

Karkowska, Renata

**Article**

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# INSTABILITY IN THE CEE BANKING SYSTEM. EVIDENCE FROM THE RECENT FINANCIAL CRISIS

Renata Karkowska\*

**Abstract:** *Sparked by the recent great recession and the role of financial markets, considerable interest exists among researchers within both the academic and public community in measuring and modeling systemic risk. This article introduces a new framework for measuring systemic risk by using a risk-adjusted balance sheet approach. In this regard, the analysis of 21 largest commercial banks operating in 7 countries from Central and Eastern Europe, shows potential risk which could threaten all the financial system. The paper concludes new directions for measuring systemic risk by using Merton model. It shows how risk management tools can be applied in new ways to measure and analyze systemic risk in European banking system.*

**Keywords:** systemic risk; Merton model; financial crisis; banking system

**JEL Classification:** G1; G11; G10; E44

## INTRODUCTION

The banking sector is by far the central part of the financial system in most of the emerging economies and is, therefore, also the main source of risk for financial stability. Traditional banking models do not adequately measure risk position of financial institutions and cannot be used to understand risk within and between balance sheets in the financial sector. A fundamental subject is that accounting balance sheets do not indicate risk exposures, which are forward-looking. Therefore, in the first step of this article author proposes the use of Merton's model, which is mainly used for option pricing as a way to assess the risk of insolvency of the company. The essence of this method is the connection of information coming from the company's balance sheet and market data, containing part of future expectations of market participants. In particular, it seems important to use option pricing methodology, which takes into account the information contained in the market prices about the increasing risks in the financial system. The study is a continuation of previous studies carried CCA method for the Polish banking sector.

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\* PhD Renata Karkowska, Institute of Financial Systems of Economy, Faculty of Management, University of Warsaw, Szturmowa 1/3, post code 02-678 Warsaw, Poland, e-mail: rkarkowska@wz.uw.edu.pl.



The main hypothesis is: Central and Eastern European banking systems are not devoid of systemic risk. The threat of a systemic crisis is ever-present.

Merton's model has been used to measure banking systemic risk. The approach was applied to the 21 commercial banks covered by Central and Eastern Europe during the period from December 2006 to December 2012. The findings suggest that the systemic risk indicator stood at its peak in March 2009, but in Hungarian banking system is still high.

The paper is structured as follows: Section 1 surveys the relevant literature on systemic risk and its reasons. Section 2 presents the data sample and methodology applied. Section 3 presents the results of the investigation. Section 4 concludes.

## **1. LITETERATURE REVIEW**

The problem of increasing systemic risk in the economy is again widely presented in the literature. Especially a lot on this subject can be read in the IMF reports (IMF, 2008; IMF 2009).

The wide scope of research about systemic risk show that there is not a single and agreed approach to this measurement. It suggests that measurements tools should support the understanding of linkages between financial institutions and the macroeconomy. The problem of systemic risk is complex and requires multiple measurements. In the literature review we have found a few specific approaches for assessing systemic risk along with different kind of data and models.

The survey of Brownlees and Engle (2011), Adrian and Brunnermeier (2008) and Acharya et al. (2010) presented how to use tail-risk measures to estimate solvency of the financial system. It measures interdependence in the tails of equity returns to financial institutions. MES measures the expected loss to each financial institution conditional on the entire set of institution s' poor performance; CoVaR measures the value-at-risk (VaR) of financial institutions.

Estimation of tail dependence is problematic because of limited historical data of a financial crisis. The tail measurement helps to identify large aggregate shocks. This approach is interesting but has some critical questions – how equity returns transmitted disturbance to the macroeconomy? How big crisis could be expected? The tail measures is based on big public financial institutions. What about so-called shadow banking sector that are not publicly traded? The study of systemic risk measures based on analysis of equity returns emphasized also Billio, Getmansky, Lo, and Pelizzon (2010).



The second approach is network models of the financial system. The information about financial firm network is very useful in prediction turbulences, but much more difficult to collect in dynamic financial system. Last time, Cont (2010) and Kim and Giesecke (2010) presented a network-based systemic risk measure.

Smets and Wouters (2007) suggested dynamic and macroeconomic equilibrium models. This econometric estimation measures the transition mechanisms of shocks and its consequences for macroeconomy. The survey remains a question how important is the model? And how to identify consequences of shocks that are very large but infrequent?

The other research apply Gray and Jobst (2011), Gapen (2009) known as contingent claims analysis. It based on the use of option pricing theory for financial institutions where there is an underlying stochastic process for the value of their assets. This approach using investors' market expectations in conjunction with equity-based measures of debt obligations uncertainty. The advantages of model is connection of market risk appetite with balance sheets statements.

The concept of credit risk measurement methods using CCA has a wide range of applications. American studies Gray and Malone (2011) used by central banks to support the analysis and management of financial risk management. The main analytical tool is the risk-adjusted balance sheet, which shows the sensitivity of the company's assets and liabilities to external "shocks" on the national and international level. Traditional approaches may have a problem with the analysis of how risks can accumulate gradually and then suddenly erupt in times of crisis. The CCA model approach is designed to overcome any "non-linearity" in the assets and liabilities, and between institutions. Simulations and stress tests, using risk-adjusted balance sheets are managing systemic risk.

Along Chan-Lau and Gravelle (2005), Lehar (2005) and Avesani, Pascual, and Li (2006) show alternative systemic risk indicators - default probabilities based on the credit default swap (CDS), equity or option market.

Overview of the theoretical and empirical aspects of systemic risk measurement and management has enabled author to determine what was missed in previous studies and is the structural default risk modeling reasonable in CEE financial system? However, the using of multitude of methods caused unequivocal conclusions. There is no doubt, that the cause of it is the randomness of economic phenomena that can't be properly described by statistical model.



According to Schuermann, Pesaran, Treuler and Weiner, (2006) accounting balance sheets do not indicate risk exposures, which are forward-looking and express market risk. He has worked on linking the default risk of corporations with macroeconomic models. He underline that the main risk is we frequently left out of our models default risk in the financial sector. Gray and Jobst, (2009:128-131) pointed out that study of financial volatility has not been well served by economic theory.

To manage and mitigate risk in financial sector there are needed new analytic tools and additional regulatory. Recent work has shown that financial sector risk indicators, such as the systemic expected losses or system default risk from Merton model, have big predictive power for GDP and the output gap Garcia, Gray, Luna and Restrepo, (2010).

Author decided to use CCA method to calculate systemic risk in banking of European emerging markets.

## **2. DATA AND METHODOLOGY**

The survey was based on systemic risk calculation in selected European banking systems, using Contingent Claims Analysis (CCA).

In the first step - CCA method of systemic risk measures has been used to estimate the market value of the assets of European commercial banks listed on stock exchange. In the study it was applied quarterly data from a period of December 2006 - December 2012, because of limited availability of banking variables, which are listed on stock exchange.

It was conducted for the selected 21 largest commercial banks from seven Central and Eastern European countries: Bulgaria, Czech Republic, Hungary, Lithuania, Latvia, Poland, Romania. Data on the size of selected assets and liabilities come from the banks' financial statements, and market data were obtained from Reuters Eikon. Because of the attention to the most accurate results, the variables are related to quarterly periods. General characteristics of the data used to calculate systemic risk are presented in Table 1 (Annex).



## 2.1. CCA method description

In order to understand the individual institutional exposure to systemic risk in times of crisis, the method of the CCA and its technique of using risk-based balance sheets of financial institutions are worth analyzing. The CCA method assumes that the total market value of bank assets at any time  $T$  is equal to the sum of the market value of equity  $E$  and its "risky" debt  $D$  at time  $T$ . The term of "risky debt" is due to the fact that there is always a chance of company insolvency. The regulation of payment of "risky debt" depends on the quality of bank assets, therefore being a claim against the assets of uncertain value. This type of claim is known as a conditional claim. The methodology of the study has been presented previously by Karkowska (2012).

At the time of bankruptcy shareholders receive payment in the amount of  $A-B$ , if  $A > B$ , or do not receive anything if  $A < B$ , where  $A$  is the market value of the assets,  $B$  – the liabilities (without equity). Similarly, we can compare the situation of a shareholder to that of a holder of a call option on the assets of the company. Exercise of the option occurs when it is in-the-money, which means  $A > B$ , while in the opposite situation, when the option is out-of-the-money, the shareholder does not exercise it (the situation of loss of the ability to pay where  $A \leq B$ ).

The CCA method describes the relation between the value of assets and the capital of the analyzed subject, derived from the theory of Black-Scholes option pricing model (Hull, Nelken, White, 2003).

$$E_T = \max[A_T - B, 0] \quad (2.1)$$

where:

$E_T$  - value of equity at the time  $T$ .

Assets take a random distribution and may fall below the value of liabilities which is equal to the level of a bank failure  $B$  (often referred to as the "default point" or "distress barrier"). Using the Black-Scholes-Merton model, the value of equity can be expressed as an implied call option on the bank assets with an exercise price equal to the level of  $B$ , which is expressed by the formula (2.1) (Gray, Malone, 2011).

$$E_T = A_T N(d_1) - B e^{-rT} N(d_2) \quad (2.2)$$



where:

$E_T$  – option value equal to the value of the bank capital at the time  $T$ ,

$A_T$  – value of the underlying bank assets at the time  $T$ ,

$B$  – exercise price equal to the value of liabilities,

$r$  – risk free rate,

$T$  – time to maturity option,

$N(d_i)$  – value of the distribution function for a standardized normal distribution equal to the argument  $d_i$ ,

where  $i=1, 2$

$N(d_2)$  – probability of exercising a call option,

$1-N(d_2) = N(-d_2)$  – probability of losing the ability to pay,

$$d_1 = [\ln(A_T/B) + (r + \sigma_A^2/2)T] / (\sigma_A \sqrt{T})$$

$$d_2 = d_1 - \sigma_A \sqrt{T}$$

$\sigma_A$  – bank assets volatility.

In the model, the variables  $E$ ,  $B$ ,  $T$ ,  $r$  are directly observable, but the market value of bank assets ( $A$ ) and its volatility ( $\sigma_A$ ) are not directly observable. Therefore, in order to estimate the market value of the asset and its variability the relationship (Hull, 2003) was used as well.

$$\sigma_E E = N(d_1) \sigma_A A, \tag{2.3}$$

where:

$\sigma_E$  – volatility of the bank equity.

With equations (2.2) and (2.3) we can calculate the market value of bank assets ( $A$ ) and its volatility ( $\sigma_A$ ) by successive iterations by comparing the two equations to zero.

$$A_T N(d_1) - B e^{-rT} N(d_2) - E_T = 0 \tag{2.4}$$

$$N(d_1) \sigma_A A - \sigma_E E = 0 \tag{2.5}$$



Minimizing the value of the expression (2.6) estimate the value of assets and volatility:

$$[A_T N(d_1) - Be^{-rT} N(d_2) - E_T]^2 + [(N(d_1) \sigma_A A - \sigma_E E)^2 \rightarrow \min \quad (2.6)$$

The estimated value is a market asset value, as assessed by investors. Let us assume that the relevant bank has a simple structure of financing (equity and foreign liabilities with maturity T). The bank's loss of the ability to pay occurs when at the time T the value of the assets is smaller than the liabilities. It follows that the loss of solvency is a function of the capital structure, the volatility rate of return on assets and the current market value of assets. When marking the probability to lose the ability to pay by the bank  $P_{def}$  we get:

$$P_{def} = \Pr [V \leq V_{def}] = \Pr [\ln V \leq \ln V_{def}] \quad (2.7)$$

When estimating the probability of losing the ability to pay in the KMV model defined by (2.7), we assume that the random variable – the return on assets adopts normal distribution, and therefore can be represented as a cumulative normal distribution of  $P_{def}$ . Which means that we can find the value of a normally distributed variable Z, that decline in the value of assets below this level will mean the bank loss of the ability to pay:

$$P_{def} = \Pr[\ln A_0 + [(\mu - \frac{\sigma_A^2}{2})t + \sigma_A \sqrt{t} Z_t \leq \ln A_{def}] \quad (2.8)$$

After the appropriate transformations we can determine the probability as:

$$P_{def} = \Pr \left[ \frac{\ln\left(\frac{V_0}{V_{def}}\right) - \left(\mu - \frac{\sigma_A^2}{2}\right)t}{\sigma_A \sqrt{t}} \geq Z_t \right] = \Pr \left[ Z_t \leq - \frac{\ln\left(\frac{V_0}{V_{def}}\right) - \left(\mu - \frac{\sigma_A^2}{2}\right)t}{\sigma_A \sqrt{t}} \right] = N(-d_2) \quad (2.9)$$

where:

$P_{def}$  – probability of the bank failure,

$V_0$  – market assets value,

$V_{def}$  – limit of the assets value resulting in bankruptcy,

$\sigma_A$  – asset volatility,

$\mu_A$  – the actual expected rate of return on assets,

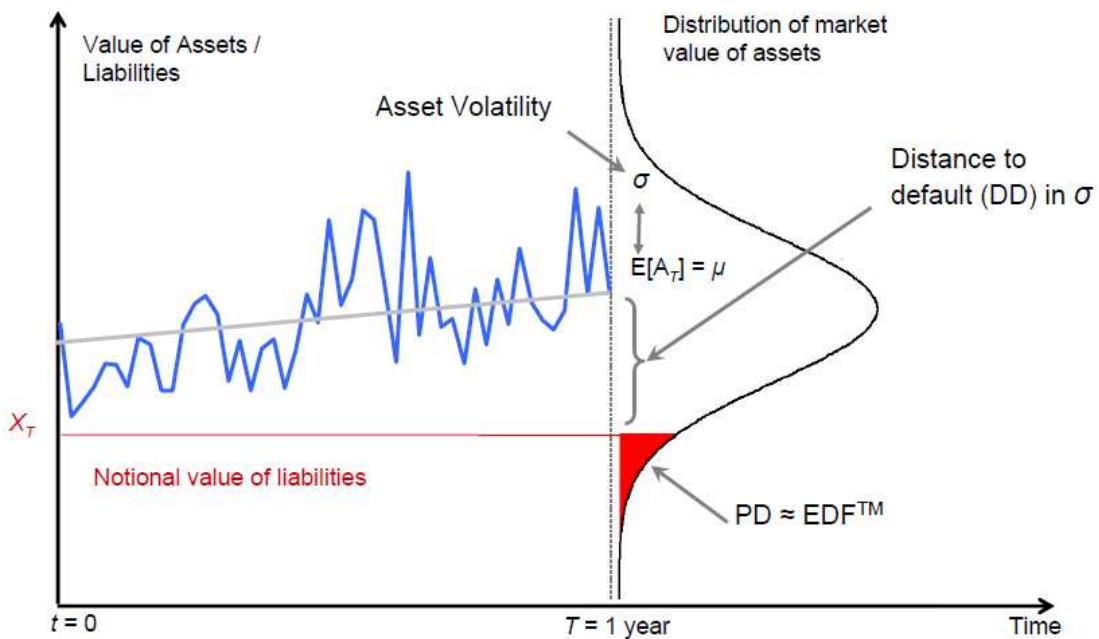




$t$  – time to option expiration.

The algorithm (2.9) is defined in literature as a DtD - Distance to Default, the number of standard deviations between the expected value of assets and the level of causing the loss of ability to pay. Use the process of estimating the likelihood of using KMV estimator turns out to be a better credit risk than the actual statistics of rating agencies - such conclusions were reached in the studies by (Kealhofer, McQuown and Vasicek, 2007). The distribution of assets at time T of the selected barrier solvency is presented in the Figure 1.

**Figure 1 Distribution of assets and the process of finding the probability of default**



As the risk-free rate is the central bank's reference rate, while the market value of equity is adopted as the capitalization of individual banks on the stock exchange. The calculation of the assets market value is based on Merton's model and were calculated by means of Microsoft Excel Solver.

### 3. EMPIRICAL RESULTS

In this paper, we advocate a methodology to measure the systemic risk of banking systems in selected CEE countries. We applied this methodology to the 21 banks covered by largest commercial banks listed on stock exchange. The results are presented in Table 2 (Annex).

The highest values of systemic risks shall cover the period of the financial crisis (September 2008 - June 2009) in the banking system Polish and Hungarian. In the individual analysis most threatened were: BRE Bank, Bank BPH, OTP Bank. The period before the crisis, most of it can be assumed to be safe, with the exception of individual units: ING Bank, Bank BPH and Latvijas Krajbanka. Wonder and anxiety can raise the fact that there is still a danger systemic risk in the CEE countries that are considered safe. The study showed that even in December 2012, the analysis showed worrying developments in Hungary, where the underestimation of OTP Bank's assets fall below EUR 3 000 million. Also questionable situation is in: the Bulgarian, Romanian, Lithuanian and Latvian banking system. Risk map shows that only individual banks, such as the Czech Komerční Banka, Bulgarian Corporate Commercial Bank, the Polish Bank Pekao and PKO BP did not show systemic risk threat throughout the research.

### CONCLUSIONS

The aim of our study was to calculate the systemic risk in CEE banking systems and identify its changes. We also try to investigate the determinants of these banking instability using panel regression models. Our results present interesting conclusions. Firstly, we do support to the recent economist survey on the increased systemic risk complexity and heterogeneity. Our results show that banking instability is changing across countries and time. Models provide measurement frameworks and facilitate communication and criticism. Our measures is not perfect, as was mentioned in the introduction has flaws, but it seems to be considered to support policy discussion and analysis. May be as CEE banking early warning indicators, such as in the stress testing exercise. The survey could be the step to expanded new regulation and put pressures on banking supervision to develop useful measurements of systemic risk. Secondly, we create the map of the most and least instable banking systems in Central and Eastern Europe and confirm instability of CEE banking systems still yet. The above-mentioned decomposition



could be used to examine to what degree the CEE banking instability can be explained by the risk premium versus default risk component.

## REFERENCES

- Acharya, V. V., Pedersen, L. H., Philippon, T., Richardson, M. (2010) *Measuring Systemic Risk*, Working Paper, NYU Stern School of Business.
- Adrian, T., Brunnermeier, M. (2009) *CoVaR*, Federal Reserve Bank of New York Staff Reports.
- Avesani, R. G., Pascual, A. G., Li, J. (2006) *A New Risk Indicator and Stress Testing Tool: A Multifactor Nth-to-Default CDS Basket*, IMF Working Paper.
- Billio, M., Mila, G., Andrew, W., Lo, Pelizzon, L. (2010) *Econometric Measures of Systemic Risk in the Finance and Insurance Sectors*, NBER Working Paper No. 16223.
- Brownlees, C., Engle, R. (2010) *Volatility, Correlation and Tails for Systemic Risk Management*, Working Paper, NYU Stern School of Business.
- Chan-Lau, J.A., Gravelle, T. (2005) *Market-Based Estimation of Default Probabilities and Its Application to Financial Market Surveillance*, IMF Working Paper, WP/06/104.
- Cont, R. (2010) *Measuring Contagion and Systemic Risk in Financial Systems*, Working Paper, Columbia University.
- Gapen, I. (2009) *Evaluating the Implicit Guarantee to Fannie Mae and Freddie Mac Using Contingent Claims* in Choi, J. J., Papaioannou, M. G. (eds.) *Credit, Capital, Currency, and Derivatives: Instruments of Global Financial Stability or Crisis?*, International Finance Review, Vol. 10.
- Garcia, C., Gray D., Luna L., Restrepo J. (2010) *Incorporating Financial Sector Risk into Monetary Policy Models: Application to Chile*, in Rodrigo, A. (ed.) *Financial Stability, Monetary Policy and Central Banking*, Santiago: Central Bank of Chile.
- Gray D. F., Malone S. (2011) *Macrofinancial Risk Analysis*, Publisher John Wiley & Sons.
- Gray, D. F. & Jobst A. A. (2009) *Higher Moments and Multivariate Dependence of Implied Volatilities from Equity Options as Measures of Systemic Risk*, Global Financial Stability Report, Chapter 3, April (Washington: International Monetary Fund), pp. 128-131.



- Gray, D.F., Jobst, A.A., Malone S. (2011) *Quantifying Systemic Risk and Reconceptualizing the Role of Finance for Economic Growth*, Journal of Investment Management, Vol. 8, No. 2, pp. 90-110.
- Hull J.C. (2003) *Options, Futures and Other Derivatives*, Prentice Hall, Upper Saddle River, NJ.
- Hull J.C., Nelken I., White A. (2003). *Merton's Model, Credit Risk, and Volatility Skews*, University of Toronto.
- International Monetary Fund (2009) *Global Financial Stability Report: Responding to the Financial Crisis and Measuring Systemic Risks*, World Economic and Financial Surveys (International Monetary Fund: Washington, D.C.).
- International Monetary Fund (2008) *Global Financial Stability Report: Containing Systemic Risks and Restoring Financial Soundness*, World Economic and Financial Surveys (International Monetary Fund: Washington, D.C.).
- Karkowska, R., (2012) *Measuring systemic risk in polish banking system using risk-based balance sheets method*, Folia Oeconomica Stetinensia, No 12 (20) 2012/2.
- Kealhofer, McQuown, Vasicek, (2003) MKMV, *Modeling Default Risk*, Moody's KMV, Moody's Analytics (www.mkmv.com).
- Kim, B., Giesecke, K. (2010) *Systemic Risk: What Defaults Are Telling Us*, Working Paper, Stanford University.
- Lehar, A. (2005) *Measuring Systemic Risk: A Risk Management Approach*, Journal of Banking and Finance, vol. 29, 2577–2603.
- Schuermann, T., Pesaran M.H., Treuler B.J., Weiner S.M. (2006) *Macroeconomic Dynamics and Credit Risk: A Global Perspective*, Journal of Money, Credit and Banking, Vol. 38, No. 5, pp. 1211-62.
- Smets F. R., Wouters R., (2007) *Shocks and frictions in US business cycles: a Bayesian DSGE approach*, ECB Working Paper Series, No 722.



## ANNEX

### Table 1 - Model CCA data description

| Country                   | Bank                           | Median of equity value (EUR mln) | Average book value of assets (EUR mln) | Average market capitalisation (EUR mln) | Average systemic risk (EUR mln) |
|---------------------------|--------------------------------|----------------------------------|--|---|---------------------------------|
| Bulgarian banking system  | Bulgarian-American Credit Bank | 93,27                            | 376,98                                 | 99,79                                   | -33,53                          |
|                           | Central Cooperative Bank       | 117,33                           | 872,21                                 | 69,40                                   | -82,38                          |
|                           | Corporate Commercial Bank      | 143,23                           | 1089,15                                | 230,77                                  | 41,36                           |
|                           | First Investment Bank          | 206,62                           | 2190,15                                | 134,26                                  | -105,65                         |
|                           | Bulgarian summary              | 560,45                           | 4528,49                                | 534,21                                  | -180,20                         |
| Romanian banking system   | Banca Comerciala Carpatica     | 49,97                            | 520,04                                 | 82,48                                   | -46,26                          |
|                           | Banca Transilvania             | 320,20                           | 3559,33                                | 456,30                                  | 115,51                          |
|                           | Romanian summary               | 370,16                           | 4079,37                                | 538,78                                  | 69,25                           |
| Latvian banking system    | Latvijas Krajbanka             | 51,83                            | 731,74                                 | 46,68                                   | -36,00                          |
|                           | Latvian summary                | 51,83                            | 731,74                                 | 46,68                                   | -36,00                          |
| Lithuanian banking system | Bankas Snoras                  | 159,90                           | 2606,24                                | 127,51                                  | -110,10                         |
|                           | Siauliu Bankas                 | 74,52                            | 601,58                                 | 62,26                                   | -17,10                          |
|                           | Ukio Bankas                    | 124,27                           | 1223,89                                | 86,24                                   | -50,66                          |
|                           | Lithuanian Summary             | 358,69                           | 4431,71                                | 276,01                                  | -177,87                         |
| Hungarian banking system  | FHB Jelzalogbank               | 120,37                           | 2105,41                                | 228,42                                  | -20,67                          |
|                           | OTP Bank                       | 2395,89                          | 22151,28                               | 4503,88                                 | 447,34                          |
|                           | Hungarian summary              | 2516,26                          | 24256,68                               | 4732,30                                 | 426,68                          |
| Czech banking system      | Komerčni Banka                 | 2123,66                          | 23160,57                               | 4723,75                                 | 2609,25                         |
|                           | Czech summary                  | 2123,66                          | 23160,57                               | 4723,75                                 | 2609,25                         |
| Polish banking system     | Bank PEKAO                     | 2997,33                          | 23483,30                               | 9771,56                                 | 5066,85                         |
|                           | BRE Bank                       | 897,03                           | 13391,28                               | 2627,41                                 | 383,74                          |
|                           | ING Bank                       | 974,02                           | 11841,53                               | 2406,85                                 | 313,96                          |
|                           | Millenium                      | 638,87                           | 7772,16                                | 1395,08                                 | 71,58                           |
|                           | PKO BP                         | 3615,12                          | 32329,99                               | 11464,97                                | 6025,09                         |
|                           | Bank HANDLOWY                  | 1466,79                          | 9424,69                                | 2613,19                                 | 555,73                          |
|                           | BOS Bank                       | 207,08                           | 2479,23                                | 301,27                                  | -74,45                          |
|                           | Bank BPH                       | 1182,94                          | 10609,36                               | 702,41                                  | -1579,67                        |
|                           | Polish summary                 | 11979,18                         | 111331,55                              | 31282,75                                | 2690,71                         |

Source: own calculation

Table 2 - Systemic risk map in CEE banking systems during the period December 2012 - December 2006 (mil. EUR)

| Bank                        | Dec' 12     | Jun' 12     | Mar' 12      | Dec' 11      | Sep' 11     | Jun' 11     | Mar' 11     | Dec' 10      | Sep' 10     | Jun' 10     | Mar' 10     | Dec' 09     | Sep' 09      | Jun' 09      | Mar' 09      | Dec' 08      | Sep' 08     | Jun' 08     | Mar' 08     | Dec' 07     | Sep' 07     | Jun' 07     | Mar' 07     | Dec' 06     |             |
|-----------------------------|-------------|-------------|--------------|--------------|-------------|-------------|-------------|--------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Bulgarian-Amer. Credit Bank | -12         | -46         | -51          | -53          | -65         | -56         | -39         | -32          | -35         | -42         | -11         | 2           | 15           | -40          | -59          | -35          | 157         | 305         | 362         | 442         | 462         | 470         | 370         |             |             |
| Centr. Cooper. Bank         | -98         | -145        | -137         | -129         | -112        | -94         | -76         | -105         | -92         | -88         | -77         | -78         | -73          | -86          | -111         | -107         | -8          | 73          | 124         | 302         | 254         | 254         | 205         | 196         |             |
| Corp. Comer. Bank           | 21          | 18          | 20           | 48           | 45          | 49          | 80          | 29           | 21          | 43          | 38          | 27          | 20           | 34           | 42           | 40           | 134         | 169         | 158         |             |             |             |             |             |             |
| First Invest Bank           | -87         | -171        | -143         | -139         | -107        | -62         | -40         | -104         | -113        | -109        | -95         | -88         | -65          | -121         | -174         | -148         | 32          | 157         | 220         |             |             |             |             |             |             |
| <b>Bulgaria total</b>       | <b>-176</b> | <b>-344</b> | <b>-311</b>  | <b>-274</b>  | <b>-238</b> | <b>-162</b> | <b>-75</b>  | <b>-212</b>  | <b>-219</b> | <b>-196</b> | <b>-146</b> | <b>-138</b> | <b>-102</b>  | <b>-214</b>  | <b>-303</b>  | <b>-250</b>  | <b>315</b>  | <b>705</b>  | <b>864</b>  | <b>744</b>  | <b>716</b>  | <b>724</b>  | <b>575</b>  | <b>196</b>  |             |
| Banca Carpatica             | -128        | -165        | -120         | -137         | -91         | -61         | -64         | -49          | -46         | -52         | -49         | -84         | -73          | -85          | -76          | -16          | -6          | 5           | 7           | 106         | 103         | 118         | 117         | 101         |             |
| Banca Transilvania          | -345        | -472        | -402         | -478         | -368        | -246        | -236        | -310         | -210        | -212        | -86         | -197        | -310         | -514         | -667         | 221          | 203         | 248         | 442         | 760         | 389         | 402         | 324         | 298         |             |
| <b>Romania total</b>        | <b>-473</b> | <b>-638</b> | <b>-522</b>  | <b>-615</b>  | <b>-459</b> | <b>-307</b> | <b>-299</b> | <b>-359</b>  | <b>-256</b> | <b>-264</b> | <b>-135</b> | <b>-282</b> | <b>-383</b>  | <b>-599</b>  | <b>-744</b>  | <b>205</b>   | <b>197</b>  | <b>253</b>  | <b>449</b>  | <b>865</b>  | <b>492</b>  | <b>521</b>  | <b>441</b>  | <b>399</b>  |             |
| Latvijas Krajbanka          |             |             |              |              |             |             |             | -49          | -65         | -74         | -82         | -125        | -94          | -134         | -146         | -232         | -115        | -86         | -41         | -31         | -12         | 6           | 27          | -8          |             |
| <b>Latvia total</b>         |             |             |              |              |             |             |             | <b>-49</b>   | <b>-65</b>  | <b>-74</b>  | <b>-82</b>  | <b>-125</b> | <b>-94</b>   | <b>-134</b>  | <b>-146</b>  | <b>-232</b>  | <b>-115</b> | <b>-86</b>  | <b>-41</b>  | <b>-31</b>  | <b>-12</b>  | <b>6</b>    | <b>27</b>   | <b>-8</b>   |             |
| Bankas Snoras               |             |             |              |              |             |             |             | 18           | -39         | -81         | -48         | -69         | -48          | -193         | -161         | -255         | -215        | -140        | -139        |             |             |             |             |             |             |
| Siaulių Bankas              | -12         | -34         | -26          | -32          | -30         | -18         | -12         | -8           | -18         | -21         | -17         | -19         | -21          | -63          | -52          | -60          | -34         | 2           | 23          | 39          | 62          | 45          | 30          | 26          |             |
| Ukio Bankas                 | -5          | -79         | -74          | -88          | -92         | -53         | -40         | -24          | -57         | -75         | -47         | -56         | -68          | -136         | -114         | -170         | -122        | -52         | -4          | 10          | 83          | 72          | 68          | 59          |             |
| <b>Lithuania total</b>      | <b>-17</b>  | <b>-114</b> | <b>-100</b>  | <b>-120</b>  | <b>-122</b> | <b>-71</b>  | <b>-52</b>  | <b>-14</b>   | <b>-114</b> | <b>-177</b> | <b>-112</b> | <b>-144</b> | <b>-137</b>  | <b>-393</b>  | <b>-327</b>  | <b>-485</b>  | <b>-372</b> | <b>-189</b> | <b>-120</b> | <b>49</b>   | <b>145</b>  | <b>117</b>  | <b>98</b>   | <b>85</b>   |             |
| FHB Jelzalogbank            | -287        | -260        | -232         | -256         | -246        | -144        | -123        | -149         | -51         | -80         | 21          | -34         | -52          | -234         | -279         | -211         | -111        | -65         | -22         | 110         | 180         | 212         | 158         | 132         |             |
| OTP Bank                    | -3476       | -3363       | -3018        | -3742        | 3346        | -585        | -834        | -1309        | -978        | 1523        | -675        | -669        | -1112        | -3087        | -5049        | -3630        | -383        | 393         | 888         | 3178        | 4151        | 5354        | 3538        | 3876        |             |
| <b>Hungary total</b>        | <b>3763</b> | <b>3623</b> | <b>-3250</b> | <b>-3998</b> | <b>3592</b> | <b>-729</b> | <b>-956</b> | <b>-1458</b> | <b>1029</b> | <b>1603</b> | <b>-696</b> | <b>-704</b> | <b>-1164</b> | <b>-3321</b> | <b>-5328</b> | <b>-3841</b> | <b>-493</b> | <b>328</b>  | <b>867</b>  | <b>3288</b> | <b>4331</b> | <b>5566</b> | <b>3696</b> | <b>4007</b> |             |
| Komerční banka              | 1598        | 1702        | 2025         | 1587         | 1734        | 3012        | 3256        | 3433         | 2622        | 2119        | 2609        | 2959        | 2377         | 1209         | 227          | 1429         | 2596        | 2451        | 2650        | 3670        | 4013        | 3453        | 2824        | 2105        |             |
| <b>Czech R. total</b>       | <b>1598</b> | <b>1702</b> | <b>2025</b>  | <b>1587</b>  | <b>1734</b> | <b>3012</b> | <b>3256</b> | <b>3433</b>  | <b>2622</b> | <b>2119</b> | <b>2609</b> | <b>2959</b> | <b>2377</b>  | <b>1209</b>  | <b>227</b>   | <b>1429</b>  | <b>2596</b> | <b>2451</b> | <b>2650</b> | <b>3670</b> | <b>4013</b> | <b>3453</b> | <b>2824</b> | <b>2105</b> |             |
| Bank PEKAO                  | 2584        | 2942        | 3107         | 2437         | 2210        | 4243        | 4707        | 5434         | 5118        | 4292        | 4919        | 4815        | 4407         | 2191         | 294          | 2729         | 5514        | 5469        | 7119        | 9074        | 6944        | 7645        | 7427        | 6336        |             |
| BRE Bank                    | 3109        | 2922        | -184         | -445         | -398        | 591         | 972         | 633          | 276         | 10          | 87          | 216         | -1176        | -1913        | -2757        | -1128        | 365         | 760         | 958         | 2159        | 2304        | 2634        | 2308        | 1384        |             |
| ING Bank                    | -924        | -847        | 370          | 159          | 106         | 610         | 1171        | 940          | 761         | 604         | 592         | 801         | 298          | -926         | -1367        | -747         | -1279       | -1425       | -1189       | -190        | 378         | 713         | 145         | 447         |             |
| Millenium                   | -852        | -559        | -294         | -495         | -216        | 89          | 356         | 83           | 158         | -58         | -23         | -95         | -820         | 1558         | -1873        | -1200        | 68          | 312         | 664         | 1423        | 1518        | 1814        | 1524        | 868         |             |
| PKO BP                      | 3598        | 2964        | 2628         | 2361         | 2831        | 5917        | 6420        | 6588         | 6479        | 4391        | 5726        | 5320        | 3427         | 1614         | 551          | 3721         | 5583        | 6442        | 6299        | 8545        | 9401        | 9594        | 8046        | 7916        |             |
| Bank HANDLOWY               | 142         | 528         | -803         | -2862        | -2228       | -1543       | -1837       | 1104         | 927         | 557         | 688         | 431         | 99           | -333         | -719         | -418         | 213         | 774         | 942         | 1354        | 1824        | 2310        | 1344        | 1122        |             |
| BOS Bank                    | -276        | -292        | -248         | -289         | -187        | -157        | -125        | -141         | -97         | -82         | -40         | -12         | -93          | -97          | -71          | -17          | -66         | -68         | -40         | -27         | 4           | -9          | 33          | 28          |             |
| Bank BPH                    | -543        | -701        | -640         | -841         | -549        | -332        | -29         | -74          | 3582        | 4120        | -3256       | -4300       | 2423         | 2623         | -2941        | -6628        | -1786       | -1667       | -1576       | -1501       | -1133       | -953        | -1047       | -1119       |             |
| <b>Poland total</b>         | <b>6838</b> | <b>6956</b> | <b>3937</b>  | <b>26</b>    | <b>1568</b> | <b>9418</b> | <b>6</b>    | <b>7</b>     | <b>1</b>    | <b>5594</b> | <b>8694</b> | <b>7177</b> | <b>3720</b>  | <b>-3645</b> | <b>-8883</b> | <b>-3688</b> | <b>8611</b> | <b>7</b>    | <b>1059</b> | <b>1317</b> | <b>2083</b> | <b>2124</b> | <b>2374</b> | <b>1978</b> | <b>1698</b> |

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