher Euro area GDP growth results in lower NPLs ratios. Higher global risk aversion was also found to increase NPLs ratios. Klein`s explanation for the latter is that a more volatile stock market index may reduce firms’ capacity to repay, perhaps because of higher interest rates in the international financial markets, which reduce firms’ ability to rollover their debt. Also, he considers that lower Euro area growth may reduce firms’ capacity to repay, because of reduced export opportunities and lower export revenues, however, we think that this is questionable. In addition, according to Klein these two factors may also lead to lower external funding of banks and therefore may result in lower or even reverse credit growth (the latter affecting NPLs ratio through the denominator). The impact of bank-specific factors is broadly in line with previous findings: the equity-to-asset ratio and return on equity (ROE) are negatively correlated with NPLs while excessive lending (measured by loan-to-asset ratio and the past growth rate of banks’ lending) leads to higher NPLs. Although bank-level factors have a significant impact on NPLs, Klein reports that their overall explanatory power was low. Their inclusion marginally increases the “within” explanatory power of each group, while it significantly reduces the “between” explanatory power (in the fixed effects estimations).

Table 6.12 provides a comparison of the variables we have used and the variables used by Klein (2013).

Table 6.12 Comparison of the variables

Dependent Variable	**Our model**	**Klein`s model**
Non-performing loans in total loans	✓	✓
Independent Variables	**Our model**	**Klein`s model**
Lagged dependent variable	✓	✓
GDP growth rate	✓	×
Unemployment	✓	✓
Inflation rate	✓	✓
Interest rate	✓	×
Exchange rate	✓	✓
Public debt (% of GDP)	✓	×
Euro area's GDP growth	×	✓
Standard & Poor's 500 stock market index	×	✓
Return on assets	✓	×
Return on equity	✓	✓
Capital adequacy ratio	✓	×
Credit growth	✓	✓
Loans in (%) total assets	×	✓
Equity in (%) total assets	×	✓
Cost to income ratio	✓	×
Market share	✓	×
Foreign/domestic ownership (dummy variable)	✓	×
Origin of foreign owner (dummy variables)	✓	×

Looking at Table 6.12 it is clear that our model specification involves more variables, with the main differences being in the choice of macroeconomic and ownership variables. Namely, Klein's model does not take into consideration interest rates and public debt, as well as bank ownership. As explained in section 6.2, increasing interest rates and public debt may contribute to an increase in banks non-performing loan ratios. Turning to the bank specific variables, most of these variables are similar in the two models. The differences are in the following variables: *equity in total assets*, *capital adequacy ratio*, *loans in assets* and *market share*. Instead of using the variable *equity in total assets*, we included the *capital adequacy ratio*. These two variables are both used as a proxy for the "Moral Hazard" hypothesis (see 5.2.2). However, we also included the *capital adequacy ratio* as a measure of the relation of each banks` capital to its risky assets, particularly because it is a measure used by national regulators to monitor each bank's capital from the perspective of whether they can absorb a reasonable amount of loss and is in accordance with statutory capital requirements. In order to measure credit growth Klein uses two measures *loans in assets* and *credit growth*. We have considered just one measure *credit growth*. Klein does not directly take into consideration the *market share* of banks' assets, instead he just considers the ten largest banks in each country without providing the rationale for that choice. The results from Klein's and our two models suggest that both bank-specific and macro variables affect banks' loans quality. In addition, our models suggest that ownership status of the banks and the home country of the parent bank also affect the banks` NPL ratios (see Tables 6.6 and 6.8). A full comparison is presented in the following Table.

Table 6.13 Comparison of the results: significant variables only

Variable name	**Our model 1**			**Our model 2**			**Klein`s model**		
Level of statistical significance	1%	5%	10%	1%	5%	10%	1%	5%	10%
1st Lag of the dependent variable	0.742			0.639			0.878		
Return on asset (ROA)	- 2.153								
Return on equity (ROE)								- 0.005	
Capital adequacy ratio			- 0.272						
Credit growth*					- 0.132				0.002
Interactioncreditgrowth2009					0.179				
Loans in (%) total assets									
Equity in (%) total assets								- 0.044	
GDP growth rate						- 0.307			
Unemployment									0.039
Inflation rate			0.272						
Exchange rate								0.009	
Public debt (% of GDP)		0.227				0.236			
Euro area's GDP growth									- 0.017
Standard & Poor's 500 stock market index							0.022		
Foreign/domestic ownership		- 2.647			- 2.166				
Origin of foreign owner - CEE		3.046			3.954				

*Note: In Klein model credit growth is in the 2nd lag

In all three models the lagged dependent variable is positive, statistically significant and large, suggesting that a dynamic specification is the appropriate empirical strategy. The persistence effect on NPL ratios, measured by the coefficient on the lagged dependent variable, suggests that the long-term effects of variables included in the model are considerably larger than the directly estimated short-term or impact effects.

The variables used as proxies for banks` performance, ROA and ROE, are statistically significant, corroborating the "Bad Management" hypothesis (see 5.2.2). In model 1 ROA affects negatively the incidence of NPLs ratio, while in Klein`s analysis the NPLs ratios are adversely affected by the ROE. Supporting the same hypothesis of "Moral Hazard", the capital adequacy ratio is positive and statistically significant in our model 1, while the equity in total assets is positive and significant in Klein's (2013) model. Excessive lending, measured as loans in total assets, leads to higher NPLs ratios in the Klein's model. Also, in Klein`s model the effect of past rapid credit growth is captured by lagged lending growth (second lag). On the other hand, in our model 2, the credit growth alone has a negative and statistically significant effect on the incidence of NPLs; while the effect of past rapid credit growth interacted with the period after 2009 (two years after the global financial crisis) results in a higher NPLs ratio, like in Klein`s model. However, there is a difference in the size of the delayed effect of credit growth of the incidence of NPLs ratio; this will be discussed later in this section. Looking at the macroeconomic variables, Klein finds that an increase in the unemployment and the exchange rate contributes to higher NPLs. In addition, Klein finds that a higher volatility index and lower Euro area growth reduce the incidence of NPLs among CEE banks. As opposed to those results, our results suggest that the increase in GDP growth rate, the public debt and in the inflation rate lead to increase in the NPLs ratio.[48]

Summing up the results of both studies, there are differences in terms of the significance and the strength of the estimated effects. Namely, looking at Table 6.13 we can see that the size of the coefficients of all the statistically significant variables in our model are larger than in Klein`s model. In particular, in Klein`s model an increase of 1 percentage point in the past fast credit growth leads to increase by 0.002 percentage points in the NPLs ratios, however, in our case the increase is much larger, 0.179 on impact and 0,495 percentage points in the long run. The effect of excessive lending in Klein`s model is statistically significant and

[48] In one of Klein`s model specifications (FE and Difference GMM) the inflation rate was statistically significant, implying that the higher inflation leads to an increase in the NPLs ratio.

different from zero, but that result is not economically important. Klein does not give much in the way of explanation for including the second lag of credit growth and for not including the current values of the variable credit growth in his model specification. In addition, an increase of 1 percentage point in the variables that characterize the banks` performance (ROA and ROE), in our case leads to decrease in NPLs ratio by 2.04 percentage points, while in Klein`s model lead to decrease by 0.005 percentage points. Turning to the macro economic variables, the coefficients' sizes in our model are also larger than in Klein`s model.

The difference in results may arise from differences in the dataset. As previously mentioned, in Klein`s dataset Russia and Ukraine are included, while Albania and Montenegro are absent in comparison with our own dataset. The rationale for the countries we have included in our dataset, can be found in Raiffaisen Research Publications, where Russia and Ukraine are not considered to be in the CEE region; instead, they are included in the Commonwealth of Independent States (CIS) region. A second important limitation of Klein's analysis is that he does not investigate all the banks that have reported NPLs ratios in BankScope, only considering the ten largest banks in each country. In our opinion, this choice is suspect, bearing in mind that the 10 largest banks in Russia are much larger than the nine banks in Estonia who reported NPL ratios and have a significantly lower market share. In order to investigate the latter we have controlled for each bank's market share. However, when the market share of the banks was included in our econometric specification, the relationship between NPLs ratios and market share variable was found to be statistically insignificant. Thirdly, Klein does not consider the ownership structure of the banks, which we find to be an important determinant of loan quality in CEE. This effect may be especially important in the years after the beginning of the global financial crisis, as foreign banks may transmit home-country shocks. Finally, Klein does not control for the countries' indebtedness, expressed as public debt as a percentage of GDP. This may be an important variable, since in most European countries the current crisis first affected fiscal indices and then extended to the banks. As explained in section 6.2, high public debts may make debtors more vulnerable to adverse shocks affecting their economic wealth, thereby raising the likelihood that they would run into debt servicing problems.

The comparison reported in this section provides a direction for future research. One suggestion for further empirical work is to extend the data set with data for Russia and Ukraine and then to check the robustness of these results. However, since that data are currently not available, in the next section we explore a different strategy: we will exclude two of our variables that Klein (2013) does not consider and then compare the results.

6.8 Model 3 - Results

We now follow the same empirical strategy as Klein (2013) used for investigating the effect of excessive lending on the incidence of NPLs. Namely, the effect of past rapid growth will be captured by the lagged credit growth (see Appendix 6.4). As noted above, Klein does not explain why the second lag of credit growth is included in his model rather than its current value. The excessive lending effect appeared positive and statistically significant on the second lag of credit growth variable, suggesting that the credit growth of two years ago positively affect the current NPLs ratio, which is in line with Klein's findings. Specifically, as presented in Table 6.14, an increase of credit growth by one percentage point in, ceteris paribus, leads to an increase of 0.006 in the NPL ratio in the second year after. It is important to note that this finding is consistent with the findings from model 2, in which the effect of credit growth before 2007 is interacted with the period after 2009 (two years after the global financial crisis) and through this interaction is found to result in higher NPLs ratios. Namely, it was revealed that, ceteris paribus, an increase of one percentage point in loan growth, prior to the peak (2007), leads to an increase in the ratio of NPLs by 0.05 percentage point two years after the peak of loans growth. In our model 2, the second lag of the variable credit growth is based on a more disaggregated analysis (i.e. including variables to analyse separately the effects of credit growth in pre- and post-crisis periods). The results for Model 3, using the second lag of credit growth in the same manner as Klein, are presented in Table 6.14.

Table 6.14 Dynamic Panel System GMM estimations results from model 3

Dependent variable	Non-performing loans (%)			
	Variables name		Coefficient	p-values
	Lag dependent variable	NPL	0.514***	0.000
Macro variable	GDP growth rate	GDP	-0.331***	0.001
	Inflation rate	INF	0.120	0.331
	Interest rate	INTR	-0.149	0.386
	Exchange rate	EXCR	-0.067	0.347
	Unemployment rate	UNEMP	-0.130	0.341
	Public debt (% of GDP)	DEBT	0.155**	0.048
Bank-specific variables	Return on assets	ROA	0.004	0.995
	Return on equity	ROE	-0.203***	0.006
	Credit growth rate 2^{nd} lag	CR	0.006*	0.083
	Capital adequacy ratio	CAP	0.059	0.252
	Loans to deposit ratio	LtD	0.004	0.382
	Cost to income ratio	CIR	-0.010	0.568
	Market share	Mshare	0.017	0.572
Ownership variables	Foreign bank	Foreign	-2.322***	0.004
	Dummy_CEE	CEE	1.712	0.266
	Dummy_USAandCH	USandCH	-0.370	0.784
	Dummy_SouthernEnlargement	SouthEnl	2.122	0.113
	Dummy_RU	RU	5.069	0.151
	Dummy_TR	TR	-3.970	0.158
Time dummies [a)]	Included in the model	Yes		
Country dummies [b)]	Included in the model	Yes		
	Number of observation			1030
	Number of groups			227
	Number of instruments			131
	Hansen test p value			0.647
	A-B AR(1) or m1 test p-values			0.005
	A-B AR(2) or m2 test p-values			0.599

Significance level: ***significant at 1%; ** significant at 5% *significant at 10%.

a) Time dummies reported in full Appendix 6.4

b) Country dummies reported in full Appendix 6.4

The Hansen test (p=0.647) suggests the over-identifying instruments are valid. As required the m1 test suggests that there is evidence of autocorrelation in the first differenced residuals (p=0.005), while the m2 test (p=0.599) suggests no evidence of serial correlation in the errors, which is also consistent with instrument validity. The coefficient on the lagged dependent variable (see Table 6.15) is within the range established by FE, the most downward biased estimator, and OLS, the most upward biased estimator. This supports the validity of the modelling strategy.

Table 6.15 Comparison statistics of System-GMM with OLS and FE in terms of the estimated coefficient on the lagged dependent variable – model 3

	FE	**OLS**	**System-GMM**
NPL (-1)	0.495	0.746	**0.514**

Looking at the results for the macroeconomic variables in model 3, the GDP growth rate suggests that the NPLs ratios are negatively affected by higher GDP growth rate, which is indicated by the statistically significant coefficient. The same result was found in model 2. An increase of one percentage point of GDP, ceteris paribus, leads to a decrease of 0.33 percentage points in the banks` NPLs ratio. Similar to the model`s 2 results, an increase public debt will contribute to the increase in NPLs ratios. Specifically, an increase of one percentage point in the public debt/GDP ratio leads to increase of 0.16 percentage points in the NPLs ratio in banks in the CEE region. Turning to the bank specific variables, the lagged NPLs ratio is positive and statistically significant, suggesting that the effect of a rising NPLs ratio is likely to have a prolonged effect on the banking system. This finding is in line with findings from models 1 and 2 as well as with Klein's investigation. Therefore, ceteris paribus, a 1 percentage point increase in the non-performing loans ratio in the previous year contributes to a 0.51 percentage point increase to the non-performing loans ratio in the current year. The results from model 3 suggest that a better return on equity ratio leads to a decrease in banks` NPLs ratios, corroborating the hypothesis that the better banks` performance improves the quality of banks' assets. Namely, a 1 percentage point increase in the return on equity leads to a 0.2 percentage point decrease in the NPLs ratio, other things being equal. This conclusion is also consistent with Klein's findings. However, in models 1 and 2 instead of the return of equity, the coefficient on return on asset suggests that a higher return on assets contributes to the lower NPLs ratios. Similarly to model 1, the estimate on the ownership identity, indicates that, on average, those banks with a foreign owner have a lower NPLs ratio than those under domestic ownership. As revealed in model 2, the significant country specific effects, Estonia and Romania, reflect unobserved time invariant influences, specific to these countries, which increase the NPLs ratios.

Given the large persistence effects of the lagged dependent variable, as in the previous section, we calculate the long-run effects of the independent variables. The results presented in the Table below suggest that estimates which were found statistically significant in the short-term, have even larger effects in the long-run.

Table 6.16 Long-run coefficients for the variables

Variables	Coefficient	p-value
GDP growth rate	-0.545***	0.000
Return on equity	-0.439***	0.001
Credit growth rate	0.014**	0.032
Foreign	-4.182**	0.009

Significance level: ***significant at 1%; ** significant at 5% *significant at 10%.

Replicating Klein's strategy, in our model 3 we find the same small effect of past credit growth on the incidence of NPLs ratios. In particular, Klein's findings, and our findings when following Klein`s strategy, are picking up part of a more complex effect of past credit growth. This was unpicked in model 2 to reveal a positive coefficient on the interaction of past credit growth and period of two years after the peak of credit growth together with a small and negative coefficient on the credit growth variable.

6.9 Model 4 - Results

As mentioned in section 6.7, Klein does not directly consider the potential effects of public debt and interest rates. In this section, we will check whether the results from model 1, 2 and 3 change if we exclude these two variables from the final models 3 specifications. The results are reported in Table 6.17.

Table 6.17 Dynamic Panel System GMM estimations results from model 4

Dependent variable		Non-performing loans (%)		
	Variables name		Coefficient	p-values
	Lag dependent variable (NPL)	NPL	0.515***	0.000
	GDP growth rate	GDP	-0.332***	0.001
	Inflation rate	INF	0.123	0.522
	Exchange rate	EXCR	-0.003	0.548
	Unemployment rate	UNEMP	-0.048	0.731
Bank-specific variables	Return on assets	ROA	0.238	0.708
	Return on equity	ROE	-0.241***	0.004
	Credit growth rate 2nd lag	CR	0.007*	0.100*
	Capital adequacy ratio	CAP	-0.062	0.239
	Loans to deposit ratio	LtD	0.006	0.332
	Cost to income ratio	CIR	-0.006	0.730
	Market share	Mshare	0.031	0.345
Ownership variables	Foreign bank	Foreign	-2.491**	0.003
	Dummy_CEE	CEE	1.770	0.271
	Dummy_USAandCH	USandCH	0.185	0.888
	Dummy_SouthernEnlargement	SouthEnl	1.816	0.185
	Dummy_RU	RU	4.636	0.331
	Dummy_TR	TR	-3.106	0.269
Time dummies [a]	Included in the model	Yes		
Country dummies [b]	Included in the model	Yes		
	Number of observation			1039
	Number of groups			228
	Number of instruments			129
	Hansen test p value			0.564
	A-B AR(1) or m1 test p-values			0.004
	A-B AR(2) or m2 test p-values			0.534

Significance level: ***significant at 1%; ** significant at 5% *significant at 10%.

[a] Time dummies reported in full Appendix 6.5

[b] Country dummies reported in full Appendix 6.5

Hansen's test for over-identification, the Arellano-Bond (1) and (2) tests for serial correlation, suggest an appropriate model specification. Namely, the Hansen test (p=0.564) suggests the over-identifying instruments are valid. . The Arellano-Bond (1) test rejects the null hypothesis of no autocorrelation in the first differenced residuals (p=0.004), while the Arellano-Bond (2) does not reject the null of no autocorrelation in the second-difference residuals (p=0.534). As can be seen in Table 6.18, the coefficient on the lagged dependent variable is again within the range established by FE and OLS and hence, this supports its validity.

Table 6.18 Comparison statistics of System-GMM with OLS and FE in terms of the estimated coefficient on the lagged dependent variable – model 4

	FE	**OLS**	**System-GMM**
NPL (-1)	0.495	0.746	**0.515**

In general, the results do not differ much from the previous model`s findings presented in previous section. As revealed in model 3, the GDP growth negatively affects the incidence of NPLs ratios, suggesting that an increase of one percentage point of GDP, ceteris paribus, leads to a decrease of 0.33 percentage points in the banks’ NPLs ratio. The lagged dependent variable again has a positive effect on the banks` NPLs ratios. Looking at the bank specific variables, the return on equity has a negative effect on the NPLs ratios, implying that an increase of one percentage point in the capital adequacy ratio, ceteris paribus, leads to a decrease of 0.24 percentage points in the banks’ NPLs ratio. This finding is in line with our previous findings. Similar to our previous results and Klein`s the excessive lending effect - the second lag of credit growth - is positive and statistically significant, suggesting that the credit growth of two year ago positively affects the current NPLs ratio. However, that effect is small (0.007) as previously estimated. Turning to the banks’ ownership, on average, those banks with a foreign owner have a lower NPLs ratio than those domestic. This result is consistent with our previous findings in model 1 and model 3.

The coefficient on the year dummies, Yr_2007 and Yr_2009 appeared to be negative and statistically significant, but only at the 10% significance level. There may be some suggestion that developments in 2007 and 2009 negatively affected banks` NPLs ratios in the CEE region, but a test found no significant difference between the period before and after the GFC.

Following the same procedure as in the previous sections we calculate the long-run effect of independent variables on the NPLs. The long-run coefficients are a little more than twice the size of the short-term estimates reported in the previous Table but do not change the inferences drawn.

Table 6.19 Long-run coefficients for the variables

Variables	Coefficient	p-value
GDP growth rate	-0.686**	0.007
Return on equity	-0.497***	0.002
Credit growth rate	0.015*	0.086
Foreign	-5.140**	0.005

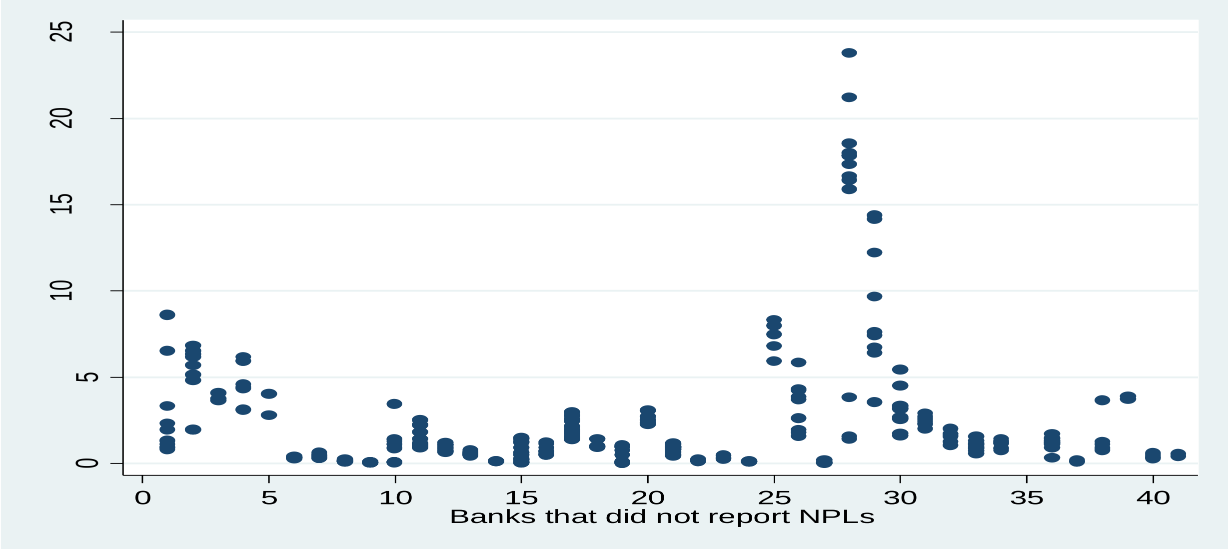
Significance level: ***significant at 1%; ** significant at 5% *significant at 10%.

To conclude, the exclusion of public debt and interest rate did not disturb the estimated effects of other variables in the model. However, the results from the three previous models do suggest that the degree of indebtedness of a country contributes to the evolution of NPLs among CEE banks. As in the previous models, the results of model 4 suggest that the ownership of a bank may be an important factor in explaining the quality of loans in CEE. Namely, results from all our models suggest that mainly foreign-owned banks have a lower NPLs ratio compared to domestic-owned banks. Implementing Klein's strategy, in our model 4 we find the same effect of past credit growth on the incidence of NPLs ratios as Klein did. However, although we find that this effect of past fast credit growth on the incidence of NPLs ratio is statistically significant, it is not economically important. As mentioned earlier, Klein does not provide an explanation for including the second lag of credit growth and for not including the current values of credit growth in his model specification. The problem with his analysis is that these results suggest that credit growth will always adversely affect NPLs. In contrast, our approach explained in section 6.6 allows a more nuanced analysis of the effects of credit growth on the incidence of NPLs ratio, by allowing these to be different before and after the global financial crisis. It is important to note that we are not arguing that 'excessive' credit growth causes financial crisis; only that once a crisis does take a place the effect of previous rapid credit growth is a contributory cause of the increase in the NPLs ratio. On the other hand, Klein considers just the excessive past credit growth (expressed in the second lag of the credit growth variable) and its adverse effect on the NPLs ratio. However, because of their underdeveloped financial systems, relatively rapid credit growth is and was needed in many European transition countries and cannot be considered a 'bad thing' as such.

6.10 Sample Selection

Not all banks could be included in our sample; i.e. those that have not reported non-performing loans are, perforce, not available for estimation. Although sample selection is commonly confronted in cross-sectional studies, it is less considered in panel data estimation. This is partially due to the conception that estimating bank-specific fixed effects will eliminate most forms of unobserved heterogeneity. Namely, when we have a FE or RE model we are controlling for the unobserved group specific effects that will include all those specific features of banks that makes them, more or less, likely to report NPLs. Hence, FE or RE models address this problem. That is, in RE estimation group specific effects in the error term control for the banks unobserved characteristics including the propensity to report NPLs. However, the effectiveness of this approach to control the unobserved characteristics depends on the assumption that the relevant unobserved effects are time invariant (or at least slowly moving).

To consider this issue further, we first estimated a probit model to investigate the determinants of the propensity to report their NPLs. In doing so, we found a positive time trend such that banks are becoming, generally, more likely over time to report their NPLs. This indicates that over time banks that do report NPLs become more typical of the whole population. In other words, over time our analysis of those banks that do report NPLs can be regarded as increasingly representative of the banking sector as a whole. This suggests that the non-reporters are, over time, becoming more similar to the reporters as is the intention of regulatory authorities. For example, in 1999 our sample covered 49.1% of total banking sector assets, however, by 2011 the sample covered 85.5% of total banking assets. Second, when we analyse the banking sector our main concern is to include those banks of the greatest importance to policy makers and regulators. Hence, even if we cannot establish that our sample is completely representative of the population, it is more important to check that we include those banks that are of systemic importance, which we assume to be the banks with a largest market share. We expect that the bigger banks are more likely to report NPLs bearing in mind that they are under greater public attention. Therefore, we investigate whether there is a correlation between the market share of the banks and propensity to report NPLs ratio. That correlation coefficient reveals the positive relationship between the market share of the banks and likelihood to report NPLs, although the size of the coefficient is not large (0.19). In Figure 6.8 we present the national market share of the banks that did not report NPLs in the period 1999-2011 in the CEE region.



Source: Bankscope data

Figure 6.8 Market shares of the banks that did not report NPLs

Note: Each dot represents one bank in one year

Looking at the Figure above, most banks (thirty-five) that have not reported NPLs have lower that 5% market share of assets of the banking sector in their country of operation. Only five non-reporting banks have a market share that is between 5-10% of total banking sector assets; and two banks have market share between 10-25% of total assets in banking sector. Therefore; as previously assumed, we conclude that banks with a larger market share (above 10% of total assets in banking sector) are more likely to report NPLs than those with a smaller market share (below 10% of total assets in banking sector). However, whilst the issue of possible sample selection bias is of interest, we restate our argument that having a sample that contains the systemically important banks in our countries of interest is, for our current study, more important than having a fully representative sample of banks.

6.11 Conclusion

The objective of the chapter was to empirically examine and analyse the factors affecting the non-performing loans ratios in 16 countries of Central and Eastern Europe from 1999 to 2011. Using data at the individual bank level, we examine the macro, bank-specific and the ownership determinants of the NPLs ratio.

The results suggest that NPLs ratios are indeed affected by both macroeconomic and bank-level factors. Among the macroeconomic determinants, the results from our preferred model

2 suggest that an improvement in the real economy is likely to see a reduction in the non-performing loan portfolios of commercial banks. In addition, the results suggest that the degree of indebtedness of a country contributes adversely to the evolution of NPLs among CEE banks. Furthermore, the results suggest that mainly foreign-owned banks have a lower NPLs ratio compared to domestic owned banks. The empirical results also indicate a significant positive effect of past rapid loans growth on the incidence of NPLs in the second year after the end of the credit boom, implying that aggressive lending coincides with more reckless risk taking.

Special attention in this chapter is dedicated to Klein`s paper where the determinants of NPLs in CEE countries are also examined. Given the same dependent variable, similar independent variables and econometric procedures of these two studies, comparison of results provides useful insights. In model 3 we followed the same empirical strategy as Klein (2013) used for investigating the effect of excessive lending on the incidence of NPLs; and in model 4 we excluded two of our variables that Klein does not consider and then compared the results. Although we find similar results to Klein, there are some important differences. In particular, there is disagreement about the effect of credit growth on the NPLs ratio.

Klein identifies a positive effect of past credit growth which is statistically significant, but not economically important. However, Klein includes the second lag of credit growth and not the current values of credit growth in his model. In contrast, in our model we analyse separately the effects of credit growth in the pre and post crisis periods. The results from Klein`s analysis suggest that the credit growth will always adversely affect NPLs. Our approach allows a more nuanced analysis of the effects of credit growth on the incidence of NPLs by allowing these to be different before and after the peak of credit growth. It is important to note that we are not arguing the rapid credit growth causes a financial crisis; only that, once the crisis does take a place, the effect of previous credit growth is a contributory cause of an increasing NPLs ratio.

CHAPTER 7: Concluding Remarks

Contents:

7.1 Introduction

The aim of this research programme was to identify the main exposures to risk of the banking system in Montenegro and more generally in Central and Eastern Europe, and hence inform the design of preventive control systems in order to preserve banking sector stability. In order to research the answer to this research question, the initial objectives were:

a) To critically review theoretical and empirical studies of banking sector stability.
b) To investigate the relative strengths and weaknesses of the instruments currently used to assess banking sector stability.
c) Estimate empirically the macroeconomic and bank specific determinants of banking sector distress in Montenegro.
d) Estimate empirically the macroeconomic, bank specific and ownership variables of banking sector distress in Central East European countries.
e) To identify forward-looking central bank policies that should be adopted in order to safeguard banking sector stability.

However, during the research programme these initial objectives gradually evolved. Namely, when addressing the first objective, banking sector stability, it was concluded that it would be useful to address which requirements for a sound and stable banking sector were disturbed in the last global financial crisis. In particular, it was decided to analyse the effect of the global financial crisis on CEE and Montenegro. Thus an additional objective was added to the research programme.

Five of the final six objectives of the research programme have been addressed in the previous chapters and the role of this final Chapter is to bring together the overall findings and to discuss their broad policy implications. In pursuing this role, the current Chapter summarises the research conducted in this thesis, highlighting the contributions made to knowledge. We start with a resume of the most prominent findings of the research undertaken in the dissertation (Section 7.2). We continue with Section 7.3 that presents the main contribution to knowledge, followed by Section 7.4 that introduces the policy implications of these findings. The inevitable limitations of the empirical work are identified and assessed in Section 7.5, while suggestions for the further research are offered in Section 7.6. The final Section (7.7) concludes the thesis.

7.2 Main Findings of the Research

In Chapter 1 we analysed the main characteristics of and developments in the banking sector in Montenegro, highlighting the importance of banking stability for its economic development. It was established that the banking sector has the dominant role in the Montenegrin economy's financial system, since banks are the primary source of funding for all sectors of the economy. Banking stability in Montenegro is necessary not only to promote internal stability but also to attract inflow of foreign direct investment and to promote the development of small and medium enterprises necessary for economic convergence to the EU's level of per capita GDP. The recent rapid growth of banking assets was driven by the entry of foreign banks, which have a dominant role in the Montenegrin banking sector. It is argued that, in 2008, 'excessive' credit growth, primarily financed by high external borrowing, posed a threat to banking sector stability, given that all sectors of the Montenegrin economy had a high level of debt. Namely, strong credit growth from 2003 to 2008 led to an unsustainable boom that suddenly ended with the occurrence of the global financial crisis (GFC). Subsequently, the deep recession pointed to a number of accumulated problems, including the poor quality of many of the loans on banks` books. Namely, the boom and bust cycle in Montenegro left behind a large number of non-performing loans, which present the main current threat to banking stability.

In Chapter 2, we concluded that banking instability is costly to the entire economy, meaning that banking crises can generate a large disruption of economic activity because of the role played by banks in the allocation of resources. Since the banking system fragility refers to the latent possibility of a crisis in the banking system, we have critically reviewed the theoretical and empirical literature on banking crises. One part of the expanding literature emphasizes moral hazard and asymmetric information, in credit contracts or in bank-depositor relations, as fundamental determinants of financial crises. While, the other part stresses that the banking sector stability depends solely on the phase of the real economy. Furthermore, according to the empirical studies, the growth in bank lending during the upswing of the business cycle and the corresponding accumulation of debt in the non-financial sector increases banks' credit risk and the occurrence of non-performing loans and, consequently, fragility in the banking sector. This generates instability, amplifies the danger of an occurrence of a financial crisis and increases systemic risk. Much research on the cause of bank failures finds that asset quality is a statistically significant predictor of insolvency (e.g. Dermirgue-Kunt 1989, Barr and Siems 1994), and that failing banks always have a high level of non-performing loans prior to failure. That has induced greater concern in studying the determinants of non-performing loans, which are likely to be affected by both bank specific and macroeconomic factors. Lastly, given that the recent GFC has been characterized by the phenomenon of contagion, Chapter 2 tackles the channels transmitting financial turmoil from a crisis-country to other countries, assessing what makes one country vulnerable to contagion. The key conclusion drawn from the theoretical discussion was that the determinants of the degree of banking stability are normally a complex and interactive mix of macroeconomic, financial and structural factors.

Accordingly, Chapter 3 researched how banking system stability was disturbed in the GFC, evaluating the fundamental causes and consequences of that crisis. Furthermore, the analysis evaluated the contagion effects of GFC, calling into question how banks treated their subsidiaries in emerging markets. Excessive leverage by banks is believed to have contributed to the GFC, as highly leveraged banks threatened to drag down the entire financial system. Special attention in this Chapter was paid to the impact of the GFC on economies similar to Montenegro, since their future development depends, to a large extent, on global economic prospects. In Central and Eastern Europe, the GFC resulted in large declines in economic activity, a large slowdown in net capital inflows, higher unemployment and increased insolvencies. These developments were followed by a credit crunch, credit quality problems, high ratios of non-performing loans, and consequently bank recapitalizations. However, the full-blown financial crisis was avoided. The review of the empirical literature suggested that international bank lending through subsidiaries is more stable than direct cross-border lending, and indicated that foreign bank subsidiaries reduce their lending during a financial crisis less than do domestic-owned banks. The stability of foreign banks' roles in Central and Eastern Europe during the GFC was guaranteed by a unique private-public co-operation with international financial institutions providing the coordination mechanisms. These findings indicate that the structure of banking sectors in CEE countries, especially regarding ownership, had a moderating effect on the transmission of the GFC to these countries.

In Chapter 4, banking stability was examined from the institutional, or more precisely, the regulator's perspective. As Caprio (1996) notes, the success of financial reform and the stability of financial systems both particularly depend on developing an effective regulatory framework that rewards prudent risk-taking and is attuned to both institutions and the specific structure of the economy. The recent financial crisis demonstrated that in many countries the existing capital regulations, in design and/or implementation, were inadequate to prevent a panic in the financial sector, with governments around the world having to engage in emergency support to prevent a collapse. Thus, recently created Basel III rules should significantly increase the liquidity requirements and the quality and level of capital that banks will hold. Amongst researchers, there is now a general agreement that the supervision standards and instruments to maintain the banking stability prior to GFC were too weak, though few economists identified these weaknesses prior to the crisis. Chapter 4 assesses the relative strengths and weaknesses of the instruments used pre-Global financial crisis (GFC) to assess banking sector stability. In practice, quantitative methodologies, such as early warning systems (EWS) and stress testing were used together with 'expert' judgment and a wealth of institutional and legal circumstance, to assess financial system stability. The analysis presented in this Chapter reveals that regulatory reform requires recognition of the linkages between the macro and microprudential approaches. Both the macro and microprudential perspectives are important and overlap with substantial complementarities. The ability to comprehensively aggregate positions and exposures across banks in a consistent way helps supervisors to identify industry-level trends and improve the macroprudential perspective. How micro and macro perspectives might work together is illustrated by the stress tests that are part of the Supervisory Capital Assessment Program (SCAP). Empirical studies have identified stress tests as one example of how the macro and microprudential perspectives can be combined to create a stronger supervisory framework that addresses a wider range of supervisory objectives for the purpose of maintaining banking stability.

Exploring the factors determining ex post credit risk is an issue of substantial importance for regulatory authorities concerned with financial stability and individual bank's management (Louzis, 2010). The ex post credit risk usually takes the form of non-performing loans (NPLs). The relation between the macroeconomic environment and loan quality has been investigated in previous studies critically reviewed in Chapter 2, which typically link the phase of the business cycle with banking stability. However, in Chapter 5 we reveal that the determinants of NPLs should not be sought exclusively amongst macroeconomic factors that are viewed as exogenous forces influencing the banking industry. On the contrary, the distinctive features of the banking sector and the policy choices of each particular bank with respect to their efforts for maximum efficiency and improvements in their risk management, are also expected to exert a decisive influence on the evolution of NPLs. Hence in Chapter 5, we consider the joint role of macroeconomic and bank-specific factors in explaining the occurrence of banking distresses, expressed in non-performing loan ratios, in Montenegro since 2004. Using data at the individual bank level, we examine whether the degree of banking distress is a function of macroeconomic developments and/or the unique difficulties of transition such as inadequate risk-assessment, excessive risk-taking or the high concentration of the banking system. The results suggest that an improvement in the real economy is likely to see a reduction in the non-performing loan portfolios of commercial banks. Looking at each individual bank, the study emphasizes the delayed effect of loan growth on the ratio of non-performing loans. This is in line with the hypothesis that the expansion phase of the economy is characterized by a relatively low proportion of NPLs, as most consumers and firms receive a sufficient stream of income and revenues to service their debts. However as the boom period continues, credit is extended to lower-quality debtors and, subsequently, when the recession phase sets in, NPLs increase. In addition, this Chapter find evidence that bank-specific features, such as market share, cost efficiency, and risk profile have an important influence on the evolution of non-performing loans.

The problems addressed in Chapter 5, are extended to a multi-country setting in Chapter 6. The intention of this Chapter is to provide a better insight into the nature of the financial weaknesses in the economies of the CEE countries and, hence, to help minimize the costs that could arise from banking instability. As argued in Chapter 3, the GFC has left a legacy of high NPLs in many CEE countries, implying a threat to the region's economic recovery. Thus, in Chapter 6 we investigate the factors affecting the non-performing loans ratios in 16 countries of Central and Eastern Europe, from 1999 to 2011. Based on the rationale developed in Chapter 5, both bank-specific and macroeconomic factors are included as independent variables in the estimation of the determinants of the ratio of non-performing loans in CEE banks. Bearing in mind that we are investigating 16 countries, the model specification is extended to control for variables that, in the context of variations between CEE countries, may be expected to affect the incidence of non-performing loans. Those additional variables are related to the extent of public debt and the exchange rate. Among the macroeconomic determinants, the results suggest that an improvement in the real economy is likely to see a reduction in the non-performing loan portfolios of commercial banks. In addition, the results suggest that the degree of indebtedness of a country contributes to the evolution of NPLs among CEE banks. Namely, high public debt often causes the governments to raise taxes, reducing disposable income for banks` clients and placing them in a worse debtor position, raising the likelihood that they would run into debt servicing problems. The empirical results also indicate a significant positive effect of past rapid loans growth on the incidence of NPLs in the second year after the end of the credit boom, implying that aggressive lending coincides with more reckless risk taking. In most of the CEE countries, foreign-owned banks dominate the banking sectors. Since the onset of the crisis, the debate about the influence of foreign bank ownership has become more prevalent as foreign banks can transmit home-country shocks. Those developments led us to investigate whether foreign ownership of a bank has an impact on the incidence of non-performing loans. Therefore, non-performing loans were modelled to capture any differences between banks based on their ownership structure. The results suggest that foreign-owned banks, in general, have a lower NPLs ratio comparing to domestic-owned banks. Apart from information on ownership status, the characteristics of the home country of the parent bank may also affect the non-performing loans of a foreign-owned bank. Accordingly, the origin of parent banks was also considered in modelling non-performing loans in CEE countries; however, this part of our investigation did not generate any significant differences by country of origin. Given that during the course of writing Chapter 6, Klein`s (2013) study, on determinants of NPLs in CEE countries, appeared we paid special attention to the comparison of Klein`s and our study. Although we find similar results to Klein, there are some important differences. Namely, our approach allows a more nuanced analysis of the effects of credit growth on the incidence of NPLs, by allowing these to be different before and after the peak of credit growth, while Klein`s approach is concentrated just on the effect of past credit growth (2nd

lag) and does not consider the current values of credit growth in his model. Furthermore, different to our analysis, Klein identifies a positive effect of past credit growth which is statistically significant, but not economically important. Lastly, our results suggest that the long-run effects on NPLs of changes in the independent variables are considerably larger than the estimated short-run effects that we obtained from GMM estimations. Given that the long-run coefficients measure the entire effect from the current impact up to infinity, these coefficients may provide useful insights for policy actions.

7.3 Contribution to Knowledge

This research makes an important contribution to knowledge, filling a gap in the empirical literature on banking stability in Montenegro, a country that chose unilateral euroization, and in CEE countries in general. Our research combines both critical theoretical and empirical analyses, providing useful insights into the distinctive challenges that countries with largely foreign-owned banking sectors may encounter in order to ensure banking and financial stability. The research contributes to knowledge by refining the concept of banking sector stability; in particular, by identifying the causes of banking sector distresses, expressed by the ratio of non-performing loans. Furthermore, our empirical research helps to explain the development of non-performing loans during the boom-bust cycle in past decade in Central and Eastern Europe, particularly in Montenegro. As noted in the previous Section, in both models, Montenegrin and Central Eastern European, the findings suggest that an improvement in the macroeconomic conditions is likely to see a reduction in the relative size of the non-performing loan portfolios of commercial banks. Furthermore, in both models the results also indicate a significant positive effect of past rapid loans growth on the incidence of NPLs in the second year after the end of the credit boom, implying that aggressive lending coincides with more reckless risk taking. In addition, in the Montenegrin model we find evidence that bank-specific features - such as size, cost efficiency, and risk profile - influence the evolution of non-performing loans.

Those findings are all contributions to knowledge concerning our substantive topic; namely, assessing banking sector stability in Montenegro and Central and Eastern Europe. Examining the Montenegrin banking sector is of special interest for researchers since it offers insights from a country with unilateral euroization and a mainly foreign-owned banking sector, with most of the parent banks coming from the euro area. Therefore, Montenegro is highly influenced by the developments in the euro area and the monetary policy of the ECB. Assessing the determinants of loans quality in order to ensure banking stability in a fully euroised economy is even more important as the limited ability to apply monetary policy may be a problem in particular phases of the economic cycle. Namely, in periods of crisis the central bank cannot assume the role of lender of last resort and the main way central bank can react is through adequate supervision of the banking sector.

To the authors' knowledge, Montenegro has not been investigated previously in the context of examination of the determinants of non-performing loans. In order to overcome the absence of empirical research on loans quality in Montenegro, we specified a model to include all available indicators that might have an effect on loans quality. As such, this contributes to the existing literature by providing further evidence on the causes of impaired loans in a small, developing country. However, our contribution goes beyond the investigation of non-performing loans in a hitherto unexplored context. In doing this, we also make a methodological contribution to this area of research: namely, we make some novel contributions to model specification, which highlight the corresponding use of bank-level data, as well as to estimation strategy. This research employs bank-level data that have previously rarely been used by those who study non-performing loans. Bank level data can support more complex analyses of the sources of banking instability. In particular, more analytical work can be done based on bank level data in order to explore complex issues like the effects of banks` management, market power and ownership status. Garrett (2002) explains that the use of aggregated data to explain individual behaviour assumes that the hypothesized relationship between the economic variables in question is homogenous across all individuals. Given the different behaviour of individual banks, analysis using bank level data can therefore provide better insights into the causes of banking instability.[49] Thus, the research in this thesis extends the literature on non-performing loans and utilizes both macroeconomic and bank specific variables.

[49] Using national (aggregate) data to explain bank (individual) behaviour is to commit what is described elsewhere in the social sciences as the "ecological fallacy". For example, as explained in Pugh et al. (2014) the "ecological fallacy" is concerned with the possibility of spurious inferences when interpreting the results of analysis at some aggregate or group level ("ecological analysis") 'in terms of the individuals who gave rise to the data' (Piantadosi, 1988, p.893). When interpreting ecological analyses, 'inferences should be confined to the level of observation' (Piantadosi, 1988, p.902; emphasis added), even if ecological analyses 'may offer valuable clues about individual behaviour' for further investigation using individual data (Freedman, 1999, p.5; also Piantadosi, 1988, p.902).

Regarding model specification, particularly innovative is how the dynamics of the credit cycle and behaviour of NPLs was modelled. Namely, there have been growing concerns about the implications of rapid credit growth for financial stability and the intention was to find an appropriate empirical strategy to capture the phenomenon of rapid growth in banks` lending, which has been particularly prominent Montenegro and other CEE countries. In order to capture that phenomenon, we introduced the interaction of the credit growth during the boom period and an indicator variable for the period after the peak of credit growth in our model specification.

In addition to the above contributions to model specification, which includes bank-specific variables, our research contributes to widening the range of approaches to econometric estimation in this area of research. Namely, in the case of the Montenegrin model, the small number of banks means that we cannot estimate a dynamic linear model (because the corresponding GMM estimation methods require a "large N", i.e. a large number of cross-section units). Accordingly, we test and apply the common factor restrictions (CRFs). Non-rejection of the CRFs suggests estimation of a dynamic linear regression model in the form of an unobservable components model with fixed effects, which is static in the observables but dynamic in unobservables. The testing and application of CRFs in analysing determinants of NPLs presents a novelty in the empirical literature, which may be applicable by other researchers confronting the problem of reconciling dynamic specification with data limited in its cross-sectional "breadth".

Apart from contributing to the empirical literature, this model may also have valuable practical implications for commercial bankers and bank regulators/supervisors in the Montenegrin banking system. Namely, the findings can be used to develop a framework for assessing and analysing credit risk, which is an important indicator of banking and financial stability, the latter being one of the key aims of the Central bank in Montenegro. In particular, it is expected that banks' measures of banks' performance, specific inefficiency measures and their excessive lending may serve as leading indicators of future trends in problem loans. That would suggest that the regulatory authorities could use these measures to detect banks with potentially damaging NPLs increases; this will be explained further examined in the following Section. In addition, the econometric relations established in the model could be used for forecasting and stress testing purposes by both regulators and banks. On the other hand, similar exercises could be performed at the bank-specific level in order to assess future problems that may ensue in particular banks characterized by relatively low performance and efficiency.

Another contribution to knowledge is related to the estimation of determinants of non-performing loans in Central and Eastern Europe. To the authors' knowledge, this is the first investigation for Central and Eastern Europe where ownership status related to the incidence of non-performing loans is examined. Namely, the estimated model captures differences between banks arising from their ownership structure. Another contribution to the empirical literature is that we have used banks` ownership indicators to check whether the country of origin of the parent bank has an impact on the quality of loans of their subsidiary bank. Foreign-owned banks are divided into sub-samples of banks originating from the EU12 countries, the countries of the "Southern Enlargement", the US and Switzerland, CEE countries, Russia and Turkey. Namely, our aim has been to differentiate between parent banks that are coming from countries with different levels of development and have suffered differently from their exposure to the GFC.

These contributions to knowledge are the product of a comprehensive empirical investigation of potential risks to banking stability in Montenegro and Central Eastern Europe. Importantly for future research in this area, the findings suggest that in assessing banking stability we need to consider a combination of macroeconomic, bank-specific and ownership measures.

7.4 Policy Implications

At the beginning of this section we will assess the policy implications drawn from our empirical work, and subsequently compare those implications with those drawn from the literature review. Our empirical research presented in Chapters 5 and 6 provides plausible models for explaining the determinants of non-performing loans. The findings of this thesis highlight the need for a particular policy approach in order to prevent the escalation of credit risks generated in the banking sector and their transformation into systemic risk, given that the credit risk is prevalent in CEE banking sectors. The findings of the thesis supplement those from previous research of the literature on banking sector stability and provide important insights into banks' lending behaviour in Montenegro and other countries of Central and Eastern Europe. Namely, appropriate lending policy designed with relevant economic and bank-specific factors will make a significant impact on reducing banks` non-performing loans.

Based on our findings in Chapters 5 and 6, commercial banks should in their stress testing models or EWSs pay more attention to the future performance of the economy when approving loans, given that our results suggest that the loan delinquencies are likely to be higher during the period of economic slowdown. Furthermore, excessive lending during the boom phase tends to lower the NPL ratio, but to increase it later on, with a delayed effect of two years after the peak, according to our results. More importantly from policy perspective, our findings on the long run coefficients in Chapter 6 indicate that the effect of past credit growth accumulates over time and is thus larger in the long-run. Our results confirmed Jimenez et al.'s (2007) findings that during the excessively high credit growth in boom times banks loosen their lending standards and exploit weaker regulatory standards. In this regard, preventing excessive risk-taking during upturns through adequate supervisory actions is highly desirable. Moreover, bank supervisors should place greater emphasis on the adequacy of the risk management systems in banks, and provisioning procedures in order to prevent future instability of the banking sector.

In order to preserve banking stability, supervisory authorities have to establish more effective monitoring processes and make greater efforts into anticipating adverse developments in non-performing loans for the following period. A strong focus on macroprudential regulation, particularly through capital buffers and countercyclical provisioning, could help to mitigate the impact of adverse macro and bank-specific indicators on the banking sector. The econometric relations exhibited in the Montenegrin model (in Chapter 5) can be used for stress testing purposes and forecasting by supervisory authorities. The regression coefficients on the macroeconomic variables and bank-specific variables can be used in a country macro-stress testing exercise to assess the likely change in NPLs and whether such a change could pose a risks of financial instability.

In addition, based on our findings, bank-specific indicators could be implemented as early warning systems to promote stability in the banking sector. Namely, there is evidence that performance, capital and inefficiency measures may be used as leading indicators of future problem loans in Montenegro, while in other countries of Central and Eastern Europe performance measures can be used as leading indicators of future NPLs. This suggests that the supervisory authorities could use these measures to detect banks with potential NPLs increases. Based on our findings in the Montenegrin model, banking sector supervisors should enforce proper capitalization of the banks during the positive phase of the business cycle, so they would be prepared for the bust period. Our findings support the arguments of BDDK (2009) that during the ‘sunny’ days when the risk appetite is increasing and the expectations are improving, the surveillance and supervision activities should be tightened, whilst during the days of crisis the regulations should be partially loosened. Namely, that during the boom period of the economy, regulatory requirements should be made by tightening the standards and provisions, while during crisis periods the regulatory requirements should be loosened by cleaning out these accommodations in order to avert bad loans.

Our findings from the literature review raise important bank supervisory policy issues: the use of macroprudential policy; the use of bank level variables as early warning indicators; and the role of ownership in determining credit risk. Supervisory authorities should be orientated to a macroprudential stance, as suggested in Chapter 4. Namely, the recent financial crisis demonstrated that the supervisory framework, in design and/or implementation, was inadequate to prevent a panic in the banking sector. As argued in Chapter 4, successful supervisory reform requires efficient monitoring, effective early warning systems, and recognition of the linkages between the macro and microprudential approaches, as they are both important and overlap with substantial complementarities. The ability to comprehensively aggregate positions and exposures across banks in a consistent way would help supervisors to identify trends in the banking sector and improve the macroprudential perspective. In particular, given that the regulatory and supervisory skills of the Central Bank of Montenegro are still developing, (e.g. stress tests and early warning systems are in their infancies) efforts to establish effective macroprudential supervision are essential. In that respect, our findings from Chapter 5 suggest that the Central Bank of Montenegro should expand its supervisory framework to include macroeconomic prudential indicators - such as GDP, inflation and interest rates - when assessing banking sector stability and soundness. However, macroprudentional policy will not be easy to apply, bearing in mind that Montenegro and surrounding countries are new countries still in a catching-up process, which implies financial deepening. Thus, the policy makers should assess whether credit growth rates exceed levels that are justified and sustainable. Periods of relatively high credit growth could be justified by a country's financial development and economic fundamentals (Zdzienicka, 2009). However, assessing whether credit growth is 'excessive' is difficult, especially in the case of the CEE countries, given the catching up processes. Zdzienicka (2009) suggests that in assessing the sustainability of credit growth in a country, we should compare the size of credit deviation to the level of financial development in the country and to the previous leading-to-crises experiences. In order to assess this in Central and Eastern Europe, Coudert and Pouvelle (2010) considered two indicators: the credit/GDP ratio and real credit growth. They identified excessive credit growth by setting the thresholds using two measures. First, they estimated the long-run trend using a Hodrick-Prescott filter and a Baxter-King filter, and then they calculated the deviations from trend. If the credit/GDP ratio and real credit growth had not yet reached its threshold[50], the rapid credit growth may stem from the catching-up process. Furthermore, recent analyses of expansions in credit by Martin and Ventura (2014) distinguish between credit expansions that are backed by expectations of future profits (i.e. fundamental collateral) and those based on expectations of future credit (i.e. bubbly collateral). Namely, Martin and Ventura (2014) explain that during the credit bubble there is more credit available credit for entrepreneurs, which indicates a crowding-in effect. However, on the other hand, entrepreneurs have to use some of this credit to cancel past credit: which indicates a crowding-out effect. They explain that when bubbles are small, the crowding-in effect dominates and investment and output increase, while, if the bubbles are large, the crowding-out effect is likely to dominate and investment and output growth are low. Thus, they conclude that there is an "optimal" bubble size that trades off these two effects to maximize long-term output and consumption growth. Given that markets are mostly unable to provide the optimal amount of bubbly collateral, they conclude that the lender of last resort can replicate the "optimal" bubble allocation by taxing credit when bubbly collateral is excessive and subsidizing it when it is insufficient.

Regarding the predominant foreign-owned banking sectors in CEE, the GFC highlighted the importance of developing mechanisms to curb the effects of large and volatile capital inflows in these economies. Prudential policies designed to influence cross-border capital flows should be a part of the toolkit for capital flows management. As suggested by Spiegel et al. (2010), developing countries should be encouraged to use a fuller range of tools available to manage the volatility associated with the international financial system. Typically these

[50] Coudert and Pouvelle (2010) set thresholds for credit boom which are defined as observations exceeding their trend by more than 1.75 times their standard deviation or 5 percentage points for the credit/GDP ratio.

should include stemming currency appreciation, reducing the volume of inflows, changing their composition towards longer maturity flows[51], providing greater room for manoeuvre for monetary policy, slowing credit growth, and dampening asset price bubbles (Habermeier et al., 2011). Furthermore, as discussed in Chapter 4, full euroization makes the financial sector more vulnerable to a slowdown in capital inflows and calls for capital controls and more prudent fiscal policy, as domestic monetary policy is limited.

Finally, the home country regulators should cooperate closely with host country (the country in which the foreign bank operates) regulators. Indeed, as presented in Chapter 3, the recent GFC underscored the importance of integrated financial supervision. Namely, if large international banking groups go bankrupt, the shock will spread to their subsidiaries in the host countries. The Euro Zone countries have adopted the universal approach of forming a banking union, forgoing the national authorities. The Banking Union is expected to start work in November 2014. Those CEE countries that are not in the EU should cooperate more deeply with this organisation, through stronger supervisory colleges[52] and elimination of legal barriers. For these countries it is also desirable to cooperate with other international institution. Namely, in order to mitigate the problem of high non-performing loans, there has been cooperation between the World Bank, the Montenegrin Ministry of Finance and the CBM, with the purpose of developing a model of voluntary financial restructuring of non-performing loans known as the “Podgorica Approach”. The model is designed with the aim to improve loan quality in Montenegrin banks, allowing the revitalization of bank lending to productive sectors of the Montenegrin economy (Ministry of Finance Bulletin, 2014). The “Podgorica Approach” implies voluntary restructuring of non-performing loans of banks based on the new measures and incentives for banks and companies to comply the assessment of their credit portfolios with the post-crisis economic conditions of their borrowers (Ministry of Finance Bulletin, 2014). The implementation of this project is expected in last quarter of 2014.

Last by not the least, commercial banks should keep improving and harmonizing their reporting of NPLs. Namely, while analysing data for our CEE model, we have noticed that

[51] Long-term flows are generally more stable than short-term ones. Generally, foreign direct investment is the least volatile, followed by long-term debt, short-term debt and portfolio investment.

[52] According to the European Banking Authority (EBA), supervisory colleges are a mechanism for the exchange of information between home and host authorities, for the planning and performance of key supervisory tasks in a coordinated manner or jointly, including all aspects of ongoing supervision, and also for the preparation for and the handling of emergency situations.

some banks did not report NPLs in the Bankscope database. This issue will be discussed in the following Section in more detail, but it also implies that national supervisory authorities should consider regular reporting of NPLs. NPL data should be transparent so as to that they are trackable, thereby increasing awareness of potential shocks. In particular, whether high NPLs could pose a risk for the stability of the banking sector based on some indicative threshold. This policy implication is in line with the Sirtaine and Rosenberg (2012) which suggests that central banks or supervisory authorities should publish monthly data on NPL ratios with a breakdown into the main categories, such as corporate loans, consumer loans, and mortgages, as well as currency denominations.

7.5 Limitations of the Research

There is one main limitation of the research presented in this thesis. This limitation relates to data availability and, in particular, the absence of data on sector-specific non-performing loans. In many transitional countries, problems arise when it is necessary to collect and collate the high-quality data crucial for good decision-making. Looking at data availability in Montenegro, loans quality data from the Central Bank of Montenegro were available only from 2004. In addition, we did not have consistent macroeconomic indicators before 2004, since Montenegro had been passing through political, structural and systemic reforms. Furthermore, the GDP growth rate has not been reported on a quarterly basis. Thus, we had to use interpolated, seasonally adjusted data for quarterly GDP growth, which might not accurately measure the actual changes in the GDP growth rate.

Further limitations apply to the dependent variable, non-performing loans. Our first aim was to conduct an empirical analysis of the determinants of non-performing loans in a disaggregated way by classifying the banks` loan portfolio into two main categories: corporate loans and consumer loans. Our intention was to examine each category of non-performing loans separately so as to identify any differences in their determinants. Unfortunately, the banks in Montenegro were not required to report bad loans in this disaggregated manner. In addition, Bankscope's data did not provide information on corporate and consumer non-performing loans. Given these limitations, we had to use aggregate non-performing loans data.

Furthermore, in Chapter 5, we encountered limitations in specifying our preferred model. Bearing in mind that just eleven banks operate in Montenegro, we were unable to implement the preferred dynamic model. Namely, as stated in Section 5.4, following the critical literature review, a fully dynamic approach – i.e. specifying the model to include the lagged dependent variable among the regressors - was favoured in order to account for time persistence in the structure of NPLs. Also the GMM approach to estimating dynamic models is able to address potential endogeneity associated with some of our independent variables. However, the small number of banks in Montenegro – i.e. the lack of cross sectional units - precludes GMM estimation. Consequently, we had to use FE estimation adjusted to take account of dynamic misspecification (which is possible given the time-series depth of our data). We tested a dynamic specification to see whether the common factor restrictions (CFRs) hold, and so – given that the CFRs cannot be rejected - we estimated an unobserved components model. In this model, we have used lagged explanatory variables, to alleviate potential endogeneity problems.

Some banks used to avoid presenting their asset quality data in Bankscope. Therefore, not all banks in Central and Eastern Europe have been included in our sample; i.e. those that have not reported non-performing loans are, perforce, not available for estimation. In order to avoid potential sample selection bias, in Section 6.11 we investigated which banks had not reported non-performing loans, by their market share of their assets in total banking sector assets in their country of operation. The findings suggested that most banks that did not report NPLs had a market share of less than 5% of total banking sector assets in their country of operation. Only five non-reporting banks had a market share that was between 5-10% of total banking sector assets and two banks had between 10-25% of total assets in the banking sector. Therefore, we concluded that banks with a larger market share (above 10% of total assets in banking sector) are more likely to report NPLs than those with a smaller market share (below 10% of total assets in banking sector). It was concluded that having a sample that contained the systemically important banks in the countries of interest was more important than having a fully representative sample of banks.

7.6 Suggestions for Further Research

The empirical research conducted in this thesis suggests the need for future research. Future work should be focused on assessing, in a disaggregated manner, the potentially different determinants and/or effect sizes of shared determinants of, respectively, non-performing corporate and consumer loans. Once suitable data becomes available, each category of non-performing loans could then be examined separately in order to detect potential differences and similarities in the behaviour of each loan category. Furthermore, in the future research it would be useful to examine the importance of the composition of capital flows for banks' asset quality in Montenegro and in CEE in general.

Our findings suggest that adverse macroeconomic developments are likely to contribute to a rise in the incidence of NPLs. In further empirical work, it would be interesting to examine the effects that the incidence of non-performing loans have on the real economy. Marcucci and Quagliariello (2008) find that there is a feedback from the banking sector to the macroeconomy which operates via the bank capital channel. Espinosa and Prasad (2010) find that the NPL ratio worsens as economic growth weakens and interest rates increase. Their investigation of the effects of increasing non-performing loans on growth suggest that there could be a strong, albeit short-lived adverse feedback effect from losses in banks' balance sheets to economic activity. Similarly, Nkusu (2011) finds that non-performing loans play a central role in the linkages between credit markets frictions and macroeconomic vulnerabilities. Namely, he finds that a sharp increase in NPLs weakens macroeconomic performance, activating a vicious spiral that exacerbates macrofinancial vulnerabilities. According to Impavido et al. (2012), weak loan portfolios might be a potential drag on economic growth. They note that banks saddled with high NPLs might be ill-placed to extend fresh credit. In addition, they reveal that overextended borrowers face reduced incentives to invest and assets remain under their control rather than being reallocated to more productive uses. In general, the literature suggests that there exist interactions between loans quality indicators and macroeconomic conditions, indicating that both directions of influence should be investigated.

Lastly, as we mentioned in Chapter 2, besides NPLs there are other measures of banking stability suggested by the literature, such as loan loss provisions (LLP), loss given default (LGD) and expected default frequencies (EDF), which could be used in assessing banking stability of a country or region. However, since NPLs have been characterised as the main indicator of distress in the banking sector in Montenegro and other CEE countries, we decided to focus on that measure. In addition, LGDs and EDFs measures were not available to use for these countries. Thus, in the future work we could consider including other measures of banking stability. However, on the other hand, the relative simplicity of the Montenegrin and CEE financial systems means a limited transferability of our findings to economies with more complex and highly developed financial systems.

7.7 Conclusion

In this Chapter we have summarized the most prominent findings of the research undertaken in this research programme. The goal of this dissertation has been to assess the main exposures to risk of the banking systems in Montenegro and Central and Eastern Europe and, hence, to inform the design of policies to achieve and preserve banking sector stability. Since assessing the determinants of credit risk is an important issue for banking stability in Central and Eastern Europe and Montenegro, we have investigated the factors that affect banks' loan quality. The non-performing loan ratio was taken as the key measure of the quality of loan portfolios. The main hypothesis was that macroeconomic environment, bank-specific variables and ownership status would jointly explain the incidence of non-performing loans. That hypothesis has been supported across different model specifications. Finally, the dissertation addresses forward-looking central bank policies that should be adopted in order to safeguard banking sector stability.

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APPENDICES

Appendix 5

Appendix 5.1 Correlation Matrix

	npl	ggdp	intr	unemp	roa	roe	cap	ltd	cir	cr	Mshare
npl	1.0000										
ggdp	-0.2267	1.0000									
intr	0.0958	0.0035	1.0000								
unemp	0.0101	0.1970	0.9180	1.0000							
roa	-0.3310	0.0557	0.1335	0.1708	1.0000						
roe	-0.5166	0.1939	0.1253	0.2008	0.5908	1.0000					
cap	0.1485	0.0684	0.0491	0.0677	-0.3318	-0.0018	1.0000				
ltd	0.2836	-0.1425	-0.1712	-0.2329	-0.1808	-0.3853	-0.0452	1.0000			
cir	0.0140	-0.0010	-0.0692	-0.0801	-0.5167	-0.1618	0.4946	-0.0608	1.0000		
cr	-0.2958	0.2698	-0.0272	0.1143	-0.1602	0.0518	0.1061	-0.1127	0.4238	1.0000	
Mshare	-0.0981	0.0237	0.0464	0.0538	0.0286	-0.1301	-0.4670	0.0500	-0.1571	-0.0458	.10000

Appendix 5.2 Testing for CFR

Testing for CFR in a FE estimation of the dynamic linear regression model of order one:		
	OLS	FE
	Prob > chi2	Prob > chi2
GDP	0.5283	0.5379
UNEMP	0.4056	0.4427
INTR	0.0534	0.0951
ROA	0.1827	0.6683
ROE	0.1916	0.0821
CAP	0.0035	0.1364
LtD	0.5883	0.555
CIR	0.023	0.0904
CR	0.2073	0.0366
MSHARE	0.1547	0.0799

Note: We cannot reject the hypothesis of CFR at 1% and at 5% significance level

Appendix 5.3 Model with time dummies

```
xtregar npl l.gdp l.unemp intr  l.roa  l.roe  l.cap  ltd  cir  cr  d2y d2ygloans Mshare
t2004q1 t2004q2 t2004q3 t2004q4 t2005q1 t2005q2 t2005q3 t2005q4 t2006q1 t2006q2 t2006q3
t2006q4 t2007q1 t2007q2 t2007q3 t2007q4 t2008q1 t2008q2 t2008q3 t2008q4 t2009q1 t2009q2
t2009q3 t2009q4 t2010q1 t2010q2 t2010q3 t2010q4, fe rhotype(dw) two

FE (within) regression with AR(1) disturbances  Number of obs      =       215
Group variable: bank                            Number of groups   =        11

R-sq:  within  = 0.3479                         Obs per group: min =        10
       between = 0.2912                                        avg =      19.5
       overall = 0.0746                                        max =        21
                                           F(34,170)          =      2.67
corr(u_i, Xb)  = -0.3368                        Prob > F           =    0.0000
------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    ggdp L1. |  -40.05015   25.75236    -1.56   0.122    -90.88573    10.78543
   unemp L1. |    .506941   1.456109     0.35   0.728    -2.367442    3.381324
        intr |  -8.614297   11.68815    -0.74   0.462     -31.6869    14.45831
     roa L1. |   .0097768   .0536153     0.18   0.856    -.0960607    .1156143
     roe L1. |  -.0068767   .0132366    -0.52   0.604    -.0330059    .0192526
     cap L1. |   .0601473   .0315881     1.90   0.059    -.0022081    .1225028
         ltd |  -.0042863   .0075282    -0.57   0.570    -.0191472    .0105746
         cir |   .0027284   .0012445     2.19   0.030     .0002717     .005185
          cr |  -.0125218   .0174377    -0.72   0.474    -.0469442    .0219005
         d2y |   .0530223   .9117181     0.06   0.954    -1.746725    1.852769
   d2ygloans |   .0781816   .0428086     1.83   0.070    -.0063234    .1626865
      Mshare |  -.4336895   .2043465    -2.12   0.035    -.8370728   -.0303061
     t2005q3 |  -22.36901   68.73775    -0.33   0.745    -158.0585    113.3205
     t2005q4 |  -9.505821   51.24567    -0.19   0.853    -110.6656    91.65399
     t2006q1 |  -1.457913   42.23476    -0.03   0.973    -84.83004    81.91422
     t2006q2 |   .4339681   28.66701     0.02   0.988    -56.15519    57.02312
     t2006q3 |   2.211919   20.76054     0.11   0.915    -38.76973    43.19357
     t2006q4 |  -1.469546   9.529277    -0.15   0.878     -20.2805    17.34141
     t2007q1 |  -4.925585   3.931267    -1.25   0.212    -12.68597    2.834801
     t2007q2 |  -6.082008   5.415391    -1.12   0.263    -16.77208    4.608065
     t2007q3 |  -.8015727   6.241583    -0.13   0.898    -13.12256    11.51942
     t2007q4 |   1.101839   6.424994     0.17   0.864    -11.58121    13.78488
     t2008q1 |   1.841725   6.314283     0.29   0.771    -10.62278    14.30623
     t2008q2 |   1.004762   6.012033     0.17   0.867    -10.86309    12.87262
     t2008q3 |   3.659367   6.118847     0.60   0.551    -8.419339    15.73807
     t2008q4 |   8.992732   6.442816     1.40   0.165    -3.725494    21.71096
     t2009q1 |   7.991669   6.368391     1.25   0.211    -4.579641    20.56298
     t2009q2 |   9.518385   6.234915     1.53   0.129    -2.789441    21.82621
     t2009q3 |   7.879273   6.603712     1.19   0.234    -5.156564    20.91511
     t2009q4 |   8.784808   6.682867     1.31   0.190    -4.407282     21.9769
     t2010q1 |   11.69317    6.34332     1.84   0.067    -.8286463    24.21499
     t2010q2 |   14.08852   6.649728     2.12   0.036     .9618498     27.2152
     t2010q3 |   15.11357   6.728697     2.25   0.026     1.831006    28.39613
     t2010q4 |   16.80419   6.861874     2.45   0.015     3.258733    30.34964
       _cons |   119.9292   32.16229     3.73   0.000     56.44034    183.4182
-------------+----------------------------------------------------------------
-------------+----------------------------------------------------------------
      rho_ar |   .7087069
     sigma_u |  5.3484261
     sigma_e |  3.2900044
     rho_fov |  .72548348   (fraction of variance because of u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(10,170) =     2.95             Prob > F = 0.0019
```

Joint test for time dummies for the pre-crisis period

```
. test  t2004q1 t2004q2 t2004q3 t2004q4 t2005q1 t2005q2 t2005q3 t2005q4 t2006q1 t2006q2 t2006q3 t2006q4
t2007q1 t2007q2 t2007q3 t2007q4

 ( 1)  o.t2004q1 = 0
 ( 2)  o.t2004q2 = 0
 ( 3)  o.t2004q3 = 0
 ( 4)  o.t2004q4 = 0
 ( 5)  o.t2005q1 = 0
 ( 6)  o.t2005q2 = 0
 ( 7)  t2005q3 = 0
 ( 8)  t2005q4 = 0
 ( 9)  t2006q1 = 0
 (10)  t2006q2 = 0
 (11)  t2006q3 = 0
 (12)  t2006q4 = 0
 (13)  t2007q1 = 0
 (14)  t2007q2 = 0
 (15)  t2007q3 = 0
 (16)  t2007q4 = 0
       Constraint 1 dropped
       Constraint 2 dropped
       Constraint 3 dropped
       Constraint 4 dropped
       Constraint 5 dropped
       Constraint 6 dropped

       F( 10,   170) =    0.96
            Prob > F =    0.4795
```

Joint test for time dummies for the period after the crisis

```
. test   t2008q1 t2008q2 t2008q3 t2008q4 t2009q1 t2009q2 t2009q3 t2009q4 t2010q1 t2010q2 t2010q3

 ( 1)  t2008q1 = 0
 ( 2)  t2008q2 = 0
 ( 3)  t2008q3 = 0
 ( 4)  t2008q4 = 0
 ( 5)  t2009q1 = 0
 ( 6)  t2009q2 = 0
 ( 7)  t2009q3 = 0
 ( 8)  t2009q4 = 0
 ( 9)  t2010q1 = 0
 (10)  t2010q2 = 0
 (11)  t2010q3 = 0

       F( 11,   170) =    1.73
            Prob > F =    0.0707
```

```
. lincom  d2ygloans+gloans

 ( 1)  gloans + d2ygloans = 0

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |   .0656597   .0420425     1.56   0.120    -.0173329    .1486523
------------------------------------------------------------------------------
```

Appendix 5.4 Model without time dummies

```
. xtregar npl l.ggdp l.unemp intr  l.roa  l.roe  l.cap  ltd  cir  cr  d2y d2ygloans Mshare,
fe rhotype(dw) two

FE (within) regression with AR(1) disturbances  Number of obs      =       215
Group variable: bank                            Number of groups   =        11

R-sq:  within  = 0.1707                         Obs per group: min =        10
       between = 0.1551                                        avg =      19.5
       overall = 0.1001                                        max =        21

                                                F(12,192)          =      3.29
corr(u_i, Xb)  = -0.6245                        Prob > F           =    0.0002

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        ggdp |
         L1. |  -13.71162   8.064401    -1.70   0.091    -29.61781    2.194577
             |
       unemp |
         L1. |  -.1596625   .2986532    -0.53   0.594    -.7487251       .4294
             |
        intr |   1.115556   1.020048     1.09   0.275     -.896383    3.127494
             |
         roa |
         L1. |  -.0050801   .0558455    -0.09   0.928    -.1152296    .1050693
             |
         roe |
         L1. |  -.0267692   .0134357    -1.99   0.048    -.0532697   -.0002687
             |
         cap |
         L1. |   .0652427   .0239263     2.73   0.007     .0180506    .1124348
             |
         ltd |   .0012097   .0072311     0.17   0.867    -.0130529    .0154723
         cir |   .0049671   .0013391     3.71   0.000      .002326    .0076083
          cr |  -.0388141   .0170018    -2.28   0.024    -.0723484   -.0052798
         d2y |  -.2081257   .8960857    -0.23   0.817    -1.975562    1.559311
   d2ygloans |   .0759995   .0437011     1.74   0.084    -.0101964    .1621954
      Mshare |  -.4143237   .2098485    -1.97   0.050    -.8282281   -.0004193
       _cons |   16.27858   4.172807     3.90   0.000     8.048151    24.50901
-------------+----------------------------------------------------------------
      rho_ar |  .66932741
     sigma_u |  5.5813076
     sigma_e |  3.5737973
     rho_fov |  .70921793   (fraction of variance because of u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(10,192) =     3.81             Prob > F = 0.0001
```

Appendix 6

List of Abbreviations

Country 1 – Albania

Country 2 – Bosnia and Herzegovina

Country 3 – Bulgaria

Country 4 - Croatia

Country 5 – Czech Republic

Country 6 - Estonia

Country 7 - Hungary

Country 8 - Latvia

Country 9 - Lithuania

Country 10 - Macedonia

Country 11 - Montenegro

Country 12 - Poland

Country 13 - Romania

Country 14 - Serbia

Country 15 - Slovakia

Country 16 – Slovenia

Yr1 – 1999

Yr2 – 2000

Yr3 – 2001

Yr4 – 2002

Yr5 – 2003

Yr6 – 2004

Yr7 – 2005

Yr8 – 2006

Yr9 – 2007

Yr10 – 2008

Yr11 – 2009

Yr12 – 2010

Yr13 – 2011

Appendix 6.1 Correlation Matrix

	npl	roa	roe	cr	cap	ltd	cir	market~e	gdp	inf	unempl	debt	excr	inter
npl	1.0000													
roa	-0.2709	1.0000												
roe	-0.3081	0.5701	1.0000											
cr	-0.2014	0.2205	0.1475	1.0000										
cap	0.1039	-0.0937	-0.0514	0.0021	1.0000									
ltd	0.0909	-0.0598	-0.1285	0.0563	0.0867	1.0000								
cir	0.1845	-0.5695	-0.3159	-0.0342	0.3752	-0.0496	1.0000							
marketshare	-0.1298	0.1269	0.1389	-0.0451	-0.1755	-0.0682	-0.1602	1.0000						
gdp	-0.2325	0.2574	0.2946	0.3003	0.0386	-0.0678	-0.0153	0.0798	1.0000					
inf	-0.0128	0.1680	0.2329	0.1297	0.1436	-0.0000	0.0291	-0.0073	0.1106	1.0000				
unempl	0.2035	-0.0849	-0.1462	-0.1003	0.2923	-0.0738	0.1155	-0.0050	-0.0378	-0.1592	1.0000			
debt	0.1196	0.0906	-0.0277	-0.0625	0.0079	-0.0167	0.0019	-0.0627	-0.1334	0.0397	0.1380	1.0000		
excr	-0.0067	0.0040	0.0009	-0.0102	-0.0122	0.0221	-0.0217	0.0867	-0.0349	0.0590	-0.0135	0.0662	1.0000	
inter	0.0824	0.0446	0.1394	0.0400	0.1818	-0.0593	0.0420	0.0078	-0.0908	0.7229	0.0937	0.1806	0.1677	1.0000

Appendix 6.2 Estimation Procedure

6.2.1 Fixed Effects

```
xtreg npl roa roe cr cap ltd cir foreigndomestic_51 marketshare gdp inf unempl debt excr inter southenl cee
usach ru tr yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4
country5 country6 country7 country8 country9 country10 country11 country12 country13 country14 country15
country16, fe
note: yr11 omitted because of collinearity
note: country1 omitted because of collinearity
note: country2 omitted because of collinearity
note: country3 omitted because of collinearity
note: country4 omitted because of collinearity
note: country5 omitted because of collinearity
note: country6 omitted because of collinearity
note: country7 omitted because of collinearity
note: country8 omitted because of collinearity
note: country9 omitted because of collinearity
note: country10 omitted because of collinearity
note: country11 omitted because of collinearity
note: country12 omitted because of collinearity
note: country13 omitted because of collinearity
note: country14 omitted because of collinearity
note: country15 omitted because of collinearity
note: country16 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =      1250
Group variable: bank                            Number of groups   =       242

R-sq:  within  = 0.3725                         Obs per group: min =         1
       between = 0.0498                                        avg =       5.2
       overall = 0.1860                                        max =        13

                                                F(31,977)          =     18.71
corr(u_i, Xb)  = -0.3512                        Prob > F           =    0.0000

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         roa |   -.395523   .2506638    -1.58   0.115    -.8874244    .0963784
         roe |  -.1155488   .0244771    -4.72   0.000    -.1635826   -.0675151
          cr |  -.0305364   .0066822    -4.57   0.000    -.0436495   -.0174234
         cap |  -.0063141   .0359121    -0.18   0.860    -.0767878    .0641596
         ltd |   .0163167   .0053615     3.04   0.002     .0057953    .0268382
         cir |  -.0009249   .0074028    -0.12   0.901    -.0154522    .0136024
foreigndo~51 |   -1.29783   1.351764    -0.96   0.337    -3.950526    1.354866
 marketshare |  -.2353636   .0865058    -2.72   0.007    -.4051221    -.065605
         gdp |  -.1298913   .0947337    -1.37   0.171    -.3157962    .0560136
         inf |   -.147729   .1118135    -1.32   0.187    -.3671512    .0716932
      unempl |   .5135481   .1095489     4.69   0.000     .2985699    .7285262
        debt |  -.0450305   .0422024    -1.07   0.286    -.1278483    .0377872
        excr |   .0040062   .0066841     0.60   0.549    -.0091107     .017123
        inter|  -.0606623   .1117615    -0.54   0.587    -.2799826    .1586579
    southenl |  -.8959394   3.573607    -0.25   0.802    -7.908768    6.116889
         cee |   2.310981   2.274434     1.02   0.310    -2.152358     6.77432
       usach |   1.003299   3.337204     0.30   0.764    -5.545614    7.552211
          ru |  -2.903197   6.093176    -0.48   0.634    -14.86041    9.054022
          tr |  -28.83644    7.85752    -3.67   0.000      -44.256   -13.41688
         yr1 |   7.124067   2.178263     3.27   0.001     2.849454    11.39868
         yr2 |   7.443512    2.10452     3.54   0.000     3.313613    11.57341
         yr3 |   4.029292   2.012101     2.00   0.046      .080754    7.977829
         yr4 |   4.872069   1.839303     2.65   0.008     1.262631    8.481508
         yr5 |   3.265078   1.801981     1.81   0.070    -.2711202    6.801275
         yr6 |  -.2249206   1.741927    -0.13   0.897    -3.643269    3.193428
         yr7 |   .4492004   1.584735     0.28   0.777    -2.660677    3.559077
         yr8 |  -.1077034   1.586159    -0.07   0.946    -3.220374    3.004967
         yr9 |   1.258387   1.451194     0.87   0.386    -1.589428    4.106202
        yr10 |   .7440161   1.275175     0.58   0.560    -1.758381    3.246414
        yr11 |  (omitted)
        yr12 |   3.448329   1.117562     3.09   0.002     1.255231    5.641427
        yr13 |   5.880707   1.281182     4.59   0.000     3.366522    8.394892
    country1 |  (omitted)
    country2 |  (omitted)
    country3 |  (omitted)
    country4 |  (omitted)
    country5 |  (omitted)
    country6 |  (omitted)
    country7 |  (omitted)
    country8 |  (omitted)
    country9 |  (omitted)
   country10 |  (omitted)
```

```
   country11 |  (omitted)
   country12 |  (omitted)
   country13 |  (omitted)
   country14 |  (omitted)
   country15 |  (omitted)
   country16 |  (omitted)
       _cons |   6.610888   2.351886     2.81   0.005     1.995559    11.22622
-------------+----------------------------------------------------------------
     sigma_u |  13.151834
     sigma_e |  6.9492899
         rho |  .78174141   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(241, 977) =     6.13           Prob > F = 0.0000
```

```
xtserial npl  roa roe cr cap ltd cir foreigndomestic_51 marketshare gdp inf unempl debt excr inter southenl
cee usach ru tr yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country2 country3 country4 country5
country6 country7 country8 country9 country10 country11 country12 country13 country14 country15 country16

Wooldridge test for autocorrelation in panel data
H0: no first order autocorrelation
    F(  1,     165) =     45.564
           Prob > F =      0.0000
```

Serial correlation has been identified and the model is misspecified.

6.2.1.1 FE with Lagged Dependent Variable

```
xtreg npl  lagnpl   roa  roe  cr  cap  ltd  cir  foreigndomestic_51  marketshare  gdp  inf  unempl  debt  excr  inter
southenl cee usach ru tr yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3
country4  country5  country6  country7  country8  country9  country10  country11  country12  country13  country14
country15 country16, fe
note: yr1 omitted because of collinearity
note: yr11 omitted because of collinearity
note: country1 omitted because of collinearity
note: country2 omitted because of collinearity
note: country3 omitted because of collinearity
note: country4 omitted because of collinearity
note: country5 omitted because of collinearity
note: country6 omitted because of collinearity
note: country7 omitted because of collinearity
note: country8 omitted because of collinearity
note: country9 omitted because of collinearity
note: country10 omitted because of collinearity
note: country11 omitted because of collinearity
note: country12 omitted because of collinearity
note: country13 omitted because of collinearity
note: country14 omitted because of collinearity
note: country15 omitted because of collinearity
note: country16 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =      1052
Group variable: bank                            Number of groups   =       226

R-sq:  within  = 0.6052                         Obs per group: min =         1
       between = 0.3377                                        avg =       4.7
       overall = 0.5306                                        max =        12

                                                F(31,795)          =     39.32
corr(u_i, Xb)  = -0.0406                        Prob > F           =    0.0000

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lagnpl |   .4953182   .0263627    18.79   0.000      .4435695    .5470668
         roa |  -1.121414   .2339452    -4.79   0.000     -1.580637   -.6621906
         roe |  -.0339501   .0207291    -1.64   0.102     -.0746402      .00674
          cr |  -.0249287    .005411    -4.61   0.000     -.0355502   -.0143071
         cap |   .0383247   .0309705     1.24   0.216     -.0224689    .0991184
         ltd |   .0113772    .004312     2.64   0.008      .0029129    .0198415
         cir |   .0050451   .0075789     0.67   0.506     -.0098319    .0199221
foreigndo~51 |  -.0742147   1.175492    -0.06   0.950      -2.38165    2.233221
 marketshare |  -.1179603   .0741624    -1.59   0.112     -.2635374    .0276169
         gdp |  -.0838108   .0763273    -1.10   0.273     -.2336377    .0660161
         inf |  -.0730275   .0928234    -0.79   0.432     -.2552355    .1091805
      unempl |   .1194146   .0913109     1.31   0.191     -.0598243    .2986536
        debt |  -.0333624   .0365669    -0.91   0.362     -.1051416    .0384167
        excr |   .0024703   .0055044     0.45   0.654     -.0083346    .0132753
       inter|   -.000307    .0980622    -0.00   0.998     -.1927984    .1921844
```

```
    southenl |  -.7053295   2.937179    -0.24   0.810    -6.470872    5.060213
         cee |   .8931705   1.825407     0.49   0.625    -2.690017    4.476358
       usach |   1.184215   2.769382     0.43   0.669    -4.251951    6.620381
          ru |  -.4630375   5.675664    -0.08   0.935     -11.6041    10.67802
          tr |   11.57175   5.938687     1.95   0.052    -.0856092    23.22911
         yr1 |  (omitted)
         yr2 |   2.181845   1.694248     1.29   0.198    -1.143884    5.507574
         yr3 |   .1474408   1.618598     0.09   0.927     -3.02979    3.324672
         yr4 |   2.335889    1.48836     1.57   0.117      -.58569    5.257468
         yr5 |   .5070228   1.432131     0.35   0.723    -2.304183    3.318229
         yr6 |  -.8256855   1.394217    -0.59   0.554    -3.562466    1.911095
         yr7 |   .3132699   1.260727     0.25   0.804    -2.161477    2.788017
         yr8 |  -.9430221   1.265795    -0.75   0.456    -3.427717    1.541673
         yr9 |  -.3584724   1.158853    -0.31   0.757    -2.633246    1.916301
        yr10 |  -.4534111   1.015142    -0.45   0.655    -2.446087    1.539264
        yr11 |  (omitted)
        yr12 |   1.829478   .8624193     2.12   0.034     .1365895    3.522366
        yr13 |   2.698665   .9968276     2.71   0.007     .7419397     4.65539
    country1 |  (omitted)
    country2 |  (omitted)
    country3 |  (omitted)
    country4 |  (omitted)
    country5 |  (omitted)
    country6 |  (omitted)
    country7 |  (omitted)
    country8 |  (omitted)
    country9 |  (omitted)
   country10 |  (omitted)
   country11 |  (omitted)
   country12 |  (omitted)
   country13 |  (omitted)
   country14 |  (omitted)
   country15 |  (omitted)
   country16 |  (omitted)
       _cons |   5.137167   2.014184     2.55   0.011     1.183419    9.090916
-------------+----------------------------------------------------------------
     sigma_u |  10.227925
     sigma_e |  5.0170533
         rho |  .80605195   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(225, 795) =     3.91            Prob > F = 0.0000
xtserial npl lagnpl roa roe cr cap ltd cir foreigndomestic_51 marketshare gdp inf unempl debt  excr inter
southenl cee usach ru tr yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country2 country3 country4
country5 country6 country7 country8 country9 country10 country11 country12 country13 country14 country15
country16

Wooldridge test for autocorrelation in panel data
H0: no first order autocorrelation
    F(  1,     152) =     33.497
           Prob > F =      0.0000
```

Again, the serial correlation has been identified and the model is misspecified.

We run OLS to check the coefficient of lagged dependent variable, because we will need to compare that coefficient with the coefficient of lagged dependent variable from GMM estimations.

6.2.1.2 OLS

```
. reg npl lagnpl  roa roe cr cap ltd cir foreigndomestic_51 marketshare gdp inf unempl debt   excr inter
southenl cee usach ru tr yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country2 country3 country4
country5 country6 country7 country8 country9 country10 country11 country12 country13 country14 country15
country16
note: yr1 omitted because of collinearity
note: yr4 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =    1052
-------------+------------------------------           F( 46,  1005) =   46.93
       Model |  90505.2604    46  1967.50566           Prob > F      =  0.0000
    Residual |  42130.1372  1005  41.9205345           R-squared     =  0.6824
-------------+------------------------------           Adj R-squared =  0.6678
       Total |  132635.398  1051  126.199237           Root MSE      =  6.4746

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lagnpl |   .7455599    .022364    33.34   0.000     .7016744    .7894454
         roa |  -.5223034   .1329762    -3.93   0.000    -.7832463   -.2613605
         roe |   -.052609   .0098879    -5.32   0.000    -.0720123   -.0332057
          cr |  -.0210101   .0056207    -3.74   0.000    -.0320398   -.0099804
```

cap	.0028556	.0226029	0.13	0.899	-.0414987	.0472098
ltd	.0037062	.0024456	1.52	0.130	-.0010928	.0085052
cir	-.0058824	.0070816	-0.83	0.406	-.0197789	.0080141
foreigndo~51	-1.001662	.5049898	-1.98	0.048	-1.992617	-.0107069
marketshare	-.0089051	.0210227	-0.42	0.672	-.0501585	.0323484
gdp	-.2288802	.0893373	-2.56	0.011	-.4041893	-.053571
inf	.163815	.1040326	1.57	0.116	-.0403311	.367961
unempl	-.196319	.1003169	-1.96	0.051	-.3931737	.0005356
debt	.1511484	.0301877	5.01	0.000	.0919102	.2103866
excr	-.0003543	.0065033	-0.05	0.957	-.0131159	.0124072
inter	-.0341631	.1082889	-0.32	0.752	-.2466614	.1783353
southenl	-.1205748	.96783	-0.12	0.901	-2.019774	1.778624
cee	1.983862	.8724892	2.27	0.023	.271753	3.695972
usach	1.041619	1.126632	0.92	0.355	-1.169201	3.25244
ru	3.438768	3.039091	1.13	0.258	-2.524924	9.402459
tr	-3.655294	2.616089	-1.40	0.163	-8.788917	1.47833
yr1	(omitted)					
yr2	-1.183402	1.711057	-0.69	0.489	-4.541057	2.174252
yr3	-2.587595	1.721626	-1.50	0.133	-5.965989	.7907997
yr4	(omitted)					
yr5	-1.666111	1.673587	-1.00	0.320	-4.950237	1.618015
yr6	-2.173886	1.591243	-1.37	0.172	-5.296425	.9486525
yr7	-.4092636	1.482422	-0.28	0.783	-3.318261	2.499734
yr8	-1.400074	1.445108	-0.97	0.333	-4.235848	1.435701
yr9	-.9623301	1.442244	-0.67	0.505	-3.792485	1.867824
yr10	-2.261062	1.506068	-1.50	0.134	-5.216461	.6943373
yr11	-1.829073	1.751229	-1.04	0.297	-5.265557	1.607412
yr12	-.4638737	1.479422	-0.31	0.754	-3.366984	2.439237
yr13	-1.104332	1.487035	-0.74	0.458	-4.022382	1.813717
country2	4.521779	2.505554	1.80	0.071	-.3949388	9.438497
country3	1.426323	2.259364	0.63	0.528	-3.007289	5.859935
country4	-2.353352	1.951094	-1.21	0.228	-6.182037	1.475333
country5	-2.391206	2.035946	-1.17	0.240	-6.386398	1.603987
country6	2.796891	2.61784	1.07	0.286	-2.340167	7.933949
country7	-7.247158	2.009504	-3.61	0.000	-11.19046	-3.303853
country8	1.284305	2.23116	0.58	0.565	-3.093962	5.662571
country9	-.5630494	2.184764	-0.26	0.797	-4.850272	3.724173
country10	3.207236	2.903653	1.10	0.270	-2.490681	8.905153
country11	-1.057407	2.209374	-0.48	0.632	-5.392922	3.278109
country12	-3.812402	1.804476	-2.11	0.035	-7.353375	-.2714295
country13	.8713631	2.198609	0.40	0.692	-3.443027	5.185753
country14	.2456278	2.120517	0.12	0.908	-3.915521	4.406776
country15	-1.350842	1.949819	-0.69	0.489	-5.177025	2.47534
country16	-2.367627	1.967193	-1.20	0.229	-6.227903	1.492649
_cons	4.541505	3.252191	1.40	0.163	-1.840359	10.92337

6.2.2 System GMM

```
xtabond2  npl lagnpl  roa roe cr cap ltd cir  marketshare foreigndomestic_51  gdp inf unempl debt    excr
inter southenl cee usach ru tr  yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2
country3 country4 country5 country6 country7 country8 country9 country10 country11 country12 country13
country14 country15 country16, gmm(lagnpl, laglimits (1 2)) gmm(cap, laglimits (2 2)) gmm(roa,laglimits (2
2)) gmm(roe, laglimits (2 2)) gmm(cir, laglimits (2 2)) gmm(cr, laglimits (2 2)) gmm(ltd, laglimits (2 2))
iv(marketshare gdp inf unempl debt excr  foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2 yr3 yr4
yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7
country8 country9 country10 country11 country12 country13 country14 country15 country16) robust twostep
```

```
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =      1052
Time variable : year                            Number of groups   =       226
Number of instruments = 204                     Obs per group: min =         1
Wald chi2(46) =   1009.43                                      avg =      4.65
Prob > chi2   =     0.000                                      max =        12
------------------------------------------------------------------------------------
                   |              Corrected
               npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
            lagnpl |   .6084145   .1025069     5.94   0.000     .4075047    .8093243
               roa |  -1.531758   .4553056    -3.36   0.001     -2.42414   -.6393754
               roe |  -.0626073   .0452898    -1.38   0.167    -.1513737    .0261591
                cr |  -.0295122   .0162571    -1.82   0.069    -.0613756    .0023512
               cap |   -.047681   .0577758    -0.83   0.409    -.1609196    .0655575
               ltd |  -.0027927   .0056642    -0.49   0.622    -.0138942    .0083089
               cir |  -.0370535   .0218095    -1.70   0.089    -.0797993    .0056924
       marketshare |  -.0212424   .0299489    -0.71   0.478    -.0799412    .0374564
foreigndomestic_51 |  -1.334955   .7542978    -1.77   0.077    -2.813351    .1434418
               gdp |  -.0387914   .1010275    -0.38   0.701    -.2368016    .1592188
               inf |   .1992409   .1366772     1.46   0.145    -.0686414    .4671232
            unempl |  -.1829795   .1478316    -1.24   0.216     -.472724     .106765
              debt |   .2142794    .125893     1.70   0.089    -.0324664    .4610252
              excr |   .0005151   .0051626     0.10   0.921    -.0096035    .0106337
             inter |  -.0707728    .125111    -0.57   0.572    -.3159858    .1744402
          southenl |  -.5372204   1.034705    -0.52   0.604    -2.565204    1.490763
               cee |   1.616707   1.242913     1.30   0.193    -.8193584    4.052772
             usach |    1.41728   1.268952     1.12   0.264    -1.069819    3.904379
                ru |   1.471435   4.076153     0.36   0.718    -6.517678    9.460548
                tr |  -2.161659   2.126665    -1.02   0.309    -6.329845    2.006528
               yr2 |   1.861715   2.548575     0.73   0.465      -3.1334    6.856831
               yr3 |   .6745507   2.083172     0.32   0.746    -3.408392    4.757493
               yr4 |   2.510812   2.001101     1.25   0.210    -1.411274    6.432898
               yr5 |   1.197975   1.578745     0.76   0.448    -1.896309    4.292259
               yr6 |    .169712   1.676164     0.10   0.919    -3.115509    3.454933
               yr7 |   1.512046   1.764114     0.86   0.391    -1.945554    4.969645
               yr8 |   .6287041   1.812034     0.35   0.729    -2.922817    4.180225
               yr9 |   .9812836   1.700989     0.58   0.564    -2.352595    4.315162
              yr10 |  -.3736068    1.60838    -0.23   0.816    -3.525973    2.778759
              yr11 |   .1134995   1.551248     0.07   0.942     -2.92689    3.153889
              yr12 |   .7458245   .8819141     0.85   0.398    -.9826953    2.474344
          country1 |   1.501583   3.035868     0.49   0.621    -4.448608    7.451775
          country2 |   5.703931   4.899917     1.16   0.244     -3.89973    15.30759
          country3 |      6.091   2.625037     2.32   0.020     .9460222    11.23598
          country4 |    .825963   1.191008     0.69   0.488    -1.508371    3.160297
          country5 |   .5980239   1.159049     0.52   0.606     -1.67367    2.869718
          country6 |   7.957407   4.184159     1.90   0.057    -.2433936    16.15821
          country7 |  -6.939815   4.216302    -1.65   0.100    -15.20361    1.323984
          country8 |   4.186452   2.254847     1.86   0.063    -.2329682    8.605871
          country9 |   2.738915   2.547031     1.08   0.282    -2.253174    7.731004
         country10 |   7.997133   4.896472     1.63   0.102    -1.599776    17.59404
         country11 |   2.734591   2.432635     1.12   0.261    -2.033286    7.502469
         country12 |  -1.324597   2.138088    -0.62   0.536    -5.515172    2.865978
         country13 |   5.121403   2.196458     2.33   0.020     .8164238    9.426382
         country14 |   6.343831   3.880705     1.63   0.102    -1.262211    13.94987
         country15 |   .3172123   1.421114     0.22   0.823    -2.468119    3.102544
             _cons |   2.846229   4.977794     0.57   0.567    -6.910068    12.60253
------------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2 yr3
yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7
country8 country9 country10 country11 country12 country13 country14 country15 country16)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).lagnpl
```

```
    L2.cap
    L2.roa
    L2.roe
    L2.cir
    L2.cr
    L2.ltd
Instruments for levels equation
  Standard
    _cons marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2
yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6
country7 country8 country9 country10 country11 country12 country13 country14 country15  country16
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.lagnpl
    DL.cap
    DL.roa
    DL.roe
    DL.cir
    DL.cr
    DL.ltd
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -3.10  Pr > z =  0.002
Arellano-Bond test for AR(2) in first differences: z =  -1.08  Pr > z =  0.280
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(157)  = 535.40  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(157)  = 147.61  Prob > chi2 =  0.693
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(74)   =  76.76  Prob > chi2 =  0.390
    Difference (null H = exogenous): chi2(83)   =  70.85  Prob > chi2 =  0.827
  gmm(lagnpl, lag(1 2))
    Hansen test excluding group:     chi2(130)  = 128.49  Prob > chi2 =  0.521
    Difference (null H = exogenous): chi2(27)   =  19.12  Prob > chi2 =  0.866
  gmm(cap, lag(2 2))
    Hansen test excluding group:     chi2(135)  = 134.77  Prob > chi2 =  0.489
    Difference (null H = exogenous): chi2(22)   =  12.84  Prob > chi2 =  0.938
  gmm(roa, lag(2 2))
    Hansen test excluding group:     chi2(134)  = 133.18  Prob > chi2 =  0.504
    Difference (null H = exogenous): chi2(23)   =  14.43  Prob > chi2 =  0.914
  gmm(roe, lag(2 2))
    Hansen test excluding group:     chi2(134)  = 132.69  Prob > chi2 =  0.516
    Difference (null H = exogenous): chi2(23)   =  14.92  Prob > chi2 =  0.898
  gmm(cir, lag(2 2))
    Hansen test excluding group:     chi2(134)  = 134.80  Prob > chi2 =  0.464
    Difference (null H = exogenous): chi2(23)   =  12.81  Prob > chi2 =  0.956
  gmm(cr, lag(2 2))
    Hansen test excluding group:     chi2(134)  = 134.50  Prob > chi2 =  0.472
    Difference (null H = exogenous): chi2(23)   =  13.11  Prob > chi2 =  0.950
  gmm(ltd, lag(2 2))
    Hansen test excluding group:     chi2(134)  = 129.12  Prob > chi2 =  0.603
    Difference (null H = exogenous): chi2(23)   =  18.49  Prob > chi2 =  0.730
  iv(marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2 yr3 yr4
yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7
country8 country9 country10 country11 country12 country13 country14 country15 country16)
    Hansen test excluding group:     chi2(118)  = 122.41  Prob > chi2 =  0.372
    Difference (null H = exogenous): chi2(39)   =  25.20  Prob > chi2 =  0.957
```

6.2.2.1 Increasing Lag Limits and Using Collapse Command

```
xtabond2  npl lagnpl  roa roe cr cap ltd cir marketshare foreigndomestic_51  gdp inf unempl debt  excr
inter southenl cee usach ru tr  yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2
country3 country4 country5 country6 country7 country8 country9 country10 country11 country12 country13
country14  country15  country16,  gmm(lagnpl,  laglimits  (1  4)collapse)  gmm(cap,  laglimits  (2  2))
gmm(roa,laglimits  (2  2)collapse)  gmm(roe,  laglimits  (2  2))  gmm(cir,  laglimits  (2  2)collapse)  gmm(cr,
laglimits  (2  4)collapse)  gmm(ltd,  laglimits  (2  3)collapse)  iv(  marketshare gdp inf unempl debt   excr
foreigndomestic_51  inter southenl cee usach ru tr yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13
country1   country2  country3  country4  country5  country6  country7  country8  country9  country10  country11
country12 country13 country14 country15 country16) robust twostep
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =      1052
Time variable : year                            Number of groups   =       226
Number of instruments = 100                     Obs per group: min =         1
Wald chi2(46) =   1253.05                                      avg =      4.65
Prob > chi2   =     0.000                                      max =        12
------------------------------------------------------------------------------
             |              Corrected
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lagnpl |   .6967034   .1393223     5.00   0.000     .4236367    .9697701
```

```
                 roa |  -1.570817   .7145712    -2.20   0.028    -2.971351   -.1702836
                 roe |  -.0297685   .0464899    -0.64   0.522     -.120887      .06135
                  cr |   .0021366   .0234816     0.09   0.928    -.0438864    .0481596
                 cap |  -.1624541   .0882081    -1.84   0.066    -.3353387    .0104305
                 ltd |  -.0012906   .0174405    -0.07   0.941    -.0354733    .0328921
                 cir |   -.014612   .0383854    -0.38   0.703     -.089846     .060622
         marketshare |  -.0091847   .0320521    -0.29   0.774    -.0720057    .0536362
 foreigndomestic_51 |   -1.41281   .9083185    -1.56   0.120    -3.193081    .3674618
                 gdp |   .0057717   .1145351     0.05   0.960     -.218713    .2302564
                 inf |   .2694532   .1366056     1.97   0.049     .0017111    .5371952
              unempl |  -.0268283   .1789099    -0.15   0.881    -.3774854    .3238287
                debt |   .1950115   .1233148     1.58   0.114    -.0466811    .4367042
                excr |  -.0006456   .0057175    -0.11   0.910    -.0118517    .0105605
               inter |  -.0313966   .1338577    -0.23   0.815    -.2937528    .2309597
            southenl |  -.0220164   1.274688    -0.02   0.986    -2.520358    2.476325
                 cee |   2.027745   1.427821     1.42   0.156    -.7707327    4.826224
               usach |   2.444645   1.376377     1.78   0.076     -.253004    5.142294
                  ru |   2.290187   3.836959     0.60   0.551    -5.230115    9.810489
                  tr |   3.640284   3.098936     1.17   0.240    -2.433519    9.714088
                 yr2 |  -.9798246   2.395117    -0.41   0.682    -5.674167    3.714518
                 yr3 |  -.6137675   2.234291    -0.27   0.784    -4.992896    3.765361
                 yr4 |   .2117823   2.178823     0.10   0.923    -4.058633    4.482197
                 yr5 |  -.0930976   1.862891    -0.05   0.960    -3.744296    3.558101
                 yr6 |  -.2176011   2.016129    -0.11   0.914     -4.16914    3.733938
                 yr7 |    .354673   2.127125     0.17   0.868    -3.814415    4.523761
                 yr8 |  -.4520186   1.961423    -0.23   0.818    -4.296336    3.392299
                 yr9 |  -.4719914    1.79865    -0.26   0.793    -3.997281    3.053298
                yr10 |  -.5540227   1.492435    -0.37   0.710    -3.479142    2.371096
                yr11 |   1.105146   1.592478     0.69   0.488    -2.016055    4.226346
                yr12 |    1.22428   .8794713     1.39   0.164    -.4994524    2.948012
            country1 |   1.677564   3.072134     0.55   0.585    -4.343708    7.698837
            country2 |   .8346636   4.111647     0.20   0.839    -7.224017    8.893344
            country3 |   4.121776   3.342826     1.23   0.218    -2.430043     10.6736
            country4 |   .0092614   1.648599     0.01   0.996    -3.221934    3.240456
            country5 |    .834569   1.436152     0.58   0.561    -1.980238    3.649376
            country6 |   7.083971   4.439563     1.60   0.111    -1.617414    15.78535
            country7 |  -6.517531   4.381156    -1.49   0.137    -15.10444    2.069378
            country8 |   2.532895   2.248906     1.13   0.260     -1.87488    6.940671
            country9 |   1.442214   2.171248     0.66   0.507    -2.813354    5.697782
           country10 |   4.985913   5.296931     0.94   0.347    -5.395881    15.36771
           country11 |   .8918828    3.25681     0.27   0.784    -5.491348    7.275114
           country12 |  -2.735061   2.450532    -1.12   0.264    -7.538015    2.067893
           country13 |   3.536119    2.42009     1.46   0.144    -1.207171    8.279409
           country14 |   1.794404   4.643123     0.39   0.699     -7.30595    10.89476
           country15 |  -.8673363   1.738105    -0.50   0.618    -4.273959    2.539286
               _cons |   .9936958   5.006929     0.20   0.843    -8.819704     10.8071
------------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2 yr3
yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7
country8 country9 country10 country11 country12 country13 country14 country15 country16)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/4).lagnpl collapsed
    L2.cap
    L2.roa collapsed
    L2.roe
    L2.cir collapsed
    L(2/4).cr collapsed
    L(2/3).ltd collapsed
Instruments for levels equation
  Standard
    _cons marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2
yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6
country7 country8 country9 country10 country11 country12 country13 country14 country15 country16
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.lagnpl collapsed
    DL.cap
    DL.roa collapsed
    DL.roe
    DL.cir collapsed
    DL.cr collapsed
    DL.ltd collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.74  Pr > z =  0.006
Arellano-Bond test for AR(2) in first differences: z =  -1.42  Pr > z =  0.156
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(53)   = 196.30  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(53)   =  47.60  Prob > chi2 =  0.684
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(24)   =  23.51  Prob > chi2 =  0.490
    Difference (null H = exogenous): chi2(29)   =  24.09  Prob > chi2 =  0.724
```

```
  gmm(lagnpl, collapse lag(1 4))
    Hansen test excluding group:     chi2(50)   =  41.55  Prob > chi2 =  0.797
    Difference (null H = exogenous): chi2(3)    =   6.05  Prob > chi2 =  0.109
  gmm(cap, lag(2 2))
    Hansen test excluding group:     chi2(30)   =  30.83  Prob > chi2 =  0.424
    Difference (null H = exogenous): chi2(23)   =  16.77  Prob > chi2 =  0.820
  gmm(roa, collapse lag(2 2))
    Hansen test excluding group:     chi2(51)   =  45.50  Prob > chi2 =  0.691
    Difference (null H = exogenous): chi2(2)    =   2.10  Prob > chi2 =  0.350
  gmm(roe, lag(2 2))
    Hansen test excluding group:     chi2(30)   =  27.37  Prob > chi2 =  0.604
    Difference (null H = exogenous): chi2(23)   =  20.23  Prob > chi2 =  0.628
  gmm(cir, collapse lag(2 2))
    Hansen test excluding group:     chi2(51)   =  46.63  Prob > chi2 =  0.648
    Difference (null H = exogenous): chi2(2)    =   0.97  Prob > chi2 =  0.616
  gmm(cr, collapse lag(2 4))
    Hansen test excluding group:     chi2(49)   =  42.25  Prob > chi2 =  0.741
    Difference (null H = exogenous): chi2(4)    =   5.35  Prob > chi2 =  0.253
  gmm(ltd, collapse lag(2 3))
    Hansen test excluding group:     chi2(50)   =  47.48  Prob > chi2 =  0.575
    Difference (null H = exogenous): chi2(3)    =   0.12  Prob > chi2 =  0.989
  iv(marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2 yr3 yr4
yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7
country8 country9 country10 country11 country12 country13 country14 country15 country16)
    Hansen test excluding group:     chi2(14)   =  13.27  Prob > chi2 =  0.505
    Difference (null H = exogenous): chi2(39)   =  34.33  Prob > chi2 =  0.683
```

6.2.3 Model 1

```
xtabond2 npl lagnpl roa roe cr cap ltd cir marketshare foreigndomestic_51  gdp inf unempl debt  excr inter
southenl cee usach ru tr  yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2
country3 country4 country5 country6 country7 country8 country9 country10 country11 country12 country13
country14 country15 country16, gmm(lagnpl, laglimits (1 4)collapse) gmm(cap, laglimits (2 2)collapse)
gmm(roa,laglimits (2 3)collapse) gmm(roe, laglimits (2 4)collapse) gmm(cir, laglimits (2 2)collapse)
gmm(cr, laglimits (2 4)collapse) gmm(ltd, laglimits (2 4)collapse) iv(marketshare gdp inf unempl debt excr
foreigndomestic_51  inter southenl cee usach ru tr yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13
country1 country2 country3 country4 country5 country6 country7 country8 country9 country10 country11
country12 country13 country14 country15 country16) robust twostep

Favoring speed over space. To switch, type or click on mata: mata set matafavor space, perm.
yr1 dropped due to collinearity
yr13 dropped due to collinearity
country16 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =      1052
Time variable : year                            Number of groups   =       226
Number of instruments = 64                      Obs per group: min =         1
Wald chi2(46) =   1001.37                                      avg =      4.65
Prob > chi2   =     0.000                                      max =        12
------------------------------------------------------------------------------
             |              Corrected
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lagnpl |   .7420183    .166945     4.44   0.000     .4148121    1.069224
         roa |  -2.153347    .853133    -2.52   0.012    -3.825457    -.481237
         roe |   .0734449   .0721273     1.02   0.309    -.0679221    .2148119
          cr |   .0026033   .0450587     0.06   0.954    -.0857101    .0909168
         cap |  -.2715326   .1690864    -1.61   0.108    -.6029358    .0598706
         ltd |   .0138888   .0118752     1.17   0.242    -.0093862    .0371637
         cir |  -.0041379   .0380529    -0.11   0.913    -.0787203    .0704445
 marketshare |  -.0327573   .0386555    -0.85   0.397    -.1085208    .0430061
foreigndo~51 |  -2.647211   1.118265    -2.37   0.018     -4.83897   -.4554523
         gdp |  -.0906458   .1282605    -0.71   0.480    -.3420317    .1607402
         inf |   .2715208   .1478819     1.84   0.066    -.0183224    .5613641
      unempl |   .0089285   .1912066     0.05   0.963    -.3658295    .3836866
        debt |   .2773126   .1229324     2.26   0.024     .0363695    .5182557
        excr |   .0071564     .00813     0.88   0.379    -.0087781    .0230909
       inter |  -.1419456   .1664192    -0.85   0.394    -.4681212    .1842299
    southenl |   .2356282   1.278896     0.18   0.854    -2.270961    2.742218
         cee |   3.045956    1.62763     1.87   0.061    -.1441389    6.236052
       usach |   2.608004   1.707578     1.53   0.127    -.7387867    5.954795
          ru |    4.11872   3.559038     1.16   0.247    -2.856865    11.09431
          tr |   5.497601   5.678104     0.97   0.333    -5.631278    16.62648
         yr2 |   1.450912   3.649518     0.40   0.691    -5.702012    8.603836
         yr3 |   .1940254    2.84592     0.07   0.946    -5.383876    5.771927
         yr4 |   2.243953    2.67966     0.84   0.402    -3.008085     7.49599
         yr5 |   .7571851   1.992324     0.38   0.704    -3.147699    4.662069
         yr6 |    .131224   2.388403     0.05   0.956     -4.54996    4.812408
         yr7 |    1.28686    2.34874     0.55   0.584    -3.316586    5.890306
         yr8 |   .6436655   2.293291     0.28   0.779    -3.851102    5.138433
         yr9 |   .5804688   2.487059     0.23   0.815    -4.294078    5.455016
        yr10 |   .3230341    1.97189     0.16   0.870    -3.541799    4.187867
        yr11 |   .8393015   1.752171     0.48   0.632     -2.59489    4.273493
        yr12 |   .7822073    .981414     0.80   0.425    -1.141329    2.705744
    country1 |  -.1697924   2.823915    -0.06   0.952    -5.704563    5.364978
    country2 |   4.377469   4.858494     0.90   0.368    -5.145004    13.89994
    country3 |   4.402888   3.669246     1.20   0.230    -2.788701    11.59448
    country4 |  -.0126423   1.467358    -0.01   0.993     -2.88861    2.863326
    country5 |   .9569909   1.379116     0.69   0.488    -1.746027    3.660009
    country6 |   9.923501   4.670071     2.12   0.034     .7703308    19.07667
    country7 |  -11.07409   4.146549    -2.67   0.008    -19.20117   -2.947002
    country8 |   3.570913   2.558039     1.40   0.163    -1.442751    8.584577
    country9 |   1.699726   2.475789     0.69   0.492    -3.152731    6.552182
   country10 |   5.355169   5.787814     0.93   0.355    -5.988737    16.69908
   country11 |   1.454926   3.558698     0.41   0.683    -5.519994    8.429846
   country12 |  -4.166729   1.980099    -2.10   0.035    -8.047651    -.285807
   country13 |   4.576759    3.28499     1.39   0.164    -1.861703    11.01522
   country14 |   3.612455   5.283627     0.68   0.494    -6.743264    13.96817
   country15 |  -.9243037   1.745685    -0.53   0.596    -4.345783    2.497176
       _cons |  -2.492458   4.615953    -0.54   0.589    -11.53956    6.554644
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
```

```
    D.(marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2 yr3
yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7
country8 country9 country10 country11 country12 country13 country14 country15 country16)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(2/4).ltd collapsed
    L(2/4).cr collapsed
    L2.cir collapsed
    L(2/4).roe collapsed
    L(2/3).roa collapsed
    L2.cap collapsed
    L(1/4).lagnpl collapsed
Instruments for levels equation
  Standard
marketshare gdp inf unempl debt excr foreigndomestic_51  inter southenl cee usach ru tr yr1 yr2 yr3 yr4 yr5
yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5  country6 country7
country8 country9 country10 country11 country12 country13 country14 country15 country16_cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.ltd collapsed
    DL.cr collapsed
    DL.cir collapsed
    DL.roe collapsed
    DL.roa collapsed
    DL.cap collapsed
    D.lagnpl collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.62  Pr > z =  0.009
Arellano-Bond test for AR(2) in first differences: z =  -1.33  Pr > z =  0.184
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(17)   =  56.40  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(17)   =  16.36  Prob > chi2 =  0.499
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(10)   =   4.34  Prob > chi2 =  0.931
    Difference (null H = exogenous): chi2(7)    =  12.02  Prob > chi2 =  0.100
  gmm(lagnpl, collapse lag(1 4))
    Hansen test excluding group:     chi2(12)   =   9.52  Prob > chi2 =  0.658
    Difference (null H = exogenous): chi2(5)    =   6.83  Prob > chi2 =  0.233
  gmm(cap, collapse lag(2 2))
    Hansen test excluding group:     chi2(15)   =  14.61  Prob > chi2 =  0.480
    Difference (null H = exogenous): chi2(2)    =   1.74  Prob > chi2 =  0.418
  gmm(roa, collapse lag(2 3))
    Hansen test excluding group:     chi2(14)   =  10.43  Prob > chi2 =  0.730
    Difference (null H = exogenous): chi2(3)    =   5.92  Prob > chi2 =  0.115
  gmm(roe, collapse lag(2 4))
    Hansen test excluding group:     chi2(13)   =  11.31  Prob > chi2 =  0.585
    Difference (null H = exogenous): chi2(4)    =   5.05  Prob > chi2 =  0.282
  gmm(cir, collapse lag(2 2))
    Hansen test excluding group:     chi2(15)   =  13.41  Prob > chi2 =  0.571
    Difference (null H = exogenous): chi2(2)    =   2.95  Prob > chi2 =  0.229
  gmm(cr, collapse lag(2 4))
    Hansen test excluding group:     chi2(13)   =  14.57  Prob > chi2 =  0.335
    Difference (null H = exogenous): chi2(4)    =   1.79  Prob > chi2 =  0.775
  gmm(ltd, collapse lag(2 4))
    Hansen test excluding group:     chi2(13)   =  15.01  Prob > chi2 =  0.306
    Difference (null H = exogenous): chi2(4)    =   1.34  Prob > chi2 =  0.854
```

We jointly test period dummies before and after the crisis. However, we do not find that they are jointly significant either before or after the crisis.

```
. test yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9

 ( 1)  yr2 = 0
 ( 2)  yr3 = 0
 ( 3)  yr4 = 0
 ( 4)  yr5 = 0
 ( 5)  yr6 = 0
 ( 6)  yr7 = 0
 ( 7)  yr8 = 0
 ( 8)  yr9 = 0

           chi2(  8) =    5.99
         Prob > chi2 =    0.6480

. test yr10 yr11 yr12

 ( 1)  yr10 = 0
 ( 2)  yr11 = 0
 ( 3)  yr12 = 0

           chi2(  3) =    0.75
         Prob > chi2 =    0.8616
```

Long-run coefficients

```
. nlcom _b[  roa]/[1- _b[  lagnpl]]

       _nl_1:  _b[ roa]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -8.346897   7.015657    -1.19   0.234    -22.09733    5.403538
------------------------------------------------------------------------------

. nlcom _b[  roe]/[1- _b[  lagnpl]]

       _nl_1:  _b[ roe]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .2846902   .3697251     0.77   0.441    -.4399578    1.009338
------------------------------------------------------------------------------

. nlcom _b[  cr]/[1- _b[  lagnpl]]

       _nl_1:  _b[ cr]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0100912   .1777237     0.06   0.955    -.3382409    .3584233
------------------------------------------------------------------------------

. nlcom _b[  cir]/[1- _b[  lagnpl]]

       _nl_1:  _b[ cir]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.0160394   .1501684    -0.11   0.915     -.310364    .2782853
------------------------------------------------------------------------------

. nlcom _b[  ltd]/[1- _b[  lagnpl]]

       _nl_1:  _b[ ltd]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0538362    .062425     0.86   0.388    -.0685145    .1761869
------------------------------------------------------------------------------

. nlcom _b[  cap]/[1- _b[  lagnpl]]

       _nl_1:  _b[ cap]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.052526   1.147166    -0.92   0.359    -3.300931    1.195878
------------------------------------------------------------------------------

. nlcom _b[   marketshare]/[1- _b[  lagnpl]]

       _nl_1:  _b[ marketshare]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.1269754   .1810204    -0.70   0.483    -.4817688    .2278181
------------------------------------------------------------------------------

. nlcom _b[  gdp]/[1- _b[  lagnpl]]

       _nl_1:  _b[ gdp]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.3513651   .5474566    -0.64   0.521     -1.42436    .7216301
------------------------------------------------------------------------------
```

```
. nlcom _b[  inf]/[1- _b[  lagnpl]]

       _nl_1:  _b[ inf]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.052481    1.05934     0.99   0.320    -1.023787    3.128749
------------------------------------------------------------------------------

. nlcom _b[   excr]/[1- _b[  lagnpl]]

       _nl_1:  _b[ excr]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0277398   .0411126     0.67   0.500    -.0528395    .1083191
------------------------------------------------------------------------------

. nlcom _b[    unempl]/[1- _b[  lagnpl]]

       _nl_1:  _b[ unempl]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0346091   .7415667     0.05   0.963    -1.418835    1.488053
------------------------------------------------------------------------------

. nlcom _b[     debt]/[1- _b[  lagnpl]]

       _nl_1:  _b[ debt]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.074931   .7928573     1.36   0.175    -.4790408    2.628903
------------------------------------------------------------------------------

. nlcom _b[      inter]/[1- _b[  lagnpl]]

       _nl_1:  _b[ inter]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.5502159   .6808352    -0.81   0.419    -1.884628    .7841967
------------------------------------------------------------------------------

. nlcom _b[      foreign]/[1- _b[  lagnpl]]

       _nl_1:  _b[ foreign]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -10.26124   7.839415    -1.31   0.191    -25.62621    5.103735
------------------------------------------------------------------------------

. nlcom _b[      cee]/[1- _b[  lagnpl]]

       _nl_1:  _b[ cee]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   11.80687   9.966959     1.18   0.236    -7.728011    31.34175
------------------------------------------------------------------------------
```

Appendix 6.3 Credit Growth Improvement Model- Model 2

```
xtabond2 npl lagnpl  int2009  roa roe cr cap ltd cir foreigndomestic_51 marketshare  gdp inf unempl debt
excr inter southenl cee usach ru tr  yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1
country2 country3 country4 country5 country6 country7 country8 country9 country10 country11 country12
country13 country14 country15 country16, gmm(lagnpl, laglimits (1 3)collapse) gmm(int2009, laglimits (2 3))
gmm(cap, laglimits (2 2)collapse) gmm(roa,laglimits (2 3)collapse) gmm(roe, laglimits (2 3)collapse)
gmm(cir, laglimits (2 2)collapse) gmm(cr, laglimits (2 4)collapse) gmm(ltd, laglimits (2 3)collapse) iv(
marketshare gdp inf unempl debt excr  foreigndomestic_51   inter southenl cee usach ru tr yr1 yr2 yr3 yr4
yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7
country8 country9 country10 country11 country12 country13 country14 country15 country16) robust twostep
```

```
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =      1052
Time variable : year                            Number of groups   =       226
Number of instruments = 64                      Obs per group: min =         1
Wald chi2(47) =   1046.35                                      avg =      4.65
Prob > chi2   =     0.000                                      max =        12
```

npl	Coef.	Corrected Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagnpl	.6391256	.1638591	3.90	0.000	.3179677	.9602835
int2009	.1786396	.097133	1.84	0.066	-.0117375	.3690168
roa	-1.166862	.7838854	-1.49	0.137	-2.703249	.3695247
roe	.0339469	.071882	0.47	0.637	-.1069391	.174833
cr	-.1320586	.0627284	-2.11	0.035	-.255004	-.0091132
cap	-.1219893	.138227	-0.88	0.377	-.3929092	.1489306
ltd	.0076811	.0186196	0.41	0.680	-.0288126	.0441748
cir	.0068972	.0433794	0.16	0.874	-.0781249	.0919192
foreigndomestic_51	-2.166027	1.078901	-2.01	0.045	-4.280634	-.0514209
marketshare	-.0372101	.0484263	-0.77	0.442	-.132124	.0577038
gdp	-.3071665	.1627277	-1.89	0.059	-.6261069	.0117739
inf	.0057176	.1798533	0.03	0.975	-.3467884	.3582237
unempl	-.2717634	.2190158	-1.24	0.215	-.7010266	.1574998
debt	.2364514	.1337966	1.77	0.077	-.0257851	.4986878
excr	-.1130883	.1119624	-1.01	0.312	-.3325305	.1063539
inter	-.0506585	.1564354	-0.32	0.746	-.3572663	.2559492
southenl	1.231525	1.15671	1.06	0.287	-1.035584	3.498635
cee	3.953803	1.782138	2.22	0.027	.4608776	7.446729
usach	.4967958	1.663717	0.30	0.765	-2.764029	3.75762
ru	4.213674	3.03366	1.39	0.165	-1.73219	10.15954
tr	-2.593956	5.272245	-0.49	0.623	-12.92737	7.739454
yr2	3.557908	3.76828	0.94	0.345	-3.827786	10.9436
yr3	2.37704	2.909726	0.82	0.414	-3.325919	8.079999
yr4	4.219914	2.660543	1.59	0.113	-.9946538	9.434483
yr5	2.373377	2.571703	0.92	0.356	-2.667068	7.413823
yr6	2.491378	2.607545	0.96	0.339	-2.619317	7.602073
yr7	3.921344	2.522601	1.55	0.120	-1.022864	8.865552
yr8	3.439165	2.724887	1.26	0.207	-1.901516	8.779846
yr9	4.427669	2.971187	1.49	0.136	-1.395751	10.25109
yr10	1.625505	1.769251	0.92	0.358	-1.842164	5.093174
yr11	-3.269063	2.464546	-1.33	0.185	-8.099484	1.561358
yr12	.1798362	1.049286	0.17	0.864	-1.876726	2.236399
country1	18.08295	13.52926	1.34	0.181	-8.433915	44.59981
country2	11.77583	6.05011	1.95	0.052	-.0821636	23.63383
country3	6.667974	3.410938	1.95	0.051	-.017341	13.35329
country4	.7696811	1.691351	0.46	0.649	-2.545306	4.084668
country5	3.070029	3.296331	0.93	0.352	-3.390661	9.530718
country6	10.13425	5.929183	1.71	0.087	-1.48673	21.75524
country7	22.5951	26.34493	0.86	0.391	-29.04	74.23021
country8	5.90355	2.962759	1.99	0.046	.0966496	11.71045
country9	4.311967	3.619534	1.19	0.234	-2.78219	11.40612
country10	19.34141	11.78519	1.64	0.101	-3.757143	42.43997
country11	3.33757	4.003617	0.83	0.404	-4.509374	11.18451
country12	-1.433383	2.301513	-0.62	0.533	-5.944265	3.077499
country13	7.558803	3.854999	1.96	0.050	.0031445	15.11446
country14	20.72956	16.42567	1.26	0.207	-11.46415	52.92328
country15	2.109947	1.962358	1.08	0.282	-1.736203	5.956098
_cons	1.398989	5.70001	0.25	0.806	-9.772825	12.5708

```
Instruments for first differences equation
  Standard
    D.(marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2 yr3
yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7
country8 country9 country10 country11 country12 country13 country14 country15 country16)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/3).lagnpl collapsed
    L(2/3).int2009
    L2.cap collapsed
    L(2/3).roa collapsed
    L(2/3).roe collapsed
```

```
    L2.cir collapsed
    L(2/4).cr collapsed
    L(2/3).ltd collapsed
Instruments for levels equation
  Standard
 _cons marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2 yr3
yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7
country8 country9 country10 country11 country12 country13 country14 country15 country16
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.lagnpl collapsed
    DL.int2009
    DL.cap collapsed
    DL.roa collapsed
    DL.roe collapsed
    DL.cir collapsed
    DL.cr collapsed
    DL.ltd collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.65  Pr > z =  0.008
Arellano-Bond test for AR(2) in first differences: z =   0.32  Pr > z =  0.751
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(16)   =  53.32  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(16)   =  15.41  Prob > chi2 =  0.495
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(7)    =   3.82  Prob > chi2 =  0.800
    Difference (null H = exogenous): chi2(9)    =  11.59  Prob > chi2 =  0.238
  gmm(lagnpl, collapse lag(1 3))
    Hansen test excluding group:     chi2(13)   =  10.93  Prob > chi2 =  0.617
    Difference (null H = exogenous): chi2(3)    =   4.48  Prob > chi2 =  0.214
  gmm(int2009, lag(2 3))
    Hansen test excluding group:     chi2(12)   =   7.87  Prob > chi2 =  0.795
    Difference (null H = exogenous): chi2(4)    =   7.54  Prob > chi2 =  0.110
  gmm(cap, collapse lag(2 2))
    Hansen test excluding group:     chi2(14)   =  11.30  Prob > chi2 =  0.662
    Difference (null H = exogenous): chi2(2)    =   4.11  Prob > chi2 =  0.128
  gmm(roa, collapse lag(2 3))
    Hansen test excluding group:     chi2(13)   =  14.24  Prob > chi2 =  0.357
    Difference (null H = exogenous): chi2(3)    =   1.17  Prob > chi2 =  0.760
  gmm(roe, collapse lag(2 3))
    Hansen test excluding group:     chi2(13)   =  13.93  Prob > chi2 =  0.379
    Difference (null H = exogenous): chi2(3)    =   1.48  Prob > chi2 =  0.686
  gmm(cir, collapse lag(2 2))
    Hansen test excluding group:     chi2(14)   =  14.18  Prob > chi2 =  0.436
    Difference (null H = exogenous): chi2(2)    =   1.23  Prob > chi2 =  0.542
  gmm(cr, collapse lag(2 4))
    Hansen test excluding group:     chi2(12)   =  12.68  Prob > chi2 =  0.393
    Difference (null H = exogenous): chi2(4)    =   2.73  Prob > chi2 =  0.603
  gmm(ltd, collapse lag(2 3))
    Hansen test excluding group:     chi2(13)   =  14.71  Prob > chi2 =  0.326
    Difference (null H = exogenous): chi2(3)    =   0.70  Prob > chi2 =  0.873


. test yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9

 ( 1)  yr2 = 0
 ( 2)  yr3 = 0
 ( 3)  yr4 = 0
 ( 4)  yr5 = 0
 ( 5)  yr6 = 0
 ( 6)  yr7 = 0
 ( 7)  yr8 = 0
 ( 8)  yr9 = 0

           chi2(  8) =    9.60
         Prob > chi2 =    0.2944


. test yr10 yr11 yr12

 ( 1)  yr10 = 0
 ( 2)  yr11 = 0
 ( 3)  yr12 = 0

           chi2(  3) =    5.12
         Prob > chi2 =    0.1633

.
```

Long run coefficients

```
. nlcom _b[  roa]/[1- _b[  lagnpl]]

       _nl_1:  _b[ roa]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -3.233431   2.469039    -1.31   0.190    -8.072659    1.605797
------------------------------------------------------------------------------

. nlcom _b[  roe]/[1- _b[  lagnpl]]

       _nl_1:  _b[ roe]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0940686   .2111597     0.45   0.656    -.3197967    .5079339
------------------------------------------------------------------------------

. nlcom _b[  cr]/[1- _b[  lagnpl]]

       _nl_1:  _b[ cr]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.3659407   .1449717    -2.52   0.012      -.65008   -.0818014
------------------------------------------------------------------------------

. nlcom _b[  cap]/[1- _b[  lagnpl]]

       _nl_1:  _b[ cap]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.3380381   .4449911    -0.76   0.447    -1.210205    .5341284
------------------------------------------------------------------------------

. nlcom _b[  cir]/[1- _b[  lagnpl]]

       _nl_1:  _b[ cir]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0191124   .1223224     0.16   0.876    -.2206352      .25886
------------------------------------------------------------------------------

. nlcom _b[  ltd]/[1- _b[  lagnpl]]

       _nl_1:  _b[ ltd]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0212848   .0564728     0.38   0.706    -.0893999    .1319694
------------------------------------------------------------------------------

. nlcom _b[  gdp]/[1- _b[  lagnpl]]

       _nl_1:  _b[ gdp]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.8511729   .5935864    -1.43   0.152    -2.014581     .312235
------------------------------------------------------------------------------

. nlcom _b[  inf]/[1- _b[  lagnpl]]

       _nl_1:  _b[ inf]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0158439   .5003431     0.03   0.975    -.9648106    .9964983
------------------------------------------------------------------------------

. nlcom _b[   inter]/[1- _b[  lagnpl]]
```

```
       _nl_1:  _b[ inter]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.1403771    .418696    -0.34   0.737    -.9610063     .680252
------------------------------------------------------------------------------

. nlcom _b[ excr]/[1- _b[  lagnpl]]

       _nl_1:  _b[ excr]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.3133731   .2750683    -1.14   0.255     -.852497    .2257508
------------------------------------------------------------------------------

. nlcom _b[  unempl]/[1- _b[  lagnpl]]

       _nl_1:  _b[ unempl]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.7530692   .6236579    -1.21   0.227    -1.975416    .4692779
------------------------------------------------------------------------------

. nlcom _b[ debt]/[1- _b[  lagnpl]]

       _nl_1:  _b[ debt]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |    .655218   .3881131     1.69   0.091    -.1054697    1.415906
------------------------------------------------------------------------------

. nlcom _b[ foreign]/[1- _b[  lagnpl]]

       _nl_1:  _b[ foreign]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -6.002164   4.022193    -1.49   0.136    -13.88552     1.88119
------------------------------------------------------------------------------
```

Appendix 6.4 Model 3

```
xtabond2 npl lagnpl lagroa lagroe lagcap lagcr2 ltd cir  marketshare foreigndomestic_51  gdp inf unempl
debt excr inter southenl cee usach ru tr  yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 country1
country2 country3 country4 country5 country6 country7 country8 country9 country10 country11 country12
country13 country14 country15 country16, gmm(lagnpl, laglimits (1 5)collapse) gmm(lagcap, laglimits (2 3))
gmm(lagroa,laglimits (2 2)) gmm(lagroe, laglimits (2 4)collapse) gmm(cir, laglimits (2 2)collapse)
gmm(lagcr2, laglimits (2 3)collapse) gmm(ltd, laglim its (2 2)) iv(marketshare gdp inf unempl debt excr
foreigndomestic_51  inter southenl cee usach ru tr yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12
country1 country2 country3 country4 country5 country6 country7 country8 country9 country10 country11
country12 country13 country14 country15) robust twostep

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =      1030
Time variable : year                            Number of groups   =       227
Number of instruments = 131                     Obs per group: min =         1
Wald chi2(46) =   1042.48                                      avg =      4.54
Prob > chi2   =     0.000                                      max =        12
------------------------------------------------------------------------------
             |              Corrected
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lagnpl |   .5139011   .0910548     5.64   0.000      .335437    .6923653
      lagroa |   .0040519    .603527     0.01   0.995    -1.178839    1.186943
      lagroe |  -.2025376   .0729778    -2.78   0.006    -.3455714   -.0595038
      lagcap |  -.0589826   .0514671    -1.15   0.252    -.1598563     .041891
      lagcr2 |   .0064747   .0037314     1.74   0.083    -.0008386     .013788
         ltd |   .0044328   .0050657     0.88   0.382    -.0054958    .0143615
         cir |  -.0102009   .0178837    -0.57   0.568    -.0452524    .0248506
 marketshare |   .0171394   .0303379     0.56   0.572    -.0423218    .0766006
foreigndo~51 |  -2.321537   .8082555    -2.87   0.004    -3.905689   -.7373855
         gdp |  -.3311122   .1032518    -3.21   0.001    -.5334821   -.1287424
         inf |   .1196589   .1232073     0.97   0.331    -.1218229    .3611408
      unempl |  -.1296743    .136307    -0.95   0.341    -.3968311    .1374825
        debt |    .155284   .0785993     1.98   0.048     .0012322    .3093357
        excr |  -.0670468   .0712297    -0.94   0.347    -.2066544    .0725609
       inter |  -.1493813   .1722783    -0.87   0.386    -.4870405     .188278
    southenl |  -.3697257    1.35023    -0.27   0.784    -3.016128    2.276677
         cee |   1.712217   1.540046     1.11   0.266    -1.306218    4.730652
       usach |    2.12182   1.337312     1.59   0.113     -.499264    4.742905
          ru |   5.069226   3.531898     1.44   0.151    -1.853167    11.99162
          tr |  -3.970125   2.809284    -1.41   0.158     -9.47622    1.535971
         yr2 |   .1876495   2.009998     0.09   0.926    -3.751874    4.127173
         yr3 |   1.425078   2.046219     0.70   0.486    -2.585438    5.435594
         yr4 |   1.808954   1.674211     1.08   0.280    -1.472438    5.090347
         yr5 |   -.467754   1.343144    -0.35   0.728    -3.100268     2.16476
         yr6 |  -.1562949   1.444072    -0.11   0.914    -2.986624    2.674034
         yr7 |   .1986144   1.257125     0.16   0.874    -2.265306    2.662534
         yr8 |  -.1118404   1.261775    -0.09   0.929    -2.584875    2.361194
         yr9 |   .0391942   1.147138     0.03   0.973    -2.209155    2.287543
        yr10 |   .2154324    1.11376     0.19   0.847    -1.967498    2.398363
        yr11 |  -1.247713   1.308707    -0.95   0.340    -3.812732    1.317306
        yr12 |  -.3683845   .7572688    -0.49   0.627    -1.852604    1.115835
    country1 |   13.34855   9.100832     1.47   0.142    -4.488758    31.18585
    country2 |   6.497319   4.230829     1.54   0.125    -1.794954    14.78959
    country3 |   4.378519   2.522963     1.74   0.083    -.5663975    9.323436
    country4 |   .4294982   1.310145     0.33   0.743    -2.138339    2.997335
    country5 |   2.286042    2.11625     1.08   0.280    -1.861733    6.433816
    country6 |   5.965782   2.954779     2.02   0.043     .1745212    11.75704
    country7 |   13.22686   17.42289     0.76   0.448    -20.92137    47.37509
    country8 |   2.294979   2.089021     1.10   0.272    -1.799427    6.389386
    country9 |    .828918   1.783801     0.46   0.642    -2.667267    4.325103
   country10 |   10.77459    6.77353     1.59   0.112    -2.501288    24.05046
   country11 |   1.277298   2.725802     0.47   0.639    -4.065176    6.619772
   country12 |  -.1418011   2.041971    -0.07   0.945    -4.143991    3.860388
   country13 |   4.602024   2.412728     1.91   0.056    -.1268353    9.330884
   country14 |   9.022261   7.387484     1.22   0.222    -5.456943    23.50146
   country15 |   1.463943   1.825303     0.80   0.423    -2.113586    5.041472
       _cons |   4.320551    3.89234     1.11   0.267    -3.308295     11.9494
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2 yr3
yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 country1 country2 country3 country4 country5 country6 country7
country8 country9 country10 country11 country12 country13 country14 country15)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L2.ltd
    L(2/3).lagcr2 collapsed
    L2.cir collapsed
    L(2/4).lagroe collapsed
    L2.lagroa
    L(2/3).lagcap
```

```
    L(1/5).lagnpl collapsed
Instruments for levels equation
  Standard
    marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2 yr3 yr4
yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 country1 country2 country3 country4 country5 country6 country7 country8
country9 country10 country11 country12 country13 country14 country15 _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.ltd
    DL.lagcr2 collapsed
    DL.cir collapsed
    DL.lagroe collapsed
    DL.lagroa
    DL.lagcap
    D.lagnpl collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.81  Pr > z =  0.005
Arellano-Bond test for AR(2) in first differences: z =   0.53  Pr > z =  0.599
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(84)   = 202.45  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(84)   =  78.57  Prob > chi2 =  0.647
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(43)   =  40.42  Prob > chi2 =  0.584
    Difference (null H = exogenous): chi2(41)   =  38.15  Prob > chi2 =  0.598
  gmm(lagnpl, collapse lag(1 5))
    Hansen test excluding group:     chi2(81)   =  75.71  Prob > chi2 =  0.645
    Difference (null H = exogenous): chi2(3)    =   2.87  Prob > chi2 =  0.413
  gmm(lagcap, lag(2 3))
    Hansen test excluding group:     chi2(51)   =  42.79  Prob > chi2 =  0.787
    Difference (null H = exogenous): chi2(33)   =  35.79  Prob > chi2 =  0.339
  gmm(lagroa, lag(2 2))
    Hansen test excluding group:     chi2(61)   =  57.31  Prob > chi2 =  0.611
    Difference (null H = exogenous): chi2(23)   =  21.27  Prob > chi2 =  0.565
  gmm(lagroe, collapse lag(2 4))
    Hansen test excluding group:     chi2(80)   =  77.46  Prob > chi2 =  0.560
    Difference (null H = exogenous): chi2(4)    =   1.12  Prob > chi2 =  0.892
  gmm(cir, collapse lag(2 2))
    Hansen test excluding group:     chi2(82)   =  75.01  Prob > chi2 =  0.695
    Difference (null H = exogenous): chi2(2)    =   3.56  Prob > chi2 =  0.169
  gmm(lagcr2, collapse lag(2 3))
    Hansen test excluding group:     chi2(81)   =  75.29  Prob > chi2 =  0.658
    Difference (null H = exogenous): chi2(3)    =   3.28  Prob > chi2 =  0.350
  gmm(ltd, lag(2 2))
    Hansen test excluding group:     chi2(61)   =  58.80  Prob > chi2 =  0.556
    Difference (null H = exogenous): chi2(23)   =  19.78  Prob > chi2 =  0.655
  iv(marketshare gdp inf unempl debt excr foreigndomestic_51 inter southenl cee usach ru tr yr1 yr2 yr3 yr4
yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 country1 country2 country3 country4 country5 country6 country7 country8
country9 country10 country11 country12 country13 country14 country15)
    Hansen test excluding group:     chi2(45)   =  43.72  Prob > chi2 =  0.526
    Difference (null H = exogenous): chi2(39)   =  34.85  Prob > chi2 =  0.659
```

We jointly test period dummies before and after the crisis. However, we do not find that they are jointly significant either before or after the crisis.

```
test yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9

 ( 1)  yr2 = 0
 ( 2)  yr3 = 0
 ( 3)  yr4 = 0
 ( 4)  yr5 = 0
 ( 5)  yr6 = 0
 ( 6)  yr7 = 0
 ( 7)  yr8 = 0
 ( 8)  yr9 = 0

           chi2(  8) =    5.46
         Prob > chi2 =    0.7079
```

```
test yr10 yr11 yr12

 ( 1)  yr10 = 0
 ( 2)  yr11 = 0
 ( 3)  yr12 = 0

           chi2(  3) =    1.56
         Prob > chi2 =    0.6674
```

Long-run coefficients

```
. nlcom _b[  lagroa]/[1- _b[  lagnpl]]

       _nl_1:  _b[ lagroa]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .2908905   1.213721     0.24   0.811    -2.087958    2.669739
------------------------------------------------------------------------------

. nlcom _b[  lagroe]/[1- _b[  lagnpl]]

       _nl_1:  _b[ lagroe]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.4387108   .1305277    -3.36   0.001    -.6945404   -.1828813
------------------------------------------------------------------------------

. nlcom _b[  lagcr2]/[1- _b[  lagnpl]]

       _nl_1:  _b[ lagcr2]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0143761   .0066855     2.15   0.032     .0012728    .0274794
------------------------------------------------------------------------------

. nlcom _b[  lagcap]/[1- _b[  lagnpl]]

       _nl_1:  _b[ lagcap]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.0589665    .112517    -0.52   0.600    -.2794958    .1615628
------------------------------------------------------------------------------

nlcom _b[  cir]/[1- _b[  lagnpl]]

       _nl_1:  _b[ cir]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.0194684   .0327892    -0.59   0.553     -.083734    .0447971
------------------------------------------------------------------------------

. nlcom _b[  ltd]/[1- _b[  lagnpl]]

       _nl_1:  _b[ ltd]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0206169   .0175664     1.17   0.241    -.0138127    .0550465
------------------------------------------------------------------------------

. nlcom _b[  gdp]/[1- _b[  lagnpl]]

       _nl_1:  _b[ gdp]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   -.544972   .1532985    -3.55   0.000    -.8454316   -.2445125
------------------------------------------------------------------------------

. nlcom _b[  inf]/[1- _b[  lagnpl]]

       _nl_1:  _b[ inf]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .2461617    .262379     0.94   0.348    -.2680916    .7604151
------------------------------------------------------------------------------


. nlcom _b[  unempl]/[1- _b[  lagnpl]]
```

```
      _nl_1:  _b[ unempl]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |     .19656   .1777193     1.11   0.269    -.1517635    .5448834
------------------------------------------------------------------------------

. nlcom _b[   debt]/[1- _b[  lagnpl]]

      _nl_1:  _b[ debt]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .1738872   .1133789     1.53   0.125    -.0483314    .3961058
------------------------------------------------------------------------------

. nlcom _b[    excr]/[1- _b[  lagnpl]]

      _nl_1:  _b[ excr]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0285726   .0386991     0.74   0.460    -.0472761    .1044214
------------------------------------------------------------------------------

. nlcom _b[     inter]/[1- _b[  lagnpl]]

      _nl_1:  _b[ inter]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.3872516   .2760308    -1.40   0.161    -.9282621    .1537589
------------------------------------------------------------------------------

. nlcom _b[     foreign]/[1- _b[  lagnpl]]

      _nl_1:  _b[ foreign]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -4.182178   1.597287    -2.62   0.009    -7.312804   -1.051553
------------------------------------------------------------------------------
```

Appendix 6.5 Model 4

```
xtabond2 npl lagnpl lagroa lagroe lagcap lagcr2 ltd cir  marketshare foreigndomestic_51  gdp inf unempl excr  southenl cee usach ru tr  yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7 country8 country9 country10 country11 country12 country13 country14 country15 country16, gmm(lagnpl, laglimits (1 5)collapse) gmm(lagcap, laglimits (2 3)) gmm(lagroa,laglimits (2 2)) gmm(lagroe, laglimits (2 4)collapse) gmm(cir, laglimits (2 2)collapse) gmm(lagcr2, laglimits (2 3)collapse) gmm(ltd, laglimits (2 2)) iv(marketshare gdp inf unempl excr foreigndomestic_51  southenl cee usach ru tr yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7 country8 country9 country10 country11 country12 country13 country14 country15 country16) robust twostep
```

```
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =      1039
Time variable : year                            Number of groups   =       228
Number of instruments = 129                     Obs per group: min =         1
Wald chi2(44) =   1009.61                                      avg =      4.56
Prob > chi2   =     0.000                                      max =        12
------------------------------------------------------------------------------
```

npl	Coef.	Corrected Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagnpl	.515331	.0971744	5.30	0.000	.3248727	.7057893
lagroa	.2378613	.6355581	0.37	0.708	-1.00781	1.483532
lagroe	-.2409742	.0839192	-2.87	0.004	-.4054529	-.0764955
lagcap	-.0624999	.0531303	-1.18	0.239	-.1666333	.0416335
lagcr2	.0072397	.0043991	1.65	0.100	-.0013824	.0158618
ltd	.0058757	.0060606	0.97	0.332	-.0060028	.0177542
cir	-.0057668	.0166883	-0.35	0.730	-.0384752	.0269416
marketshare	.0309742	.0327781	0.94	0.345	-.0332696	.095218
foreigndo~51	-2.491272	.8423261	-2.96	0.003	-4.142201	-.840343
gdp	-.3324357	.1018636	-3.26	0.001	-.5320847	-.1327868
inf	.1232216	.1924155	0.64	0.522	-.2539058	.500349
unempl	-.0486939	.1415709	-0.34	0.731	-.3261678	.22878
excr	-.0027612	.0045978	-0.60	0.548	-.0117728	.0062503
southenl	.185354	1.315553	0.14	0.888	-2.393082	2.76379
cee	1.769984	1.608432	1.10	0.271	-1.382485	4.922452
usach	1.815761	1.371379	1.32	0.185	-.8720924	4.503615
ru	4.636306	4.769615	0.97	0.331	-4.711969	13.98458
tr	-3.105521	2.807621	-1.11	0.269	-8.608358	2.397315
yr2	-2.519873	1.64184	-1.53	0.125	-5.737819	.6980738
yr3	-1.504794	1.625482	-0.93	0.355	-4.690679	1.681092
yr4	.0251359	1.296283	0.02	0.985	-2.515533	2.565805
yr5	-1.57423	1.193397	-1.32	0.187	-3.913244	.7647849
yr6	-1.449028	1.261888	-1.15	0.251	-3.922284	1.024228
yr7	-1.164914	1.074649	-1.08	0.278	-3.271187	.9413584
yr8	-1.570335	1.123917	-1.40	0.162	-3.773172	.6325032
yr9	-1.645792	.9658671	-1.70	0.088	-3.538857	.2472723
yr10	-1.810459	1.10864	-1.63	0.102	-3.983352	.3624348
yr11	-2.344152	1.234915	-1.90	0.058	-4.764541	.0762377
yr12	-.7828788	.7904962	-0.99	0.322	-2.332223	.7664652
country1	7.775814	2.215828	3.51	0.000	3.43287	12.11876
country2	3.624138	3.584194	1.01	0.312	-3.400753	10.64903
country3	2.317437	2.208861	1.05	0.294	-2.011851	6.646725
country4	.4382427	1.256423	0.35	0.727	-2.024301	2.900787
country5	1.013155	1.140667	0.89	0.374	-1.222512	3.248822
country6	1.205839	2.24708	0.54	0.592	-3.198356	5.610034
country7	1.721533	1.608122	1.07	0.284	-1.430328	4.873395
country8	-.3175092	1.784688	-0.18	0.859	-3.815434	3.180416
country9	-1.212134	1.747712	-0.69	0.488	-4.637586	2.213318
country10	3.745563	4.4206	0.85	0.397	-4.918654	12.40978
country11	.5643212	2.891011	0.20	0.845	-5.101956	6.230598
country12	2.116313	1.595355	1.33	0.185	-1.010525	5.243151
country13	1.192071	2.419451	0.49	0.622	-3.549966	5.934109
country14	4.376857	3.620291	1.21	0.227	-2.718784	11.4725
country15	2.107155	2.09937	1.00	0.316	-2.007535	6.221845
_cons	8.913159	2.882586	3.09	0.002	3.263395	14.56292

```
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(marketshare gdp inf unempl excr foreigndomestic_51 southenl cee usach ru tr yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7 country8 country9 country10 country11 country12 country13 country14 country15 country16)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L2.ltd
    L(2/3).lagcr2 collapsed
    L2.cir collapsed
    L(2/4).lagroe collapsed
    L2.lagroa
    L(2/3).lagcap
    L(1/5).lagnpl collapsed
```

```
Instruments for levels equation
  Standard
marketshare gdp inf unempl excr foreigndomestic_51 southenl cee usach ru tr yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8
yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7 country8 country9
country10 country11 country12 country13 country14 country15 country16 _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.ltd
    DL.lagcr2 collapsed
    DL.cir collapsed
    DL.lagroe collapsed
    DL.lagroa
    DL.lagcap
    D.lagnpl collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.85  Pr > z =  0.004
Arellano-Bond test for AR(2) in first differences: z =   0.62  Pr > z =  0.534
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(84)   = 204.71  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(84)   =  81.27  Prob > chi2 =  0.564
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(43)   =  38.75  Prob > chi2 =  0.656
    Difference (null H = exogenous): chi2(41)   =  42.52  Prob > chi2 =  0.405
  gmm(lagnpl, collapse lag(1 5))
    Hansen test excluding group:     chi2(81)   =  76.71  Prob > chi2 =  0.614
    Difference (null H = exogenous): chi2(3)    =   4.56  Prob > chi2 =  0.207
  gmm(lagcap, lag(2 3))
    Hansen test excluding group:     chi2(51)   =  43.87  Prob > chi2 =  0.750
    Difference (null H = exogenous): chi2(33)   =  37.40  Prob > chi2 =  0.274
  gmm(lagroa, lag(2 2))
    Hansen test excluding group:     chi2(61)   =  55.60  Prob > chi2 =  0.671
    Difference (null H = exogenous): chi2(23)   =  25.67  Prob > chi2 =  0.317
  gmm(lagroe, collapse lag(2 4))
    Hansen test excluding group:     chi2(80)   =  79.00  Prob > chi2 =  0.511
    Difference (null H = exogenous): chi2(4)    =   2.27  Prob > chi2 =  0.686
  gmm(cir, collapse lag(2 2))
    Hansen test excluding group:     chi2(82)   =  77.02  Prob > chi2 =  0.635
    Difference (null H = exogenous): chi2(2)    =   4.25  Prob > chi2 =  0.119
  gmm(lagcr2, collapse lag(2 3))
    Hansen test excluding group:     chi2(81)   =  77.40  Prob > chi2 =  0.593
    Difference (null H = exogenous): chi2(3)    =   3.87  Prob > chi2 =  0.276
  gmm(ltd, lag(2 2))
    Hansen test excluding group:     chi2(61)   =  57.92  Prob > chi2 =  0.588
    Difference (null H = exogenous): chi2(23)   =  23.35  Prob > chi2 =  0.441
  iv(marketshare gdp inf unempl excr foreigndomestic_51 southenl cee usach ru tr yr1 yr2 yr3 yr4 yr5 yr6
yr7 yr8 yr9 yr10 yr11 yr12 yr13 country1 country2 country3 country4 country5 country6 country7 country8
country9 country10 country11 country12 country13 country14 country15 country16)
    Hansen test excluding group:     chi2(47)   =  45.80  Prob > chi2 =  0.522
    Difference (null H = exogenous): chi2(37)   =  35.47  Prob > chi2 =  0.541


. test yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9

 ( 1)  yr2 = 0
 ( 2)  yr3 = 0
 ( 3)  yr4 = 0
 ( 4)  yr5 = 0
 ( 5)  yr6 = 0
 ( 6)  yr7 = 0
 ( 7)  yr8 = 0
 ( 8)  yr9 = 0

           chi2(  8) =    8.22
         Prob > chi2 =    0.4121

. test yr10 yr11 yr12

 ( 1)  yr10 = 0
 ( 2)  yr11 = 0
 ( 3)  yr12 = 0

           chi2(  3) =    5.61
         Prob > chi2 =    0.1321
```

Long-run coefficients

```
. nlcom _b[  lagroa]/[1- _b[  lagnpl]]

       _nl_1:  _b[ lagroa]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .4907707   1.319255     0.37   0.710    -2.094922    3.076463
------------------------------------------------------------------------------

. nlcom _b[  lagroe]/[1- _b[  lagnpl]]

       _nl_1:  _b[ lagroe]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.4971934   .1611041    -3.09   0.002    -.8129516   -.1814352
------------------------------------------------------------------------------

. nlcom _b[  lagcr2]/[1- _b[  lagnpl]]

       _nl_1:  _b[ lagcr2]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0149375   .0086976     1.72   0.086    -.0021095    .0319844
------------------------------------------------------------------------------

. nlcom _b[  lagcap]/[1- _b[  lagnpl]]

       _nl_1:  _b[ lagcap]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.1289538   .1087197    -1.19   0.236    -.3420404    .0841329
------------------------------------------------------------------------------

. nlcom _b[  ltd]/[1- _b[  lagnpl]]

       _nl_1:  _b[ ltd]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0121231   .0127913     0.95   0.343    -.0129474    .0371936
------------------------------------------------------------------------------

. nlcom _b[  cir]/[1- _b[  lagnpl]]

       _nl_1:  _b[ cir]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.0118985   .0339835    -0.35   0.726    -.0785049    .0547079
------------------------------------------------------------------------------

. nlcom _b[  gdp]/[1- _b[  lagnpl]]

       _nl_1:  _b[ gdp]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.6859026   .2549174    -2.69   0.007    -1.185532   -.1862736
------------------------------------------------------------------------------

. nlcom _b[  inf]/[1- _b[  lagnpl]]

       _nl_1:  _b[ inf]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .2542387   .4094082     0.62   0.535    -.5481867    1.056664
------------------------------------------------------------------------------

. nlcom _b[  unempl]/[1- _b[  lagnpl]]
```

```
       _nl_1:  _b[ unempl]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.1004684   .2896073    -0.35   0.729    -.6680883    .4671515
------------------------------------------------------------------------------

. nlcom _b[    excr]/[1- _b[  lagnpl]]

       _nl_1:  _b[ excr]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.0056971   .0095119    -0.60   0.549    -.0243401    .0129458
------------------------------------------------------------------------------


. nlcom _b[  unempl]/[1- _b[  lagnpl]]

       _nl_1:  _b[ unempl]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.1004684   .2896073    -0.35   0.729    -.6680883    .4671515
------------------------------------------------------------------------------

. nlcom _b[     foreign]/[1- _b[  lagnpl]]

       _nl_1:  _b[ foreign]/[1- _b[ lagnpl]]

------------------------------------------------------------------------------
         npl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -5.140151   1.816915    -2.83   0.005    -8.701239   -1.579063
------------------------------------------------------------------------------
```