Cyclicality of bank capital buffers in South-Eastern Europe: endogenous and exogenous aspects

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Abstract

The interdependence between the regulatory capital ratio and macroeconomic indicators, with reference to the phenomena cyclicality and pro-cyclicality is a widely emphasized disadvantage of the capital adequacy concept. Redesign of the aforementioned concept towards the countercyclical capital requirements is a kind of recognition of the creators of the Basel standards of the previous oversights in its development. This paper aims to explore empirically the direction, intensity and significance of endogenous and exogenous determinants of the changes in banks' capital buffers by taking into consideration both the impact of the macroeconomic properties and the bank-specific characteristics of South-Eastern Europe. More than 80 commercial banks in the period from 2000-2010 have been encompassed by the research. Use of a dynamic panel analysis led to the conclusion that the bank capital buffers decreased during the observed period, with the exception of certain years during the economic expansion, which confirms the appropriateness of regulatory requirements considering the countercyclical capital buffers. Nevertheless, it might be that capital building and spending in the future will not follow the pattern from the last decade due to the specificities of the observed period, as well as the banking sector ownership transformations, economic and credit growth as well as asset prices growth in the post-transitional period, and finally, the real crisis which spilled over onto the financial sectors.

Keywords: bank capital buffers, cyclicality, commercial banks, South-Eastern Europe

1 INTRODUCTION

The capital requirements regulation for banks, in common with the practice of referring to capital adequacy as the ultimate measure of the banking stability, has persisted as the key instrument of prudential oversight worldwide for a more than two decades, despite criticisms from both the academic community (Daníelsson et al., 2001; Rodríguez, 2003; Saidenberg and Schuermann, 2003; Benston, 2007; Moosa, 2010) and the banking lobbies (Herring, 2007; Kane, 2007a, b). The phenomena of capital requirements cyclicality and pro-cyclicality, among other controversies, are rather important points of reference when the adequacy of this regulatory concept is being disputed (Jackson et al., 1999). While cyclicality stands for macroeconomic impacts on a bank's performance, pro-cyclicality implies a bank's reaction to the macroeconomic environment which amplifies macroeconomic fluctuations (Marcucci and Quagliariello, 2008:47).

Examinations intent on determining the implications of capital requirements for the size of banking intermediation and which directly or indirectly tackled the question of the macroeconomic consequences of the observed regulatory measure long dominated researches on the effects of capital requirements implementation. Moreover, in the first decade of the capital adequacy standard implementation in practice the relationship between the capital requirements and the volume as well as the structure of banking activities was at the centre of research. In fact there was an endeavour to explain the credit contraction recorded at the beginning of the 1990s in the countries that signed the Basel Accord by the adoption of the capital requirements. Thus the hypothesis that the bank capital channel (i.e.

the hypothesis of the financial accelerator induced by bank capital) provided the impulse that led to the credit crunch, a regulatory mechanism that had pro-cyclical effects, was examined in many empirical investigations. Most research on the macroeconomic effects of the implementation of the capital requirements was oriented to the identification of the relationship between the credit volume fluctuations (and consequently the economic output) and the more restrictive capital regulation. Likewise, Van den Heuvel (2008) calculated that the compliance with capital requirements leads to a permanent loss in the volume of consumption in the United States in the range of from 0.1% to 1%.

On the other hand, the bank capital channel works out only if the following assumptions are satisfied (Francis and Osborne, 2009b:1): if banks do not have a sufficient capital buffer through which they could insulate themselves from the movements in the credit supply when regulatory changes occur; if capital enlargement is a costly process; if economic agents are highly dependable upon bank loan financing. If the phenomena of demand-driven and supply-driven credit rationing are taken into consideration, the macroeconomic effects of "adequate" capitalization might be an argument for a reasonable or, on the other hand, a more stringent criticism of the (supra)national prudential authorities. Thus, the importance of principles and practice of the occurrence of business and economic cycles is temporarily downgraded, while primacy in the explanations of movements in the aggregate credit and investment level is given to the effects of the capital requirements or to the supply side of the process. It is in this sense that the phrase capital crunch is used to indicate the cause of pro-cyclicality or, to be more precise, the contraction in credit activities, particularly in the case of more weakly capitalised banks and of loan categories assigned with high risk weights (for example, loans to small and medium-sized firms, which are anyway highly dependent on bank financing). However, the capital requirements are not the only relevant factor of the credit activity level and structure, and recent researches with inconsistent conclusions brought this issue sharply into focus. Gambacorta and Mistrulli (2004) empirically confirm that the bank capital might cause shocks in aggregate lending; Brissimis and Delis (2009) prove that bank specificities cannot be the main reasons for the aforementioned conclusions; while Berrospide and Edge (2010) verify the modest impact of bank capital on lending. A solution to reconcile these contradictions is modelled by Miyake and Nakamura (2007), who ascribe to capital regulation long-term stabilising effects that address the macroeconomic consequences of negative shocks to productivity. On the other hand, in the short term it can have a pro-cyclical effect, because of which the tightening of capital regulation needs timing precisely; this is the key practical implication of their research. Generally, there are two groups of conclusions present in this type of research: (1) the implementation of capital requirements did not induce the credit shock, (2) the implementation of capital requirements combined with another supply-side and with demand-side determinants of the credit level contributed to the development of the credit shock.

For these reasons, this research does not aim to simulate or estimate the macroeconomic consequences of the implementation of capital requirements, indirectly throughout the bank credit activity level, but rather concentrates on the cyclicality in the volume of

capital requirements (i.e. regulatory indicators of financial leverage, to be more precise, capital buffers). Additional justification for the exogenous treatment of economic trends in the analysis of the capital requirements efficiency is found in Quagliariello (2008), while Saidenberg and Schuermann (2003:18) point out that if capital requirements pro-cyclicality even exists, it is not clear how it can be confirmed. A distinction of the direct effects deriving from the capital requirements prescriptions from the effects induced by the shifts in the economic cycles remains an empirical challenge, although pro-cyclicality has always previously been the most tested aspect of the capital requirements effects. However, if the assumption of pro-cyclicality is a consequence of cyclicality is accepted (Quagliariello, 2008:103; Marcucci and Quagliariello, 2008), then research that explores the capital buffers or regulatory capital cyclicality might indirectly serve as a support for a certain conclusions on the macroeconomic implications of the implementation of capital requirements i.e. on the pro-cyclicality of capital requirements.

The size of banks' regulatory capital is a volatile category, what might be a consequence of endogenous and exogenous factors. Thus, it is justified to question the role of economic cycles in the (non)functionality of capital requirements. Nevertheless, there are only a few research works that combine microeconomic or bank-specific and macroeconomic determinants of capital requirements volatility. With reference to the aforementioned, this research acknowledges the empirical background in the following papers: Bikker and Hu (2002), Ayuso et al. (2004), Bikker and Metzemakers (2007), Jokipii and Milne (2008), Stolz (2007), Francis and Osborne (2009a), and Stolz and Wedow (2011). By taking into consideration cyclicality in the capital itself rather than its cyclical implications, the paper is in line with the current trends in empirical research into the issues and challenges related to capital adequacy standards; theoretical and empirical findings have shown that capital alone cannot be held responsible for a contraction in credit activity, as used to be argued, irrespective of whether increases in capital requirements or shocks in capital size were concerned. Moreover, banks pro-cyclical behaviour might be mitigated by maintaining surpluses of capital above those regulatorily required (i.e. capital buffers) and with their accumulation in the periods of economic expansion, which is currently being promoted within the Basel III framework. Whatever the case might be, new versions of the aforementioned regulatory concept should not be designed without empirical evidence on the endogenous and exogenous determinants of capital buffers cyclicality being provided and taken into consideration.

2 CYCLICALITY OF BANK CAPITAL BUFFERS: A REVIEW OF EMPIRICAL RESEARCH

A certain novelty of empirical research into the interdependence between the capital requirements and macroeconomic trends is found in the empirical analysis of the impact of macroeconomic tendencies on the volatility of the regulatory capital level. Following the methodological framework developed by Shrieves and Dahl (1992), the changes in bank capitalization ($\Delta CAP_{j,t}$) are determined with both exogenous factors ($\tilde{E}_{j,t}$) and endogenous, controllable or discretionary adjustments ($\Delta CAP^{M}_{j,t}$), which can be summarized as follows:

$$\Delta CAP_{j,t} = \Delta CAP^{M}_{j,t} + \tilde{E}_{j,t} \quad (1)$$

Furthermore, the discretionary changes in capital ($\Delta CAP^{M}_{j,t}$) are defined as the difference between the target capital level ($CAP^{*}_{j,t}$) and the capital level in the previous period ($CAP_{j,t-1}$):

$$\Delta CAP^{M}_{j,t} = \alpha(CAP^{*}_{j,t} - CAP_{j,t-1}) \quad (2)$$

Altogether, the following equation can be written:

$$\Delta CAP_{j,t} = \alpha(CAP^{*}_{j,t} - CAP_{j,t-1}) + \tilde{E}_{j,t} \quad (3)$$

where α is adjustment speed in the capital level.

The aforementioned formula takes into account the fact that banks can have deviations from the target capital level, i.e. that they are not always in a position to make *ad hoc* adjustments to the targeted capital levels. Thus, banks usually maintain a higher level of regulatory capital than that prescribed, which is also the key conclusion of the capital buffer theory (Milne and Whalley, 2001). The surplus of capital above the minimally prescribed level (by the regulators) is replaced by the formulation of capital buffer in the rest of the paper, with the following note in mind: prudential authorities may request banks that they perceive to engage in unusually high risk-taking behaviour to maintain a capital adequacy level higher than that which is minimally prescribed. Therefore, the capital buffer or the discretionary capital can be an outcome of the bank's discretion (as an object of regulation), as well as, the regulator's discretion. Whatever the case might be, it is evident that banks usually have the higher capital levels than those minimally prescribed, while the motives for the maintenance of the capital buffers might be strategic or reputational (Lastra, 2004:230; Bikker and Metzemakers, 2007:13; Jokipii and Milne, 2008:1441), i.e. have to be supported by the following considerations:

- cheaper refinancing and borrowing in the future, i.e. the market discipline functionality (practiced by the bank clients, creditors, credit rating agencies, shareholders),
- avoiding the costs of regulatory interventions in case of insufficient capitalization,
- granting loans in a recession, i.e. reduced pro-cyclical effects of bank capital (not missing the chance for future bank growth),
- financing mergers and acquisitions,
- expansion in the business of banking,
- a more flexible bank management, and
- protection against unexpected losses.

Thus, banks have to weigh the costs and benefits from holding a certain level of capital above the minimally prescribed. In such a manner, when determining the discretionary capital they have to bear in mind the following costs: the remuneration cost of capital requested by the shareholders, the costs of the franchise value loss, the costs of reputation loss, bankruptcy costs, the costs of regulatory interventions and sanctions and the costs of adjustment to the requirements of the regulator and the market participants, for example, the credit rating agencies, potential and existing shareholders, uninsured depositors and

other, wholesale creditors of banks (Ayuso et al., 2004:253). Consequently, the targeted capital level is ambiguously determined. Moreover, it is dependent upon the bank specificities, which are proxied by numerous bank-specific variables in empirical researches. Further, an exogenous changes of capital might be the outcome of regulatory pressures for an increase of capital or unexpected changes in the volume of earnings caused by operating income volatility or loans value impacting the level of provisioning, and is connected to or is, in the first place, originated by the general economic context (Shrives and Dahl, 1992:446-447). Whatever the case might be, due to the manner in which the measure of capital requirements has been designed, the level of risks taken and the changes in the risk level ought to be reflected in the capital level. According to Shrieves and Dahl (1992) a positive relationship between risk and capital is explained by banks' efforts to mitigate bankruptcy costs or by the risk aversion of bank managers, while a negative impact of risk on capital can be the consequence of oversights in the deposit insurance premiums. The level of risks taken is correlated with the expected or achieved return (which is an outcome of the size and the structure of bank activities). Altogether, this makes bank profitability as well as growth indicators the endogenous factors of volatility in capital requirements. And finally, the cyclicality of capital requirements is determined by bank characteristics and macroeconomic trends.

The key methodological features and conclusions of the reviewed empirical researches (encompassed by table 1) on the exogenous determinants of capital requirements cyclicality can be summarized in the following points:

- *Research methodology selection*. Almost all the research works reviewed employ dynamic panel analysis.
- *Data sample unit*. Researches usually observe commercial and savings banks or savings banks and cooperatives (Ayuso et al., 2004; Lindquist, 2004; Stolz, 2007; Jokipii and Milne, 2008; Stolz and Wedow, 2011), which enables subsamples to be analysed and conclusions to be made as to how much capital requirements of various groups of credit institutions are volatile due to cyclical movements and how much volatility is caused by bank specificities, banking sector characteristics and by a given bank's being a certain kind of credit institution. Research that focuses on savings banks and cooperatives usually has significantly larger data samples (according to number of observations) than those that take into consideration solely commercial banks (Boucinha and Ribeiro, 2007; Francis and Osborne, 2009a).
- *Data sample spatial characteristics*. Researches that consider the banking sector of a certain country are the most frequent (Ayuso et al., 2004; Lindquist, 2004; Boucinha and Ribeiro, 2007; Stolz, 2007; Francis and Osborne, 2009a; Stolz and Wedow, 2011), while Stolz (2007) and Stolz and Wedow (2011) focus solely on one region of one observed country, i.e. the western part of Germany, due to the disparities in the economic development of the two parts after the unification of the country. Cross-country analyses are usually related to the political or economic affiliation of a country to a certain association, e.g. the Organization for Economic Co-operation and Development (OECD) (Bikker and Metzemakers, 2007) or the European Union (EU) (Jokipii and Milne, 2008). An exception to this is constituted by Fonseca and González (2010) and Fonseca et al. (2010), who analyse the banking sectors of 70 and 92 countries worldwide, respectively. Excluding the last mentioned research works,

it can be concluded that investigations have been carried out only for developed countries, which means that there is an urgent need to bridge the research gap with respect to the banking sectors of developing countries. Interestingly, in this theme, research into European countries dominates, while there is little or no research related to the United States (except a part of the research by Jokipii and Milne, 2011).

– *Data sample time period characteristics.* The shortest time period range, that of 7 years, is encompassed by Lindquist (2004), while the longest time period is found in Ayuso et al. (2004), Bikker and Metzemakers (2007), Boucinha and Ribeiro (2007), Stolz (2007) and Fonseca et al. (2010) with more than 11 years encompassed by the data sample. Empirical researches at the level of a single country's banking sector have not taken into consideration data later than the year 2006 (Francis and Osborne, 2009a).
– *Variables selection.* Most of the research aims to examine the impact of macroeconomic and bank-specific variables on the capital buffers which is set out as the dependent variable, while some researches, e.g. Bikker and Metzemakers (2007) and Francis and Osborne (2009a) use also the capital adequacy indicator. Other ones likewise Stolz (2007) or Stolz and Wedow (2011) use an indicator of regulatory capital over total assets or equity to total assets ratio, as do Bikker and Metzemakers (2007). Economic trends are usually described by taking into account the real gross domestic product (GDP) growth.
– *Impact of economic cycles on capital requirements volatility.* All research (at the level of the overall sample, as there are some differences in the subsample approach) confirmed that capital buffers increase in an economic downturn, and that they tend to decrease in periods of economic expansion.
– *Other conclusions.* Commercial banks have lower capital buffers than savings banks and/or cooperatives (Lindquist, 2004). In addition, the results reveal a positive relationship between capital buffers and economic growth in small banks and in cooperatives (Jokipii and Milne, 2008) due to the earnings-retaining policy of these credit institutions in periods of expansion and a slower growth of placements (and thus the risk-weighted assets) as they mainly finance themselves with their core deposits. Jokipii and Milne (2008) confirmed that there is a difference in the cyclicality of capital buffers between the newly acceded countries and the older member countries of the European Union; in the older member countries there is a negative correlation between capital buffers and economic growth, while in the newly acceded countries there is a positive correlation.

According to the presented research findings, it is evident that there is a gap in the empirical literature on the research issue for the South-Eastern European countries. In fact, as the capital adequacy standard was aimed at the most developed countries, or rather, at internationally active banks originating in these countries, it is explainable why research works for those countries outnumber those for developing countries, which adopted the Basel Committee recommendations in their national regulatory acts at a later date. However, numerous researchers warn that the effects and implementation of capital requirements might be significantly different in countries at different economic development levels (e.g. Caprio and Honohan, 1999; Morisson and White, 2005). This paper acknowledges that idea.

TABLE 1

A review of empirical research on capital requirements cyclicality

Authors	Data sample characteristics / spatial and time period attributes	Research assumptions and goals	Methodology	Results	Main conclusions on the exogenous determinants of capital buffers cyclicality
Ayuso, Pérez and Saurina (2004)	142 commercial and savings banks/Spain; 1986-2000	To explore the effects of economic trends on capital buffers.	Dynamic panel data model; GMM estimator	The return on equity and the ratio of non-performing loans negatively impact the buffers. Lagged dependent variable has a positive influence. Bank size has a negative effect, as does growth of loans. Commercial banks' buffers are more robust to negative influences of the business cycles than savings banks.	The business cycle has a negative impact on the capital buffers.
Lindquist (2004)	131 savings banks and 16 commercial banks/Norway; 1995-2001	To explore the determinants of capital buffers with focus on the microeconomic variables.	GLS Random-Effects Model	There are differences in the obtained results for the savings and commercial banks. A negative connection between the risk and the dependent variable is recorded for savings banks. The debt price and the buffers size are negatively related, which implies that banks with a lower regulatory capitalization pay higher costs of debt financing. Larger savings banks have smaller buffers than small-sized savings banks. There is also a negative relationship between the risk and capital for the commercial banks. A more stringent regulatory oversight over the commercial banks increases the buffers. Besides, a negative impact of the reserves for unidentified losses, and a positive impact of the losses on the level of capital is confirmed, which might lead to the following conclusions: banks use reserves as an alternative to increasing capital buffers, and banks build up their buffers after the period of losses no matter what their price. Bank size negatively drives its buffers. The main conclusion is that banks do not enlarge their capital because of increased risks.	Economic growth negatively impacts the capital buffers of the commercial and savings banks. The commercial banks have, on average, lower capital buffers in comparison to the savings banks.
Bikker and Metzemakers (2007)	29 OECD countries; 1990-2001	To explore the impact of macroeconomic and bank-specific variables on the bank capitalization level and the regulatory capital level.	Dynamic panel data model; GMM estimator	In the equation in which the equity to assets ratio is the dependent variable, it was found that the lagged dependent variable has a positive impact. This means that banks gradually adjust their capital to the targeted level. Credit risk indicators have a negative impact on capital, while the effect of the return on assets is a positive one. Results of the equation with the regulatory capital being a dependent variable are similar to the aforementioned, with a significant difference in the (country level) cost of capital (or the average return on equity of the banking sector) in the previous period being significant and having a negative sign. Subsamples analysis (when the banks' size was a criterion variable for the subsampling) reveals differences in the results for the banks according to their size.	There is no strong evidence of cyclicality in the equity financing with reference to the economic trends. There is some evidence of regulatory capital cyclicality.

Authors	Data sample characteristics / spatial and time period attributes	Research assumptions and goals	Methodology	Results	Main conclusions on the exogenous determinants of capital buffers cyclicality
Boucinha and Ribeiro (2007)	17 banks/ Portugal; 1994-2004	To explore the determinants of capital buffers.	Dynamic panel data model; GMM estimator	The lagged dependent variable has a positive impact on buffers, which confirms the assumption that banks gradually increase their capital buffers. A negative impact of the loan loss reserves proves that reserves are a substitute for the capital surplus. Banks with larger investments in stocks maintain larger capital buffers, while the bank size negatively impacts the buffers. Higher profitability and smaller volatility reduce the capital buffers.	Results reveal capital buffers cyclicality in dependence with the economic growth. Higher economic growth reduces buffers. Stock markets growth positively impacts the capital buffers.
Stolz (2007)	492 savings banks and 2,159 cooperatives/ Germany (western part); 1993-2003	To explore the impact of economic trends on the capital buffers, as well as on the ratio of regulatory capital to total assets and risk-weighted assets to total assets. Dependent and independent variables (without dummy variables) are defined as changes, rather than the level of the observed indicator.	Dynamic panel data model; GMM estimator	The lagged dependent variable in the equation where the change in the capital buffers is dependent variable has a positive sign, as well as the ratio of liquidity and the ratio of loan loss reserves to total assets. The bank size and the return on assets have a negative impact on the changes in capital buffers.	There is inverse relationship between the economic cycles and the changes in capital buffers.
Jokipii and Milne (2008)	468 banks (commercial, savings and cooperatives)/ EU-25; 1997-2004	To identify the dependence of the capital buffers on economic growth. Subsampling analysis according to the criterion of the newly acceded and older members of the EU, as well as the bank size and the bank type criterion are assumed to be relevant in explaining the relationship between economic growth and capital level.	Dynamic panel data model; GMM estimator	There is a difference in the cyclicality of the capital buffers between the new and the old members of the EU; whereas, in the old members a negative movement of the capital buffers and the economic growth is recorded, in the new members that relation is a positive one. That means that in the old members economic growth follows a reduction in capital and vice versa. In the new members economic growth follows growth in the capital buffers. A negative impact of the cost of equity (the return on equity) and of bank size on the capital buffers is confirmed. Credit risk positively determines the buffers in most of the subsamples. The lagged dependent variable has a positive impact on the capital buffers, as it was expected, which is also proven for reinvested earnings. The growth of loans reduces the buffers.	There is a negative relationship between economic growth and capital buffers. Commercial, savings and big banks confirm a negative relationship, while the data sample which is composed of small-sized banks and cooperatives confirms a positive relationship. A positive relationship of the latter mentioned banks is a consequence of earnings-retaining policy, retaining earnings being more frequent in economic growth periods. Furthermore, small-sized banks and cooperatives have a slower growth of placements due to a mainly core deposit financing policy.

Authors	Data sample characteristics / spatial and time period attributes	Research assumptions and goals	Methodology	Results	Main conclusions on the exogenous determinants of capital buffers cyclicality
Francis and Osborne (2009a)	168 banks in the period 1998-2006 and 147 banks in the period 1990-1995; United Kingdom	To identify what, determines the banks' capital adequacy levels, how and how much, and the nature of the role of prudential regulation in this process. The bank-specific and macroeconomic determinants of the bank capitalization are thus explored. Besides, the research aims to check whether the regulatory requirements' impact changes depending on bank characteristics and the overall economic activity. The dependent variable is the capital adequacy ratio. The quality of capital is measured with the Tier 1 capital. Risk is proxied by the risk-weighted assets to total assets.	Partial Adjustment Model; Random Effects Model, Arellano-Bond and Blundell-Bond GMM estimator	Banks with the higher quality of capital have higher capital adequacy ratios. The level of risk in the current period is negatively connected with capital, while the level of risk in the previous period is positively connected with capital. The ratio of loan loss reserves to total assets has a positive impact on capital. Bank size negatively drives the capital adequacy. The market discipline proxy with the share of the subordinated debt in total liabilities increases the capital adequacy. Variables which approximate the adjustment costs of capital (lagged capital adequacy and the Tier 1 indicator) positively impact the capital adequacy. Estimations of the various subsamples revealed the following results: large banks increase their capital adequacy more, if they are under the regulatory pressures, than small banks; banks with lower capitalization increase their capital adequacy more; if banks are under regulatory pressure in periods of economic expansion they increase their capital more than in times of recession; banks under market pressures experience a weaker impact of the capital requirements, and a higher impact of risk on the capital adequacy is expected in these banks. All the aforementioned results were obtained for the period 1998-2006. Similar results were obtained for the period from 1990-1995, with reference to the estimated parameters signs, but they usually lack statistical significance.	A negative connection between GDP growth and the level of capital is recorded, and thus the (pro)cyclicality phenomenon asks for an additional empirical estimations.

Authors	Data sample characteristics / spatial and time period attributes	Research assumptions and goals	Methodology	Results	Main conclusions on the exogenous determinants of capital buffers cyclicality
Fonseca and González (2010)	1,337 banks/ 70 countries; 1995-2002	To explore the determinants of capital buffers by taking into account the bank-specific variables and the disparities in the supervisory, regulatory and accounting standards of the observed countries.	Dynamic panel data model; GMM estimator	The lagged dependent variable positively impacts the capital buffers, as well as, market power (except if it is at a substantial level) and the costs of deposits. The bank size and the credit risk indicators negatively impact the buffers.	There is some evidence of a negative impact of the GDP growth on the capital buffers.
Fonseca, González and Pereira da Silva (2010)	2,361 banks/ 92 countries; 1990-2007	To explore the effect of capital buffers on the banks' credit and deposit price in the developed and developing countries. Further, the determinants of capital requirements cyclicality are identified with a presumption of their lower volatility in the developing countries in comparison to the developed countries.	Dynamic panel data model; GMM estimator	The cost of deposits in the previous period positively influences the buffers, while bank size has a negative impact. The credit price in the previous period positively impacts the buffers.	There is a negative relationship between the GDP growth and capital buffers.
Stolz and Wedow (2011)	492 savings banks and 2,139 cooperatives/ Germany (western part); 1993-2004	To explore the impact of economic trends on the capital buffers, as well as on the ratio of regulatory capital to total assets and the ratio of risk-weighted assets to total assets.	Dynamic panel data model; GMM estimator	There is a difference in the buffers' movements during the business cycles depending on bank capitalization. Weakly capitalized banks reduce their buffers in periods of economic expansion and downturns. The lagged dependent variable positively impacts the buffers, while bank size has a negative sign. Banks with a higher liquidity tend to maintain larger capital buffers. Well capitalized banks increase their regulatory capital over the total assets in the economic expansion and downturn, while for weakly capitalized banks the results are opposite. Well capitalized banks do not change their risk-weighted assets during the business cycle, while weakly capitalized banks increase them during economic expansion and economic downturns.	An economic downturn positively affects the capital buffers. Weakly capitalized banks do not increase capital in periods of expansion and downturn (they decrease it, rather), nor do they decrease their risk-weighted assets in the downturn period (on contrary, they increase it).

Source: Author's presentation.

3 EMPIRICAL RESEARCH CONCERNING THE BANKING SECTORS OF SOUTH-EASTERN EUROPE

3.1. DATA, METHODOLOGY AND MODEL DEVELOPMENT

Empirical research into the endogenous and exogenous determinants of the cyclicality of capital buffers has been carried out on a data sample of commercial banks from the 9 South-Eastern European countries that were active in the period from 2000-2010 and whose financial statements and financial indicators (which serve as approximations of the endogenous aspects of capital buffers cyclicality) were available in the *Bankscope* database. A distribution of banks by countries in the selected data set is given in the appendix (table A1).

TABLE 2

Data sources for the groups of indicators

Variable	Explanation	and/or	Data source
Microeconomic indicators			
Microeconomic, i.e. financial, indicators of banks in the period from 2000-2010 were selected in the data sample according to the geographical criteria (Balkan States), status (active banks), type (commercial banks) and financial statements consolidation code (banks with consolidated (C1 and C2) and unconsolidated statements (U1)).			Bankscope, Bureau van Dijk
Banking sector indicators			
minCAP	Minimally prescribed capital adequacy ratio (for all the countries the officially prescribed indicator is taken into consideration, while for Romania in 2009 and 2010 the required rate is proxied by the IMF recommendations of 10%, due to the non-transparency of this information on the official website of the central bank of that country for the observed years). Minimally prescribed capital adequacy ratios by countries are encompassed in table A2 in the appendix.		Official websites of central banks by countries (various publications and decisions), the European Central Bank, annual publication *Transition report* in the period 2000-2010, Wisniwski (2005), Barisitz and Gardó (2008), Jokipii and Milne (2008), Athanasoglou (2011)
E_A	Equity to assets ratio for the observed banking sector		The World Bank (World Development Indicators & Global Development Finance)
Macroeconomic indicator			
GDP growth	Annual rate of growth of gross domestic product		The World Bank (World Development Indicators & Global Development Finance)
Dummy variables			
Dummy variable for an economic cycle (growth – dyEXP, downturn – dyREC)			Δ GDP (%) ἐ 0 (downturn – recession) Δ GDP (%) > 0 (growth – expansion)
Dummy variables for the following years: 2007 and 2008			Years which indicate a shift in an economic trend

Source: Author's presentation.

Banking sector indicators and macroeconomic indicators are taken from the official websites of central banks of the countries encompassed by the data sample as well as from the World Bank. Detailed insight into the data sources for the groups of indicators is provided in table 2. By taking into consideration the empirical background, an econometric model which encompassed the microeconomic variables from table 3 was developed. All the selected variables report annual values. The data were taken in euros, while delta (Δ) stands for the first difference of the observed variable value in order to cover the absolute changes in the variable in the two successive periods.

TABLE 3

Definition of banks financial indicators employed in the econometric model

Variable	Explanation	Group of indicators
ABBUFF	Absolute value of capital buffer = Bank capital adequacy ratio – Minimally prescribed capital adequacy ratio	Regulatory capitalization ratio
NPL_L	Non-performing (bad debt) and partially performing loans / Total loans	Credit risk (asset risk) indicator
ROA	Return on assets	Overall profitability indicator
GROWL	Growth of loans	Growth indicator
LLR_L	Loan loss reserves (identified and unidentified losses) / Total loans	Credit risk indicator
dydevBUFLow, dydevBUFWell[a]	Undercapitalized banks in comparison to the regulatory prescriptions; Adequately capitalized banks	Regulatory pressure variable
LOWCA, WELLCA[b]	Below-average capitalized banks; Above-average capitalized banks	Regulatory pressure variable

[a] *If a bank's regulatory capital (capital adequacy ratio) is higher than the minimally prescribed plus a standard deviation of the minimally prescribed capital adequacy ratio, a bank is perceived to be a well-capitalized one (dydevBUFWell). In the opposite case, it is held to be under-capitalized (dydevBUFLow).*

[b] *If a bank equity to assets ratio is higher than the average value of the aforementioned indicator for the banking sector in which a bank operates, a bank is perceived to be well-capitalized (WELLCA). In the opposite case it is considered undercapitalized (LOWCA).*

Source: Author's presentation.

The empirical research employed the econometric method of dynamic panel models. The collected secondary data have a time and spatial component, and a suitable data analysis method is thus an econometric method of panel analysis. Namely, use of the simple multiple regression is not possible as it cannot be assumed that there is an independence between the observations of one observed item during a time period (Škrabić, 2009:14). Thus, in a situation of the analysis of bank financial indicators, the indicators of one period are dependent on the same indicators in the previous period, i.e. there is a process of the first-order autoregression. "The dynamic panel models contain the dependent variable which is being lagged for one or more periods" (Škrabić, 2009:29). Furthermore, the collected data

are characterized with a larger number of groups (N) than the time component (t), which this method handles very well. The empirical estimation of the panel data was performed using the dynamic panel model, to be more precise with the GMM (generalized method of moments) Arellano-Bond two-step estimator as well as the GMM Blundell-Bond two-step estimator. In the empirical work on the research issue both the "difference" GMM Arellano-Bond and the "system" GMM Blundell-Bond estimator as a certain improvement of the Arellano-Bond in a case in which the autoregressive parameter value is near to one, and the number of observations is relatively small, were used. The preliminary data analysis using the Arellano-Bond estimator gave sufficient reasons for employing the improved estimator. By using the Arellano-Bond estimator the values of the lagged dependent variables were below 0.15 at worst. However, the specificities of the models in which the dependent variables were the first differences (absolute changes – Δ) of selected financial indicators, and where lagged absolute values of the same variables were used as independent variables, ask for an additional analysis if the estimated parameters of the aforementioned independent variables are high. Additional analysis can be obtained by dropping the variable from the model or by employing the Blundell-Bond estimator when there is large number of groups. Thus, from this point forward, only the Blundell-Bond estimations of the econometric model will be presented. The model's quality is evaluated using the tests which are usually applied in the dynamic panel analysis likewise Sargan's test as well as autocorrelation tests. The data were analysed in the statistical package STATA 12.

The dynamic panel model for the selected variables is given with the following equation:

$$y_{it} = \mu + \gamma \cdot y_{i,t-1} + \beta_1 \cdot x_{it1} + \beta_2 \cdot x_{it2} + ... + \beta_K \cdot x_{itK} + \alpha_i + \varepsilon_{it},\ i = 1,... N,\ t = 1,... T \quad (4)$$

where i denotes an individual and t denotes time, μ is an intercept, γ is a parameter of the lagged dependent variable, $\beta_1, \beta_2, ..., \beta_K$ are the parameters of the exogenous variables, x_{it} are independent variables, α_i is an individual-specific effect and ε_{it} the error term.

The basic dynamic panel model on the dependence of changes in the banks' capital buffers upon endogenous aspects has the following form:

$$\begin{aligned} \Delta ABBUFF_{it} = {} & \mu + \gamma \cdot \Delta ABBUFF_{i,t-1} + \beta_1 \cdot \Delta NPL\_L_{it1} + \beta_2 \cdot ROA_{it2} \\ & + \beta_3 \cdot ABBUFF_{i,(t-1)3} + \beta_4 \cdot GROWL_{it4} + \beta_5 \cdot LLR\_L_{it5} + \alpha_i + \varepsilon_{it}, \\ & i = 1,... N,\ t = 1,... T \end{aligned} \quad (5)$$

The exogenous aspects of the macroeconomic variables influence are approximated with the dummy variables and various interaction terms. Namely, due to the small number of groups and observations for certain countries, the traditional use of the GDP growth rate and other macroeconomic variables was not an advisable solution.

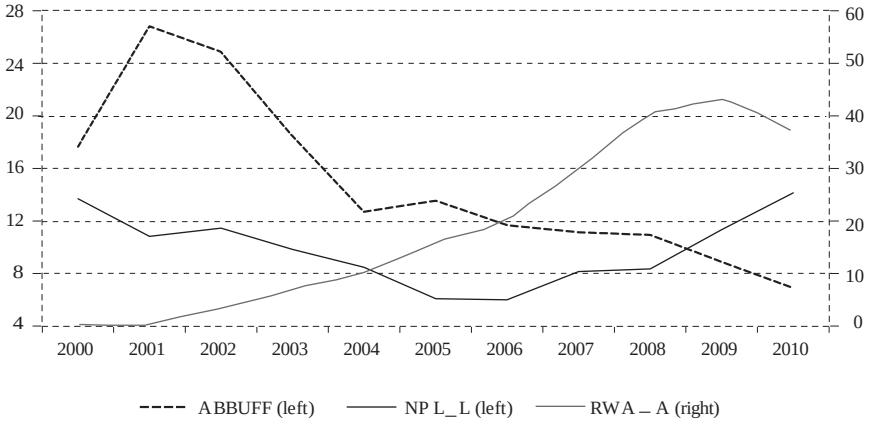
3.2 RESULTS OF EMPIRICAL RESEARCH

The descriptive data of the selected model variables precede the estimations of the econometric models. The mean value of the capital buffers (absolute level) has continuously decreased since the year 2001 (figure 1). This might lead to the conclusion that the South-Eastern European banks have used their capital buffers, i.e. that they have increased the volume of risk-weighted assets more than they have built up their regulatory

capital. Namely, when looking at the figure it is clear that the mean value of the ratio of risk-weighted assets to total assets was continuously on the increase until the year 2009, after which it started to decline. Besides, in certain countries minimally prescribed capital adequacy ratios increased, which serves as an additional explanation of tendencies for the capital buffers to decrease. In the year 2001 the mean value of the capitalization for the data-sample banks was 27 percentage points higher than the minimally prescribed value, while in the year 2010 the equivalent figure was less than 7 percentage points.

FIGURE 1

The mean values of capital buffers (ABBUFF), the ratio of non-performing loans (NPL_L) and the ratio of risk-weighted assets to total assets (RWA_A)



Source: Bankscope.

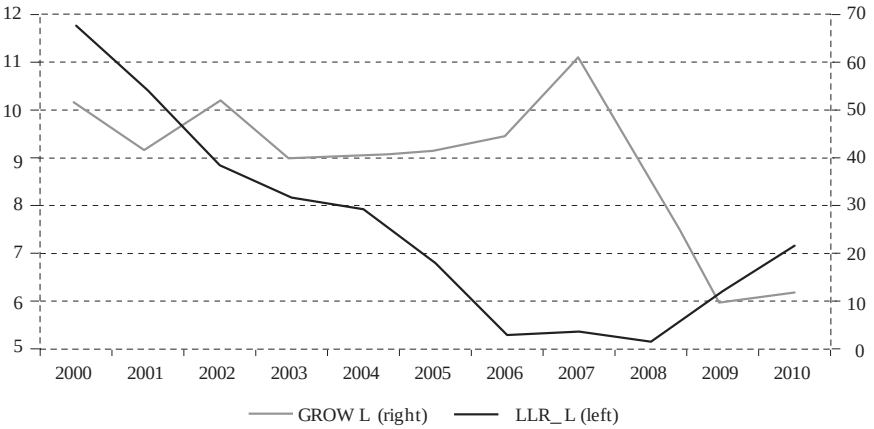
According to the figure 1 a conclusion on the cyclical movement of the ratio of non-performing loans can be made. A quality improvement of the credit portfolio of the data sample banks is evident after the year 2002, what represents the first considerable effects of liberalization and almost completed ownership transformation of the banking sectors of the data-sample countries. A quality of credit receivables is getting worse in the last two observed years and reaches the mean value of 14%, as it was in the year 2000. The lowest mean value of the non-performing loans to total loans was below 6% what was recorded in the years 2005 and 2006. When looking at the figure it is clear that there is cyclicality in the movement of capital buffers and in the variable which approximates a credit risk as the potential key bank-specific determinant of capital buffer.

The ratio of loan loss reserves continuously falls down over the period 2000-2006 from the level slightly lower than 12% to the level of about 5% (figure 2). The reserves were stagnating, from 2006 to 2008 and in the last two observed years they rose up to the level of about 7%. These movements correspond to the impaired loans movements. The fact on the most of the bad loans being originated in good times makes the credit growth rates interesting for an observation. It is evident that the credit portfolio of the data sample banks was on average increasing a more than 40% annually until 2008, while in the last observed year it

is on the level of just 10%. Although on the descriptive level, the aforementioned confirms the thesis on the credit activity "freezing" or the so called credit crunch as a radical form of the credit rationing process in the presence of the global financial crisis, and in the South-Eastern European area the shift towards negative economic tendencies with a stronghold in the serious structural problems. With reference to profitability (figure 3) it is observable that the mean value of the return on assets for the data-sample banks was higher than 0.5% until 2008, while from 2009 onwards that indicator is being zero or has a negative value.

FIGURE 2

The mean values of the ratio of loan loss reserves (LLR_L) and the credit growth (GROWL)



Source: Bankscope.

FIGURE 3

The mean value of the return on assets (ROA)

Source: Bankscope.

TABLE 4

Panel data estimation of developed model with changes in capital buffers as dependent variable

Explanatory variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$\Delta ABBUFF_{i,t-1}$	-0.1139*** (0.0148)	-0.1137*** (0.0149)	-0.1253*** (0.0162)	-0.1139*** (0.0148)	-0.1132*** (0.0168)	-0.1206*** (0.0161)
ΔNPL_L_{it}	0.0210** (0.0105)	0.0229** (0.0098)	0.0242** (0.0109)	0.0210** (0.0105)	0.0221** (0.0095)	0.0253** (0.0122)
ROA_{it}	1.1334*** (0.1537)	1.0745*** (0.1494)	1.1108*** (0.1652)	1.1333*** (0.1537)	1.1102*** (0.1469)	1.1727*** (0.1706)
$ABBUFF_{i,t-1}$	-0.4028*** (0.0175)	-0.3972*** (0.0176)	-0.3889*** (0.0165)	-0.4028*** (0.0175)	-0.3970*** (0.0168)	-0.3907*** (0.0168)
$GROWL_{it}$	-0.0640*** (0.0072)	-0.0630*** (0.0067)	-0.0545*** (0.0046)	-0.0640*** (0.0072)	-0.0635*** (0.0061)	-0.0572*** (0.0054)
LLR_L_{it}	0.5782*** (0.0545)	0.5673*** (0.0544)	0.5820*** (0.0539)	0.5782*** (0.0550)	0.5780*** (0.0554)	0.5693*** (0.0548)
dy2007	0.9903*** (0.2321)	0.9608*** (0.2300)	–	–	–	–
$dydevBUFLow_{it}$	–	-1.8682*** (0.6899)	–	–	–	–
$dydevBUFLow_{it}$ * *dy2008*	–	–	-3.4941*** (0.5903)	–	–	–
$dydevBUFWell_{it}$ * *dy2007*	–	–	–	0.9903*** (0.2321)	–	–
$LOWCA_{it}$ * *dy2007*	–	–	–	–	1.4592*** (0.2649)	–
$LOWCA_{it}$ * *dyREC*	–	–	–	–	–	-0.5561** (0.2559)
α	-0.8738*** (0.2589)	-0.7972*** (0.2554)	-1.0133*** (0.2675)	-0.8738*** (0.2589)	-0.9019*** (0.2807)	-0.7823*** (0.2839)
No. of observations	266	266	266	266	266	266
No. of banks	88	88	88	88	88	88
Sargan test (p-value)	0.1063	0.0913	0.1105	0.1063	0.0986	0.1107
First-order autocorrelation (p-value)	0.0164	0.0207	0.0210	0.0164	0.0136	0.0144
Second-order autocorrelation (p-value)	0.6785	0.6655	0.5902	0.6785	0.7594	0.4495

**** Statistically significant at 1% level, ** statistically significant at 5% level, * statistically significant at 10% level.*

Source: Author's calculation.

TABLE 5

Panel data estimation of developed model with changes in capital buffers as dependent variable

Explanatory variables	Model 7	Model 8	Model 9
$\Delta ABBUFF_{i,t-1}$	-0.1219***	-0.1347***	-0.1107***
	(0.0161)	(0.0160)	(0.0211)
ΔNPL_L_{it}	0.0242**	0.0316***	0.0200**
	(0.0109)	(0.0118)	(0.0095)
ROA_{it}	1.0898***	1.0551***	0.9977***
	(0.1657)	(0.1627)	(0.1641)
$ABBUFF_{it-1}$	-0.3874***	-0.3600***	–
	(0.0166)	(0.0175)	
$GROWL_{it}$	-0.0545***	-0.0649***	-0.0501***
	(0.0047)	(0.0067)	(0.0036)
LLR_L_{it}	0.5706***	0.5196***	0.5423***
	(0.0538)	(0.0498)	(0.0716)
$dydevBUFLow_{it} * dyREC$	-1.9806***	–	–
	(0.8179)		
$dydevBUFWell_{it} * dyREC * ABBUFF_{i,t-1}$	–	-0.1159***	–
		(0.0222)	
$dydevBUFWell_{it} * dyEXP * ABBUFF_{i,t-1}$	–	–	-0.0952***
			(0.0145)
α	-0.9113***	-0.2440	-2.6632***
	(0.2680)	(0.2857)	(0.4114)
No. of observations	266	266	266
No. of banks	88	88	88
Sargan test (p-value)	0.0966	0.0925	0.3385
First-order autocorrelation (p-value)	0.0182	0.0716	0.0040
Second-order autocorrelation (p-value)	0.4980	0.3948	0.1426

**** Statistically significant at 1% level, ** statistically significant at 5% level, * statistically significant at 10% level.*

Source: Author's calculation.

In the empirical estimation of the exogenous determinants of the cyclicality of the capital buffers, already specified the basic model has been supplemented with the dummy variables and various interaction terms which reflect the economic environment. As the years 2007 and 2008 are perceived to be the breaking points between the periods of the financial and economic stability and distress in the financial system functionality as well as indicating a shift towards economic downturn (as evident from the previous figures), the models have been supplemented with dummy variables for the years 2007 and 2008. Apart from that, the dummy variables that represent the periods of recession and expansion were used in the following way: positive GDP percentage changes stand for an expansionary period, while negative percentage changes denote a period of recession. With reference to this, and taking into consideration the empirical background, annual GDP growth and annual GDP decrease proxy the periods of expansion and recession in this paper, while

in practice it is common to use two successive annual (percentage) GDP changes in order to reach a conclusion of whether an expansion or a recession is involved.

The empirical results of the estimated models with the changes in the capital buffers set out as a dependent variable obtained with the Blundell-Bond estimator are presented in the tables 4 and 5. From the correlation matrices given in the appendix it is clear that independent variables are not strongly correlated, except for some interaction variables, which are thus not simultaneously included in the model. In the model, which contains *dy2007*, the appearance of the variable $dydevBUFWell_{it}$ instead of $dydevBUFLow_{it}$ does not cause a sizeable deviation in results. Namely, the difference is visible in the sign of estimated parameter of this variable which becomes a positive one, while the constant term has a somewhat lower-estimated parameter and is statistically insignificant. Analysis shows that well-capitalized banks dominate within the sample, due to the results of the model with $dydevBUFWell_{it}$ * *dy2007* and of the model with *dy2007* being almost equal. Besides the presented models, models with other possible combinations of interaction terms were estimated, but those results are not presented here, as those variables which were assumed to improve the basic model were statistically insignificant. In addition, estimations of the data subsamples in which the economic cycle, i.e. the existence of expansion or recession was the criterion variable for the data subsampling were made. The results of the latter approach are given in the appendix (table A3).

3.3. INTERPRETATION AND DISCUSSION OF RESEARCH RESULTS

The lagged dependent variable $\Delta ABBUFF_{i,t-1}$, lagged value of capital buffers $ABBUFF_{i,t-1}$ and credit growth $GROWL_{it}$ are in a negative relationship with the changes in capital buffers, while the changes in the non-performing loans ΔNPL_L_{it}, the return on assets ROA_{it} and the ratio of loan loss reserves LLR_L_{it} have a positive sign of the estimated parameters. From figure 1, which shows the movement of the capital buffers volume in the observed period, a negative sign of the lagged dependent variable was somewhat expected: since the year 2002 onwards, a continuous decrease in the mean value of capital buffers was recorded. Analogously to this, the empirical estimation results confirmed that the lagged variable $ABBUFF_{i,t-1}$ has a statistical significance and that the estimated parameter has a negative sign. The conclusion can be made that the growth of capital buffers in one period will have a negative impact on the capital buffers in the following period, i.e. the growth of capital buffers in one period leads to a decrease in the capital buffers in the following period and *vice versa*. This might be a consequence of the risk-weighted assets being increased and/or an increase in the minimally prescribed capital adequacy ratio, which occurred in certain South-Eastern European countries in the observed period (Bosnia and Herzegovina, Croatia and Serbia).

All models report a positive influence of the changes in non-performing loans ΔNPL_L_{it} on the changes in capital buffers, which might be interpreted in the following way: with an increase in the credit portfolio riskiness, banks increase capital buffers and *vice versa*. The mean value of capital buffers was continuously falling in the observed period, while the mean value of non-performing loans decreased in the first five years. Since the year

2008 this has exponentially increased up to the level of the mean value from the beginning of the observed period (figure 1). Thus, according to the graphical presentation, no conclusion that an increase in the riskiness of assets caused an increase in the capital buffers can be made. On the contrary, a decrease in the riskiness of assets contributed to a reduction in capital buffers. In addition, subsamples analysis (table A3 in the appendix) reveals that in the period of economic expansion there is no significant linkage between the changes in the non-performing loans and the changes in capital buffers, while in the recessionary period there is a certain level of significance. Bank profitability measured by return on assets ROA_{it} positively drives the changes in the bank capital buffers. The higher the return on assets, the higher the capital buffers and *vice versa*, a decrease in bank profitability reduces the capital buffers, which is logical if the bank regulatory capital structure is borne in mind. These tendencies are even more noticeable during economic expansion than in recession, and the estimated parameters from the table A3 in the appendix clearly serve as a proof.

In the presented estimations, the sign of the estimated parameter of the lagged value of capital buffers $ABBUFF_{i,t-1}$ is negative and significant. During the whole period the mean value of capital buffers was 12.22, i.e. the banks had capital adequacy that was 12.22 percentage points on average higher than that minimally prescribed. Thus, a gradual "spending" of the capital surplus is expected. The aforementioned confirms the practice of having periods of capital accumulation and periods of capital "consumption". For the observed data set the accumulation of capital above that regulatorily required occurred in the years 2001 and 2002 or even earlier, and after that the process of capital spending, i.e. a decrease in the capital buffers took place. Thus the value of capital buffers was "only" 6.88708 percentage points on average at the end of 2010. Finally, it can be concluded that banks with higher initial capital buffers endeavour to maintain these levels, while the banks with the lower capital buffers tend to build up their levels of regulatory capital, which adds up to an empirical verification of the capital buffer theory.

The ratio of loan loss reserves LLR_L_{it} has a positive sign, which implies that an increase/decrease of reserves leads to an increase/decrease of capital buffers. This relationship is partly explainable by the fact that reserves, in a certain measure, contribute to a buildup process of regulatory capital (directly throughout the special reserves for unidentified losses in the supplementary capital I). Nevertheless, most of the loan loss reserves are the reserves for identified losses, whose costs are a deductible item in the income statement, and thus, indirectly, through their influence on profit, contribute to the regulatory capital variations. Therefore, an alternative interpretation is possible. The figure on the mean value of the ratio of loan loss reserves shows a long period of the ratio being decreased, together with the continuous fall of the capital buffers (figure 2). That is, a radical decline in the ratio of loan loss reserves is partially an outcome of the so called process of "cleaning" the credit portfolios of bad debt (i.e. exclusion of the bad debt from the banks' balance sheets) which happened in the years of the observed banking sectors' restructuration and rehabilitation (in the years 2000 and 2001). With reference to this, the average value of the ratio of net charge-off of loans to total loans was 16% in 2000; it was below 2% in 2001,

after which it remained at the same or a somewhat lower level. At the same time, after a sizeable growth of the capital buffers (in the first two observed years), a long period in their decline followed. Thus, in a period of a small frequency of the occurrence of risk events (loans charge-offs, costs recognition and value adjustments of reserves, due to an increase in non-performing loans), banks reduce their capital buffers, aimed at diminishing the effects of the unexpected losses. By taking into consideration a synchronization of the variables of the non-performing loans and the loan loss reserves as well as the appearance of a credit expansion in the period of their decrease (from 2001-2007), and on the contrary the appearance of the credit crunch in the period of their increase (from 2007-2010), a conclusion on the banks' perceptions of credit risk and the pro-cyclicality of their credit activity can be made. Thus, a decline in the banks' capital buffers is the consequence of a long period of expansive credit policies on the part of the banks, which are connected to their perceptions of reduced credit risks and the occurrence of risk events, and which are altogether reflected in their provisioning policies and loans classifications into groups according to their quality.

Obviously, the changes (to be more precise, the droop in the observed data set) in the banks' capital buffers can be explained in various ways. Besides the aforementioned factors, like a decrease in profitability or recorded losses, an increase in the risk-weighted assets as well as the minimally prescribed capital adequacy ratio, there is also the reason of the growth of loans. Empirical findings confirmed that the growth of loans $GROWL_{it}$ leads to a decrease in the capital buffers, due to an increase in the banks' exposures, i.e. the volume of the risk-weighted assets when there is a speed-up in credit growth. Furthermore, the size of the banks' capital buffers may vary due to the changes in the structure of exposures. A threat from the so called cosmetic adjustments of the capital adequacy ratio (i.e. the unchanged regulatory capital) or even from the false impressions of an increase in the capital buffers, due to loans being made to economic agents with lower risk-weights in crisis episodes, requires additional attention when the dynamics of the capital buffers movements are being explained. Namely, the maintenance of capital buffers at a certain level, besides by an increase in the regulatory capital, might be driven by the following factors: a decrease in the risk-weighted assets, a credit "freezing" process, continuity of recording profits and their reinvestment as well as by raising the minimally prescribed capital adequacy ratio. Thus, in the banking sectors that experienced periods of extremely large recapitalizations (e.g. the large banks in Croatia after an introduction of the marginal obligatory reserve) it is realistic to expect a further decrease in the capital buffers. Nevertheless, the credit crunch caused by the accumulated structural problems of the observed economies contributed to the capital buffers being enlarged in the recession period.

The year 2007 positively influenced the changes in the capital buffers. Until 2007 capital buffers were, on average, trending down on a yearly basis. A slowdown in the credit growth that took place after the year 2007 as well as a slowdown in the growth of risk-weighted assets, due to the shift in lending activity favouring economic agents whose debt is assigned lower risk weights (e.g. the governmental sector), explain the tendency for there to be slower usage of (or smaller changes in) the capital buffers. The variable of

the regulatory pressures for an increase in capital is proxied by the two types of dummy variables that are interchangeably employed in the models, as well as the interaction terms which contain those dummy variables. The first approximation is set out in form of the banks with a lower or a higher capitalization in comparison to the minimally prescribed capital adequacy ratios for the country (*dydevBUFLow* and *dydevBUFWell*). The second one differentiates banks with a lower or a higher equity to assets ratio in comparison to a mean value of a certain banking sector in which the bank operates (*LOWCA* and *WELLCA*). Most of the banks from the South-Eastern European area were well-capitalized, which is supported by the fact of the sizeable capital buffers. That caused a number of options for a definition and analysis of the regulatory pressure impact as being rather small. Thus, the methodology that is regularly applied in the empirical background is borrowed in this paper. With reference to this, banks with a capitalization that is lower than or equal to that which is regulatorily required are treated as the banks under regulatory pressures, while banks that according to that criterion were well-capitalized were banks without regulatory pressures. Although this logic may be absolutely justified soon after the capital requirements standard was put into effect, when there was a substantial number of undercapitalized banks, a familiarity with the characteristics of banking sectors of the observed countries serves as a support for the conclusion that weakly capitalized banks are usually large banks or those that are "too big to fail", while the banks with extremely high capitalization are usually small-sized banks (for which there was a poor data continuity in the available financial indicators), which do not serve prime customers, but most often riskier clients. However, that knowledge might contribute to the economic interpretation of the research findings. As was earlier pointed out, there were more well-capitalized banks (*dydevBUFWell*) than weakly capitalized banks (*dydevBUFLow*) in the data set, when the benchmark is the minimally prescribed capital adequacy ratio. In the case of the second dummy variables group (*LOWCA* and *WELLCA*) the differences between the subsamples' size with reference to capitalization were not so remarkable. The obtained results confirm that the banks which are assumed to be under the regulatory pressure (*dydevBUFLow*) had a greater drop in the capital buffers. A literal and isolated approach would lead to a conclusion that bank capital requirements regulation did not add to the banks' capitalization, i.e. that it did not fulfill its purpose. On the other hand, if there is an understanding that accumulation and consumption of capital are carried out in phases or cycles, and that in the observed data sample a decreasing trend in the capital buffers was recorded, then the obtained results are expected. If lower capitalization is linked to the larger banks, the estimated direction of influence is even clearer. This implies the following conclusion: the weakly capitalized banks at least maintained a certain capitalization level, as the volume of loans and the risk-weighted assets was continuously increasing during the observed period. Thus, capital adequacy regulation is not irrelevant, as might be concluded from the research results. Furthermore, the weakly capitalized banks could be perceived as the most efficient ones in terms of the cost of capital, as they keep the required capitalization at the minimum level, as do those whose market position obviously ensures them fast and successful recapitalization if necessary in periods of economic expansion, which is in contrast to the understanding that those banks are under regulatory pressures. Thus, higher bank capital buffers may not necessarily have positive connotations, if riskier operations

and volatile secondary financial funds of the small-sized banks are borne in mind, which altogether has to be compensated with substantial capital surpluses.

Using the interaction terms $LOWCA_{it} * dyREC$ and $dydevBUFLow_{it} * dyREC$ it is found out that the capital buffers of the weakly capitalized banks decrease in the recession period. This is additionally confirmed for well-capitalized banks ($dydevBUFWell_{it} * dyREC * ABBUFF_{i,t-1}$). A particularly negative influence on the changes in capital buffers was recorded in the year 2008 (variable $dydevBUFLow_{it} * dy2008$). On the other hand, well-capitalized banks, which dominate the sample, in the expansion periods reduce their capital buffers ($dydevBUFWell_{it} * dyEXP * ABBUFF_{i,t-1}$). To sum up, it might be concluded that at the data set level, capital buffers are continuously trending downwards, which is driven not only by the banks' specificities, but also by the general economic conditions.

4 CONCLUSION

The initial introduction of capital requirements was followed by a radical decrease in the aggregate credit level, and thus the problem of the capital requirements pro-cyclicality was heavily exploited and empirically examined in the 1990s. Nevertheless, when it is learned that the changes in the aggregate volume of loans could be also explained by some other effects, apart from the effect of regulatory restrictions, the cyclicality of the capital requirements begins to be more at the focus of research. Requirements for the better capitalization of banks regularly occur in periods of economic distress. In such times, the volume of the partially collectable and non-performing loans increase and with the drop in banks' credit and investment activity, their profitability declines. In the aforementioned circumstances, credit and market risks enlarge, recapitalizations are less available, while deposits stagnate or in an even worse case they decline. All this leads to credit and, most often, equity rationing as well as fire sales of securities portfolios. In that case, the volume of the "free" regulatory capital or the capital buffers may neutralize any impairment of the key elements of the banking stability. Thus, it is rather important empirically to identify what drives the volume of the banks' capital buffers. The discovery that there has been no empirical research into the determinants of changes in the capital buffers of South-Eastern European banks inspired this research.

Empirical research into South-Eastern Europe confirmed that there is a certain amount of evidence for the cyclicality of changes in the capital buffers, which is an outcome of the financial characteristics of the observed banks, as well as the economic environment. In periods of economic expansion, banks increase their capital the most often as a consequence of market pressures and their appetites for risk taking, while in economic downturns or crisis periods, banks usually have to increase their capital due to the regulatory pressures. Meanwhile, the risk undertaken in the previous periods is already significantly being materialized. The research into South-Eastern Europe reveals that the changes in the level of the credit risks taken, as well as an increase in the profitability and the loan loss reserves, positively determine changes in the banks' capital buffers, while the initial levels of capital buffers and credit growth negatively drive the changes in ca-

pital buffers. Furthermore, the capital buffers increase in only certain years of economic expansion, while during the recession they tend to decrease continuously. Although the applied methodology is not completely comparable to the earlier empirical estimations in the part of an approximation of the economic cycle, the conclusion can be made that the obtained results are comparable to the empirical background. Notwithstanding the initial capitalization level, banks mainly reduced their capital buffers over the observed period. Thus, an affirmation of the counter-cyclical capital buffers seems to be an adequate direction in the capital adequacy standard development. Nevertheless, a question can be asked as to the repercussions from the implementation of counter-cyclical capital buffers, as well as from the changes of the regulatory capital structure towards a higher share of the Tier 1 capital. Namely, the cost of capital is an integral part in loan pricing, and thus it remains questionable what the implications of the mentioned regulatory restrictions will be in addition to those from the selected or regulatory required capital buffers to the risk and return of banks with a time lag. The importance of getting an empirical answer to this question for South-Eastern European countries is additionally supported by the high risk premiums of the observed countries, which enlarge the cost of capital and other financing sources of banks in the crisis periods[1]. Thus, there is a great challenge for the prudential authorities in their attempts to maintain the banking sectors' stability, which can be summarized in the following: with the discussed regulatory changes, they must not encourage banks to adjustments in their operations such as to reveal the counter-effectiveness of the regulatory actions in the long-term.

[1] Examinations show that the risk-free rate (which reflects the country risk premium) in the estimations of the cost of equity capital, using the CAPM model, represents up to 1/3 of the overall cost of the bank equity capital (e.g. King, 2009).

APPENDIX

TABLE A1

Distribution of banks by countries in the selected data sample

Country	Number of banks (N=88)
Croatia	15
Romania	13
Bulgaria	12
Greece	12
Slovenia	11
Serbia	7
Macedonia	7
Bosnia and Herzegovina	7
Albania	4

Source: Author's presentation.

TABLE A2

Required regulatory minimum in the capital adequacy ratio in the South-Eastern European countries in observed years

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Albania	12	12	12	12	12	12	12	12	12	12	12
Bosnia and Herzegovina	10	10	10	12	12	12	12	12	12	12	12
Bulgaria	12	12	12	12	12	12	12	12	12	12	12
Greece	8	8	8	8	8	8	8	8	8	8	8
Croatia	10	10	10	10	10	10	10	10	10	10	12
Macedonia	8	8	8	8	8	8	8	8	8	8	8
Romania	12	12	12	12	12	12	12	8	8	10	10
Serbia		8	8	8	8	10	12	12	12	12	12
Slovenia	8	8	8	8	8	8	8	8	8	8	8

Source: Official websites of central banks across countries (various publications and decisions), ECB, annual publication Transition report in the period from 2000-2010, Wisniwski (2005), Barisitz and Gardó (2008), Jokipii and Milne (2008), Athanasoglou (2011).

PRINT OUT A1

From STATA 12: Correlation matrix

```
. correlate deltaABBUFF deltaNPL_L ROA lagABBUFF GROWL LLR_L dy2007 dydevBUFLow BUFLow_dy2008 BUFWell_dy2007 LOWCA_dy2007 LOWCA_dyREC BUFLow_dyREC BUFWell
> _dyEXP_lagABBUFF
(obs=341)
```

	deltaA~F	deltaN~L	ROA	lagABB~F	GROWL	LLR_L	dy2007	dydevB~w	BUF~2008	BUF~2007	LOW~2007	LOWCA_~C	BUFLow~C	B~REC_~F	B~EXP_~F
deltaABBUFF	1.0000														
deltaNPL_L	0.0572	1.0000													
ROA	0.1819	-0.1516	1.0000												
lagABBUFF	-0.4745	-0.0799	-0.0464	1.0000											
GROWL	-0.3953	-0.1655	0.0939	0.1417	1.0000										
LLR_L	-0.0160	0.0838	-0.0318	0.1703	-0.1584	1.0000									
dy2007	-0.0660	-0.0986	0.1252	0.0371	0.3881	-0.1344	1.0000								
dydevBUFLow	-0.0348	0.0376	-0.1117	-0.0756	-0.0493	-0.0030	-0.0445	1.0000							
BUFLow_~2008	-0.0344	-0.0124	-0.0436	-0.0504	-0.0145	-0.0159	-0.0280	0.6297	1.0000						
BUFWell~2007	-0.0660	-0.0986	0.1252	0.0371	0.3881	-0.1344	1.0000	-0.0445	-0.0280	1.0000					
LOWCA_dy2007	0.0016	-0.0612	0.0598	-0.0684	0.2198	-0.0816	0.7027	-0.0312	-0.0197	0.7027	1.0000				
LOWCA_dyREC	0.0892	0.1314	-0.1887	-0.1970	-0.1987	-0.0237	-0.1684	0.1999	0.0654	-0.1684	-0.1184	1.0000			
BUFLow_dyREC	-0.0339	0.0478	-0.1289	-0.0683	-0.0448	0.0059	-0.0397	0.8931	0.3483	-0.0397	-0.0279	0.2358	1.0000		
B~REC_lagA~F	-0.1554	0.0355	-0.1733	0.3504	-0.1483	0.0751	-0.1343	-0.0449	-0.0283	-0.1343	-0.0944	0.0909	-0.0401	1.0000	
B~EXP_lagA~F	-0.4054	-0.1044	0.0525	0.8433	0.2338	0.1347	0.1165	-0.0688	-0.0433	0.1165	-0.0167	-0.2605	-0.0614	-0.2077	1.0000

Source: Author's calculation.

PRINT OUT A2

From STATA 12: Correlation matrix (statistically significant at the 5% level)

```
. pwcorr deltaABBUFF deltaNPL_L ROA lagABBUFF GROWL LLR_L dy2007 dydevBUFLow BUFLow_dy2008 BUFWell_dy2007 LOWCA_dy2007 LOWCA_dyREC BUFLow_dyREC BUFWell_dyREC
> EXP_lagABBUFF, star(5)
```

	deltaA~F	deltaN~L	ROA	lagABB~F	GROWL	LLR_L	dy2007
deltaABBUFF	1.0000						
deltaNPL_L	0.0595	1.0000					
ROA	0.0968*	-0.1529*	1.0000				
lagABBUFF	-0.7010*	-0.0903	-0.0575	1.0000			
GROWL	-0.3680*	-0.1661*	-0.0299	0.2192*	1.0000		
LLR_L	0.0648	0.0400	-0.1524*	0.0343	-0.1673*	1.0000	
dy2007	0.0025	-0.0556	0.0250	-0.0089	0.1352*	-0.0716*	1.0000
dydevBUFLow	-0.0187	0.0162	-0.0789*	-0.0553	-0.0459	0.1241*	-0.0228
BUFLow_~2008	-0.0016	-0.0105	-0.0216	-0.0295	-0.0162	-0.0138	-0.0200
BUFWell~2007	0.0025	-0.0996	0.0764*	-0.0147	0.2117*	-0.0577	0.9948*
LOWCA_dy2007	0.0128	-0.0203	0.0180	-0.0699	0.0996*	-0.0900*	0.6585*
LOWCA_dyREC	0.0565	0.1687*	-0.0744*	-0.1454*	-0.1381*	-0.0184	-0.1037*
BUFLow_dyREC	-0.0119	0.0496	-0.1163*	-0.0493	-0.0573	0.0401	-0.0347
B~REC_lagA~F	-0.2319*	0.0361	-0.2385*	0.3956*	-0.0945*	0.1404*	-0.0771
B~EXP_lagA~F	-0.6339*	-0.1083*	0.0497	0.8715*	0.2987*	-0.0035	0.0261

	dydevB~w	BUF~2008	BUF~2007	LOW~2007	LOWCA_~C	BUFLow~C	B~REC_~F
dydevBUFLow	1.0000						
BUFLow_~2008	0.3895*	1.0000					
BUFWell~2007	-0.0510	-0.0199	1.0000				
LOWCA_dy2007	0.0065	-0.0131	0.6425*	1.0000			
LOWCA_dyREC	0.1447*	0.0625	-0.1395*	-0.0683*	1.0000		
BUFLow_dyREC	0.6764*	0.2858*	-0.0345	-0.0227	0.2474*	1.0000	
B~REC_lagA~F	-0.0268	-0.0119	-0.0771	-0.0520	0.0623	-0.0207	1.0000
B~EXP_lagA~F	-0.0634	-0.0282	0.0261	-0.0503	-0.1904*	-0.0489	-0.1051*

	B~EXP_~F
B~EXP_lagA~F	1.0000

Source: Author's calculation.

TABLE A3

Subsamples results when economic trend is criterion variable for the data subsampling (REC is for recession, EXP is for expansion)

Explanatory variables	REC=1	EXP=1
$\Delta ABBUFF_{i,t-1}$	-0.1191***	-0.1720***
	(0.0404)	(0.0230)
ΔNPL_L_{it}	0.0286**	0.0091
	(0.0141)	(0.0192)
ROA_{it}	0.3983**	1.7256***
	(0.1844)	(0.2373)
$ABBUFF_{i,t-1}$	-0.6724***	-0.3400***
	(0.1016)	(0.0154)
$GROWL_{it}$	-0.0273**	-0.0441***
	(0.0134)	(0.0073)
LLR_L_{it}	0.5085***	0.4982***
	(0.1302)	(0.0602)
α	0.9302	-1.8949***
	(0.8258)	(0.3477)
Number of observations	105	161
Number of banks	75	73
Sargan test (p-value)	0.4817	0.4817
First-order autocorrelation (p-value)	0.0658	0.0658
Second-order autocorrelation (p-value)	0.9297	0.9297

**** Statistically significant at 1% level, ** statistically significant at 5% level, * statistically significant at 10% level.*

Source: Author's calculation.

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