IMPACT ANALYSIS OF FACTORS INFLUENCING BANK CAPITAL MANAGEMENT

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Abstract. Issues of bank capital management have always been topical for each commercial bank and for bank supervisory institutions. After-effects of the financial crises have encouraged strengthening of capital adequacy requirements and therefore supporting the reasonable risk level. Basel Committee on Banking Supervision adopted a range of guidelines, which promote raising of bank stability and safety, stressing the importance of capital as risk coverage. The aim of the research is the determination of factors influencing bank capital adequacy and assessment of financial strength of capital and especially equity in commercial banks. The subject of this research is focusses on commercial banks of Eastern Europe. Methodologically, research methods as comparison, factors analysis, ratio analysis, charts showing statistic information and others have been used by authors. As the result of the investigation, factors influencing bank capital adequacy have been identified. The most important of these factors is credit risk, which is specially analysed in this research. The obtained results allowed the authors to make a range of conclusions, of which some are: in the period of financial crises most of European commercial banks were operating on the verge of capital adequacy, banks did not have sufficient buffer capital, due to substantial losses during the period of crises capital adequacy was maintained only by the inflow of new share capital and subordinated capital. The authors have provided several suggestions concerning the management of bank capital adequacy to commercial banks.

Keywords: Capital adequacy management; Capital safety margin; Bank assets; Buffer capital; Regression analysis

1. Introduction

Banking sector in most Eastern Europe countries within the period 2009 to 2012 was loss-making. Thus, maximum losses of banking sector in Romania were fixed in 2011 and amounted to 800 mln RON = 185 mln EUR (National Bank of Romania, Statistical data). The year 2011 was the most loss-making also for Hungary where banking sector had suffered losses nearly 300 mln HUF = 1 mln EUR (Central Bank of Hungary, Statistical data). Banking sector in Baltic countries – Lithuania, Latvia and Estonia – had maximum losses in 2009. Estonian commercial banks in 2009 had suffered losses 600 mln EUR (Eesti Pank, Statistical data; Estonian Financial Supervision Authority, Statistical data) while losses in banking sector of Lithuania and Latvia within the same period had exceeded 1 bln EUR (Bank of Lithuania, Statistical data; Bank of Latvia, Statistical data; Securities

Commission of the Republic of Lithuania; Latvian Financial and Capital Market Commission, Statistical data). Although the banking sector of such Eastern Europe countries as Poland, Czechia, Slovakia during the crisis and postcrisis periods was in general loss-free, many banks of these countries also incurred losses and faced problems with risk management. A similar situation was observed also in other European countries. It all demanded to review the bank regulation, which was reflected in Basel III requirements. With the objective to increase the banking sector stability, reduce the systemic risk and prevent the systemic crises in future, Basel III toughened the requirements for the capital adequacy and liquidity as well as implements the financial leverage ratio.

The research methodology is based on study from general to specific, which assumes in the beginning the determination of macroeconomic factors affecting the regulation of banks' equity in the countries of Eastern Europe, identifying the dependence between the various elements of equity and calculation of financial strength margin in the banks of Eastern Europe, and after that a transition to the regression analysis method of capital in Latvian commercial banks, which are the part of banking system in Eastern Europe. Regression analysis was performed by stepwise. The dependent variable - a natural logarithm of banking capital of size. 9 indicators were selected for modelling through economic analysis. The purpose of regression analysis was to confirm the hypothesis of the influence of factors selected by the method of economic analysis on the amount of bank capital. The Durbin-Watson test was conducted to check the hypothesis that there was no autocorrelation of balances.

The observation and collection of financial information about activity of commercial banks, the analysis and synthesis of acquired data, the method of comparison between economic groupings, the ratio method as well as the method of graphic display of statistic information are used in the study. The official statistical data of the European Central Bank, National Central Banks of analysed Eastern Europe countries and data of the Supervisory Institutions are provided in the research.

The novelty of the research is that a statistically significant model of change in the value of bank capital, which can be used in the management of capital adequacy of bank, has been defined.

The limitations of the study are determined by the availability of data and the possibility of obtaining them. Therefore, the authors used the data of commercial banks of 8 Eastern European countries as the subject of the study.

2. Theoretical framework of bank capital management

The stability of a bank depends on a bank's capital management. A bank's capital is a mandatory and integral part of its financial resources, and its development in the form of core capital is a required step even before establishing a commercial bank (S. Saksonova, 2006). Practically every stage of a bank's business is directly or indirectly linked to the capital management. A bank's capital serves as one of determinants in the evaluation process of its stability. The adequacy of the bank's own funds provides for its financial stability and neutralises different risks inherent to a commercial bank's course of business (H.Greuning and S.Brajovic Bratanovic 2009). The size of a bank's capital is crucial not only for the safety of its customers, but also for the bank's own stability, avoiding the impact of short-term financial problems (S. Saksonova, 2006). The capital also serves as an indicator of the bank's credit solvency, since the total amount of its assets may not exceed a certain capital adequacy limit, which means that the maximum amount of the bank's assets depends on the size of its capital. The size of capital greatly determines the bank's competitiveness. Since shareholders of a bank always seek to increase the profitability of their investments, the bank's endeavours to increase the profit reflect on prices of products and services it provides. On the other hand, a bank must attract a certain amount of customer deposits to be able to ensure full-scale lending operations, which is only possible, if the bank has gained public trust and that is possible with sufficient capital reserve. In case of sudden capital adequacy problems a bank may lose its competitiveness (H.Greuning and S.Brajovic Bratanovic 2009).

The American scientist D.Chorafas (2004), in his turn, believes that the main function of a commercial bank's capital is generation of bank's income and profit respectively, and provide for a possibility to cover unexpected operating losses of a commercial bank. American scientists H.Schooner and M.Taylor (2009) in their book „Global Bank Regulation: Principles and Policies" offer an identical definition, but in addition to that they stress the possibility to use capital of a commercial bank to cover possible losses caused by credit risk. American economists H.Greuning and S.Brajovic Bratanovic (2009) hold a view that capital adequacy level must be consistent with the risk level of the bank's operations. Capital structure is a significant factor in business valuing. Capital structure matters because it influences the cost of capital (Valaskova, K. et al. 2019). At the same time, Andrea Szalavetz claims that a significant part of the organizational changes aimed at reducing costs and improving efficiency caused by the global crisis of 2008 can be beneficial to some subsidiaries, including banks (Szalavetz A. 2016). But capital strict requirements will be associated with higher capital costs. Strong corporate governance provides effective financial decisions connecting with the cost of capital (Mokhova, N. et al. 2018). To evaluate banks activity and stability use a lot of internal and external indicators. Authors Saksonova S. and Koļeda O. identified a stable link between bank retained earnings and GDP growth. They proved this fact in the paper "Evaluating the Interrelationship between Actions of Latvian Commercial Banks and Latvian Economic Growth" and emphasize that that the empirical link between bank retained earnings and GDP growth is more robust that between credit growth and GDP growth, although this does not mean that credit growth is not important. The relationship is bidirectional – GDP growth has a significant effect of bank retained earnings and vice versa. The implication for banks is to continue optimizing their asset and liability structure and adjust to both current unprecedented monetary accommodation and its eventual unwinding (Saksonova S., Koļeda O., 2017).

A. Berke-Berga and I. Dovladbekova claim that capital structure is the proportional combination of equity and debt that is used to finance and business activity of any company (A. Berke-Berga and I. Dovladbekova, 2019). Now in banking sector this proportion is adjusted with leverage ratio, which was introduced by Basel III. Capital adequacy is also used in an aggregate measure of bank stability. The authors of the article "Stability of the Banking Sector: Derailing Stability Indicators and Stress-Testing" have developed an aggregate indicator of banking stability, which is assessed on the basis of such independent sub-indices as capital adequacy ratio (CA), asset quality (AQ), profitability (P) and liquidity (L). Additionally, banking stability was evaluated using vulnerability assessment and stress testing (Mayis G. Gulaliyev et al. 2019). In the Financial and Capital Market Commission's regulations Capital Adequacy Ratio (Tier I and Tier II) is defined as the amount of provisions to cover a bank's operating losses. They also elaborate that a capital requirement is an estimate of probable losses based on information available at the moment such estimate is made. The amount of a capital requirement depends on the amount of a bank's assets and their structure, as well as risks assumed by the bank. Almost all unmanaged risks cause losses, which, in their turn, cause volatility of capital adequacy. Thus, to determine the amount of capital needed to cover risks a bank identifies risks included in the capital adequacy evaluation. A bank must evaluate all risks inherent to its business, including risks, for which minimum regulatory capital requirements are set, and the risks, for which no such minimum requirements exist (FCMC, 2012). After the introduction of Basel III requirements, banks began to increase the volume of capital. Capital management is affected by dividend policy. Authors Renata Legenzova, Otilija Jurakovaite and Agne Galinskaite in paper "The Analysis of Dividend Announcement Impact on Stock Prices of Baltic Companies" write: "In general, two main dividend strategies exist: not to pay dividends (zero dividend strat-egy) – value for shareholders comes from additional gain due to increased stock prices; and to pay dividends" (Legenzova R., et al. 2017). Those banks that refuse to pay dividends reinvest part of their profits in development of bank and increasing of capital, and thus use internal sources of capital growth. It should be noted that after the crisis of 2008, the countries of Eastern Europe, including Latvia, showed a trend of mergers and acquisitions of banks and firms. These issues have been investigated by the authors Saksonova S. and Kantāne I. In the paper "Mergers and Acquisitions: Examples of Best Practice in Europe and Latvia" they concluded that in evaluating decisions on the possibilities for mergers and acquisitions Latvian firms and banks have to be guided by the most important results of this process: possible increases in foreign direct investment and the growth in market share (Saksonova S., Kantāne I., 2016). This will

allow banks to increase a capital value and to become more stable and competitive. All conditions above mentioned confirm that bank capital management is important function for successful bank activity.

3.   Analysis of capital adequacy and capital safety margin in banking sector of Eastern European countries

In order to analyze and manage capital, it is necessary to maintain the required divisions between different levels and constituents of capital. Thus, for effective capital management, the Basel Committee recommends dividing all capital of a bank to 2 levels: Tier 1 capital and Tier 2 capital and establish appropriate proportions between them and their constituents (Figure 1).
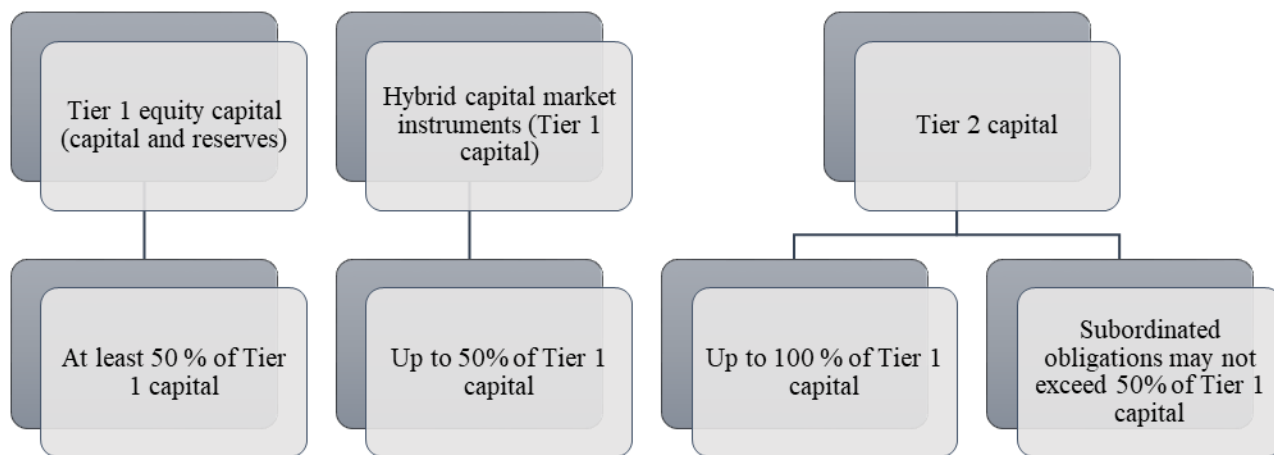

Figure 1. Division of capital and relations ratios between its constituents
(FCMC, 2012)

Since 2013, a staged implementation of new capital ratios has begun, which was fully completed by 2019. Capital conservation buffer, which started in 2016 with 0.625% and amounted 2.5% in 2019. How are Basel III requirements being implemented in the banking sector of Eastern Europe countries? The behavior of various capital ratios and their fulfilment by the banks of countries such as Poland, Czechia, Slovakia, Hungary, Romania, Lithuania, Latvia and Estonia wiil be examined (Tables 1-2). The analysis of the capital adequacy ratios behavior in the banking sector of Eastern European countries within the period 2006 to 2019 has demonstrated that the strongest and most protected banks during the crisis period were in Czech Republic, Slovakia and Romania. Their capital (both Tier 1 and total equity) adequacy within 2007 and 2009 consistently exceeded 10%. Polish and Hungarian banks also held strong enough positions (their total capital base in most dramatic 2009 was above 11%). However, in 2008 the tier 1 capital adequacy ratio in Polish banking sector was the lowest – 4.5% (at that time norm value was 4%). Alas, Polish banks have managed to withstand the crisis events and demonstrated their stability by ensuring the overall capital adequacy due to the increase in Tier 2 capital elements. The banks of Eastern Europe countries were the most vulnerable during the crisis period. In addition, if Estonian banking sector somehow stayed afloat by providing a relative adequacy of the capital base, the banks of Lithuania and Latvia were really threatened and hardly covered ever-growing losses during the crisis and post-crisis periods.

Table 1. Tier 1 capital ratios in banking sector of some Eastern European countries,
Basel III (calculated by the authors)

Period	Poland	Czech Republic	Slovakia	Hungary	Romania	Lithuania	Latvia	Estonia
2006	14,3	10.1	14.1	9,1	13,5	9.7	7.8	10.2
2007	12.8	10.3	13.8	9.5	10.7	9.8	9.8	10.7
2008	4.5	11.8	10.6	10.3	11.8	10.2	9.6	13.5
2009	12.0	12.7	11.0	11.0	13.5	10.3	10.8	16.0
2010	12.5	14.1	11.6	10.9	12.1	11.6	10.9	16.5
2011	11.7	14.2	12.4	11.2	12.0	12.0	14.2	17.8
2012	13.1	15.9	14.7	13.8	12.8	14.0	15.2	19.3
2013	14.1	16.9	14.4	14.1	13.0	15.2	17.3	21.0
2014	13.5	17.5	16.0	15.5	13.5	15.4	18.3	25.5
2015	15.1	17.9	16.5	13.2	13.9	17.9	19.7	27.8
2016	15.7	17.1	16.2	13.9	14.2	18.0	19.3	27.1
2017	15.8	17.5	16.7	14.0	14.3	17.8	18.7	28.3
2018	16.1	17.8	16.7	16.2	18.6	19.8	19.7	28.7
2019	16.3	18.1	17.2	16.8	18.2	19.9	19.3	28.8

It should be noted that many banks of Eastern European countries have increased their capital even before implementation of Basel III requirements (Tables 1-2) and currently pay more attention to the quality of the capital in its management. It means that the capital structure in the banks is changing for the benefit of its stable part – the core capital (CET 1 – Common Equity Capital) and tier 1 capital (T1C - Tier 1 Capital). As evident from Table 1, Tier 1 capital and its adequacy ratio are growing rapidly since 2011. The highest Tier 1 capital adequacy growth rates are observed in Estonian banks. In 2019, Tier 1 capital adequacy in Estonian banking sector was 28.8%. All other analyzed banks of Eastern European countries have a good Tier 1 capital safety margin (Table 1). It should be noted that Romanian banks are operating in conditions of a broad gap between the Tier 1 capital adequacy and the core capital adequacy. It means that the Romanian banking sector has a high share of tier 2 capital compared to the most stable capital elements and Romanian banks will still have to consolidate their capital base.

Table 2. Total capital ratios in banking sector of some Eastern European countries,
Basel III (calculated by the authors)

Period	Poland	Czech Republic	Slovakia	Hungary	Romania	Lithuania	Latvia	Estonia
2006	14.9	14.8	12.5	12.7	13.9	10.3	9.7	10.5
2007	12.4	15.5	16.3	13.7	13.0	10.1	10.7	10.6
2008	11.6	19.3	13.1	11.0	17.3	10.2	8.2	15.5
2009	14.7	19.1	15.5	15.6	20.8	10.7	9.2	16.2
2010	15.1	20.8	15.3	17.1	23.7	10.7	9.3	16.7
2011	14,4	20.6	18.6	17.0	25.8	13.2	14.4	21.1
2012	15.8	22.7	17.4	17.9	26.2	18.1	17.6	21.6
2013	16.9	16.5	16.5	17.4	15.5	17.6	19.9	20.0
2014	16.4	17.0	17.3	16.9	17.6	21.3	21.1	35.7
2015	16.2	17.6	17.8	16.9	19.2	24.8	22.3	28.0
2016	16.0	17.7	18.0	18.0	19.7	19.4	21.5	31.8
2017	16,7	18.1	18.8	18.1	20.0	19.1	21.4	29.2
2018	18.3	18.3	18.4	18.5	21.7	20.1	21.6	29.5
2019	18.4	18.4	18.7	18.4	21.9	20.3	21.7	29.3

The preparatory period for the transit to Basel III was featured in Eastern European countries not so by the growth in the capital volume as by the improvement of its quality. Thus, it is evident from Fig. 2 that most banks had considerable capital growth rates just in the pre-crisis and crisis periods, which is explained by the banks' endeavour to withstand the growing risks. Considerable slowdown in capital growth rates in the banking sector of Latvia, Lithuania and Estonia during the period 2009 – 2010 was caused by great losses incurred by the banks of these countries, which has resulted in the reduction of equity capital and its adequacy. Slowdown in capital growth rates and even decreasing capital growth rates in Hungary (2014 – 2019) and Estonia (2011 – 2019) as well as a slowdown in capital growth rates in Slovakia (2011 – 2019) is associated with the subordinated debt substitution and subsequent transition to more qualitative and stable elements of equity capital.
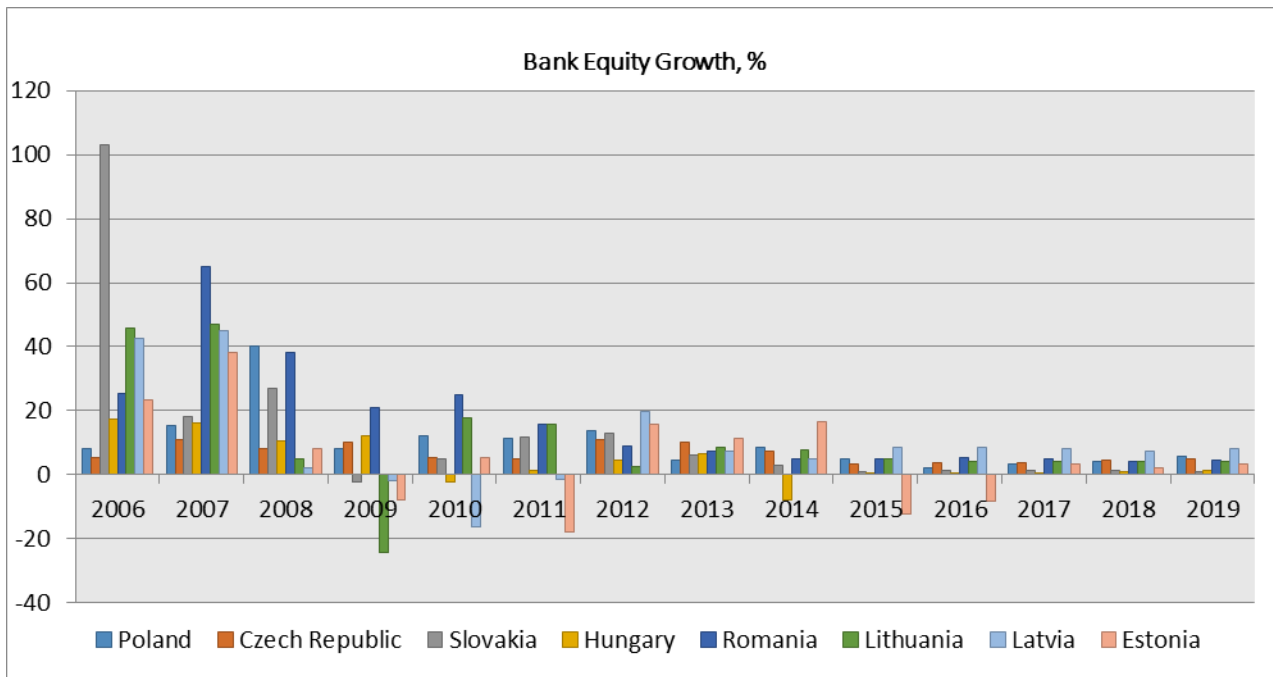

Figure 2. Bank equity growth in banking sector of Eastern European countries (prepared by the authors)

The question is how do Eastern European banks meet the financial leverage? The leverage ratio of banks indicates the financial position of the bank in terms of its debt and its capital or assets and it is calculated by Tier 1 capital divided by consolidated assets where Tier 1 capital includes common equity, reserves, retained earnings and other securities after subtracting goodwill. Since the financial leverage is defined as a ratio of the common equity to the aggregate assets and off-balance-sheet liabilities (without risk adjustment), it can be expressly said that this ratio will have the biggest impact first of all upon banks having considerable off-balance-sheet items and a big share of assets with a low risk level. Banks using the internal rating based system (IRB) for the credit assessment may also be negatively affected by this ratio since they will have a lower share of risk-bearing assets in total assets volume compared to banks assessing the credit risk based on external ratings. Financial leverage does not reflect the level of risk and only shows the general ratio. Thus, the financial leverage ratio will be the same for both banks carrying out a conservative or moderate policy and banks pursuing a high-risk aggressive policy. Although certain banks of Eastern European countries experienced problems when achieving the required level of this ratio, for the whole of the system the aggregate financial leverage ratio is observed and has a strong reserve (Fig. 3). Thus, 3%-limit of the financial leverage is generally observed in all analyzed Eastern Europe countries during the period

2006 to 2019. In 2019, the highest financial leverage level (9%) was achieved in the banking sector of Poland, Slovakia, Latvia and Estonia.
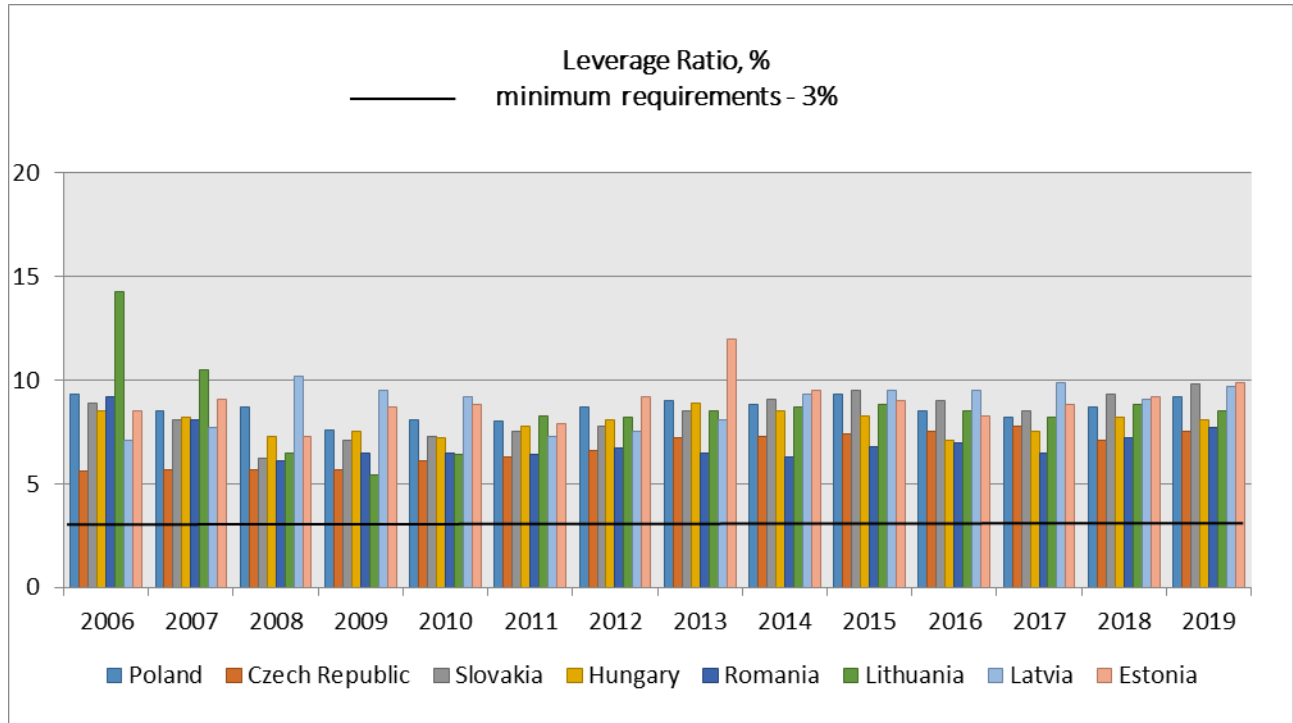

Figure 3. Leverage ratios in banking sector of Eastern European countries, % (calculated by the authors)

In the next step will be examined how strong and stable the capital base of commercial banks in Eastern European countries was within the period 2006 to 2019. To assess the stability of commercial banks, the concept of "capital safety margin" is introduced, which is defined as an excess of the actual capital tier above the minimal requirement established by a supervisory body. Assessment of "capital safety margin" in the banking sector of Eastern European countries includes the analysis of complete fulfilment of requirements for establishment of the capital buffer (+ 2.5%) in accordance with Basel III (Figure 4).
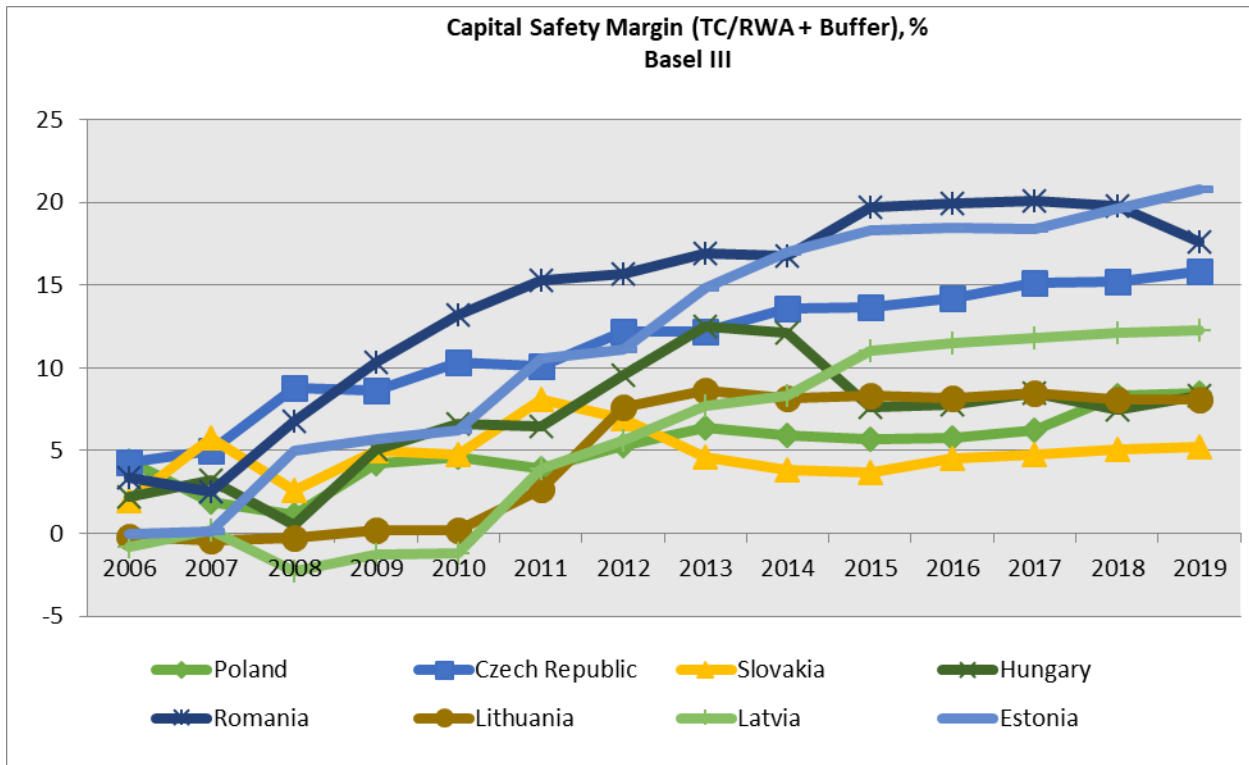
Figure 4. Capital safety margin in banking sector of Eastern European Countries (calculated by the authors)

Thus, as a result of the analysis it was found out that the banks had the minimum capital safety margin during the crisis period. The Latvian banking sector in this period appeared to be especially vulnerable. During the period 2006 to 2010 Latvian commercial banks had a negative safety margin in accordance with Basel III, therefore the transit to the new standards became especially complicated for Latvia. However, by 2011 Latvian banking sector already had a positive capital safety margin and demonstrated its consistent upward trend. Stable, progressive and even behavior features the capital safety margin of Czech banks. Czech banks had an adequate safety of the capital base and were ready to withstand the financial shocks during the crisis period. In Romanian banking sector the safety margin is largely ensured at the expense of tier 2 capital while the banks of Poland, Czechia, Slovakia, Hungary and Estonia provide the capital safety margin mostly due to the increase in the share of the equity capital.

4. Regression analysis as a method of banks capital management

As Latvian banks were the most vulnerable during financial crisis, a regression analysis of capital for Latvian commercial banks was carried out. For purposes of regression analysis, data for the period 2006 – 2019 with quarterly distribution were used. The modelling was carried out in SPSS statistical program. The regression analysis was performed by *stepwise* method with natural logarithm of bank capital amount being the independent variable (*capital*). To carry out the modeling by means of economic analysis, the following 9 indicators were selected: annual inflation rate (*infl*); natural logarithm of gross domestic product (*gdp*); natural logarithm of assets Latvian commercial banks (*size*); natural logarithm of credit portfolio amount of commercial banks (*cr_portf*); natural logarithm of securities portfolio amount of commercial banks (*sec_portf*); natural logarithm of deposits amount at commercial banks (*deposits*); natural logarithm of subordinate capital of commercial banks (*sub_cap*); natural logarithm of net interbank position of commercial banks (*interbank*); ratio of credit provisions to gross credit portfolio (*provisions*).

The task of the regression analysis is to confirm the hypothesis about influence of factors selected by the method of economic analysis upon value of bank capital. In order to check the hypothesis on absence of autocorrelation of balances the Durbin-Watson test was performed. Statistics of Durbin-Watson coefficient equal to 2.388 witnesses that the absence autocorrelation of balances can be stated with 95% probability. The summarized results of the regression analysis are presented in Table 3.

Table 3. Model Summary for regression analysis of banks' capital
(calculated by the authors)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.983	0.968	0.968	0.1683	
2	0.987	0.979	0.977	0.1458	2.297
3	0.992	0.981	0.982	0.1271	

Three models were obtained in the result of modeling, of which all demonstrate a high determination ratio. In the table 4 each model is considered individually and asses the significance of factors (Table 4).

Table 4. Regression ratios of factors influencing the amount of banks' capital (calculated by the authors)

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	B	Std.Error			
1. (Constant)	0.478	0.301		1.596	0.000
size	0.819	0.028	0.986	42.208	0.000
2. (Constant)	-0.254	0.287		-0.825	0.000
size	0.857	0.021	1.034	46.214	0.000
provisions	1.879E-02	0.03	0.109	4.877	0.000
3. (Constant)	-5.827	1.331		-4.375	0.000
size	0.462	0.095	0.558	4.834	0.000
provisions	1.907E-02	0.02	0.108	5.567	0.000
gdp	0.821	0.193	0.485	4.278	0.000

0.000 p-values of all factors witness that the selected factors are statistically significant with probability higher than 99.9%. The performed correlation analysis of factors influencing the result (see Table 5) showed that the assets of commercial banks had the strongest correlation dependence with the result – the amount of bank capital.

Table 5. Correlation coefficients of factors influencing the amount of bank capital (calculated by the authors)

	Capital	Provisions	Size	GDP
Capital	1			
Provisions	-0.368	1		
Size	0.988	0.468	1	
GDP	0.899	0.008	0.987	1

Meanwhile, the factors of commercial banks' assets and GDP are tightly intercorrelating (correlation ratio = 0.987) which is evident since within the analyzed period the banks increased their assets at the expense of crediting in pre-crisis period which, in turn, contributed to the increase in GDP. Banks' credit activity is slowed down in crisis period and in the first 5 years in post crisis period that led to slowdown in growth rates of banks' assets and to slowdown in GDP growth rates. To avoid the presence of two tightly correlating factors in the model, the one of them which correlates more strongly with bank capital – the amount of assets was left off. Thus, the second one of the three obtained models was chosen, because this model describes 97.7% of variations in the

amount of bank capital at Latvian banks. The results of dispersion analysis demonstrate that the model is statistically significant with 99.9% probability.

Summary

Growing requirements for the capital will increase the borrowing power and solvency of banks and, therewith, the sustainability of the entire banking sector. The banking system and economy in general will be more resistant to financial shocks. The regulations based on Basel III are contributions to reduction in systemic risk and prevention of systemic crises in future.

Basing on obtained findings, the following proposals can be concluded for commercial banks:

1. Ensure continuous control and monitoring of capital adequacy and changes in indicators Tier 1 capital ratio and total capital ratio.
2. Review the capital management policy not rarer than once a year.
3. Estimate the capital demand of banks in stress situations as well as taking into consideration long-term strategy.
4. Timely reveal reasons and factors having impact upon changes in capital indicators.
5. Use regression analysis for management of bank capital.
6. Continuously search for possibilities to increase equity capital through emission of shares.

The banks' equity plays a substantial role in the formation of banking resources. Regarding this would be interesting to investigate banks capital management in total banks resources management, especially the impact of a financial leverage on the results of banking activity.   Further research also may be devoted to the study of regulatory requirements influence on economic growth. These issues can be investigated in banking sector of different countries.

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