

Analyzing Systemic Risk in CEE Markets in 2007–2008 Financial Crisis

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The purpose of the article is to attempt to answer the question of how the crisis affected the banking systems of CEE countries, with special emphasis on liquidity risk. It seems that this problem has particularly affected emerging economies. First, the liquidity risk began to exert considerable influence on the functioning banking system and, indirectly, the whole economy. In this paper author wanted to answer the following questions: What are the channels of transmission systemic risk on CEE markets? What is the role of big world banking groups in these financial systems? This concept is applied to ten Central Eastern European countries, which experienced a financial crisis. In the research author hypothesized about interconnectedness of liquidity in financial systems and solvency problems of big banking groups operating in CEE.

Key words: liquidity risk, financial crisis, contagion effect

Introduction

The banking sectors of CEE countries have gone through a profound transformation since the second half of the 1990s. Foreign ownership levels are the highest in the world and bank credit to the private sector has expanded rapidly in recent years. This well-documented process, which was already apparent at the beginning of the decade, became even stronger from 2004.

Most of the banking sectors of CEE countries are dominated by similar and aggressive business strategies of Western European banking groups.

Rising LTD (Loan-to-Deposit) ratios therefore have required increasing reliance on foreign funding channeled through the banking sector. The relatively undeveloped state of domestic capital markets, as a funding source in these countries, and easy access by the mostly foreign-owned banks to cheap funding from their parents. The differences in funding structures suggest that some countries are more exposed than others to financial market disturbances originating from advanced markets or to spillovers from problems in other countries in the region. Banking systems that are heavily dependent on

foreign funding to support credit growth could face a sudden shortfall or costly access to funds and experience difficulties in expanding credit. While reputational risks and long-term business plans may render it unlikely that parent banks would not support their daughters, the degree of their support depends on market conditions; as funding conditions in home countries become more difficult. Liquidity or solvency problems in a parent (which is measured by CDS spread in the market) could hence be transmitted to local banks in a concentrated and largely foreign-owned banking system.

Financial stability is a base of each financial system to cope with shocks and market imbalances, thus reducing the likelihood of disruption of financial intermediation process. Protection of financial stability requires the identification of major sources of risk and vulnerability, such as the inefficiency of the allocation of financial resources from savers to investors, valuation and bad financial risk management. Identification of risk and sensitivity is needed, because overseeing financial stability must be a pre-emptive. Inefficiency in the allocation of capital or shortcomings in the valuation and risk management could undermine the future stability of the financial system, and therefore economic stability.

The depth and scale of the current financial crisis has shown clearly that the globalization of markets financial economic system has created a lot of dangerous.

Particular importance for financial system stability is to maintain stability of the banking system. Banks play a key role in financing the economy and settlements of payment. The important function of banks is also creating products that enable financial risk management for others. For these reasons there will be especially strong emphasis on analysis and evaluation of stability of banking system.

Due to the very low level of interest rates in major world economies to tackle the feedback process indicated by conventional monetary policy tools are limited. The realization of such a negative scenario could lead to the materialization of credit and liquidity risk in the CEE banking sector. Under conditions of increased global risk aversion, banks could face difficulties with the renewal of swap operations to safeguard the risks, associated with foreign currency loans portfolio, as well as the renewal of funding derived from the financial markets in a different form. Strong growth in risk aversion also would involve the intensification of market pressure on European banks deleveraging, particularly visible in a further increase in the cost of market financing, the reduced availability and shorter maturity. Under such conditions, the cost and availability of funding pro-

vided by the subsidiaries of strategic investors in the CEE countries could become worse. An additional cause of deleveraging European banks may be increased capital adequacy requirements, especially in a situation, when banks were not able to raise capital by issuing shares, or conversion of other liabilities items (e. g. subordinated debt) in capital quality. Deleveraging may take the form of changes in the structure of assets in the direction of growth of low risk weights items, which may induce banks to reduce their exposures to subsidiaries operating in other countries. Existing still uncertainty about the implementation of fiscal consolidation in the euro area countries with high debt also indicates that the likelihood of worsening debt crisis in these countries, combined with an increase in volatility in financial markets has increased and remains at elevated levels. The strength of disorder may depend on the changes in financial position of strategic investors, banks operating in the CEE countries, as well as the actions taken by the economic authorities of home countries of these institutions. Banks do not have sufficient liquidity buffers, which could cover a possible outflow of funds associated with the scenario withdrawal of foreign capital. It leads to systemic liquidity problems in CEE banking systems. There is also the risk of changes in ownership in CEE banks. Some banks, strategic investors in the CEE region, despite the high profitability, it may decide to sell the subsidiaries under the restructuring of its activities. As the financial situation of some dominant shareholders of the banks operating in the CEE countries, is a difficult decision to sell its shares may also be enforced by the regulator of the home country (in response to large capital requirements) or (in case of involvement of public funds) by the European Commission. The process of any changes of ownership, however, is associated with the risk of decline in confidence in banks that are in the process of selling, due to the increased likelihood of changes in ownership in CEE countries.

Literature Review

The last global financial turmoil provoked debates about controlling systemic risk with financial monitoring, regulations and network approach. In many countries the financial crises can be considered as realizations of the systemic risk in the financial system. Lo (2008) proposes a set of measures for systemic risk, which are leverage, liquidity, correlation, concentration, sensitivities and connectedness. The systemic risk studies have generally focused on interbank markets; exposures among different banks have the strong potential for

contagion in the case of a banking failure (Rochet and Tirole 1996). Another presents systemic liquidity approach, which takes into account the liquidity of banks in the interbank market linkages (Allen and Gale 2000). It has a dual character. First – the banks respond similarly to changes in the macroeconomic environment. This is due to the similarity of the structure of the balance sheets of banks and their functions in the economy (withdrawal of bank deposits may occur at the same time and in extreme cases leads to the so-called run on banks). Second, the lack of ability to discharge liabilities of the bank to other banks may lead to liquidity problems in banks-creditors. This phenomenon is called domino effect of the lack of liquidity.

There is a lot of research describing difficulty in maintaining liquidity in banking system. For example Diamond and Dybvig (1983) construct a model of the economy which allowed them to analyze the dynamics of deposits in banks, deposit insurance role in preventing phenomenon of ‘run on the banks,’ and the role of lender of last resort. Allen and Gale (2000) enrich the model Diamond and Dybviga (1983), adding the interbank market. This allows answering the question, whether the banking system can deal with liquidity problems itself, without assistance such as the central bank. Assumptions of the model described by Diamond and Dybviga (1983) and Allen and Gale (2000) were subjected to criticized and modified in many publications (e.g. Diamond and Rajan 1999; Kiyotaki and Moore 1997; Postlewaite and Vives 1987; Acharya 2009).

Another study investigated systemic risk and contagion by using network theory (Nier et al. 2007; Árvai, Driessen, and Öther-Robe 2009). Banks were modeled as nodes of a network and they have two types of assets that were interbank assets and external assets. A shock was given to the external assets of one bank and the effects of this shock were observed by simulation.

Interbank credit lines are introduced as a channel of contagion (Müller 2006). A bank’s failure creates contagion not only through its liabilities but also through the dry up of credit lines of the failed bank to other banks. Interbank exposures and credit lines channels are modeled distinctly.

Recent global financial crisis raised new questions. New methods on financial modeling and systemic risk calculation have been searched to increase the foresight of academic work. Most disturbances move in a particular group of countries, and the mechanism of contagion model assumes a correlation between market volatility of countries with similar macroeconomic risk.

Purpose of the Study and Methodology

In my study I aim to find out how the solvency crisis of big banking groups, operating in the European market, caused the liquidity problem in CEE financial systems. To the best of my knowledge the analysis of the role of institutional factors in liquidity and stability problems bank operating in the CEE was not conducted thus far.

The analysis is based on data of financial systems available in the Reuters Thomson database. The study sample is based on ten countries (selected due to limited accessibility of data for at least 7 years time span – 2005–2011 years) – Bulgaria, Czech Republic, Slovenia, Hungary, Lithuania, Latvia, Estonia, Poland, Slovakia, Romania. For each country there was selected particular variables of its financial system, which has influence on the banking system and economy: main stock index changes, real effective exchange rate, interbank short term interest rate 3M, CDS spread of banking group operating in CEE financial systems, real GDP growth (table 1).

There will apply two types of econometric models. The first for testing the association between liquidity problem in CEE banking systems and changes in interbank short term interest rates, stock exchange index, real effective exchange rate as well as CDS spread of big banking groups operating in CEE countries. Liquidity is measured as changes in relation of interbank assets to liabilities. The other model, to find out whether variable from financial system affect macroeconomy, measured as GDP growth. I apply GMM estimators developed for dynamic models of panel data (Greene, 2012). The

TABLE 1 Summary description of data

Country	Short term IR		Stock index 1		REER		Time span
	M	SD	M	SD	M	SD	
Bulgaria	-0,25	0,61	-0,09	0,70	0,03	0,03	2005–2011
Czech Republic	-0,35	0,67	-0,02	0,38	0,04	0,06	2005–2011
Slovak Republic	-0,37	0,96	-0,06	0,18	-0,01	0,03	2005–2011
Hungary	0,00	0,27	0,02	0,43	0,01	0,06	2005–2011
Estonia	-0,37	0,96	0,02	0,54	-0,01	0,03	2005–2011
Latvia	-0,40	1,37	-0,02	0,41	0,03	0,05	2005–2011
Lithuania	-0,18	0,69	0,00	0,54	0,02	0,04	2005–2011
Poland	0,00	0,21	0,05	0,40	0,02	0,09	2005–2011
Romania	-0,05	0,21	-0,00	0,58	0,03	0,08	2005–2011
Slovenia	-0,37	0,96	-0,05	0,56	-0,01	0,03	2005–2011
Total	-0,23	0,75	-0,01	0,46	0,02	0,05	2005–2011

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TABLE 1 Continued from the previous page

Country	CDS spread		Liq. interb.		GDP growth		Time span
	M	SD	M	SD	M	SD	
Bulgaria	0.45	0.97	0.03	0.59	0.03	0.05	2005–2011
Czech Republic	0.43	0.83	0.08	0.44	0.03	0.04	2005–2011
Slovak Republic	0.23	0.91	0.92	0.31	0.05	0.05	2005–2011
Hungary	0.34	0.93	0.32	0.14	0.01	0.04	2005–2011
Estonia	0.35	0.97	0.29	0.32	0.03	0.09	2005–2011
Latvia	0.23	0.93	0.12	0.24	0.02	0.10	2005–2011
Lithuania	0.25	0.94	0.56	0.24	0.03	0.08	2005–2011
Poland	0.23	0.91	0.34	0.19	0.05	0.02	2005–2011
Romania	0.32	0.98	0.37	0.18	0.03	0.05	2005–2011
Slovenia	0.25	0.92	0.35	0.32	0.02	0.05	2005–2011
Country	0.31	0.93	0.64	0.61	0.03	0.06	2005–2011

NOTES M – median, SD – standard deviation.

liquidity (equation 1) and macroeconomy (equation 2) models, respectively, read as:

$$\begin{aligned}
 \text{Liquid_interbank}_{i,t} = & \alpha_0 + \alpha_1 \text{Short_ir}_{i,t} + \alpha_2 \text{Stock_inx}_{i,t-1} \\
 & + \alpha_3 \text{Reer}_{i,t} + \alpha_4 \text{CDS_spread}_{i,t} \\
 & + \text{GDP_growth}_{t,i} + \sum_{t=2005}^{2011} T_t + \vartheta_i + \varepsilon_t,
 \end{aligned} \quad (1)$$

$$\begin{aligned}
 \text{GDP_growth}_{t,i} = & \alpha_0 + \alpha_1 \text{Short_ir}_{i,t} + \alpha_2 \text{Stock_inx}_{i,t-1} \\
 & + \alpha_3 \text{Reer}_{i,t} + \alpha_4 \text{CDS_spread}_{i,t} \\
 & + \text{Liquid_interbank}_{i,t} + \sum_{t=2005}^{2011} T_t + \vartheta_i + \varepsilon_t,
 \end{aligned} \quad (2)$$

where, indices i and t refer to country and time, respectively; $\text{Liquid_interbank}_{i,t}$ – a relation of interbank assets to liabilities; $\text{Short_ir}_{i,t}$ – a logarytm of interbank short rate (3M); $\text{Stock_inx}_{i,t-1}$ a logarytm of main country stock index; $\text{Reer}_{i,t}$ – real effective exchange rate; $\text{CDS_spread}_{i,t}$ a logarytm of average bank CDS spread (Uni-credit; Raiffeisen; Erste; Societe Generale; Swedbank; Citibank; Commerzbank; EFG Eurobank, Santander bank, Rabobank, BNP Paribas); $\text{GDP_growth}_{t,i}$ is real GDP growth; $\sum_{t=1996}^{2010} T_t$ – a set of dummy time variables; ϑ_i – unobservable country specific effects that are constant over time but vary across countries; $\varepsilon_{i,t}$ sa – white noise error term. In the models it is also regress interbank liquidity on GDP and GDP growth on interbank liquidity to find out whether liquidity and macroeconomic risks are interconnected.

TABLE 2 Estimation results for CEE countries

Dependent variable	Liquidity (equation 1)		Marcoeconomic (equation 2)	
	Coefficient	<i>p</i> -value	Coefficient	<i>p</i> -value
<i>Const</i>	0,002	0,1634	0,01023	0,14684
<i>Short_ir</i>	-0,456	0,0037***	0,02067	0,00943***
<i>Stock_inx_1</i>	0,0204	0,0912**	0,17307	<0,00001***
<i>Reer</i>	0,8376	0,0002***	0,70312	0,00145***
<i>cds_spread</i>	-0,915	0,0045***	-0,8440	0,0012***
<i>Liquid_interbank</i>			-0,0125	0,1010*
<i>GDP_growth</i>	0,0400	0,7500		
AR(1)z	1,2392	[0.2153]	0,1607	[0.5488]
AR(2)z	1,7987	[0.0456]	0,2164	[0.6509]
R ²	0,9313		0,6898	

NOTES Significance: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. First and second lags of dependent variable were included but not reported.

Results

Whereas table 2 reports findings of the study, the analysis shows that *cds_spread* exerts negative impact on GDP growth and interbank liquidity. Real effective exchange rate seems to be an important and significant enhancing determinant of liquidity and macroeconomy (coefficients for Interbank liquidity and GDP growth are, 0.8376 and 0.70312, respectively). This can be due the increase (decrease) in foreign capital flows during upturns (downturns) and stock market boom (bust). Stock exchange changes does not affect so hardly on liquidity decisions of banks. It is not surprising the result obtained on the changes in interest rates, as in all countries can be observed significant growth 3M rates accompanying decline in banking system liquidity.

The research supports hypothesis about interconnectedness of liquidity in financial systems and solvency problems of big banking groups operating in CEE.

As the results show one of the potential sources of systemic risk in the CEE countries is the financial situation of European banking groups, particularly those with their subsidiaries in CEE. The deterioration of European banks may affect the banking sector, among others by reducing the availability of funding parent companies and other financial institutions and by increasing the cost of market financing. Difficulties in obtaining capital from market sources and the limited possibilities of recapitalization of banks due to the difficult fiscal situation will cause home countries, that parent banks may be forced to intensify the deleveraging process by reducing the

scale of operations, and sales subsidiaries. Parent banks that have received state aid may also be forced to sell some assets. Market financing costs are high, especially for banks from countries with public finance crisis risk. Banks' funding costs are highly dependent on risk assessment and cost of financing the government sector of their home countries. Strong growth in profitability and CDS premiums of some Euro area countries in the second half of 2011 resulted in increased funding costs of banks. This illustrates the significant increase in the CDS premium during the same period for most European banks. As a result of the deterioration of the fiscal situation of some Euro area countries, the rating agencies downgraded their credit assessment, which led to a reduction in the ratings of banks operating in these countries. Concerns about the fiscal situation of some countries of the Euro area resulted in an increased risk of bank losses in the event of fall in the value of Treasury bonds, and also limited the possibility of providing further public support for endangered financial institutions. Share prices of most European banks recorded a strong decline, especially banks with significant exposures to risk of Euro area countries and banks perceived as having an unstable situation of liquidity.

Also, the CDS premium quotations of parent companies are strongly associated with CDS premiums on their government debt. The solvency problem of some Euro area countries can decrease market assessments of financial sector companies, which worsen the conditions for the functioning of both parent companies and their affiliates. The reduction in lending will further restrict economic activity leading to a negative feedback loop between the financial and real sectors. Ratings of parent companies for CEE banks persist at low levels, especially in comparison with the period before the outbreak of financial crisis. High levels of CDS premium of certain parent companies has a significant influence liquidity in banking system, due to the high probability of insolvency of parent companies.

The results of the estimation models (equations 1 and 2) show that the most important influence on liquidity in CEE interbank market have: CDS spread on major banking group operating in Europe and the real effective exchange rate (coefficients of CDS spread and real effective exchange rate are, -0.91 and 0.83 , respectively). Much smaller influence presents GDP growth ($0,04$) and changes in the capital markets ($0,02$) (see table 2). The reason of this situation was in the past. Years 2007–2008 is a dynamic growth in loans and growing at a relatively lower rate of bank deposit base contributed to the widening funding gap (the ratio of loans to deposits on the interbank

market). Banks 'closing' the gap by borrowing funds in the interbank markets both at home and abroad, attracting deposits from non-bank financial institutions. The stability of such a model of funding was disrupted in September 2008, the collapse of us bank Lehman Brothers, which contributed to a significant increase in counterparty risk in global markets, reducing transaction limits and decline the interbank liquidity in financial markets. The consequence of disturbances in the international markets was reducing the mutual limits of the interbank transactions in local markets in the CEE region. The liquidity of the interbank market increased the market price of short-term transactions (up to 3M). The study of short-term interest rates in the interbank market in CEE region showed a significant increase in rates at this time. Low limits on interbank transactions could also due to the increased difficulties in assessing the credit risk of local banks' customers and hence, future financial position of banks themselves. It was difficult to determine security of credit portfolios and capital adequacy in particular banks. This was reflected in the increase in risk premiums and the cost of obtaining financing. Banks earn a lot of resources at a price above the level of interbank rates. Lack of trust between banks led to a increasing risk premium in interbank rates. The reaction of banks to reduce the possibility of 'closing' the funding gap in the wholesale markets was similar, and practically uniform across CEE countries.

The fast convergence in credit ratios is mainly driven by similar and aggressive business strategies of Western European banking groups that dominate the banking sectors of most CEE countries. For the banks with smaller relative presence in the region, vulnerability to contagion from mother to subsidiary banks is more relevant, while in the case of truly regional banks contagion is likely in both directions with potential spillover across subsidiaries as well.

Conclusion

The focus has been on how the statistical characteristics of a market's constituents and the nature of their interconnectedness affect the tradeoff between banks for contagion. It has been proven that in CEE parent model of banks leads to the contagion and liquidity problems, in interbank lending market. The process of internationalization in the banking sector in CEE countries has facilitated the development of banking and integration into the global system of capital flows. The presence of foreign capital in the banking sector, however, are related to concerns about: the deterioration of domestic banks operating conditions due to intense competition from foreign

institutions, the difficulties in conducting monetary policy, system instability, the reluctance to finance investments by foreign banks.

The study shows that the situation and solvency problem in big banking groups operating in Central and Eastern Europe, measured by CDS spreads exerts negative impact on liquidity in local financial systems, where they have subsidiaries. There is not connected with economic problem in particular countries, but it was so called contagion effect. This can be due the increase (decrease) in foreign capital flows during upturns (downturns) and stock market boom (bust). Stock exchange changes does not affect so hardly on liquidity decisions of banks. It is not surprising the result obtained on the changes in interest rates, as in all countries can be observed significant growth 3M rates accompanying decline in banking system liquidity. The research supports hypothesis about interconnectedness of liquidity in financial systems and solvency problems of big banking groups operating in CEE.

The high degree of financial interlinkages in the region and the risk of regional contagion argue strongly for a more regional approach to managing potential vulnerabilities. In addition to strengthening bank supervision and prudential regulation is needed close cooperation between home and host supervisory authorities. Initiatives are needed to develop cooperative arrangements for crisis management, some of which are already taking place. At a minimum, this calls for conducting coordinated inspections of internationally active banks and undertaking joint risk assessments.

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