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**THE IMPACT OF THE 2008 CRISIS
ON THE BANKING SECTORS OF THE CEE-11
COUNTRIES: MULTI LEVEL PERFORMANCE (MLP)
SCORE AS A SYNTHETIC MEASURE OF BANK RISK
ADJUSTED PERFORMANCE**

**WPLYW KRYZYSU FINANSOWEGO Z ROKU 2008
NA SEKTORY BANKOWE KRAJÓW EŚW –
MLP SCORE JAKO SYNTETYCZNA MIARA
EFEKTYWNOŚCI SKORYGOWANEJ O RYZYKO**

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Summary: The aim of this paper was to analyze the long term impact of the 2007-2009 global financial crisis on the banking sectors of CEE countries, in particular in analyzing the consequences of the crisis on bank stability, efficiency and lending policies. Analyzing bank performance and stability, the paper suggests adding a new analytical tool in analyzing risk-adjusted performance: the Multi Level Performance (MLP) Score. The 2008 crisis has illustrated how devastating for the economy the credit crunch could be and how important anti-cyclical lending is for both consumers and businesses. Consequently, in the empirical section the paper analyzes whether the overall performance of the CEE banking sectors, measured, among others, by the MLP Score, was important for loan growth. For the empirical analysis, the paper uses an adjusted dataset on eleven Central and East European Countries (CEE), members of the EU, based on the Bankscope database, employing panel data models for unconsolidated banking data for the 2004-2014 period.

Keywords: CEE banking, bank performance, MLP Score.

Streszczenie: Celem artykułu była analiza długoterminowego wpływu globalnego kryzysu finansowego 2007-2009 na sektory bankowe krajów Europy Środkowo-Wschodniej, w szczególności ocena skutków tego kryzysu w kontekście stabilności, efektywności i polityki kredytowej banków w regionie. W celu analizy wyników banku i ich stabilności w artykule zaproponowano zastosowanie nowego narzędzia analitycznego – indeksu *MLP Score*, będącego miarą efektywności skorygowanej o ryzyko. Kryzys z roku 2008 zilustrował, jak katastrofalne skutki dla gospodarki może mieć kryzys kredytowy i jak ważny jest antycykliczny charakter akcji kredytowej zarówno dla konsumentów, jak i dla przedsiębiorstw. W związ-

ku z tym w części empirycznej artykułu testowano hipotezę, czy ogólna kondycja banków Europy Środkowo-Wschodniej, mierzona między innymi przez *MLP Score*, była ważna dla wzrostu kredytów. Opierając się na bazie Bankscope, do analizy empirycznej w artykule wykorzystano zestaw danych dla jedenastu krajów Europy Środkowej i Wschodniej (CEE), będących członkami UE. Przeprowadzono badanie z wykorzystaniem modeli danych panelowych o ustalonych efektach dla jednostkowych danych bankowych w latach 2004-2014.

Słowa kluczowe: banki w krajach EŚW, efektywność, *MLP Score*.

1. Introduction

The aim of this paper is to analyze the long term impact of the 2007-2009 global financial crisis on the banking sectors of CEE countries, in particular in analyzing the consequences of the crisis on bank stability, efficiency and lending policies. Analyzing bank stability, the traditional approach is to look at bank-specific variables and balance sheet ratios such as capitalization and NPLs, and in the post-crisis period the Z-score index of bank distance to bankruptcy is also frequently employed. Bank efficiency is typically analyzed in terms of operational ratios and parametric or non-parametric models [Bikker, Bos 2008]. This paper suggests adding a new analytical tool in analyzing risk-adjusted performance: the Multi Level Performance (MLP) Score.

The 2008 crisis has illustrated how devastating for the economy the credit crunch could be and how important anti-cyclical lending is for both consumers and businesses. Consequently, in the empirical section the paper analyzes whether the overall performance of the CEE banking sectors, measured, among others, by the MLP Score, was important for loan growth. For the empirical analysis, the paper uses an adjusted dataset on eleven Central and East European Countries (CEE), members of the EU, based on the Bankscope database, employing panel data models for unconsolidated banking data.

The outline of this paper is as follows. Section 2 provides an overview of the performance of the CEE banking sectors in the 2004-2014 period, Section 3 explains the construction of the MLP Score, Section 4 employs the index in analyzing factors influencing loan growth in the CEE-11 countries and Section 5 concludes the paper.

2. The characteristics of CEE banking sectors

The term CEE – Central and Eastern Europe – is broad and often unclear. It encompasses various subgroups of transition countries, in many cases heterogeneous. This paper analyzes eleven CEE countries, all members of the EU: eight of which entered the block in 2004 (without the non-transition Malta and Cyprus), two in 2007 (Bulgaria and Romania) and one (Croatia) in 2013, assuming that the EU membership resulted in a common regulatory and infrastructural framework. After EU accession,

the CEE countries enjoyed rapid economic and banking sector growth, fueled by foreign capital inflow. Today, approximately 70% of the CEE banking market is controlled by foreign capital, at the expense of the low engagement of domestic private capital in banking. Typically, the other large investor in CEE is the State (particularly in Slovenia and Poland). As a consequence of the privatization policies based on foreign capital inflow, the CEE banking markets are largely concentrated, particularly in the Baltic countries, with the exception of Poland which has managed to keep a diversified banking market structure with the highest presence of local, cooperative banks (Figure1).

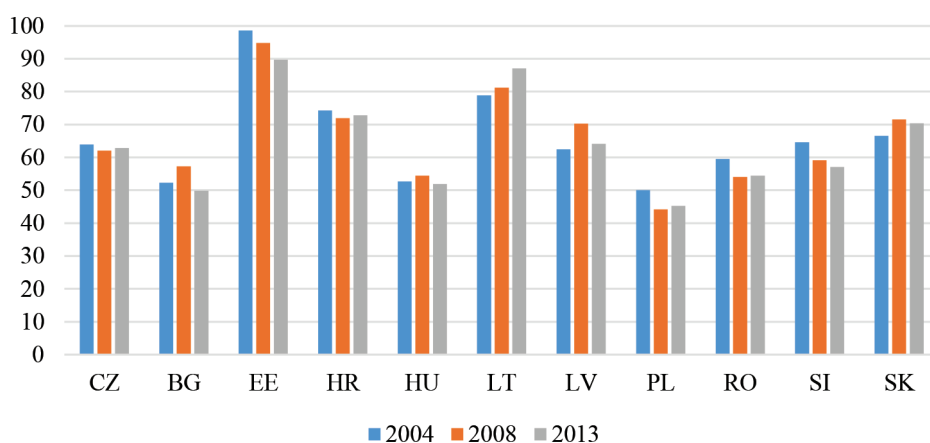


Fig. 1. Banking market concentration in CEE-11 countries, CR5 (%)

Source: own presentation, based on ECB: Banking Structural Financial Indicators.

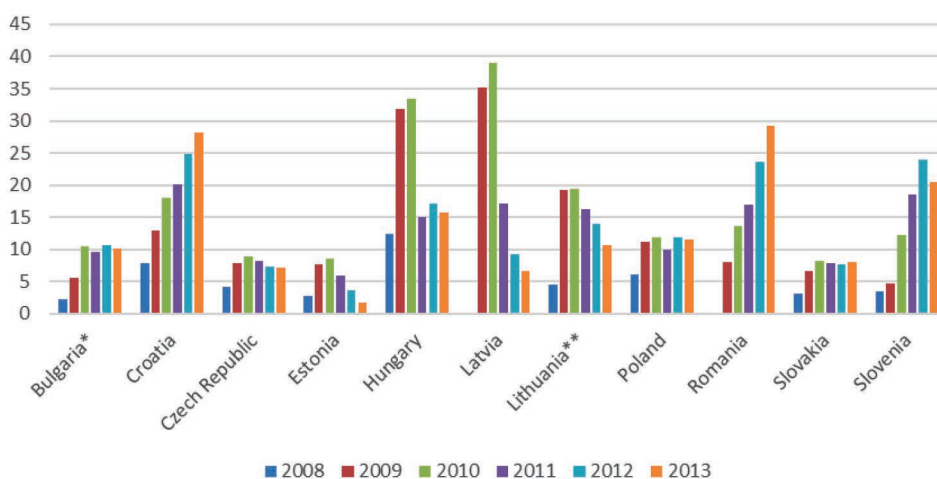
The global crisis of 2007-2009 had a negative effect on the assessment of this region [Bikker, Spierdijk 2009]. However, bank capitalization remained high for most of the CEE countries during the crisis and in the post-crisis period. In 2014 the highest bank capitalization (TCR) was in Estonia, the lowest in Poland. For the profitability ratio (RoE), the most seriously affected country was Hungary and recently Romania; the long-term decline in profitability was most detrimental for Slovenia and Croatia, while the Czech Republic, Poland, Slovakia and the Baltic countries managed to keep up satisfactory profitability in the post-crisis period (Table 1).

In CEE, the period after EU accession was characterized by dynamic loan growth. However, a dynamically growing loan portfolio carries a substantial risk. Many researchers point out that dynamic loan growth significantly affects loan performance, however with a lag [Carbó-Valverde, Marqués-Ibáñez, Fernández 2011]. Consequently, many CEE countries which have experienced a credit boom

Table 1. CEE: Bank profitability and capitalization (in %)

Country	Total Capital Requirements (TCR)				Return on Equity (ROE)			
	2004	2007	2009	2014	2004	2007	2009	2014
Bulgaria	16.60	13.85	17.04	21.51	20.02	18.31	8.33	7.17
Czech Republic	12.55	11.05	13.97	17.04	23.40	18.27	16.67	11.42
Estonia	13.37	13.16	15.76	41.85	20.00	33.44	-41.30	9.69
Croatia	15.40	16.20	17.10	20.44	16.05	12.72	6.92	3.89
Hungary	11.64	12.90	14.37	17.03	22.98	15.03	22.68	-21.89
Lithuania	12.50	9.67	12.90	21.29	13.52	19.87	-56.07	7.73
Latvia	11.70	11.01	13.72	19.98	21.40	3.12	-44.31	10.27
Poland	15.40	12.27	13.46	14.90	17.50	17.72	7.02	9.35
Romania	18.80	11.47	15.76	17.75	15.58	22.52	6.33	-15.24
Slovenia	11.80	10.57	11.68	17.87	13.34	11.49	1.14	-2.48
Slovakia	18.68	11.80	12.75	17.35	29.03	13.91	5.94	9.24

Source: own presentation, based on the EBC Consolidated banking data and the BSCEE Review.

**Fig. 2.** NPL for non-financial corporations in CEE, 2008-2013

Source: data from Banking Supervisors from Central and Eastern European Countries (BSCEE) Reviews (various issues) [www.bscee.org].

have also been burdened by a growing non-performing loan portfolio, as indicated in Figure 2 (corporate loans) and Figure 3 (consumer loans). For both types of loans, Latvia and Hungary had the highest ratios during the crisis. For corporate

loans, Romania, Croatia and Slovenia have gradually built a large NPLs portfolio, while NPLs below 10% were noted in the Czech Republic, Estonia and Slovakia. For consumer loans, Estonia, the Czech Republic, Slovakia and Slovenia have the most satisfactory ratios. Overall, NPLs in corporate sectors seemed to be more of a problem in CEE, while NPLs in consumer sectors are smaller, but steadily growing in a number of countries.

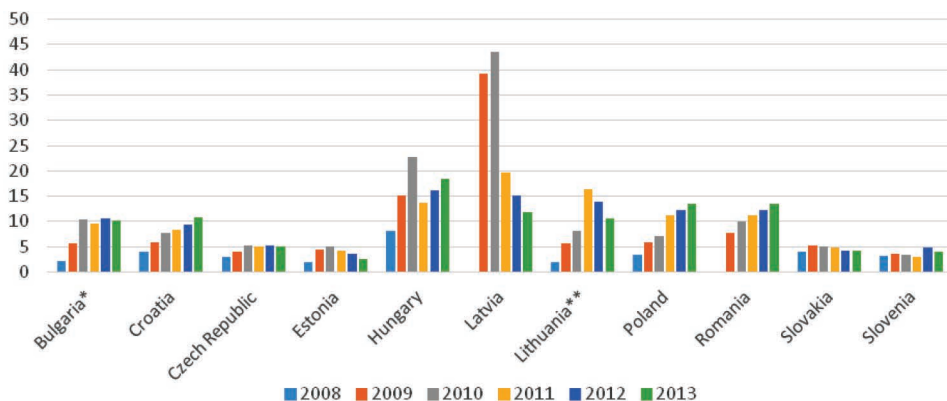


Fig. 3. NPL for households in CEE, 2008-2013

Source: data from Banking Supervisors from Central and Eastern European Countries (BSCEE) Reviews (various issues) [www.bscee.org].

Analyzing bank stability, a frequently used measure in the post-crisis research is the Z-score stability (probability of default) index [Lown et al. 2000]. The ratio is defined as return on assets (ROA) plus capital asset ratio (CAR) for a given year divided by the standard deviation of the return on assets over a given period, or using the rolling windows technique. A high level Z-score indicates low default risk, and vice-versa. The value of the index crucially depends on the variability of returns and bank capitalization level advantageous to well capitalized traditional banks with stable strategies (and profit-base).

Table 2 presents the value of the Z-score index for the CEE countries in the analyzed period (standard deviation calculated over the 2004-2014 period). For the whole group, 2010 and 2011 are the years of lowest index value, indicating that the crisis has impacted the CEE countries with a lag. Its 2014 value of around 16 still indicated the considerable riskiness of the CEE banks (as opposed to 20 in the initial year of 2004). For the whole 2004-2014 period, the lowest cumulative value of the index was that of Slovenia (9), indicating that large state-ownership in banking did not enhance bank stability, followed by Hungary (10), which was most seriously affected by the crisis. A low value of the index was also recorded in Romania and Lithuania.

Table 2. Average Z-score level in the CEE region

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2004-2014
CZ	19.84	17.21	18.70	19.66	21.24	19.47	19.40	18.25	18.98	17.65	18.90	19.05
BG	12.38	10.75	11.33	8.34	12.49	14.25	14.54	13.63	14.37	14.62	16.93	12.89
EE	22.43	23.71	25.11	18.72	21.57	23.77	20.36	18.31	22.23	23.02	20.33	21.87
HR	34.93	32.50	31.65	30.12	27.88	27.35	16.47	14.97	15.37	14.62	16.16	23.06
HU	10.49	12.33	11.34	9.36	10.14	9.95	10.02	9.76	10.93	10.15	10.18	10.38
LT	13.17	13.52	12.45	17.51	18.14	13.65	7.10	10.08	10.87	10.63	9.46	11.96
LV	25.44	19.44	18.41	13.44	13.56	14.17	8.19	7.54	9.37	10.24	8.44	12.89
PL	24.91	21.54	17.87	16.51	14.55	15.37	16.83	17.30	21.62	20.70	21.91	18.66
RO	13.33	13.14	8.45	9.57	9.77	9.97	14.12	14.03	12.99	11.46	13.46	11.68
SI	9.14	9.50	9.88	9.65	12.76	15.36	5.69	6.56	6.66	4.66	7.46	9.06
SK	19.52	19.91	21.84	17.46	15.84	16.42	27.32	26.71	29.32	27.79	28.48	22.61
CEE group	19.95	18.11	16.85	15.57	16.02	16.33	14.87	14.66	16.02	15.19	15.85	16.22

Source: own calculations, based on Bankscope, total number of 2756 observations.

The highest stability was that of Croatia (23), Slovakia (23), Estonia (22), the Czech Republic (19) and Poland (18). However, for Croatia the high score was a result of the safe banking system in the pre-crisis period, since 2010 the score has been deteriorating. In 2014, both Lithuania and Latvia had a very low score and from the Baltic countries only Estonia managed to keep a stable banking system. In 2014, the best score was that of Slovakia and Poland, while the Czech Republic continued with a stable and high index value, indicating the CEE-3 countries (Poland, Slovakia and the Czech Republic) survived the consequences of the 2008 crisis with the least damage to bank stability.

In the financial literature, in the post-crisis period other synthetic stability measures have been proposed, such as the S-Score (or Bankometer). The index is based on Altman's methodology and is defined by the following formula:

$$S = 1.5 \cdot CA + 1.2 \cdot EA + 3.5 \cdot CAR + 0.6 \cdot NPL + 0.3 \cdot CI + 0.4 \cdot LA$$

where 'S' stands for solvency, CAR for capital adequacy ratio, CA for capital assets ratio, EA for equity to assets ratio, NPL stands for non-performing loans to total loans, CI for cost to income ratio and LA stands for loans to assets ratio. S-score categorizes banks as solvent or insolvent on the basis of IMF recommendations [Evans et al. 2000]. The model is focused on capital adequacy, asset quality and profitability (earnings). Every indicator in the formula has a different weight, depending on their estimated importance and impact on the solvency indicator [Shar, Shah, Jamali 2010]. Banks that have "S" value above 70% are considered

solvent, while banks with “S” value under 50% are considered insolvent and the area between 50 and 70 is defined as a gray area. According to this procedure, a bank that has a capital adequacy ratio between 8%-40%, a capital to assets ratio above 4%, an equity to assets ratio greater than 2%, a non-performing loans ratio below 15% and a loans to assets ratio below 40% may be categorized as solvent. However, the S-index is heavily based on bank capitalization as the main stability indicator and does not have a simple interpretation, such as in the case of the Z-score.

Table 3. Bank stability index % change

	12.06	06.07	12.07	06.08	12.08	06.09	09.09	12.09
Commercial banks	-5.0	-4,7	-4.4	-4.6	-8.8	-17.6	-18.9	-17.7
Cooperative banks	-9.3	-7.5	-7.1	-5.5	-6.1	-7.6	-7.4	-8.9

Source: own calculations based on: Information on Methodology, BFG Annual Reports for 2008-2010.

In the past, the Polish Bank Deposit Guarantee Found (BFG) had also been using an interesting synthetic stability index, which was an aggregated, standardized assessment of solvency, efficiency, quality of assets and off-balance sheet commitments, weighted by the share of each bank’s deposits in the banking sector and calculated on a scale from 0-100. 0 represented no risk to bank stability, 100 the highest level of risk. The factors included in the calculations were both efficiency (ROA, reserve requirements, costs, net losses in the last 12 months) and quality of assets indicators (NPL volume, NPL dynamics, off-balance sheet transaction, capital adequacy indicator, cumulated losses/own capital, own funds/liabilities, profit-generating, assets/costs). Changes in index values reflect changes in risk assessment, as illustrated in Table 3 for Polish commercial and cooperative banks. The index pointed out that the cooperative banks were much more resilient in the crisis years than the commercial banks. However, the index was quite complex to calculate and has been discontinued by BFG.

3. The construction of the MLP Score

To assess the impact of the crisis on CEE countries, the paper proposes a new risk-adjusted comprehensive performance indicator, called the Multi-Level Performance Score (MLP). It is composed of the sum of the scores allocated in five areas vital to a bank’s long-term stability and stable performance: three efficiency indicators (ROE, C/I and loan accessibility L/A) and two stability indicators (Z-score and NPL). This is defined by the following formula:

$$\text{MLP Score} = \text{ROE} + \text{L/A(Loans to Assets)} + \text{C/I(Cost to Income)} + \\ + \text{Z - Score} + \text{NPL}$$

Scores for the MLP Score in all five areas are allocated as follows:

- the bank results for each indicator are divided into ten deciles for the whole group in a given year;
- the median for the group has a value of 0 (is neutral);
- each subsequent decile above the median for ROE, L/A and Z-Score has a score ranging from +1 to +5, while each subsequent decile below the median has a score ranging from -1 to -5;
- for C/I and NPL indicators the signs are the opposite: values above the median are negative from -1 to -5, and below the median are positive from +1 to +5 for the last decile;
- due to this scoring methodology, the ratio has a simple interpretation, similar to that of the Z-score: the higher the value of the MLP Score, the better.

In computing the MLP-Score there is a significant problem with data on the NPLs, since many banks in CEE do not disclose it. Consequently, a modified version of the score was also tested: the MLP_TCR Score, where NPLs were replaced by total capital ratio (TCR). In the latter case, the number of available observations increased in our sample from 1550 to 1688. Tables 4 and 5 provide the MLP scores (basic and modified) for the analyzed CEE countries, and Table 6 compares the MLP scores with the Z-score.

Table 4. MLP Score (basic)

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2004-2014
CZ	2.57	4.41	4.32	3.00	1.72	0.04	9.89	7.82	7.43	5.48	8.00	4.79
BG	4.25	4.50	3.80	-0.45	-1.93	1.07	1.68	0.67	-1.17	0.59	3.31	0.78
EE	-5.50	1.50	-4.50	-3.00	-1.17	-1.80	2.00	8.33	4.00	9.00	10.88	3.18
HR	-3.33	-4.50	0.20	-1.54	-1.57	-3.39	0.26	-1.71	-3.41	-4.38	-1.67	-2.26
HU	-1.67	-1.75	1.67	1.13	2.24	4.22	-2.18	-5.38	-6.62	-7.92	-14.6	-1.89
LT	5.00	3.00	2.50	6.50	7.67	9.00	-6.63	-0.43	-1.43	-0.14	-2.71	-0.08
LV	n.a.	5.00	-6.00	3.33	0.75	1.18	-10.4	-9.14	-5.36	-1.77	-1.80	-4.09
PL	-0.50	2.88	2.19	3.68	5.04	3.00	4.54	7.73	8.17	7.81	8.45	5.00
RO	-1.00	1.29	-0.89	-0.86	0.23	-0.56	-2.33	-3.74	-5.16	-3.95	-4.53	-2.43
SI	-1.67	-2.60	2.50	-1.91	0.08	-0.50	-1.33	-2.83	-3.94	-6.06	-4.07	-2.34
SK	3.75	1.00	-0.60	1.14	-0.44	0.80	4.00	4.82	6.08	7.38	6.90	3.72
Av. for CEE	0.60	1.48	1.61	1.01	1.10	0.79	0.62	0.74	0.43	0.71	1.44	0.90

Source: own calculations. Number of observations: 1550.

Table 5. MLP_TCR Score (modified)

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2004-2014
CZ	5.19	5.89	7.72	5.04	2.40	-0.14	8.21	5.67	3.95	3.32	4.75	4.43
BG	3.67	4.33	1.63	0.85	1.45	1.92	1.47	-1.11	-1.45	-0.16	2.82	0.68
EE	-4.60	1.00	0.20	1.33	1.00	-0.67	-0.50	-2.57	-3.56	0.89	3.57	-0.40
HR	-4.56	0.33	1.42	-0.11	0.43	-2.22	-3.55	-1.96	-4.26	-4.33	-2.33	-2.14
HU	1.36	1.93	0.75	1.14	2.15	2.48	2.07	-1.11	-3.24	-5.20	-10.6	-0.16
LT	1.00	8.00	4.50	4.00	5.33	3.80	-4.13	2.86	0.29	-1.14	-2.71	1.10
LV	3.00	2.25	-3.33	-1.67	0.30	0.67	-6.64	-5.27	-3.73	-2.50	-5.31	-2.87
PL	0.57	1.05	3.21	5.29	6.76	4.21	3.73	7.69	5.79	6.04	7.30	4.80
RO	0.29	0.09	0.77	-0.13	1.57	1.07	-2.56	-4.05	-2.56	-1.81	-4.82	-1.32
SI	-3.71	1.22	1.00	0.36	-0.20	0.00	3.93	1.94	0.31	-2.33	-1.43	0.25
SK	1.64	2.09	2.18	6.50	6.38	5.10	3.50	2.70	3.25	5.42	5.78	3.90
Average for CEE	0.66	2.22	2.20	2.30	2.53	1.30	0.88	0.81	-0.20	0.09	0.24	1.13

Source: own calculations. Number of observations: 1688.

Table 6. Comparison of the MLP Scores and Z-Scores for the aggregated data in the 2004-2014 period for CEE Countries

Country	MLP basic	MLP modified	Z-score
PL	5.00	4.80	18.66
CZ	4.79	4.43	19.05
SK	3.72	3.90	22.61
EE	3.18	-0.40	21.87
BG	0.78	0.68	12.89
LT	-0.08	1.10	11.96
HU	-1.89	-0.16	10.38
HR	-2.26	-2.14	23.06
SI	-2.34	0.25	9.06
RO	-2.43	-1.32	11.68
LV	-4.09	-2.87	12.87

Source: own calculations.

The analysis of the MLP Scores (Tables 4-6 and Figure 4) allows us to form some interesting observations:

- For the MLP both scores, the high aggregate values were achieved by CEE banks between 2005-2008, there was a visible drop in 2009 and the lowest value was reached in 2012. However, 2014 witnessed the beginning of a substantial score recovery, indicating the improved performance of the CEE banks.

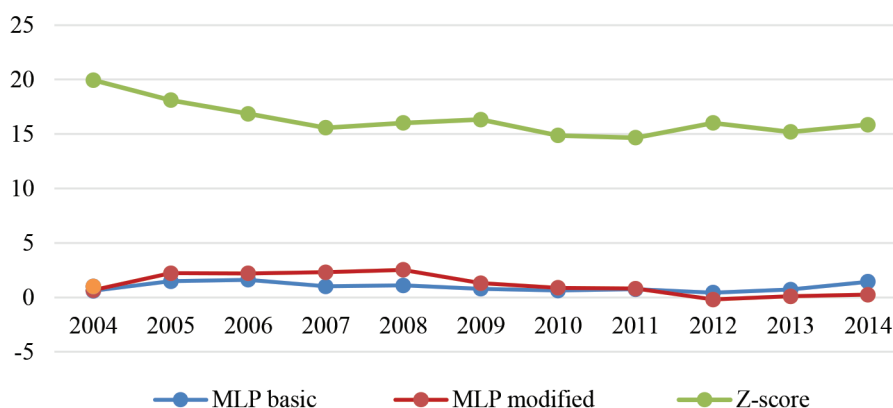


Fig. 4. Comparison of aggregate performance scores (MLP and Z-score) for CEE Countries

Source: own calculations.

- For individual countries, the highest MLP (basic and modified) scores were attained throughout the whole period by Poland, the Czech Republic and Slovakia. These countries (except Poland in 2004 and Slovakia in 2008 for the basic score) have positive index scores in every year, above the CEE median, indicating consistently stable results.
- The lowest MLP-Scores values were those of Latvia, followed by Romania, Slovenia, Croatia and Hungary.
- In the analyzed period, we may observe growing disparities between the scores of different countries: for MLP both scores, in 2004 bank performance ranged from -5 to +5, while in 2014 from -14 (Hungary) to +11 (Estonia) for the basic score and from -11 (Hungary) to +7 (Poland) for the modified score.
- For Hungary, there was a dramatic decline in bank performance from 2010-2011.
- The biggest difference for MLP basic and modified indices were for Estonia, because of Estonia's small NPLs indicator.
- There are some significant disparities between MLP performance scores and the stability Z-score index, particularly for Croatia, which indicates that a multi-level indicator might be a more useful measure to assess longer-term bank potential. Overall, MLP-Scores proved to be a useful, integrated performance indicator.

4. The effect of the 2008 crisis on loan growth in CEE countries

The evidence from the global financial crisis of 2007-2009 and many empirical studies have clearly indicated that bank lending has a strong effect on growth [Cappiello et al. 2010; EC 2014]. Bank-loans are particularly important in lower-income countries, because they offer inexpensive risk management for standardized

risks and can compensate for weaker institutions [Gambacorta· Yang, Tsatsaronis 2014]. To analyze trends in the lending policies of the eleven CEE countries, panel data estimations were employed, where the dependent variable was Growth of Gross Loans (yoy). As explanatory variables, two groups of indicators were used: macroeconomic variables and bank-level data. The following model was used in estimations:

$$\text{dependent variable}_{ijt} = \alpha_0 + \alpha_1 X_{1ijt} + \alpha_2 X_{2ijt} + \varepsilon,$$

where X_1 is a vector of macroeconomic variables, X_2 – bank-level characteristics, ε error term; i indicates the bank, j the country and t the year. The analysis was conducted for the period 2004-2014 and bank-level data were extracted from the Bankscope database, with a number of adjustments. As a consequence of the problems with data accessibility, the unbalanced panel was used in which the number of time-series observations was different across the banks. The fixed effects panel data methodology was employed, which holds constant individual differences and stresses the marginal effects of the explanatory variables. The definitions and data sources for explanatory variables are summarized in Table 7.

Table 7. Control variables used in the models

Symbol	Description	Rationale	Data source
1	2	3	4
Macroeconomic characteristics			
Δ GDP	Real GDP growth rate	Impact of the business cycle	Eurostat
LT_GBY	Long-term government bond yield (10-year bonds)	Interest rates approximation	Eurostat (for Estonia own estimation)
HICP	Harmonized Index of Consumer Prices	Inflation	Eurostat
HHI	Herfindahl-Hirschman Index for Credit Institutions	Banking market concentration	ECB: Banking Structural Financial Indicators
Coop	Cooperative banks' market share: assets of cooperative banks in total banking assets of a given country	Banking market structural diversification	Own calculations based on data from: European Association of Cooperative Banks (EACB); Banking Supervisors from Central and Eastern European Countries (BSCEE) Reviews For 2014 approximated

1	2	3	4
Bank-level characteristics			
ln_TA	Logarithm of Total Assets (in EUR)	Bank size	Bankscope
L/D	Loans to Deposits ratio	Bank profile	
D/A	Deposits to Assets Ratio	Bank financial strategy and risk	
C/I	Cost to Income Ratio	Cost efficiency	
ROE	Return on Average Equity	Profit efficiency	
NetII_NoIOI	Net Interest Income/ Total Non-Interest Operating Income	Income diversification	
NPL	Nonperforming loans to total gross loans	Loan portfolio risk	
MLP_Score	Multi Level Performance Score: basic. Calculated as a sum of 5 scores: ROE; C/I; L/A; Z-Score; NPL (in points, methodology explained in the text)	Comprehensive, risk- based bank performance indicator	Own calculation
MLP_TCR Score	Multi Level Performance Score: modified. NPLs replaced by TCR: regulatory risk-based capital ratio	Comprehensive, risk- based bank performance indicator	
Z-score	The ratio of the return on assets (ROA) plus the capital asset ratio (CAR) for a given year divided by the standard deviation of the return on assets over the period 2004-2014. Low level of Z-score indicate high default risk.	Risk measure: bank insolvency risk (probability of default).	

Source: own elaboration.

Two panel models were run: a model with a number of fragmented control variables (Table 8), and a model with comprehensive MLP Score replacing some balance sheet ratios, which were encompassed in the MLP Score (Table 9).

Explaining the growth of gross loans, macroeconomic variables such as a dynamic GDP growth, high concentration and growing consumer price index were important for the whole period for generating loans' growth. Bank-level variables, such as size of bank (lnTA) and income diversification (NetII_NoIOI) had negatively influenced the dependent variable, suggesting that large banks with non-diversified incomes had lower dynamics of loan growth. Bank size (lnTA) had a significant but negative impact on loan growth both in the pre and post-crisis period. The link between bank

Table 8. Estimations for Growth of Gross Loans

Control variables	2004-2014		2004-2008		2009-2014	
const	312.843	***	244.271	**	186.020	**
	<i>(44.935)</i>		<i>(96.427)</i>		<i>(79.633)</i>	
LT_GBY	-0.404		-1.482		-0.691	
	<i>(0.906)</i>		<i>(5.022)</i>		<i>(1.113)</i>	
COOP	4.250		6.862		5.604	
	<i>(3.143)</i>		<i>(6.965)</i>		<i>(4.903)</i>	
Δ GDP	0.711	**	1.768		-0.574	
	<i>(0.332)</i>		<i>(1.399)</i>		<i>(0.454)</i>	
HHI	478.023	***	2.365		24.858	
	<i>(116.906)</i>		<i>(341.422)</i>		<i>(177.579)</i>	
HICP	1.998	***	0.504		0.688	
	<i>(0.500)</i>		<i>(1.839)</i>		<i>(0.819)</i>	
ln_TA	-25.343	***	-19.177	***	-12.018	**
	<i>(2.846)</i>		<i>(5.048)</i>		<i>(5.249)</i>	
L/D	0.027	**	0.055		0.022	
	<i>(0.013)</i>		<i>(0.038)</i>		<i>(0.015)</i>	
D/A	0.151		0.743	*	-0.049	
	<i>(0.095)</i>		<i>(0.448)</i>		<i>(0.137)</i>	
C/I	-0.014		-0.173		-0.017	
	<i>(0.025)</i>		<i>(0.270)</i>		<i>(0.027)</i>	
ROE	0.044		0.427		0.030	
	<i>(0.040)</i>		<i>(0.392)</i>		<i>(0.041)</i>	
Z_score	-0.016		-0.038		-0.338	
	<i>(0.197)</i>		<i>(0.731)</i>		<i>(0.296)</i>	
NetII_NoIOI	-0.001		-0.007	*	-0.001	
	<i>(0.001)</i>		<i>(0.004)</i>		<i>(0.001)</i>	
NPL	-0.776	***	-0.979		-0.591	***
	<i>(0.134)</i>		<i>(0.650)</i>		<i>(0.154)</i>	
R ²	0.438		0.713		0.347	
Adjusted R ²	0.305		0.514		0.127	
No. of observations	1248		337		906	

Note: For all panel models in this section the least squares method with fixed effects was used.

***, ** and * correspond to 1%, 5% and 10% significance level.

Source: own calculations.

Table 9. Estimations for Growth of Gross Loans, with MLP Score

Control variables	2004-2014		2004-2008		2009-2014	
const	266.024	***	251.922	***	86.212	
	(41.901)		(77.753)		(72.892)	
LTGBY	0.176		-1.197		-0.142	
	(0.894)		(4.000)		(1.084)	
COOP	2.003		7.896		3.270	
	(2.861)		(6.191)		(4.637)	
Δ GDP	0.847	***	-0.295		-0.664	
	(0.325)		(1.135)		(0.436)	
HHI	253.143	***	-339.670		81.029	
	(75.620)		(221.803)		(170.686)	
HICP	2.230	***	-0.996		0.250	
	(0.486)		(1.505)		(0.802)	
ln_TA	-20.312	***	-12.702	***	-6.583	
	(2.713)		(4.417)		(4.926)	
NetII_NoIOI	-0.002	***	-0.008	**	-0.001	
	(0.001)		(0.003)		(0.001)	
MLP_Score	0.791	***	0.926	*	0.664	***
	(0.164)		(0.479)		(0.207)	
R ²	0.385		0.610		0.329	
Adjusted R ²	0.245		0.390		0.098	
No. of observations	1417		467		945	

Source: own calculations.

size and risk-taking has been investigated in the literature, e.g. Bhagat et al. found that size is positively correlated with risk-taking measure (Z-score), particularly in the pre-crisis period (2002-2006) and the crisis period (2007-2009), and the decomposition of the Z-score revealed that financial firms engage in excessive risk-taking mainly through increased leverage [Bhagat, Bolton, Lu 2015]. Other research also indicated that banks with high rates of loan growth were more risky [Mercieca, Schaeck, Wolfe 2007]. A study by Köhler found that banks were more stable if they increased their non-interest income share due to the better diversification of income sources, and indicated that supervisors should carefully monitor loan growth on the individual level, since high rates of loan growth are associated with high bank risk-taking [Köhler 2012]. The empirical research presented in our paper supports the above observations.

Bank individual efficiency ratios were not significant, however, the comprehensive efficiency score: the MLP Score was significant and positively influencing loan growth in the whole period and in the sub-periods, suggesting that the overall conditions of banking markets are very important for stimulating loan growth.

5. Conclusions

The analysis presented in the paper has illustrated that the MLP score, both interpreted on a country level as a performance yardstick, and employed in a panel data model as a control variable for analyzing loan growth, turned out to be an significant explanatory tool. At country level, the MLP Score has been useful in differentiating countries with the strongest bank performance (the Czech Republic, Poland and Slovakia) and the weakest (Latvia, Romania, Slovenia, Croatia and Hungary). For loan growth, strong macroeconomic indicators (such as GDP growth) and positive overall bank performance, as indicated by the MLP Score, were both crucial explanatory variables; and the MLP Score has successfully replaced the individual balance sheet ratios in the estimations.

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