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Article

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E u r o E c o n o m i c a

Issue 1(35)/2016 *ISSN: 1582-8859*

The Impact of International Financial Crisis on Bank Performance in Eastern and Central European Countries

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Abstract: In this paper we investigate the determinants of bank profitability in 10 countries from Central and Eastern Europe, in the period between 2004 and 2013. We proxy the profitability of banks with more commonly used ratio: the return on assets (ROA), computed as a ratio of the net profit to the total bank assets. We used multiple regression with bank specific variables, banking industry variables and macroeconomic variables. Moreover, we added a global financial crisis dummy to highlight the crisis impact on asset return. OLS is the main estimation method, but we also used difference-in-difference in order to test if the crisis impact was amplified or diminished by the bank specific characteristics. The evidence shows significant differences between the profit levels of the CEEC banks. Our results are in line with the empirical literature. The impact of the international financial crisis on ROA was negative and statistically significant, as expected. The second part of the analysis we separate the banks sample in three categories: banks with high capital adequacy, large banks by total assets and foreign-owned banks. Our findings show that the three selected variables both amplified and decreased the crisis effect.

Keywords: international financial crisis; bank performance; banking industry variables; macroeconomic variables

1. Introduction

During the global financial crisis, the banking system faced significant difficulties, with an impact on its performance. The crisis has been preceded by a rapid growth of loan portfolios, low risk premia, abundant liquidity, high leverage, quick asset price increases and real estate bubbles. In the first part of the crisis, financial institutions were confronted with a shortage of liquidity needed for short-term debt coverage. In this phase the bank solvability was the main concern, but the authorities and market players weren't considering the threat of a systemic collapse. This belief has changed with the collapse of Lehman Brothers financial group that induced a drop of trust in the system and panic among investors, that decided investment exits. From that point, the European economy entered the largest collapse since 1930's. The transmission of financial sector's problems to the real sector took place in a short period, because of the strict loan-granting conditions, the drop of trust in the financial sector and the drop in financing demand (originating both from retail and corporate businesses). The interdependencies of the economies led to a relative simple contamination of other countries that were economic partners.

The main objective of this study is to analyze the determinants of bank profitability in 10 countries from Central and Eastern Europe, in the period between 2004 and 2013. This period is important at least from two points of view. First of all, 8 of 10 countries started to be EU members since 2004 and

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the rest of 2 countries (Romania and Bulgaria) became EU member beginning with 2007. Second, during this period, it encountered the international financial crises, thus we can assess banking development in this context. In these conditions, the results can be useful both for banking management, in order to build strong and performing banks, and for the regulating authorities – national and international, in order to approve regulations that assure a competitive and sound banking system. The empirical literature considers three categories of factors that determine banks' profitability: bank-specific (internal) factors; industry specific and macroeconomic factors (Demirguc-Kunt and Huizinga, 1998, 2000). Our investigation goes further, splitting the sample of banks in three categories: banks with high capital adequacy, large banks by total assets and foreign-owned banks. This deep analysis is motivated by different reasons. After financial crises, it is use to be a greater tendency of banks to increase capital (Berger and Bouwman, 2013). Some studies emphasize the role of capital as a buffer to absorb shocks to earnings (e.g., Repullo, 2004; Von Thadden, 2004).

Foreign banks have played an important role in the development of banking markets in the Central and Eastern European Countries (CEEC), because the banks' foreign investors decreased fiscal costs of banks' restructuring (Tang et al., 2000), foreign banks brought expertise in bank management (Bonin et al., 2005) and foreign bank presence increased the competition, driving domestic banks to cut costs and increase efficiency (Claessens et al., 2001). At the same time, foreign banks can be influenced by poor performance or change in strategy of their parent banks (Havrylchyk and Jurzyk, 2005).

The results obtained could be also useful for European Single Supervisory Mechanism's reform concerning the "close cooperation" between European Central Bank (ECB) and the national supervisors of other EU countries that do not yet have the euro as their currency. The ECB directly supervises the significant banks of the participating countries. The significance of a bank is determined upon the asset size. The relationship between bank size and profitability was captured by many studies with contradictory results (Goddard et al., 2004; Athanasoglou et al. 2008). The implication of bank size during the crises it is also important, especially from the "to big to fail" perspective.

Even though there are significant differences between the bank profit levels in Central and Eastern Europe, their variance can be quite well explained by the variables we propose. The results are consistent with our expectations and in line with the empirical literature, both for the crisis dummy that reveals a negative and significant impact, and the other control variables. When we use all the three categories of variables for estimating the coefficients we found statistical significance for all variables except the liquidity and the nature of ownership for bank specific variables, concentration/competition for industry specific variables and the volatility of exchange rates for macroeconomics ones. An interesting result is that capital adequacy and the size of the bank have positive impact on the bank profitability of CEEC for the period assessed. Also, in the second part of the investigation, we noticed that capital adequacy amplified the crises effect, but this was diminished in the case of large banks and foreign ones. This chapter has 5 sections. First describes the importance, objective, methods and reminder of the chapter. The second reviews the literature regarding the bank performance determinants and the financial crisis literature. The third describes the methodology and data and the results are exhibited and discussed in the fourth part. The conclusions are the final part.

2. Literature Review

The analysis of bank profitability was the objective of numerous studies that showed the changes that took place during crisis period versus the pre-crisis period. These papers focused both on single

countries and country groups and considered bank specific, banking industry specific and macroeconomic variables.

The bank profitability for groups of countries in Europe was studied by Molyneux and Thornton (1992), Demirgüç-Kunt and Huizinga (1998, 2000), Mendes and Abreu (2003), Goddard *et al.* (2004), Havrylchyk and Jurzyk (2005), Micco *et al.* (2005), Athanasoglou *et al.* (2006), Pasiouras and Kosmidou (2007), Brissimis *et al.* (2008).

The most common bank specific factors in these papers were the bank size, capital adequacy, inefficiency and credit risk. Pasiouras and Kosmidou (2007) found a positive relation between the bank size and bank profit. This can be explained by the fact that large banks benefit from scale economies and offer a higher range of products when compared to smaller banks. On the other hand, Micco *et al.* (2007) didn't find a significant relation between the bank size and return on bank assets (ROA). Regarding the credit risk, expressed as provisions to total assets ratio, Brissimis *et al.* (2008) and Athanasoglou *et al.* (2006) found a negative and significant influence on bank efficiency and productivity, respectively on assets and equity returns. Dietrich and Wanzenried (2010) found an insignificant influence of the credit risk on ROA and ROE, before the recent global financial crisis, but during the crisis the effect was negative and significant.

The credit risk, expressed as non-performing loans to total loans ratio, represented a bank specific factor frequently encountered in the literature. Căpraru and Ihnatov (2014) demonstrated that credit risk has a negative and significant effect on ROA and ROE but don't influence the net interest margins in 5 CEEC. The credit risk impact on bank stability in CEE, expressed by the z-score, was high and significant during the crisis (Andrieș *et al.*, 2012).

Demirgüç-Kunt and Huizinga (1998), Mendes and Abreu (2003), Goddard *et al.* (2004), Pasiouras and Kosmidou (2007) concluded that the most performing are the banks with high equity; moreover they have a low default risk and lower financing costs. The efficiency variable has a negative and significant impact over profitability, meaning that costs and revenues management is inefficient (Dietrich and Wanzenried, 2010; Kosmidou *et al.*, 2007; Athanasoglou *et al.*, 2008).

Another important result of the Demirgüç-Kunt and Huizinga (1998) research paper was the influence of the bank owner's structure on the bank profitability. They discovered that foreign banks are more profitable than the domestic ones in developing countries. The findings of Micco *et al.* (2007) and Athanasoglou *et al.* (2006) are confirming this evidence. On the contrary, Molyneux and Thornton (1992) concluded that the owner's nature is not relevant in explaining the bank profitability.

Athanasoglou *et al.* (2006) have analyzed the profitability determinants in seven countries from Central and Southern Europe in the period between 1998 and 2002. They included among the bank specific factors the index that reflects the bank reform progress that is characteristic to transition economies. The relationship between this indicator and bank profitability (ROA and ROE) is negative and significant. On the contrary, Brissimis *et al.* (2008) and Fang *et al.* (2011) found a positive effect, both on efficiency and productivity, but negative on interest rate margin. The progress of regulation implementation, the credit expansion and progressive adoption of sound macroeconomic policies conducted to an increase of competitivety in the banking sector. The banks were offering competitive rates for deposits and loans that affected the profits.

Beltratti and Stulz (2012), Bolt *et al.* (2012), Dietrich and Wanzenried (2010), Berger and Bowman (2013) and Cull and Martinez-Peria (2013) analyze he impact of recent global financial crisis on bank performance.

Bolt *et al.* (2012) concluded that the bank profitability during the current recession is influenced by the economic cycle. They demonstrated that if real GDP contracts by 1% during deep recessions, then ROA reduces by 0.24% at banking industry level. This finding can be explained by the fact that bank loans granted to private sector are depending significantly on the GDP level. A GDP drop deteriorates the asset quality and increases the non-performing loans.

Berger and Bouwman (2011) made a study on the impact of bank equity on survival probability and market share during different financial crises and "normal" periods. The period considered was 1984-2010 and included 2 banking crises, 3 financial crises and 2 "normal" periods. Their findings show that a high level of equity increases the survival probability and market share of small banks during banking crises.

Cull and Martinez-Peria (2013) analyzed the impact of bank ownership on the level of loans granted in pre-crisis and during the crisis in emerging countries from Latin America and Eastern Europe. In the case of domestic banks, both from Latin America and Eastern Europe, the growth rates of loan portfolios had decreased during crisis. The growth rates of loan portfolios of foreign banks in Eastern Europe have decreased more quickly than in the case of domestic banks, mainly due to the decrease of corporate loans. In Latin America, the growth rates of loans granted by government owned banks overtook the growth rates in the case of private domestic and foreign banks.

Beltratti and Stulz (2012) questioned why some banks evolved better during the crisis and analyzed the impact of bank governance, country governance, domestic regulation, bank balance sheet and the profit before crisis on bank performance. Banks got better performance in the countries with strict capital adequacy requirements and independent supervision authorities. On the other hand, banks from countries with powerful supervision authorities recorded low market returns, as the shareholders were asked to raise new equity during crisis, which was very costly for the shareholders.

Finally, the literature offers a comprehensive examination of the bank specific, industry specific and macroeconomic factors that have an impact on the bank profitability. However, the results differ from one research paper to other, especially because of the particularities of countries in the samples and due to different macroeconomic conditions, but also due to the time period and datasets used.

Our contribution to the research in the field is the following. We used a particular dataset that differs from the previous papers (countries, time period, variables). Moreover we tried to clarify the different factor influence on bank profitability, as the previous papers' findings were contradictory. Considering the global financial crisis, our research tried to establish if the crisis impact was amplified or decreased by the bank specific factors, by using the difference-in-difference methodology. We appreciate that the stakeholders should offer more attention to the variables that deteriorated during the crisis. This is necessary in order to prepare for future actions that counter the negative impact of these indicators and prevent a further international crisis.

3. Data and Methodology

The research is carried out on a panel of 10 countries in Central and Eastern Europe, members of European Union: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia and Slovak Republic. We have chosen these countries as they are part of the two waves of EU expansion (2004 and 2007) that took part during the analyzed period (2004-2013). We excluded from this sample Croatia, because of missing data, as this country joined EU only in 2013. In what regards the number of banks in the sample, we first considered all the commercial banks that were

active in those countries, namely 170. However, due to lack of transparency of some banks and high degree of data adjustment in the financial reports, we had to exclude 42 banks. Finally, the regression was carried out on a sample of 128 banks. The number of banks in each country is available in Appendix 1. Bank level data are from Bankscope database, and are reported as percent, except total assets that are expressed in thousands of Euros. The banking industry and macroeconomic data are from EBRD, ECB and Eurostat reports.

Following Sufian and Habibullah (2010), bank profitability is expressed by the return on assets (ROA) that is calculated as a ratio of the net profit to total assets of the bank. This indicator reflects the management ability to raise profit from bank assets and shows the net profit generated by a unit of asset.

3.1 Bank Specific Variables

Among the internal factors, the most frequently encountered in the literature are: capital adequacy, inefficiency, credit risk and bank size. *Capital adequacy (Capital)* is the ratio expressed in percents of equity to total bank assets. The banks with a high level of adequacy are considered more secure and with a higher risk aversion. On the other hand, banks with a lower level of adequacy can involve in more risky projects and raise more revenue. Moreover, high equity banks remain profitable even during difficult periods and can raise financing with lower costs. Thus, the arguments expressed above do not point to a negative or positive effect of the capital adequacy level on the bank profitability. This will result from our empirical analysis.

Following Andrieș et al. (2012), *operating inefficiency (Inefficiency)* is expressed as a ratio of operational costs to total revenue. A high level of this indicator shows high operational costs that negatively affect the bank profit. *Credit risk (Risk)* is determined as the ratio of non-performing loans to total loans. This indicator reflects the quality of loan portfolio and an increase of this ratio determines a decrease of the recorded profit, because of the loss provisions. *Liquidity (Lcdt)* was calculated as the ratio of liquid assets to total deposits and short-term debt (Kosmidou *et al.,* 2007). Usually, banks that hold a low level of liquid assets are confronted with a higher risk of not being able to pay off their short-term debt obligations. On the other hand, a high level of liquidity generates costs that negatively influence the level of bank profit.

Bank size (Size) is expressed as the total assets in log form. The previous studies have contradictory results regarding this bank profitability determinant (Goddard et al., 2004; Athanasoglou et al. 2008). These can be explained by the fact that large banks offer a wide range of products and services and can benefit from scale economies, but, in the same time, may take large and insufficiently fundamented risks, that can have a negative impact on bank stability („Too big to fail").

Bank investment strategy (Invest) may be calculated as the ratio of off-balance sheet revenues to total assets. This variable is expected to have a positive impact on the bank profit (Căpraru and Ihnatov, 2014). *Nature of ownership (Owner)* defines the foreign banks (minimum 51% of equity is owned by foreign investors) and domestic banks (Dietrich and Wanzenried, 2010). For this variable we created a dummy that is 0 for domestic banks and 1 for foreign banks.

3.2 External Determinants

3.2.1 Banking Industry Determinants

Bank reform index (Reform) reflects the progress of liberalization and institutional reform (Brissimis *et al.*, 2008). This expresses the progress in adopting the international regulations, in implementing a more efficient supervision, in privatizing the government owned banks, in settlement of non-performing loans and in closing banks in default.

HHI index (HHI) measures the degree of concentration in banking industry (Athanasoglou *et al.*, 2006). It is calculated as a sum of squares market shares of all the banks in the system (in each country). The influence of this index on the bank profit cannot be determined theoretically. A high level of concentration may be the result of an agreement between the largest banks in the system to practice certain, usually higher, interest rate levels (positive effect on the profitability) or may be the result of a competitive banking system (lower revenues that have a negative effect on the profitability).

3.2.2 Macroeconomic Determinants

The most important macroeconomic factors that have an impact on the bank profitability are: exchange rate volatility, GDP per capita growth, inflation rate. *Exchange rate volatility (Vol)* is expressed as the standard deviation of daily exchange rates, computed for every country and year. The impact of this variable can be both negative and positive. An increase of the *GDP per capita growth (GDP)* generates an increase of loans demand and, on the contrary, a contraction of the economy reduces it, generates the increase of the non-performing loans with negative effects on the bank profits. The literature reveals a positive relation between the two variables.

Inflation rate (Inflation) expresses the change of the general level of prices or the inflationary conditions in the economy. It is measured as the annual inflation rate in every country. This variable can have both a negative and a positive effect on the bank profitability (Athanasoglou et al., 2008). In case of the anticipated inflation, banks can quickly adjust interest rates that will proportionally increase the revenues and costs. In case of unanticipated inflation the revenues may be adjusted in time, slower than the costs, fact that negatively affects the profit.

The Table 1 exhibits, in synthesis, how the variables of the model are calculated and their expected effect on the bank profitability.

Table 1. Variables in the model (computation and expected effect)

Notation	Variable	Computation	Expected result
Dependent variable			
ROA	Return on assets	Net profit/Total assets	
Independent variables			
Bank specific variables			
Capital	Capital adequacy	Equity/Total assets	+/-
Inefficiency	Management inefficiency	Costs/Revenues	-
Risk	Credit risk	Non performing loans /Total loans	-
Lcdt	Liquidity	Liquid assets/Total deposits and short term debt	+/-
Size	Bank size	Logarithm of total assets (the EUR)	+/-
Invest	Bank investment strategy	Revenues from off balance sheet operations/Average assets	+

Owner	Nature of ownership	Dummy (Foreign vs. domestic)	+/-
Banking industry variables			
Reform	Banking reform index	Calculated by EBRD	+
HHI	Banking industry concentration index	Herfindhal-Hirschman Index	+/-
Macroeconomic variables			
Vol	Exchange rate volatility	Standard deviations of daily exchange rates (yearly)	+/-
GDP	Economic growth	GDP per capita growth (lag)	+
Inflation	Inflation	Inflation rate (lag)	+/-
Crisis			
Crisis	Crisis	Dummy (crisis vs. before-crisis)	-

3.3 Descriptive Statistics

The average return on assets for the entire sample was 0.36% during the period 2004-2013. Regarding yearly averages, large losses were recorded starting with 2009 as an effect of the global financial crisis. Every country in the sample was more or less affected. In the pre-crisis period (2004-2008) the average of ROA was 1.36%, while during the crisis (2009-2013) it decreased to -0.37%. The difference between the ROA average and the ROA median shows that there are significant differences between the banks in the sample. The capital adequacy is 10.25% on average, with the highest level at 82.34% and the lowest at 1.6%. In the latter case, there is a high risk of default.

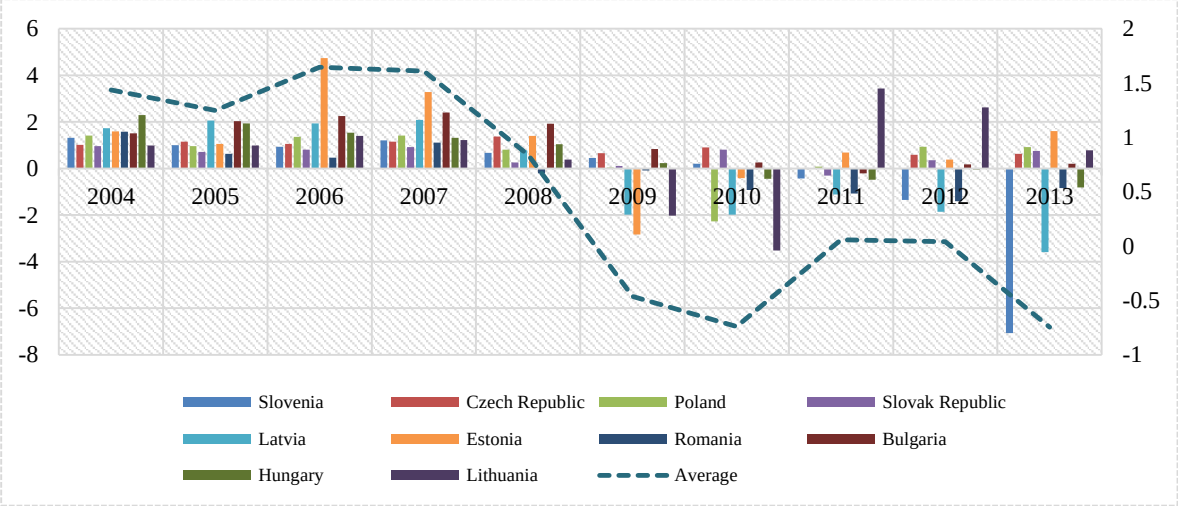

Figure 1. ROA average for every country during the period 2004-2013 and the yearly average (scale in the right side %)

The ratio of non-performing loans to total loans that indicates the portfolio quality is 11.33% on average, with significant differences between individual banks. The highest credit risk was recorded in Latvia, namely 87.39% in 2013 at AS Reverta bank.

The average of the bank efficiency recorded a level of 66.10%. The revenues far outweigh the costs in the case of Equa Bank S.A. (Czech Republic) in 2012 showing a highly inefficient management (767.47%). When considering the investment strategy of the banks we may notice that the average of the off-balance sheet revenues to total assets is only 1.79%. This shows that the banks in the sample are focused on the traditional activity, generating revenues from interest and fees.

The average level of banking reform index for the considered sample was 3.55 and it shows a considerable progress of the liberalization and institutional reforms (the maximum level is 4). The banking systems in the sample are on average a competitive banking market with differences from one country to another. For example, the Estonian banking sector is characterized as very concentrated and low competitive, because only 7 banks are active. On the opposite side, the Polish banking system is highly competitive, with 36 active banks.

Table 2. Descriptive statistics (%, except the variables marked with *)

	Average	Median	Maximum	Minimum	Std. dev.s
Dependent variable					
ROA	0.361	0.774	8.972	-23.262	2.303
Independent variables					
Bank specific variables					
Capital	10.253	9.305	82.338	1.598	5.073
Inefficiency	66.094	58.012	767.474	13.753	51.879
Risk	11.327	7.099	87.385	0.000	12.000
Lcdt	25.476	21.165	367.175	0.024	21.608
Size*	14.631	14.756	17.457	10.178	1.483
Invest	1.702	1.473	10.344	-2.118	1.190
Owner*	0.661	1.000	1.000	0.000	-
Banking industry variables					
Reform*	3.550	3.670	4.000	3.000	0.335
HHI*	1133.072	1045.000	4039.000	559.000	461.509
Macroeconomic variables					
Vol*	0.725	0.031	15.255	0.000	2.452
GDP	2.820	3.593	13.267	-16.589	5.358
Inflation	4.160	3.700	15.300	-1.200	2.876

The dependent variable is ROA and the independent variables are defined as follows: Capital is the ratio of equity to total bank assets; Inefficiency is the ratio of operational costs to total revenue; Risk is the ratio of non-performing loans to total loans; Lcdt is the ratio of liquid assets to total deposits and short-term debt; Size represents the total assets in log form; Invest is the ratio of off-balance sheet bank revenues to total assets; Owner expresses the nature of ownership as a dummy variable that is 0 for domestic banks and 1 for foreign banks; Reform is the banking reform index computed by EBRD; HHI represents the Herfindhal-Hirschman Index; Vol is the standard deviation of daily exchange rates, computed for every country and year; GDP expresses the GDP per capita growth rate; Inflation is the annual inflation rate.

In what regards the economic growth per capita, there were recorded significant differences in the analyzed countries. The average level is 2.82%, but there are countries that confronted with a high contraction of the economy during this period.

The appropriateness of the variable choice for our model can be appreciated by analyzing the correlation matrix in the Appendix 2.

3.4 Methodology

In order to study the empirical relationship between the bank profitability and its determinants we used a dynamic multiple linear regression model, as follows:

$$ROA_{i,j,t} = \alpha + \beta_1 \times ROA_{i,j,t-1} + \beta_2 \times Bank_{i,j,t} + \beta_3 \times BS_{j,t} + \beta_4 \times Macro_{j,t} + \varepsilon \quad (1)$$

where: *i*-bank, *j*-country, *t*-year; $Bank_{i,j,t}$ – bank specific variables; $BS_{j,t}$ – banking industry variables; $Macro_{j,t}$ – macroeconomic variables; ε-error term.

In order to reveal the impact of the international financial crisis on bank profitability we included a "crisis" dummy in the model. This takes value 0 for the pre-crisis period (2004-2008) and value 1 for the crisis period (2009-2013). The year 2009 was chosen as the first year of the crisis because in Central and Eastern Europe its effects were visible with a delay, namely starting with 2009. The regression equation is the following:

$$ROA_{i,j,t} = \alpha + \beta_1 \times ROA_{i,j,t-1} + \beta_2 \times Bank_{i,j,t} + \beta_3 \times BS_{j,t} + \beta_4 \times Macro_{j,t} + \beta_5 \times Crisis + \varepsilon \quad (2)$$

where: CRISIS- dummy; c_{5}- corresponding coefficient.

The coefficients of the above equation are estimated by OLS. Bank profitability indicators show a tendency to persist over time (Berger et al., 2000), so we specify a dynamic model by including a lagged dependent variable among the independent variables, $ROA_{i,j,t-1}$ is the one-period lagged performance indicator.. Moreover, the previous studies showed that the impact of the macroeconomic variables is delayed and that is why the model includes their lagged values (Dietrich and Wanzenried, 2011).

The second part of the analysis of the global financial crisis over the bank profitability uses the difference-in-difference methodology, in order to reveal if the crisis impact was amplified or diminished by the high capital adequacy, high bank size or foreign ownership. The estimated equation is:

$$ROA_{i,j,t} = \alpha + \beta_1 \times Crisis + \beta_2 \times Z_{i,t} + \beta_3 \times Crisis * Z_{i,t} + \beta_4 \times ROA_{i,j,t-1} + \beta_5 \times Bank_{i,j,t} + \beta_6 \times BS_{j,t} + \beta_7 \times Macro_{j,t} + \varepsilon \quad (3)$$

where: $Z_{i,t}$ represents highly capitalized banks, large banks, respectively foreign owned banks.

All the models include bank-fixed effects in order to isolate the bank specific characteristics that were not considered as separate variables.

4. Results

Table 3 exhibits the results of the regression analysis for the entire period (2004-2013). Each of the first three columns show the coefficients estimated for a different category of variables, respectively for bank specific, industry specific and macroeconomic variables; the fourth column exhibits the estimated coefficients for all variables and entire period. In this case, with all the variables included in the model, 67% of the ROA variation is explained by the determinants considering 823 observations.

Table 3. Regression analysis results

Dependent variable: ROA	Model 1	Model 2	Model 3	Model 4
Crisis	-0.7646*** (0.1533)	-1.2344*** (0.2380)	-1.0070*** (0.2755)	-0.3582** (0.1801)
Bank specific variables				
C	-12.1336*** (3.6200)			-9.6429** (3.8020)
Capital	0.0813*** (0.0198)			0.0757*** (0.0193)
Inefficiency	-0.0126*** (0.0015)			-0.0128*** (0.0015)
Risk	-0.0519*** (0.0071)			-0.0502*** (0.0073)
Lcdt	-0.0026 (0.0040)			-0.0032 (0.0039)
Size*	0.8422*** (0.2262)			0.5184** (0.2237)
Invest	0.5628*** (0.0837)			0.5669*** (0.0810)
Owner*	0.4635 (1.4638)			0.1434 (1.4117)
LAGROA1	0.1779*** (0.0186)			0.1866*** (0.0184)
Banking industry variables				
C		-4.3757** (2.1792)		
Reform		0.7381 (0.5426)		0.8857*** (0.3461)
HHI		0.0025*** (0.0008)		-0.0003 (0.0005)
Macroeconomic variables				
C			0.6400** (0.3181)	
Vol			-0.0384 (0.0734)	-0.0675 (0.0432)
GDP			0.0853*** (0.0254)	0.0506*** (0.0125)
Inflation			-0.0019 (0.0442)	-0.1468*** (0.0218)
Adj. R^2	0.6435	0.2964	0.2914	0.6688
Observations	823	1360	1260	823

The dependent variable is ROA and the independent variables are defined as follows: Capital is the ratio of equity to total bank assets; Inefficiency is the ratio of operational costs to total revenue; Risk is the ratio of non-performing loans to total loans; Lcdt is the ratio of liquid assets to total deposits and short-term debt; Size represents the total assets in log form; Invest is the ratio of off-balance sheet bank revenues to total assets; Owner expresses the nature of ownership as a dummy variable that is 0 for domestic banks and 1 for foreign banks; Reform is the banking reform index computed by EBRD; HHI represents the Herfindhal-Hirschman Index; Vol is the standard deviation of daily exchange rates, computed for every country and year; GDP expresses the GDP per capita growth rate; Inflation is the annual inflation rate. Crisis is expressed as a dummy variable that takes value 1 for the period 2009-2013. Standard errors in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In all cases the impact of the international financial crisis on ROA was negative and statistically significant, as expected, with significant differences between the coefficients for all the cases. The capital adequacy had a positive and statistically significant effect on the bank profitability, expressed as ROA. In theory this effect can be both positive and negative. In our case, the positive effect may be explained by the fact that banks with high capital adequacy have a high risk aversion and didn't involve in risky investments. They had the possibility to manage easier the crisis period and to raise cheaper financing. This result is consistent with the findings of Goddard *et al.* (2004), Pasiouras and Kosmidou (2007), and Dietrich and Wanzenried (2010).

Managerial inefficiency has a negative and statistically significant effect on ROA in CEE banks. In their research Dietrich and Wanzenried (2010), Kosmidou *et al.* (2007), Athanasoglou *et al.* (2006) have obtained similar evidence. As more a bank is efficient, as higher its profit is. This means that the banks in the sample are inefficiently managed, as the operational costs were higher than the revenues. Another statistically significant coefficient that has the expected sign (negative) is the credit risk coefficient. The increase of the non-performing loans during the crisis generated the depreciation of the assets' quality, and the bank profit was affected in this way. The liquidity variable had a negative impact on ROA due to massive capital withdrawals during crisis that affected banks' available liquidity.

In what regards the bank size, this exhibits a positive and statistically significant impact on the bank performance. This result confirms the Pasiouras and Kosmidou (2007) findings. The result may be explained by the fact that large banks had the possibility to easier withstand the macroeconomic and financial pressures, as they offered a broad range of products and services and benefited from scale economies. By considering also the influence of the macroeconomic factors (Column 3), the coefficient of the bank size increased in value and remain statistical significant

The bank investment strategy has an important impact on the bank profit – it is positive and statistically significant, and confirms the expectations. Revenue diversification is essential for banks, but under the condition that they are obtained from less risky activities, in order not to affect the depositors. The banks in CEEC had a lower exposure on the stock exchange. They don't use derivatives extensively and don't involve in securitization operations. These practices were the main causes of the crisis that emerged in US.

The fact that banks owned by foreign entities impact positively on the bank profit, but this result is not statistically significant. In the Swiss banking system Dietrich and Wanzenried (2010) discovered a negative and significant relationship between the ownership nature and bank profitability before the crisis, as well as a positive and insignificant effect during the crisis. Foreign banks played an important role in the development of banking sector in CEEC, contributing in this way to an increase in efficiency and competitivity in this industry. The evidence show the time persistence of the ROA - the current year's profitability is significantly influenced by the previous year's one.

In what regards the banking industry variables there are differences between the two estimation results (column 2 vs. column 4). In the base model, bank reform index has a positive and significant effect on ROA. This is due to the progress recorded by these countries in financial liberalization, privatization and implementation of a more efficient supervision.

The macroeconomic variables don't exhibit significant differences between the two estimations (column 3 vs. column 4). Thus, in the all-variable model both the exchange rate volatility and inflation rate have a negative impact on the bank profitability, but only the inflation rate is statistically significant. The evolution of inflation and the difficult macroeconomic conditions during the crisis

have surprised the bankers, that haven't had enough time to adjust the interest rates. Thus, the costs increased quicker than the revenues and negatively affected the bank profits.

The last variable of this analysis, the GDP growth rate has a positive and significant impact on ROA. The economic growth determines a rise of the population living standard and increases the loans demand, which reflects as an increase of bank assets and of profit.

The second part of the analysis separates the banks sample in three categories: banks with high capital adequacy, large banks by total assets and foreign-owned banks. The first category includes banks with a capital adequacy larger than the median. The median of the capital adequacy for every year is exhibited in Table 4. The large banks category was defined similarly to the "high capital adequacy" banks. All the banks that have a level of total assets higher than the median were considered large banks.

Table 4. Annual values of the median of bank capital adequacy and bank size

	2008	**2009**	**2010**	**2011**	**2012**	**2013**
Capital (%)	8.80	9.38	10.44	10.03	10.39	9.96
Size	14.41	14.26	14.24	14.19	14.22	14.41

Note: Capital is defined as the ratio of equity to total assets of the bank; Size is expressed as the natural logarithm of total assets.

The foreign banks didn't have to be defined in a particular way, as the "Owner" dummy has been previously built. The foreign banks are the ones with the "Owner" value that equals 1

Table 5. Regression results (difference-in-difference methodology)

Dependent variable: ROA	Model 1	Model 2	Model 3
C	-19.9639*** (3.8736)	-20.7658*** (3.8821)	-20.9018*** (3.8424)
Crisis	-0.4844** (0.2207)	-0.8263*** (0.2699)	-1.3028*** (0.2787)
Capital	0.1356*** (0.0159)		
Size		1.3096*** (0.2237)	
Owner			-0.1397 (1.6574)
Crisis*Capital	-0.4789** (0.1981)		
Crisis*Size		0.1460 (0.2424)	
Crisis*Owner			0.7909*** (0.0252)
Bank specific variables			
Risk	-0.0733*** (0.0083)	-0.0721*** (0.0084)	-0.0717*** (0.0082)
Lcdt	-0.0066 (0.0044)	-0.0052 (0.0043)	-0.0042 (0.0043)
Size/ (Capital)	1.2444*** (0.2242)	0.1238*** (0.0153)	1.3846*** (0.2225)
Owner/ (Capital)	0.3439 (1.6486)	0.5139 (0.3106)	0.1182*** (0.0153)

LAGROA1	0.2667*** (0.0204)	0.2711*** (0.0204)	0.2677*** (0.0203)
Banking industry variables			
Reform	0.7700* (0.4029)	0.6734* (0.4033)	0.5256 (0.4039)
HHI	-0.0003 (0.0005)	-0.0002 (0.0005)	-0.0001 (0.0005)
Macroeconomic variables			
Vol	-0.0881* (0.0504)	-0.0902* (0.0506)	-0.0853* (0.0503)
GDP	0.0318** (0.0142)	0.0293** (0.0143)	0.0258* (0.0142)
Inflation	-0.1338*** (0.0252)	-0.1317*** (0.0253)	-0.1267*** (0.0252)
Adj. R^2	0.6667	0.6640	0.6682
Observations	829	829	829

The dependent variable is ROA and the independent variables are defined as follows: Capital is the ratio of equity to total bank assets; Inefficiency is the ratio of operational costs to total revenue; Risk is the ratio of non-performing loans to total loans; Lcdt is the ratio of liquid assets to total deposits and short-term debt; Size represents the total assets in log form; Invest is the ratio of off-balance sheet bank revenues to total assets; Owner expresses the nature of ownership as a dummy variable that is 0 for domestic banks and 1 for foreign banks; Reform is the banking reform index computed by EBRD; HHI represents the Herfindhal-Hirschman Index; Vol is the standard deviation of daily exchange rates, computed for every country and year; GDP expresses the GDP per capita growth rate; Inflation is the annual inflation rate. Crisis is expressed as a dummy variable that takes value 1 for the period 2009-2013. Standard errors in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5 summarizes the results of the difference-in-difference estimations. Our findings show that the three selected variables both amplified and decreased the crisis effect. In the first case, the crisis effect on ROA was amplified in the banks with large capital adequacy. This can be explained by the fact that banks had to adjust the equity level because of the difficulties, in order to protect the deponents and to conserve the trust of the bank clients. During whole crisis period, it may be noticed an increase of the average of capital adequacy (ratio of equity ot total assets). This is the consequence of the crisis, as authorities were involved in supporting the banking system.

In the second case, the crisis effect on the profitability was reduced in large banks versus small banks, but this result is not statistically significant. In the same time, the findings show that the presence of the foreign banks in CEEC had lowered the crisis effects on the bank performance. This may be explained by the fact that foreign financial groups acquired local banks in CEEC, which are involved especially in the retail market, while the foreign banks subsidiaries, which work especially in the corporate market, depend on the economic conditions in home countries. However it is profitable to open subsidiaries in developing countries, because the asset profitability is higher than in home countries (Havrylchyk şi Jurzyk, 2005).

5. Conclusions

The effect of financial crisis on the Central and Eastern European economies was significant and determined a worsening of both macroeconomic indicators and bank specific characteristics. At bank

level, the most affected variable was the credit risk, augmented by the non-performing loans growth that affected the profits, according to our research findings.

The evidence shows significant differences between the profit levels of the CEEC banks. Moreover, an important part of its variation is explained by the variables in the model. According to the findings, the equity level has a positive impact on the asset profitability, as long as it has the role of a "safety net" and it is not raised for a bail-out. The banks in the sample are characterized by cost inefficiency, but also asset inefficiency, as it is suggested by the high level of non-performing loans and high credit risk taken. During the first part of the crisis, the credit institutions were confronted with sharp liquidity shortage needed to cover short-term debt, which had a negative impact on their performance. Although the ownership nature has an insignificant impact on the bank profits, it may be stated that the crisis had a lower effect in terms of asset profitability on the foreign owned than on domestic owned banks in CEEC.

The banks in CEEC had a small exposure on the stock exchange, contrary to the US where the extensive use of derivatives and securitization operations where the main cause of the emergence and development of the crisis. Thus, the ratio of the off-balance sheet operations to total assets had a positive impact on the bank profitability. The specific and macroeconomic determinants have also a significant impact on the dependent variable.

6. Acknowledgement

This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-RU-TE-2014-4-0443.

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Appendices

Appendix 1. Number of banks in the sample by country

	Bulgaria	Czech R.	Estonia	Latvia	Lithuania	Poland	Slovakia	Slovenia	Romania	Hungary	Total
No Banks	18	17	7	18	9	36	9	14	21	21	170

Appendix 2. Correlation matrix of the variables in the model

	ROA	Capital	Inefficiency	Risk	Lcdt	Size	Invest	Owner	Reform	HHI	Vol	GDP	Inflation	Crisis
ROA	1.0000													
Capital	0.0221	1.0000												
Inefficiency	-0.3586	0.1481	1.0000											
Risk	-0.3672	0.1934	0.1653	1.0000										
Lcdt	0.0070	0.2890	0.1102	0.0621	1.0000									
Size	0.2697	-0.2529	-0.2886	-0.2894	-0.2739	1.0000								
Invest	0.2367	0.1113	-0.1248	0.1340	0.1575	-0.0793	1.0000							
Owner	0.0537	0.0528	-0.0343	-0.0556	-0.1234	0.2150	-0.0177	1.0000						
Reform	0.2151	-0.0361	-0.0894	-0.3475	0.0870	0.1865	-0.0689	0.0496	1.0000					
HHI	0.0160	0.0410	-0.0223	-0.0916	-0.0408	-0.0004	-0.0413	0.0394	0.2117	1.0000				
Vol	-0.0398	-0.0898	-0.0296	0.0559	-0.0802	0.1915	0.1137	-0.0326	0.1149	-0.1613	1.0000			
GDP	0.2854	-0.0518	-0.1001	-0.2851	0.0899	0.0040	0.0532	0.0511	0.0724	0.0989	-0.0873	1.0000		
Inflation	-0.0350	0.0678	-0.0291	0.0487	0.1148	-0.1393	0.1611	-0.0214	0.0730	0.0053	0.0640	0.1868	1.0000	
Crisis	-0.3109	0.1532	0.1109	0.3749	-0.1410	-0.0680	-0.0727	-0.0198	-0.2880	-0.1205	0.0003	-0.5553	-0.1380	1.0000