# What Determines the Price to Book Ratio in the European Banking Sector*

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*Abstract*

*The main research objective of the paper is to find the determinants of the price to book ratios in the European banking sector. Since the outbreak of the last global financial crisis, the price to book ratios of most European banks have remained unexpectedly low as a consequence of the macroeconomic environment, regulatory measures and banks' business model structures. The dynamic panel analyses is done on the sample of 23 European Union largest public quoted banks for 2002-2017 period. The empirical evidence shows that the price to book ratios of European banks is directly related to the macroeconomic environment and prudential measures, but there are significant differences at individual bank level in terms of activity structure and business performance indicators. The results of the paper are used as a basis for recommendations on management objectives enhancing the value of banking firms, as well as promoting a regulatory dialogue on optimizing a prudential framework structure.*

## 1. Introduction

In the post crisis period, the financial markets reduced the market value of European banks as a result of macroeconomic, regulatory and structural changes in the banking industry. The P/B ratio (*price to book ratio*)[1] of European banks fell and reflected the market concerns about banks' health and profitability, requesting a shift in banks' business models (Bogdanova et.al, 2018). The P/B ratio is significant information when taking investment decisions. The P/B ratio indicates the firm's capability to achieve income efficiency and growth capacities of a going concern business (Penman, 1996). The P/B ratio is defined as the ratio of the firm's market value and the accounting value of its equity. A high P/B ratio indicates a high efficiency of investment in equity (Fairfield, 1994) and shows expected future market profitability over the current profitability per share. The P/B ratio indicates the intrinsic value of a banking firm, which springs from the bank core product and services to stable client base.
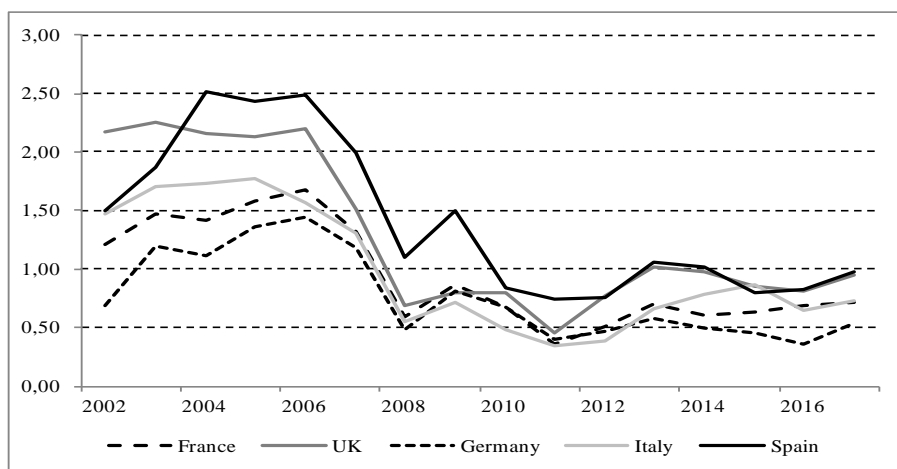
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[1] The P/B ratio is a common abbreviation for the price to book ratio and is used in the same sense in the text.

The decrease in the market value of banking firms, including the P/B ratio, is related to the regulatory changes during the financial crisis period and the controlling of the bank risk activities followed by regulatory capital requirements (Chousakos and Gorton, 2017). The structural changes in the banking sector, in the pre-crisis period, made the banking industry extremely complex, globally present, and dependent on the financial market development. Banks with lower dependence on standard loan and deposit activities have been more exposed to the financial crisis, which indicates a strong relation between the bank business model and the bank risk profile (Ercegovac et. al., 2019). The basic research hypothesis is that the P/B ratio of a banking firm is determined by the individual bank's performance indicators, movements in macroeconomic indicators (Calomiris and Nissim, 2014), and the regulatory measures which shape the framework of business activities of banking firms and have an impact on future earning potentials.

The collapse of the P/B ratio values in the banking industry has been caused by the global financial crisis and the breakdown of financial markets, and its recovery opportunities, have been limited by the strong regulatory framework reducing the banking sector's earning opportunities and bank assets growth (Bank for International Settlements, 2011). The average P/B ratio for leading EU banking sectors is presented in Figure 1. The same figure indicates that the values of the P/B ratio decreased during the financial crisis in most developed EU banking sectors without prospects of recovery to their pre-crisis levels.

**Figure 1 P/B Ratio in Leading EU Banking Sectors**



*Source:* Annual Reports (based on average data of banks with higher assets). Reuters and authors' calculation (2019).

The main contribution of the paper lies in the selection of a sample representing the overall European banking system, the quantification of the announcement risk measure and application of regulatory measures, and the selection of model variables identifying the asset structure and income of banking firms. Thus, our research contributes to a better understanding of the patterns of the banking industry's reactive behaviour under changing regulatory conditions, as well as a

better understanding of the same problem by policymakers and regulators themselves. Finally, the results of this research are certainly aimed at public investors, banking managements and regulatory bodies in the context of further regulatory alignment aimed at preserving financial stability as a public good.

The paper consists of six sections. The Introduction and Literature review are followed by Data selection and the empirical framework. The fourth section, Model, presents the rationale behind the choice of the dynamic panel model, whereas the fifth section, presents the research results. The final section gives conclusion remarks, implicates the major determinants of P/B ratio movements during the economy cycle, and emphasizes the necessity of structural change of the banking system within the new regulatory framework.

## 2. Literature Review

The relationship between market and book value has been the subject of vast number of theoretical and empirical literature, mostly in the context of capital markets development theories. Ohlson (1995) developed the value relevance theory and presented the model of share prices as a linear function of base accounting variables. Other theories have been based on expected future returns and firm value derived from the difference of book value and future expected earnings (Penman, 1998). Choi and Levich (1991) indicated that a timing difference exists between the performance of a firm and the stock price and that the estimated value is derived from investor's future benefits. Fairfield and Harris (1993) analysed the price to book value anomalies inside the firms in order to recognize their intrinsic value and strong deviation of market evaluation.

The costly external financing theory assumes that higher external financing costs are related to asymmetric information between market participants having a direct impact on the firm's capital structure decision (Baker and Wurgler, 2002). Welch (2004) defined the P/B ratio as one of the major parameters in capital structure definition where higher ratios cause lower external capital costs. Welch (2004) concluded that a firm can exploit a positive market valuation by decreasing the leverage ratio.

The trade-off theory explains that the intention of the firm is to keep an optimal capital structure by exploring the benefits of debt financing due to financial cost minimization. Firms with higher price to book value have higher growth opportunities due to the business' underinvestment position (Hovakimian et.al, 2001). Empirical examples show that P/B ratios are sensitive towards accounting parameters and are different between heterogeneous types of sectors. Barber and Lyon (1997) excluded banking firms, due to the high leverage ratio, from the analysis of the P/B values.

After the financial crisis, the P/B ratio of banking firms has come into focus of financial theoretical and empirical research. Bini and Penman (2013) analysed the P/B ratio between sectors in different regions and indicated the low value of P/B ratio of European banks. Bogdanova et. al. (2018) found that after the latest financial crisis and the implementation of new capital and liquidity regulatory requirements (BCBS, 2017), the P/B ratio of European banks remained low in comparison to the pre-crisis period. Ferretti et. al. (2018) regressed the European banks P/B ratio over the

performance measures and risk indicators. The fact is that European banks hold to comply with the new regulatory framework (Ercegovac, 2016), with a negative impact on business performance (Behn et. al., 2016) keeping the market value underestimated in comparison to the accounting value.

## 3. Data Selection and Empirical Framework

In this section, we examine the impact of the new regulatory capital requirements on the determinants of the P/B ratios in the banking industry on the EU financial market. The analysis is performed for 23 banking groups operating with end of year data in the period from 2002 to 2017, selected by asset size.

### 3.1 Research Sample

The sample in this research was formed pursuant to the data obtained from the Reuters database, with reference to the bank balance sheet data for each selected group as well as business indicators, forming a strongly balanced panel data set. The total share of observed bank groups in the total assets of credit institutions of the European Monetary Union (EMU) was approximately 68.0 percent at the end of 2017[2]. The total assets of the observed banks amounted to EUR 19,812,148 million, while the total assets of the EMU credit institutions amounted to EUR 29,209,456 million as of December 31, 2017.

In addition to the size of the assets and the significance a particular group has according to experiential knowledge, the public listing or the criterion of listed shares of an individual group of banks in the European Union capital markets was an additional basic criterion for the selection of a particular group in the observation sample. For additional verification of this criterion, the Orbis database (Bankscope) was used. According to the criterion of public quotation, the large regional development banks, that essentially do not operate according to market criteria, were omitted from the sample, although they are subject to the same banking regulation in question.

Thereby, a maximum relevance, unbiasedness and objectivity was secured during the statistical analysis, presentation of results, and finally in the making of the relevant judgments based on previous empirical processing. Data and associated indicators were collected from the consolidated annual reports of observed banking groups, published under International Financial Reporting Standards (IFRS)[3]. To make the subject research model less complex and to avoid analysing the effects of mergers and acquisitions on the dependent variable, the issues regarding mergers and acquisitions that are contained in the same consolidated reports for the period 2002 - 2017 were not considered relevant in this research problem. In conclusion, the selected banking firms are unquestionably taking the position of market makers on the single EU banking market. Although global banking groups generate revenue outside the EU as well, their dominant business activities take place in the EU economic area.

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[2] A selected sample of banks is shown in the Appendix, Table A1.

[3] Consolidated financial statements contain business information about all members of individual banking groups and thus avoid any possible error in estimating the size and share of individual observed banking firm parameter.

### 3.2 Description of Model Variables

Following on the research by Klinac and Ercegovac (2018), who used the same methodology, where the authors problematized the level of lending activity of the banking industry, as well as that on the EU banking system reactive action through announcement of the prudential regulatory framework (Klinac, 2019), the dependent variable of this survey is the P/B ratio. The P/B ratio is in direct relation with the market trends of banking shares and determines the financial market sentiment toward the intrinsic value of the banking industry as a whole. The description of all variables and the expected impact of independent variables are given in the Table 1. All model variables are used as the first differentiation except the inflation rate (CPI) variable, which is used as the percentage growth rate.

**Table 1 Description of Variables**

| Label | Definition of the variable | Expected impact |
|-------|---------------------------|-----------------|
| P/B | The P/B ratio measures the market's valuation of a firm relative to its book value. | Dependent variable |
| IntINC/OpINC | Indicator of the profitability of the selected business model of a particular banking firm. | - |
| FeeINC/TA | Indicator of banks' activities that does not include lending and other forms of core business. | + |
| NpA | Level of the credit risk of an individual bank and the quality of the loan portfolio. | - |
| GDc/GDPc | Indicator of regulatory risk-free debt financial instruments in the banks' asset portfolio. | - |
| DLA | Period of regulatory announcement | + |
| DLE | Period of regulatory enforcement | + |
| UNPL | Unemployment rate in the EU-28 (in %) | +/- |
| CPI | Consumer price index in the EU-28 (in %) | +/- |

*Source*: Author's calculation (2019).

The independent variables are directly or indirectly related to the profitability of the banking firm and its ability to meet regulatory capital requirements, and the following have been selected:

- *IntINC/OpINC* – analytical ratio that gives us the information on the share of interest income in the banking firm's operating income (*Interest Income/Operating Income*). This dynamically observed indicator reflects the propensity of an individual bank towards credit risk and reflects the chosen business operation model,
- *FeeINC/TA* – (*Net Fee and Commissions Revenue/Total Assets*) - analytical ratio that represents an individual banking firm's non-interest income and is, at the same time, a very important indicator of bank's activities that do not include lending and other forms of core business (e.g. transaction banking, market mediation services, asset and wealth management and other forms of financial

services). The same activities do not include banking business core credit risk contained in interest rate margins affecting the entire profitability of banks.

- *NpA* – (*Non-performing Assets*) – a ratio that gives us the information about the level of the credit risk of an individual bank and the quality of the loan portfolio. The dynamically observed indicator indirectly provides information about the individual bank's orientation toward crediting small and medium sized firms (SMEs) as well as more risky projects (European Banking Authority, 2016).

- *GDc/GDPc* - ratio that gives us the information about the country's government debt in relation to its gross domestic product (*Government Debt/Gross Domestic Product*). Indirectly it represents the financial assets in bank's portfolio that is regulatory neutral or at a very low risk of loss materialization (i.e. *risk-free assets*). Regulatory adjustments encourage the bank management structure to invest in government debt securities having a lower or minimum risk weight by raising the capacity of a banking firm to meet the required capital requirements. On the other hand, the reduced margin on increased portfolio, consisting of risk-free assets combined with credit activity exclusively to the lower-risk corporate sector, leads to a net reduction in the interest margin and less sentiment of the investment public towards the profitability of the banking industry. Finally, the orientation to lower risk clients has reduced the nonperforming loans ratio in European banks (European Commission, 2019).

Moreover, for the purpose of the empirical analysis of the research subject, it has been necessary to define the period of announcement and enforcement of prudential regulations of capital requirements on the basis of which the banks' behaviour and alignment would be observed. Namely, one of the basic assumptions of this research is that any regulatory modelling with the aim of securing financial stability produces direct causal effects on the asset structure and profitability of the banking firm.

The basic breakdown of the variables has been made for 2010 (announcement of the Basel III Standards), 2013 (implementation of the Basel III Standards), 2015 (implementation of the Liquidity Cover Ratio - LCR) as well as for 2016 and 2017 (implementation of the Capital Conservation Buffers), which altogether represent the years of enforcement. In this way, two other variables of the empirical research have been formed:

- *DLA - Announcement of regulatory measures.* The announcement period of regulatory measures - i.e. when the value of the variable is 1 - starts in 2010 and lasts until the end of the observed period. For all other years the value of this variable is 0, and

- *DLE - Enforcement of regulatory measures.* The period of enforcement of the regulatory measures (value of the variable is 1) begins in 2013 and lasts until the end of the observed period. For all other years the value of this variable is $0$[4].

The control variables and main indicators of the macroeconomic environment of the observed banking market makers included the unemployment rate in the EU-28 countries (*UNPL*) and the inflation rate (*CPI*) in the EU-28 area[5].

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[4] Research sample data analysis was performed using the STATA 14.2. statistical package.

Although the econometric analysis is constantly improving and becoming more accurate, the empirical research has shown that the data being analysed posses simultaneous temporal and spatial components. The data containing temporal and spatial components of some variables are called panel data. Panel data are repeated observations on the same cross-section, typically of individuals or firms in microeconomics applications, observed for several time periods (Cameron and Trivedi, 2005). Verbeek (2004) points out that the main advantage of the panel data in comparison to time series or cross-sectional assemblies is that they allow the identification of certain parameters or questions without the need to limit the assumptions. Panel data allows for the analysis of changes at individual level, i.e. the main advantages of panel analysis is the ability to model individual dynamics. The panel analysis also highlights the heterogeneity control at individual level, and the difference between observed units is assumed. Models that do not have this feature can have negative implications in the context of bias estimation (Wooldridge, 2002). Panel data analysis extracts maximum information from a limited number of observations over a given period and maximizes the number of degrees of freedom. Finally, the higher efficiency of model parameters is assured with less restrictive assumptions.

## 4. Model

The determinants of the P/B ratio have been analysed by a panel regression model. Considering that the observed variables within this empirical research are of a dynamic nature, the static panel models, due to the absence of autocorrelation, i.e. the dependence of the present value of a variable on its previous value, are not appropriate for estimating the research variables. Therefore, for the purposes of this study, a panel analysis was performed using a dynamic panel with a GMM estimator with one or two steps (the Arellano-Bond dynamic panel-data estimation GMM-type; one-step/two-step). The basic model for the selected variables can be written as follows:

$$
\begin{aligned}
y_{i,t} = \mu + \gamma \cdot y_{i,t-1} + \beta_1 \cdot x_{i,t} + \beta_2 \cdot x_{i,t} + \cdots + \beta_k \cdot x_{i,tk} + \alpha_i + \varepsilon_{i,t}, \\
i = 1, \dots N, t = 1, \dots T.
\end{aligned}
\tag{1}
$$

where $i$ is the unit, $t$ the time, $\mu$ the constant, $\gamma$ the parameters besides the dependent variables with a lag, $\beta_1$, $\beta_2$,..., $\beta_k$ the parameters of exogenous variables, $x_{i,t}$ the independent variables, $\alpha_i$ a specific error for a $i$-th bank, and $\varepsilon_{i,t}$ the error of relation of the $i$-th bank.

The number of observation units (bank groups) exceeds the number of observation periods that meet the requirement for the Arellano-Bond estimator. Due to the presence of the standard error bias for the GMM estimator in two steps, an additional panel model analysis lead to the choice of a dynamic panel with a GMM estimator in one step.

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[5] The observed indicators have been downloaded from the common statistical database EUROSTAT (http://ec.europa.eu/eurostat/data/database).

The analysis also found that the number of instruments does not exceed the number of cross-sections, and therefore, the properties of the GMM estimator system are not compromised. To keep the number of instruments under control, a one-step dependent variable is used as an instrument.

Finally, the Arellano-Bond's one-step estimator with the use of robust standard errors has been used to test the research hypothesis. By using the robust standard errors, in a model for which the Sargan test cannot be used, the validity of the models is estimated on the basis of the autocorrelation test of the first differences of the second-order residuals. In order to verify the hypothesis, the basic model had to be expanded by introducing the dummy variable of the announcement and enforcement of regulatory measures.

## 5. Results

The general features of the observed research sample variables were determined by descriptive statistics, as shown in Table 2.

However, the dynamic analysis of the dependent variable (the P/B ratio) was formed based on the calculation of the average value for all banking groups for each of the observed years (Appendix, Table A2). Although the number of observations is not the same at the level of the entire sample, which can slightly reduce the credibility of the approximation through the calculation of the average annual value, we still have enough data to obtain a simpler insight into the very dynamics of the observed portfolio of banks, as well as the movement of the average P/B ratio value in the unit of time.

**Table 2 Descriptive Statistics of Sample Variables**

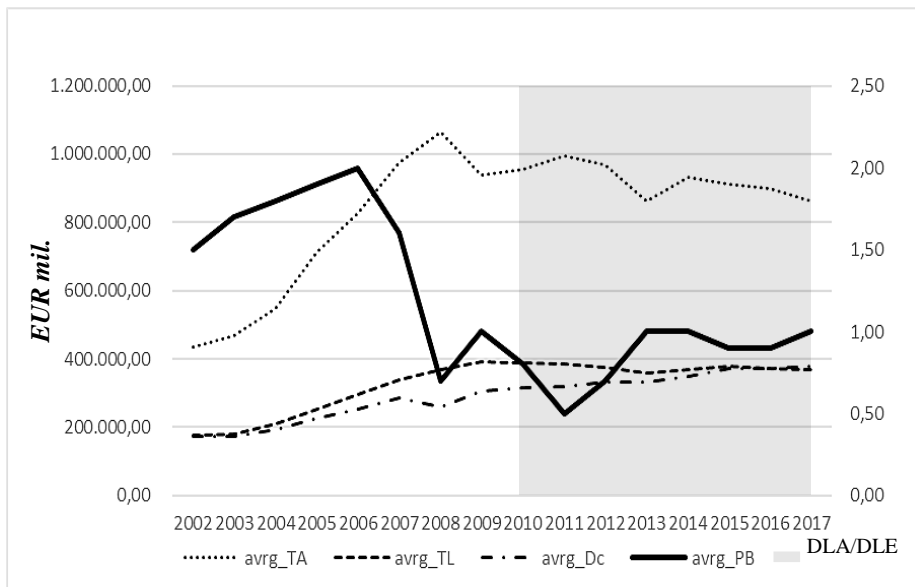| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| *Banks business indicators* | | | | | |
| P/B | 341 | 1.19 | 0.61 | 0.17 | 3.38 |
| IntINC/OpINC | 353 | 0.032 | 0.018 | 0.01 | 0.17 |
| FeeINC/TA | 353 | 0.008 | 0.004 | 0 | 0.02 |
| NpA | 353 | 0.019 | 0.020 | 0 | 0.01 |
| GDc/GDPc | 349 | 71.05 | 25.72 | 26 | 133 |
| *Macroeconomic environment* | | | | | |
| UNPL | 367 | 9.03 | 1.07 | 7 | 10.9 |
| CPI | 368 | 1.91 | 0.98 | 0.1 | 3.7 |

*Source*: Author's calculation (2019).

Upon the expiry of the expansive movements of bank assets growth, a drastic fall in the P/B ratio of the observed banking groups occurred (Figure 2). A very stable P/B ratio growth, starting with 2002, recorded its first negative correction in 2007, and, at the end of 2008, fell sharply to only 0.7. The ratio approximately increased for 0.3 to 1.0 in 2009 but did not obviously encounter a real base in quality business performance of the banking industry as a whole. Further movement of the P/B ratio was marked by stagnation, with an obvious negative tendency. Starting from the very unstable or respectively cyclical trend of bank assets, particularly loan

portfolio assets with a negative tendency after 2008, it can certainly be expected that the P/B ratio will remain yet below pre-achieved levels.

In addition to the basic analysis of the P/B ratio dependent variable dynamics, it has been necessary to determine whether there are differences in the arithmetic means of the selected banking group variables before and after the announcement of regulatory changes, specifically before and after the application of the same measures. The analysis performed using a two-way t-test of the P/B ratio, indicated expected statistical significance of differences before and after the announcement of regulatory measures, and before and after the enforcement of measures (Appendix, Table A3). Moreover, further analysis also confirmed the significance of almost all selected independent variables, which is in line with the basic assumptions of the research, i.e. the expected influence of regulation on the chosen banking industry specific variables. Variable *FeeINC/TA* recorded no significant changes only after the enforcement of the measure.

**Figure 2 The Dynamics of the Average Value of Bank Total Assets, Loans, Deposits and Price to Book Ratio of Banks**



*Notes*:    *Avrg_TA* – total average assets (left scale); *Avrg_TL* – total average loan (left scale); *Avrg_Dc* – total average customer deposits (left scale); *Avrg_PB* – total average price to book ratio (right scale); *DLA/DLE* – time period of announcement / enforcement of regulatory requirements.

*Source*: Annual Reports (based on average data of banks with higher assets). Reuters and authors' calculation (2019).

Moreover, before the formation of the final model and interpretation of given results, it was necessary to check the correlation between the selected variables. According to present knowledge, an appropriate test for the detection of multicollinearity in panel models does not exist and the empirical studies use coefficients between pairs of potential independent variables to discover the multicollinearity-related issues. The correlation matrix is shown in the Table 3.

Based on the correlation matrix results, it can be concluded that there are no pairs of variables which could cause multicollinearity with simultaneous inclusion in the model since there is no coefficient exceeding the 0.5 value.

**Table 3 Correlation Matrix: Impact on the Price to Book Ratio**

|  | P/B | IntINC/OpINC | FeeINC/TA | NpA | GDc/GDPc |
|---|---|---|---|---|---|
| P/B | 1 |  |  |  |  |
| IntINC/OpINC | -0.14* | 1 |  |  |  |
| FeeINC/TA | 0.29* | 0.44* | 1 |  |  |
| NpA | -0.01 | -0.07 | 0.04 | 1 |  |
| GDc/GDPc | 0.04 | -0.26* | -0.07 | 0.29* | 1 |

*Source:* Author's Calculation (2019).

*Notes:* *denotes significance at 10%; **denotes significance at 5%; ***denotes significance at 1%.

To test our research model, the basic equation can be written as follows (MODEL1):

$$
\begin{aligned}
\Delta LogP/B_{i,t} &= \mu + \gamma \cdot \Delta LogP/B_{i,t-1} + \beta_1 \cdot \Delta LogIntINC/OpINC_{i,t} + \beta_2 \\
&\quad \cdot \Delta LogFeeINC/TA_{i,t} + \beta_3 \cdot \Delta LogNpA_{i,t} + \beta_4 \\
&\quad \cdot \Delta GDc/GDPc_{i,t} + \beta_5 \cdot \Delta UNPL_{i,t} + \beta_6 \cdot CPI_{i,t} + \alpha_i + \varepsilon_{i,t}, \\
&\quad i = 1, \dots N, t = 1, \dots T.
\end{aligned}
\tag{2}
$$

Table 4 presents the results of the research models in the analysis of the main determinants of banking firms' P/B ratios.

All models satisfy the second-order autocorrelation test of the first residual differences AR (2) and, specifically, the test at the significance level of 5% does not reject the null hypothesis regarding no correlation of second order first residual differences, indicating that there is no autocorrelation between the residuals in the model. It can be concluded that the models are well-specified. The coefficients with the dependent variable from the previous period are statistically significant and contribute to the reduction of the dependent variable of the current period, which is in line with the expectations and the basic assumptions.

The results of the basic MODEL1 show a significant negative influence of the interest income to operating income (*IntINC/OpINC*) ratio on the P/B ratio. Furthermore, the research clearly indicates a change in the business model of observed groups of banks through the significance and positive direction of the independent variable fees and non-interest income to total assets (*FeeINC/TA*). In the pre-crisis period, the strong growth of financial market price of bank shares had been driven by market activities of the globally present banks, which is in line with research results of Baele et al. (2007) and Calomiris and Nissim (2014).

Banks with significant trade income and non-interest income from bank client services took over investment sentiments in comparison to the banking firms with a standard income structure with a high ratio of interest income. The net value of client oriented banks was more stable in the period of financial disturbance due to the evaluation principles of credit assets by cost accounting and less exposure in mark-to-market or mark-to-model impact in the recognition and valuation of financial instruments. Finally, the credit expansion was intermediated through complex links

between traditional banks and nonbank financial institutions beyond the regulatory perimeter (Chen et. al., 2019).

**Table 4 Results of the Panel Analysis Influence of the Increase of Regulatory Capital Requirements on the Real Market Value of a Banking Firm**

| Variable | MODEL1 | MODEL2 | MODEL3 |
|---|---|---|---|
| *Banks business indicators* | | | |
| $\Delta$LogP/B$_{i,t-1}$ | -0.174*** (0.036) | -0.175*** (0.037) | -0.195*** (0.036) |
| $\Delta$LogIntINC/OpINC$_{it}$ | -0.206* (0.119) | -0.200* (0.119) | -0.183 (0.122) |
| $\Delta$LogFeeINC/TA$_{it}$ | 0.731 *** (0.134) | 0.747*** (0.137) | 0.698*** (0.139) |
| $\Delta$LogNpA$_{it}$ | -0.352*** (0.075) | -0.333*** (0.067) | -0.354*** (0.076) |
| $\Delta$GDc/GDPc$_{it}$ | -0.006* (0.003) | -0.007* (0.003) | -0.006* (0.003) |
| *Announcement of regulatory measures* | | | |
| DLA$_{it}$ | | 0.007 (0.019) | |
| *Enforcement of regulatory measures* | | | |
| DLE$_{it}$ | | | 0.063** (0.027) |
| *Macroeconomic environment* | | | |
| $\Delta$UNPL$_{it}$ | 0.099*** (0.018) | 0.096*** (0.018) | 0.112*** (0.019) |
| CPI$_{it}$ | -0.067*** (0.009) | -0.065*** (0.009) | -0.050*** (0.013) |
| µ | 0.125*** (0.020) | 0.117*** (0.022) | 0.072** (0.032) |
| Number of observations | 266 | 266 | 266 |
| Number of groups | 22 | 22 | 22 |
| AR(1) test | 0.0002 | 0.0002 | 0.0001 |
| AR(2) test | 0.2555 | 0.2414 | 0.3389 |

*Source*: Author's Calculation (2019).

*Notes*: $\Delta$ - the first differentiation, *denotes significance at 10%; **denotes significance at 5%; ***denotes significance at 1%.

In addition, the independent variable of non-performing assets (*NpA*) also significantly contributed in the reduction of the P/B ratio. Ozili (2019) conducted a comparative study of different banking systems development and nonperforming loans ratio. Bad debt assets traditionally affect bank's solvency and show the efficiency of credit capacity allocation in financing investment and consumption deficits. Banks with high asset growth are usually exposed to high ratio of non-performing assets together with the related systemic risk that cause economic instability and aggregate shocks. Ferretti et. al. (2018) showed that the selected macroeconomic variables were the important ones in explaining the variance of the P/B ratio of banking firms. The model also indicates a statistical negative influence of government debt ratio in total GDP (*GDc/GDPc*) on the bank's outcome performance.

Strong deleverage on the financial markets and an increase in government securities in order to meet the regulatory request within the context of higher regulatory capital ratio caused bank's exposure to sovereign risk. Government debt crisis, connected with fragile economies of most European countries, caused distrust in bank shares in countries where the debt ratio indicated structural economic problems. In most countries, a high debt ratio came about as a result of banking system bailout, euro zone stability measures, and other non-conventional monetary policy measures. Investors in bank shares in countries with a high debt ratio have negative expectations due to the transfer of the sovereign risk to the banks' balance sheets and its strong effect on banks' solvency. The final result is in fall of share prices and the P/B ratio.

The results are in line with the findings of Calomiris and Nissim (2014) research on the effects of macroeconomic variables on the market value of banking firms. The control variables of the macroeconomic environment, the unemployment rate and the inflation rate, show statistical significance for all observed models but of the opposite direction and with low economic significance in the context of the research problem.

In the next steps, the basic model was expanded by introducing the regulatory announcement (*DLA*) variable, and the regulatory measure enforcement (*DLE*) variable. Most studies (Chousakos and Gorton, 2017) confirmed that the market value of a banking firm is related to regulatory interventions.

An extended model can be written using equation 3 (MODEL2):

$$\Delta LogP/B_{i,t} = \mu + \gamma \cdot \Delta LogP/B_{i,t-1} + \beta_1 \cdot \Delta LogIntINC/OpINC_{i,t} + \beta_2 \cdot \Delta LogFeeINC/TA_{i,t} + \beta_3 \cdot \Delta LogNpA_{i,t} + \beta_4 \cdot \Delta GDc/GDPc_{i,t} + \beta_5 \cdot DLA_{i,t} + \beta_6 \cdot \Delta UNPL_{i,t} + \beta_7 \cdot CPI_{i,t} + \alpha_i + \varepsilon_{i,t}, \qquad i = 1, \dots N, t = 1, \dots T. \tag{3}$$

Coefficients of banks' business indicators, presented by operating activities, have the same sign and are statistically significant as in the previous models, as well as the independent variables of non-performing assets and government debt. When introducing the regulatory announcement (*DLA*) variable into MODEL2, the results show lack of significant influence. Although the announcement of regulatory measures has no contribution in the increase in the P/B ratio, it can be concluded, based on the results in Table A3, that there is a statistically significant negative difference between the P/B ratio before and after the announcement. This was linked to the sovereign debt crisis period, the maintenance of the euro zone stability, dysfunctional interbank market, distrust in the quality of global bank assets and their solvency, and the spill over of the crisis from the financial sector to the real economy. The reaction of the European Union monetary authorities has been swift and decisive. The European Central Bank modified the standard operational framework and the governments of the euro area countries supported monetary measures in preventing a collapse. The final effect was seen in the stabilization of the financial system and introduction of the new regulatory framework (Ercegovac, 2016).

The extended model by introducing the variable of regulatory enforcement (*DLE*) can be written as follows (MODEL3), in the equation 4:

$$\Delta LogP/B_{i,t} = \mu + \gamma \cdot \Delta LogP/B_{i,t-1} + \beta_1 \cdot \Delta LogIntINC/OpINC_{i,t} + \beta_2 \\ \cdot \Delta LogFeeINC/TA_{i,t} + \beta_3 \cdot \Delta LogNpA_{i,t} + \beta_4 \\ \cdot \Delta GDc/GDPc_{i,t} + \beta_5 \cdot DLE_{i,t} + \beta_6 \cdot \Delta UNPL_{i,t} + \beta_7 \cdot CPI_{i,t} \\ + \alpha_i + \varepsilon_{i,t}, \qquad i = 1, \dots N, t = 1, \dots T. \tag{4}$$

Coefficients of the banks' business indicators are of the same sign and are statistically significant as in previous models, except for the interest income ratio. The value of the $\beta_5$ coefficient of the enforcement of regulatory measures (*DLE*) variable, based on which the test was performed is positive and statistically significant. It is evident from the model that the introduction of the enforcement of regulatory measures variable has a positive impact on the P/B ratio. It has been recovering during the last years and the banks have been adapting to the regulatory requirements and have been increasing the self-financing of lending assets, whereas the total bank assets are continuing to be decreased with the final objective of stabilizing the bank system risk (Figure 1). Unfortunately, bank lending activities do not show recovery in post crisis period what can be a consequence of the strong capital requirements and constraints in increasing bank equity.

## 6. Conclusion

During the last financial crisis, the values of the P/B ratios in the banking sector drastically fell. The market price of the banking firms within the European banking system has not recovered in the post crisis period despite the historical maximum values reached by stock price indexes. The analytical models in the analysis of the determinants of banking firms' stock price movements indicate some significant findings.

The growth of the P/B ratio in the period preceding the financial crisis is a result of the extreme growth in bank assets and is an indicator of the return on capital employed by exploiting the function of financial intermediary and the possibility of creating financial assets in credit and deposit multiplication (De Haas and Van Lelyveld, 2014). The credit potential above the absorption capacity of the real sector has been deployed to money and capital markets thus enhancing further growth of the financial sector. In the desire for larger profits, the allocation of banks' credit potentials towards the financial sector competed equally with the investments in the real sector, which had a positive impact on growth, but also had a negative impact on the economic system's long-term development and competitiveness. The last financial crisis has confirmed the unsustainability of such a business model.

The lack of functionality within the inter-bank system, the large share of bad loans, the lack of capital in the event of a somewhat meaningful market disturbance and general illiquidity, having a direct pro-cyclical impact on the real economic sector, represent a strong signal to the regulatory authorities on the existing need for restructuring the banking system in order to sustain its long-term sustainability (Kalemli-Ozcan et. al, 2013).When several firms want at the same time to access public markets in response to a reduction in credit supply, the supply of new funds

will not be able to accommodate this demand, and the cost of raising funds in public markets might significantly increase (Carvalho et. al, 2015). Continued political risks, increases in public debt and sovereign risk as well as other non-economic risks contribute to further distrust of investors towards the banking sector.

Regulatory authorities face the choice in the trade-off of regulatory measures in terms of safety and stability, activity and competitiveness of the banking system. Optimal regulation requires banks to hold more equity when loan supply is high, but also allows banks to hold very little equity when loan supply is low (Schroth, 2019). Revolutionary changes in the capital structure and the capital requirements and the high amounts of low earning liquid assets, are a step forward in restricting further uncontrolled growth of the banking sector (overbanking) and narrowing the possibility of achieving extra profit. According to Chen, Mrkaic and Nabar (2019), economies that moved quickly to assess the health of their banking systems and recapitalize banks appeared to have suffered smaller output losses subsequently.

A lack of investment sentiment in regard to equity holdings in banks, which has kept the P/B ratio at relatively low values for almost a decade after the last financial crisis came about as a result of the ending of a period of significant growth of the banking sector and as a result of the regulatory measures indicating a need for its restructuring into sufficiently capitalized, sufficiently liquid and cost-effective institutions. The low P/B ratio is also a constraint in the development of the banking firm because of low investment sentiment toward bank equity. In addition to this, the dilution of bank capital risk in case of a new shares issue at low P/B values also discourages current owners in external equity increase. The final consequence of low levels of the banking firms' P/B ratio is the limitation of bank assets growth and lending activities in financing production and consumption deficits. Active measures of the monetary credit policy aimed towards stabilizing the banking system have contributed to maintaining its liquidity and crediting activities within the structural adjustments to the new operating and regulatory environment.

The return to the values of the P/B indicators of the pre-crisis period shall not be expected in the near future due to the fall in the growth rate and the increased competitiveness of non-banking institutions within the segment of financial products and services. In such conditions, banks are directly and indirectly forced to return to traditional forms of product and services and the reaffirmation of strong relations with commercial clients (De Jonghe, 2010). Bearing in mind the recent consequences of the uncontrolled growth in the number of bank financial intermediaries, the regulator should not depart from its long-term goals. Effective supervision and regulation require banks to have robust corporate governance arrangements that incentivise bank management and owners to understand the risks they are taking and to price risk efficiently in order to cover both the private costs that such risk-taking poses to bank shareholders and the social costs for the broader economy if the bank fails (Kern, 2019).

The research results are useful to banking firms' management bodies in supporting sustainable bank business models under the existing macroeconomic and macro prudential environment, aimed at stabilizing the volatility of market to book values. Since the global financial crisis has reduced the explanatory power of the variables within this research, a challenge for future researchers would be to continue

in analysing the determinants of market to book ratios in bank industry in a going concern business environment.

# APPENDIX

**Table A1 Sample Bank Data as of December 31, 2017 (Assets in Million EUR)**

| Bank name | Country | Assets | CET 1 (%) | ROE (%) | P/B ratio |
|---|---|---|---|---|---|
| ABN Amro Group NV | Netherlands | 393,171 | 17.7 | 13.00 | 1.2 |
| Banco Bilbao Vizcaya Argentaria, SA | Spain | 690,059 | 11.7 | 6.60 | 1.0 |
| Banco Santander, SA | Spain | 1,444,305 | 12.3 | 6.20 | 0.9 |
| Barclays, PLC | UK | 1,274,800 | 13.3 | -1.97 | 0.6 |
| BNP Paribas, SA | France | 1,960,252 | 11.9 | 7.24 | 0.8 |
| CaixaBank, SA | Spain | 383,186 | 12.7 | 6.82 | 1.0 |
| Commerzbank, AG | Germany | 452,493 | 14.9 | 0.52 | 0.5 |
| Crédit Agricole, SA | France | 1,550,283 | 11.7 | 5.64 | 0.7 |
| Credit Suisse Group AG | Switzerland | 680,320 | 13.5 | -2.46 | 1.1 |
| Danske Bank, A/S | Denmark | 475,470 | 17.6 | 12.43 | 1.4 |
| Deutsche Bank, AG | Germany | 1,474,732 | 14.8 | -1.10 | 0.5 |
| Dexia, SA | Belgium | 180,938 | 19.5 | -8.55 | 0.8 |
| Erste Group Bank, AG | Austria | 220,659 | 13.4 | 7.20 | 1.1 |
| HSBC Holdings, PLC | UK | 2,097,600 | 14.5 | 5.82 | 1.2 |
| Intesa Sanpaolo, SpA | Italy | 796,861 | 13.3 | 12.92 | 0.8 |
| KBC Group, NV | Belgium | 292,342 | 16.5 | 13.69 | 1.7 |
| Lloyds Banking Group, PLC | UK | 913,572 | 14.1 | 7.14 | 1.1 |
| Nordea Bank, AB | Sweden | 581,612 | 19.5 | 9.10 | 1.3 |
| Royal Bank of Scotland, PLC | UK | 830,267 | 15.9 | 2.85 | 0.8 |
| Société Générale | France | 1,275,128 | 11.4 | 4.38 | 0.6 |
| Swedbank, AB | Sweden | 225,015 | 24.6 | 14.78 | 1.7 |
| UBS Group, AG | Switzerland | 782,291 | 14.9 | 2.16 | 1.3 |
| UniCredit, SpA | Italy | 836,789 | 13.7 | 9.09 | 0.6 |

*Source*: Reuters (2019).

**Table A2 Average Value of the Sample Dependent Variable at the Level of the Observed Groups of Banks Total Portfolio**

| Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|
| Avrg_P/B | 1.5 | 1.7 | 1.8 | 1.9 | 2.0 | 1.6 | 0.7 | 1.0 |

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|
| Avrg_ P/B | 0.8 | 0.5 | 0.7 | 1.0 | 1.0 | 0.9 | 0.9 | 1.0 |

*Source*: Author's calculation (2019).

**Table A3 Results of the Two-Way T-Test of Differences in Arithmetic Means of the Observed Sample Variable for the Announcement Period and the Enforcement Period of Regulatory Measures**

| Variable | | Period | Obs | Mean | Std.Dev | p-value |
|---|---|---|---|---|---|---|
| DLA | P/B | 0 | 168 | 1.53 | 0.636 | 0.0000*** |
| | | 1 | 173 | 0.86 | 0.350 | |
| | IntINC/OpINC | 0 | 169 | 0.04 | 0.022 | 0.0000*** |
| | | 1 | 184 | 0.03 | 0.010 | |
| | FeeINC/TA | 0 | 169 | 0.009 | 0.004 | 0.0002*** |
| | | 1 | 184 | 0.008 | 0.004 | |
| | NpA | 0 | 169 | 0.013 | 0.013 | 0.0000*** |
| | | 1 | 184 | 0.026 | 0.025 | |
| | GDc/GDPc | 0 | 165 | 60.12 | 22.01 | 0.0000*** |
| | | 1 | 184 | 80.86 | 24.90 | |
| DLE | P/B | 0 | 232 | 1.30 | 0.673 | 0.0000*** |
| | | 1 | 109 | 0.95 | 0.349 | |
| | IntINC/OpINC | 0 | 238 | 0.036 | 0.020 | 0.0000*** |
| | | 1 | 115 | 0.024 | 0.010 | |
| | FeeINC/TA | 0 | 238 | 0.009 | 0.004 | 0.1275 |
| | | 1 | 115 | 0.008 | 0.004 | |
| | NpA | 0 | 238 | 0.017 | 0.018 | 0.0014*** |
| | | 1 | 115 | 0.025 | 0.026 | |
| | GDc/GDPc | 0 | 234 | 65.19 | 23.16 | 0.0000*** |
| | | 1 | 115 | 82.99 | 26.63 | |

*Notes:* *denotes significance at 10%; **denotes significance at 5%; ***denotes significance at 1%.
*Source:* Author's Calculation (2019).

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