

# Bank Profitability and Regulation in Emerging European Markets

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This paper investigates the effect of bank-specific, industry-specific and macroeconomic determinants, as well as the regulatory environment on the profitability of the emerging European banking sector over the period 2000-2016. Banks in countries with higher capital requirements, market discipline and more restrictions on banking activities performed better, while the better-performing banks had extensive foreign ownership. The empirical analysis reveals that performance is affected by bank-specific determinants like equity capital and bank size, while traditional activities lead to increased profitability. The specific measures of economic policy must be oriented towards specific aspects of the banking business. This will set new standards in performance and efficiency, urging bank management to address particular firm-specific issues, such as the composition of the balance sheet, the quality of the credit portfolio, as well as the range of financial products and services. Overall, the evidence shows that regulation, and balance sheets help in understanding bank profitability during the crisis.

**Keywords:** banking sector profitability; financial crisis; regulatory framework; emerging markets

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## I. Introduction

Credit institutions are idiosyncratic organizations bearing distinctive intermediation characteristics and calling for exceptional regulatory treatment. Banks provide liquidity insurance and allow better risk sharing among depositors with varying consumption needs. Moreover, they constitute the principal originators of non-market finance to the economy while monitoring borrowers on behalf of lenders, hence significantly reducing information asymmetry and screening costs. In other words, the banking sector provides financing for commercial enterprises, basic financial services and access to payment systems to a broad segment of the population, turning itself to a critical component of any economy.

The banking industry is one of the most regulated in the world. Two arguments are usually presented to justify this kind of practice: systemic risk and depositor protection. The first argument contends that the purpose of regulation is to prevent systemic bank runs, which in turn may be caused by the inherent instability of banks' structure or weaknesses in the framework within which banks operate. According to the second argument, the regulation rationale builds on a corporate governance problem. The challenge of safeguarding financial stability has become even more vital in recent years in light of the new global financial environment that has rapidly evolved. The new environment is characterized by enhanced financial liberalization and integration, rapid development of new financial products and technologies, as well as consolidation in the banking industry and increasing competition (Moshirian, 2008).

During the last three decades, forces such as globalization, technological change, deregulation and European integration have fundamentally transformed the European banking industry. It is clear that rapid changes in the financial industry structure occur around the globe. Even though banking system restructure was quite profound over the last decade in most emerging European markets, there is still much to be done for their financial systems to be classified in the category of developed markets.<sup>1</sup> The Central and Eastern European countries (CEE)

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1. This term includes Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia,

have undergone major structural changes during the transition period dated back in the early 1990s. They present a quite different group of emerging economies as opposed to Latin America and Southeast Asia since the last two groups have not gone through a transition from centrally planned economies to market economies. Therefore the establishment of financial markets and the banking sector is a fairly new process and we expect that the determinants of CEE bank profitability could differ to some extent from those in the banking system of Latin America and Southeast Asia on the basis that although these economies are considered to be emerging economies they have always operate within the broad context of a market economy.

The varying transition paths from central planning to market economy have resulted in different legal and politico-institutional frameworks, which have consequently affected the efficient functioning of banking systems and national economies in general. This process involved the restructuring, rehabilitation and privatization of state-owned banks, the liquidation of insolvent institutions and an improvement in the administrative efficiency and capability of the banking sector. Other factors that enhanced banking intermediation were the introduction of new prudential regulation and tighter supervision. Despite faster development in the second half of the 1990s, when relatively stable financial and macroeconomic conditions emerged, the quantity and quality of banking products and services still lagged behind those of more developed European countries.

In emerging markets, an efficient and properly governed banking sector is better equipped to withstand negative shocks and contribute to the stability of the financial system, considering the underdeveloped, in many cases, stock markets. Moreover, regulators are interested in the sources of financial instability and mechanisms to avoid it, taking into account that banks are highly leveraged firms taking a wide range of complex risks in their daily operations, including, among others, credit, liquidity, interest rate, operational and market risk. Capital adequacy and liquidity requirements set by the regulators, constraints on large exposures, and requirements concerning the efficiency of internal control and risk management systems of financial institutions all constitute an ex-ante response to systemic risk.

The intensified information asymmetry problems (Furfine, 2001) and/or psychological factors may trigger the spread of isolated liquidity problems into the banking system, as depositors may perceive such problems as a warning sign of a more general banking crisis. The strong

interdependencies existing between banks also contribute to the augmentation of the “contagion” or “domino” effect (Rochet and Tirole, 1996). It is believed that there could be a contagion effect resulting from the instability of one bank, which would affect a class of banks or even the entire financial system and the economy. As one bank becomes unstable, there may be a heightened perception of risk among depositors for the entire class of such banks, instigating a run on the deposits and putting the entire financial system in jeopardy. The consequences of mismanaging their risks can be severe indeed - not only for an individual bank, but also for the system as a whole. This reflects the fact that the failure of one bank can rapidly affect another through inter-institutional exposures and confidence effects. Consequently any prolonged and significant disruption of the financial system can potentially incur severe repercussions on the wider economy.

The crisis reshaped the environment in a way that distorted the features of the banking business and its income structure. With the regulatory changes implemented (Basel III), a scenario of lower profitability is emerging in which there will be a structural change in the income structure. In times of both expansion and crisis, banks have reacted to the changing environment with a view to maintaining their levels of profitability (Maudos, 2017). A wide range of studies on transition countries have highlighted the fact that the financial reform process positively affects bank profitability and that a banking sector reform is a necessary condition for the development and deepening of the sector (Fries and Taci, 2002; Agoraki, Delis and Pasiouras, 2011).

One of the central issues in emerging banking systems, along with the transition process to a market economy, is the development of a profitable and efficient financial system. The empirical analysis is carried out for 11 emerging European banking systems over the period 2000-2016. The examined period includes two different phases of the financial cycle: a pre-crisis period of booming financial markets, with the sample starting date being the year 2000 up to 2006 and the global financial crisis, from 2007 to 2016. A better understanding of the determinants of the profitability could be valuable for modeling and predicting the decision towards expansion, reorganization or default. The theoretical financial literature identifies several firm-specific factors (strategic and non-strategic factors) that can explain profitability.

This study employs the important research output of the European Bank of Reconstruction and Development (EBRD), i.e. the bank and enterprise reform database, to quantify the reform process in emerging European banking. Since the EBRD performs a yearly assessment of regulatory reform we are able to make the best use of the time-series aspect of these indices. Finally, we rely on information from the World

Bank (WB) database on bank regulations and supervision (Barth Caprio and Levine, 2001, 2006, 2008; Cihak et al., 2102) to construct indices that relate to capital requirements, market discipline, official supervisory power and restrictions on bank activities.<sup>2</sup>

The rest of the paper is organized as follows. Section II reviews the theoretical underpinnings of the relevant literature. Section III describes how the profitability of banks during the crisis relates to bank-specific characteristics, regulation, and country characteristics. Section IV discusses the dataset. Section V presents and analyzes the empirical results. A number of conclusions are offered in the final section.

## **II. Literature review**

Several researchers have focused on the causes and determinants of financial crises in both single and cross-country studies as well as the impact on bank profitability. Adrian and Shin (2008) and Diamond and Rajan (2009) among others have emphasized the run on the funding of banks that relied on short-term finance in the capital markets for a substantial fraction of their financing. Barth, Caprio and Levine (1999) show that the banking system is more fragile in countries where banking activities are more restricted.

Claessens, Demirguc-Kunt and Huizinga (1998) using 7900 bank observations from 80 countries for the 1988-1995 period, found that foreign banks enjoy higher profits than domestic banks in developing countries, but the opposite is the case for developed countries. Demirgüç-Kunt and Huizinga (1999) report that banks in countries with more competitive banking sectors are less profitable, as well as banks that rely largely on deposits for their funding. Naceur (2003) in his study investigates the impact of bank characteristics, financial structure and macroeconomic indicators on bank profitability in the Tunisian banking industry for the time period 1980-2000.

Bouzgarrou, Jouida and Louhichi (2018) conclude that foreign banks are more profitable than domestic banks, especially during the financial crisis. Bitar, Pukthuanthong and Walker (2018) in a sample of 39 OECD countries demonstrate that both risk- and non-risk based capital ratios improve bank efficiency and profitability. Aydemir and Ovenc (2016) suggest that a short-term interest rate has a negative and significant impact on profits while Bolt et al. (2012) find long-term

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2. Beck, Demirguc-Kunt and Levine (2006), Schaeck, Sihak and Wolfe (2009), Agoraki (2009) and Agoraki, Delis and Pasiouras (2011) have also used these indices as control variables in their somehow related cross-country studies.

interest rates in previous years to be important determinants of bank profit in times of high economic growth.

Barth, Caprio and Levine (2008) also find that greater regulatory restrictions on bank activities are associated with higher probability of suffering a major banking crisis and bank fragility, respectively. Demirgüç-Kunt, Detragiache and Tressel (2008) conclude that countries where banks have to report regular and accurate financial data to regulators and market participants have sounder banks. Demirgüç-Kunt and Detragiache (2002) provide evidence that an explicit deposit insurance scheme, in the absence of strong banking regulations tends to increase the probability of a collapse taking place. However, Barth, Caprio and Levine (2003) point out that official government power is particularly harmful to bank development in countries with closed political systems. According to Miyake and Nakamura (2007), capital adequacy regulations work as a factor of stabilization in the sense that they moderate the macroeconomic effects of negative productivity shocks.

Finally, in times of both expansion and crisis, banks have reacted to the changing environment with a view to maintaining their levels of profitability. During the expansion, the progress of disintermediation drove a change in income structure, with an increase in the relative importance of non-interest income, associated with what could be termed non-traditional business. Increased competition led to a drop in the financial margin, which also acted as an incentive to find other sources of income (Berger et al., 2000; Lepetit et al., 2008; Maudos, 2017).

### III. Empirical specification

#### *A. Theory and identification*

Given the considerations of the theoretical and empirical literature, we specify the following empirical model to study the determinants of bank profitability, as a function of income structure and bank-specific factors, macroeconomic indicators, market power and regulation.

Due to the dynamic nature of the reforms implemented, the impediments to informational opacity and/or the sensitivity to regional/macroecomic shocks, a dynamic specification of the model has been adopted, which includes a lagged dependent variable.<sup>3</sup>

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3. We apply the system GMM estimator proposed by Blundell and Bond (1998) to

$$BP_{it} = c' + aBP_{i,t-1} + \sum_{j=1}^J \beta_j' X_{it}^j + \varepsilon_{it}' \quad (1)$$

where  $BP_{it}$  denotes the observed bank profitability for bank  $i$  at year  $t$ ,  $c$  is a constant term,  $X_{it}$ s are  $j$  explanatory variables and  $\varepsilon_{it}$  is the disturbance term. All variables are expressed in natural logarithms to improve the goodness of fit of the regression and to reduce possible simultaneity bias. Country effects are included in the estimations because structural conditions in banking and general macroeconomic conditions, such as differences in accounting standards and tax structures may generate differences in bank performance as well. Finally, a dummy variable that takes value 1 for the years 2007-2016 has been included, in order to reflect the crisis effect, as well as an EU membership dummy variable that takes value 1 if the country is a member of the eurozone.

As the consistency of the GMM estimator depends on the validity of the instruments, we consider two specification tests suggested by Arellano and Bond (1991). We report results of the Sargan-Hansen test as well as the Arellano-Bond test of first- and second-order autocorrelation. To test model specification validity, the Sargan test of over-identification of restrictions is estimated. This test examines the lack of correlation between the instruments and the error term. The AR (1) and AR (2) statistics measure first- and second-order serial correlation. Given the use of first-difference transformations, some degree of first-order serial correlation is expected, in order for the estimator to be consistent, this correlation does not invalidate the results though. However, the presence of second-order serial correlation does suggest omitted variables.

The dependent variable is bank profitability. All performance measures, regardless of their specific objectives, use accounting and market data to assess the financial condition of an institution at a point in time, as well as to determine how well it has been managed over a period of time. Profitability can be used as a summary index of performance. Therefore, we incorporate the two most widely used measures of bank profitability, the return on average assets (ROA), i.e., the ratio of earnings to average assets, and the return on average equity (ROE), i.e., the ratio of earnings to average equity. In both cases, profits

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tackle the potential endogeneity of bank characteristics. Moreover, this estimator does not break down in the presence of unit roots (see Binder, Hsiao and Pesaran, 2003; Agoraki, 2009; Agoraki, Delis and Pasiouras, 2011).

are taken before tax to avoid discrepancies resulting from the different taxation systems that are implemented across the European region.

Accounting profitability can be used as a measure of performance for at least three reasons. First, researchers have shown some market inefficiencies even in the most developed countries (Lo and MacKinlay, 1988; Conrad and Kaul, 1998). Thus, stock prices are less likely to reflect all available information when the stock market shows inefficiency (Joh, 2003). Second, Mossman et al. (1998) show that a firm's accounting profitability is more directly related to its financial viability than its stock market value is. Many studies use accounting measures to predict bankruptcy (Takahashi, Kurokawa and Watase, 1984) or financial distress (Hoshi, Kashyap and Scharfstein, 1991). Third, accounting measures allow the evaluation of performance for both privately held firms as well as that of publicly traded firms (Jensen and Murphy, 1990; Ely, 1991).

The bank-specific variables account for differences in output quality and risk preferences, and capture the heterogeneity of financial institutions. We focus on the CAMEL approach.<sup>4</sup> The theoretical considerations discussed above point to a number of variables to be used as proxies for the determinants of Bank Profitability (*BP*). In what follows all the variables used in the present study are discussed.

**Income Structure:** A commonly used practice to analyse the diversification of banking activities is to examine the income structure, i.e. traditional intermediation activities versus other non-traditional activities (non-interest income). Non-interest income includes dividends, net fee income, income from financial transactions, earnings on exchange rate differences and other income. Income structure is measured by the ratio of non-interest income in total net income (see also Maudos, 2017).

**Default risk:** Credit risk (a bank's quality of assets) is measured by the ratio of non-performing loans to loans and refers to the uncertainty associated with loan repayment. Since most of bank earning assets are in the form of loans, problems with loan quality have been the major cause of bank failure. A high proportion of loan loss relative to loan assets and rapid growth of the loan portfolio are potential early-warning indications of loan-quality problems, which may indicate potential failure. Musumeci and Sinkey (1990) and Strong and Meyer (1987) suggest that investors use information on loan-loss provisions to revise their expectations of a bank's future performance while Cooper, Jackson and Patterson (2003) find that loan-loss reserves to total loans is important in forecasting the cross-section of bank stock returns.

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4. Capital Adequacy; Asset Quality; Management Quality; Earnings and Liquidity.



**Portfolio performance:** Portfolio performance captures the bank's capability in matching the needs for deposit and loan services and is measured by the loans to assets ratio. Bank loans are naturally the main source of income, being the most risky and having the highest yield (in terms of expected return) among bank assets as well as the highest operational costs, as they need to be originated, serviced and monitored. If banks that held fewer loans had more credit-risky securities, we would expect these banks to have performed worse because of the increase in credit spreads that took place during the crisis (see also Beltratti and Stulz, 2012).

**Leverage:** Leverage (capital adequacy) is proxied by the ratio of equity to assets and serves as an indicator for the risk of insolvency and the market value of assets (Maudos and Fernández de Guevara, 2004). Equity represents the amount of own funds available to support a bank's activities and acts as safety net in the case of adverse developments. Since equity is a relatively expensive source of funding, an increase in equity capital on a voluntary basis or as a result of regulation may increase the average cost of capital (Saunders and Schumacher, 2000; Martinez Peria and Mody, 2004). It is believed by depositors, especially in developing countries that well capitalized banks are safer and face lower costs of going bankrupt. Especially in southern economies, depositors have few alternatives for bank deposits; yet they are regularly confronted with information about bad asset quality in some banks and even outright bank failures. Moreover, since capital is considered to be the most expensive form of liabilities in terms of expected return, holding capital above the regulatory minimum is a credible sign of creditworthiness on the part of the bank.

**Management quality:** This variable is proxied by the ratio of earning assets to total assets. Management decisions are reflected in the composition of a bank's portfolio by means of providing, inter alia, profitable composition of assets and low-cost liabilities.

**Overhead expenses:** This variable is measured by operational expenses divided by total assets and is used to capture cost management (Demirgüç-Kunt and Huizinga, 1999; Abreu and Mendes, 2003; Demirgüç-Kunt, Laeven and Levine, 2004).

**Bank size:** We employ the logarithm of total assets (SIZE) to capture the effect of bank size in order to account for potential economies or diseconomies of scale in the banking sector. Scale economies in banking may arise from a variety of sources. Size entails a reduction in costs insofar as it may offer better diversification opportunities in the deposit base as well as investment and loans, and therefore it reduces the likelihood of a liquidity shortage. On the other hand, agency problems, control problems and all the difficulties and costs associated with

managing large institutions may decrease the benefits of scale economies, while large banks may hold a substantial amount of market power and/or higher efficiency levels.

Moreover, we incorporate regulatory and macroeconomic variables to capture the differences in the banking and macroeconomic environment.

Regulation: To examine the impact of banking sector reform we apply the EBRD index of banking sector reform and individual regulatory indices.

The EBRD index of banking sector reform has been compiled with the primary purpose of assessing the progress of the banking sectors of formally centrally planned economies.<sup>5</sup> As this indicator quantifies and qualifies the degree of liberalization of the banking industry, it is suitable for an explicit evaluation of the effect of banking sector reform on the profitability of banks (see also Claeys and Vander Vennet, 2007). The reform scores of EBRD range from 1.0 to 4.0+, with 1.0 indicating a rigid centralized economy and 4.0+ implying the highest level of reform, which corresponds to a fully industrialized market economy. Since the EBRD performs a yearly assessment of regulatory reform we are able to exploit the time-series aspect of these indices.

Finally, we rely on information from the World Bank (WB) database on bank regulations and supervision (Barth, Caprio and Levine, 2001, 2006, 2008; Cihak et al., 2012) to construct indices that relate to capital requirements, market discipline, official supervisory power and restrictions on bank activities. We focus on these four regulatory policies because they are central in the agenda of policy makers and theory suggests that they can have a direct impact on risk-taking (for a detailed analysis see also Agoraki, 2009 and Agoraki, Delis and Pasiouras, 2011).<sup>6</sup>

The capital requirements index shows the extent of both initial and overall capital stringency. Initial capital stringency refers to whether the sources of funds counted as regulatory capital can include assets other than cash or government securities and borrowed funds, as well as whether the regulatory or supervisory authorities verify these sources. The supervisory power reveals the power of the supervisory agencies to take specific actions in relation to their authority against bank

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5. The EBRD uses the number of banks (and the share of foreign owned banks), the asset share of state-owned banks, the percentage of bad loans, credit to the private sector and stock market capitalization (EBRD, 2001).

6. New regulatory initiatives are unlikely to affect the profitability of banks in the immediate term. In the estimations below, we will be using both the first and the second lags of the regulation variables.

management and directors, shareholders, and bank auditors. Higher values indicate more powerful supervisors. Barth, Caprio and Levine (2004) mention that among others, strong official supervision can prevent managers from engaging in excessive risk-taking behaviour, contributing to bank development, performance and stability. However this may not always be the case, especially in transition economies.

The activities restriction index is determined by considering whether securities, insurance, real estate activities, and ownership of non-financial firms are unrestricted, permitted, restricted, or prohibited. Higher values indicate higher restrictions. Barth, Caprio and Levine (2004) indicate that restricting bank activities is negatively associated with bank development and stability. The market discipline index shows the degree to which banks are forced to disclose accurate information to the public (e.g., disclosure of off-balance sheet items, risk management procedures, etc.) and whether there are incentives to increase market discipline (e.g., subordinated debt, explicit deposit insurance). Higher values indicate higher disclosure requirements and more incentives to increase market discipline.

Macroeconomic environment: To capture the effect of the macroeconomic environment we use GDP growth (*gdpg*) as a proxy for the fluctuations in economic activity and the short-term interest rate to capture monetary stance. An increase in GDP growth could be expected to increase a bank's income as a result of more lending and lower default rates (Brock and Suarez, 2000; Claey's and Vander Vennet, 2007).

Market structure: The structure of a banking market is captured by the degree of competition and concentration. According to the structure-conduct-performance (SCP) hypothesis (Bain, 1951), bank concentration (or market share) implies market power and a positive association between profits and concentration. In other words, market structure influences the behavior of banks through the pricing of their products in an imperfectly competitive market, with increased concentration resulting in higher profits. This hypothesis postulates that greater profits are the results of collusion between the firms of the industry.

As a proxy of the degree of concentration, we consider Herfindahl-Hirschman index (HHI) (calculated as the sum of squared market shares in term of assets of the individual banks).<sup>7</sup> As an alternative measure, we also apply a direct indicator of market power following the method of Uchida and Tsutsui (2005). A common

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7. For a review of concentration ratios and the Herfindahl-Hirschman index, see Rhoades (1977).

argument is that competition drives down loan rates and bank profits, reducing banks' incentives to screen loan applicants (Gehrig, 1998), leading to eased lending criteria and increased bank failures (Bolt and Tieman, 2004).

In particular, we jointly estimate the following system of three equations that correspond to a translog cost function, to a revenue equation obtained from the profit maximization problem of banks, and to an inverse loan demand function:

$$\begin{aligned} \ln C_{it} = & b_0 + b_1 \overline{\ln q_{it}} + \frac{1}{2} b_2 (\overline{\ln q_{it}})^2 + b_3 \overline{\ln d_{it}} + \frac{1}{2} b_4 (\overline{\ln d_{it}})^2 + b_5 \overline{\ln w_{it}} \\ & + \frac{1}{2} b_6 (\overline{\ln w_{it}})^2 + b_7 (\overline{\ln q_{it}})(\overline{\ln w_{it}}) + b_8 (\overline{\ln q_{it}})(\overline{\ln d_{it}}) \\ & + b_9 (\overline{\ln q_{it}})(\overline{\ln w_{it}}) + e_{it}^C \end{aligned} \quad (2)$$

$$\begin{aligned} R_{it} = & \frac{\theta_t}{\eta_t} R_{it} + r_{it} q_{it} + c_{it} (b_1 + b_2 \overline{\ln q_{it}} + b_7 \overline{\ln w_{it}} + b_8 \overline{\ln d_{it}}) \\ & + C_{it} \frac{q_{it}}{d_{it}} (b_3 + b_4 \overline{\ln d_{it}} + b_8 \overline{\ln q_{it}} + b_9 \overline{\ln w_{it}}) + e_{it}^s \end{aligned}$$

$$\ln p_{it} = g_0 - (1/\eta_t) \ln q_{it} + g_1 \ln gdp g_t + g_2 \ln ir_t + e_{it}^D$$

where  $C$  is the total cost (i.e., total expenses) of bank  $i$  at time  $t$ ,  $q$  is bank output measured by total earning assets,  $d$  are total deposits and short-term funding,  $w$  are the prices of inputs, in this case measured by the ratio of total operating expenses (overheads) to total assets,  $R$  is total bank revenue,  $r$  is the interest rate on deposits calculated as the ratio of interest expenses to total deposits and short-term funding,  $p$  is the price of bank output given by the ratio of total revenue to total earning assets, and  $e$  are the error terms. Variables with bars represent deviations from their cross sectional means at each time period, and are transformed in this way so as to remove their trend, specified in this way to reduce multicollinearity. We use the annual % GDP growth ( $gdp g$ ) and the short-term interest rate ( $ir$ ) as exogenous variables that affect demand. The degree of competition in each year is denoted by  $\theta$ , which

represents the well-known conjectural variations elasticity of total industry output with respect to the output of the  $i$ th bank.<sup>8</sup>

The range of possible values of  $\theta$  is given by  $[0, 1]$ . In the special case of Cournot competition,  $\theta_{it}$  is simply the output share of the  $i$ th bank at each point in time. In the case of perfect competition,  $\theta_{it} = 0$ ; under pure monopoly,  $\theta_{it} = 1$ ; and, finally,  $\theta_{it} < 0$ , implies pricing below marginal cost and could result, for example, from a non-optimizing behavior of banks. Estimation is carried out for each country separately using seemingly unrelated regression. The full set of  $\theta_t$  results are presented in table 2.

**Ownership:** We distinguish banking institutions into three mutually exclusive categories, namely, majority state-owned banks, majority domestic private ownership, and strategic foreign ownership. We include dummy variables for the foreign ownership that equals one if the majority is held by strategic foreign owners, the government ownership variable that equals one if the majority is held by a governmental body and the domestic private ownership variable that equals one if the majority is held by domestic private investors.

#### **IV. Data sources**

We use an unbalanced panel dataset of approximately 3750 bank-annual observations of 388 commercial, savings and cooperative banks operating in the 11 CEE markets shown in table 1 over the period 2000-2016.<sup>9</sup> We collect our data from a number of sources. Individual bank data are taken from annual statements. Data for the regulatory indices are obtained from the World Bank database on “Bank Regulation and Supervision” developed by Barth, Caprio and Levine (2001) and updated by Barth, Caprio and Levine (2006, 2008) and Cihak et al. (2012). Data for the market structure and macroeconomic conditions are collected from the EBRD’s Transition Reports and the World Bank’s World Development Indicators (WDI). Table 1 provides some descriptive statistics for our sample.

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8. See also Agoraki (2009) and Agoraki, Delis and Pasiouras (2011)

9. This panel data set is of substantial size given the availability of the data for all transition economies and has been used in many recent papers to obtain robust results (see for example Drakos, Kouretas and Tsoumas, 2016; Giannetti and Ongena, 2012, Kouretas and Tsoumas, 2013).

TABLE 1. Banking sector indicators (2000-2016)

	Bulgaria	Croatia	Czech Republic	Estonia	Hungary
Return on Assets (ROA)	0.010	0.021	0.029	0.017	0.017
Return on Equity (ROE)	0.080	0.111	0.136	0.112	0.121
Income structure	0.135	0.156	0.242	0.217	0.345
Total expenses (C)	72,008	112,325	277,628	315,829	77,622
Total earning assets (q)	656,785	952,148	1,975,165	3,283,007	1,486,338
Total deposits and short-term funding (d)	568,225	799,828	785,152	1,416,848	1,612,549
Price of funds (interest expenses / total deposits and short-term funding) (w1)	0.062	0.067	0.082	0.070	0.074
Price of labor (personnel expenses / total assets) (w2)	0.012	0.013	0.013	0.010	0.014
Price of physical capital (total depreciation and other capital expenses/total fixed assets) (w3)	0.524	0.507	0.398	0.545	0.425
Total revenue / total earning assets (pq)	0.162	0.147	0.151	0.172	0.161
Loans/Total assets	0.432	0.448	0.411	0.417	0.455
Total equity/ Total assets	0.188	0.142	0.117	0.225	0.132
Non-performing loans / Total loans	0.042	0.038	0.044	0.059	0.020
Liquid assets/total assets	0.521	0.331	0.428	0.402	0.405
Earning assets/total assets	0.925	0.817	0.841	0.822	0.857
Overhead cost/total assets	0.018	0.064	0.041	0.032	0.039
Capital requirements index	6.57	3.86	4.86	4.43	6.00
Supervisory power index	11.14	11.54	9.57	13.14	14.00
Activities restrictions index	2.39	1.96	2.86	1.68	2.68

(Continued )

TABLE 1. (Continued)

	Bulgaria	Croatia	Czech Republic	Estonia	Hungary
Market discipline index	6.00	6.00	6.14	6.43	6.29
Total assets (th. Euros)	812,127	1,658,452	980,420	2,754,348	1,751,120
Herfindahl-Hirschman index	1647.08	1824.65	1752.48	1926.32	1649.06
Annual % GDP growth rate ( <i>gdp</i> )	4.15	2.19	2.95	2.08	4.21
Inflation	17.25	11.14	5.41	12.02	12.72
Short-term Interest rate	14.55	7.08	8.43	14.32	17.05
Public ownership (%)	38.3	14.5	9.5	7.0	0.0
Domestic private ownership (%)	26.0	35.5	35.5	44.4	62.5
Foreign ownership (%)	20.9	46.2	43.2	42.0	27.5
EBRD index on banking reform	2.84	3.21	3.37	3.57	3.75

(Continued)

TABLE 1. (Continued)

	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Return on Assets (ROA)	0.033	0.025	0.015	0.013	0.021	0.021
Return on Equity (ROE)	0.145	0.076	0.117	0.078	0.084	0.107
Income structure	0.259	0.154	0.246	0.156	0.151	0.153
Total expenses (C)	52,452	247,527	82,284	83,256	189,525	202,137
Total earning assets (q)	486,227	1,892,467	816,452	1,256,220	2,657,722	1,920,340
Total deposits and short-term funding (d)	4,553,717	1,220,435	757,618	920,642	2,220,747	1,450,128
Price of funds (interest expenses / total deposits and short-term funding) (w1)	0.045	0.068	0.052	0.081	0.056	0.066
Price of labor (personnel expenses / total assets) (w2)	0.016	0.010	0.016	0.010	0.014	0.018
Price of physical capital (total depreciation and other capital expenses/total fixed assets) (w3)	0.442	0.517	0.422	0.505	0.412	0.328
Total revenue / total earning assets (pq)	0.115	0.127	0.151	0.144	0.128	0.142
Loans/Total assets	0.359	0.473	0.418	0.463	0.417	0.485
Total equity/ Total assets	0.147	0.212	0.163	0.148	0.182	0.163
Non-performing loans / Total loans	0.050	0.047	0.055	0.049	0.055	0.062
Liquid assets/total assets	0.458	0.442	0.485	0.382	0.425	0.442
Earning assets/total assets	0.722	0.750	0.805	0.703	0.748	0.851
Overhead cost/total assets	0.064	0.071	0.065	0.057	0.042	0.065
Capital requirements index	5.00	3.57	4.57	4.86	5.00	6.57
Supervisory power index	11.29	12.00	9.29	9.86	13.14	12.71
Activities restrictions index	1.89	2.36	1.96	2.93	2.57	2.57

(Continued)



TABLE 1. (Continued)

	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Market discipline index	6.86	6.00	6.00	4.86	5.29	6.86
Total assets (th. Euros)	560,430	2,412,620	981,217	1,310,451	2,615,327	2,378,617
Herfindahl-Hirschman index	1812.17	1724.22	1835.28	1705.42	1642.37	1758.97
Annual % GDP growth rate ( <i>gdpg</i> )	2.18	2.45	4.61	3.49	4.21	2.87
Inflation	13.05	9.73	11.48	14.52	7.82	8.63
Short-term Interest rate	9.95	9.58	16.56	25.90	11.85	10.45
Public ownership (%)	14.0	30.0	29.05	32.00	40.00	33.50
Domestic private ownership (%)	16.2	27.0	35.00	40.50	20.45	42.80
Foreign ownership (%)	68.0	32.0	23.80	25.50	25.87	19.00
EBRD index on banking reform	3.23	3.03	3.23	2.71	3.04	3.17

**Note:** Data are averaged across all banks in the country. Source: Banks' Annual reports; European Bank for Reconstruction and Development (EBRD); World Bank's World Development Indicators and own estimations.

TABLE 2. Evolution of competitive conditions in the emerging European banking systems ( $\theta$ )

	Bulgaria	Croatia	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
2000	0.169	0.515	0.500	0.670	0.317	0.713	1.147**	0.888	0.153	0.445	0.901
2001	0.187	0.502	0.366	0.703	0.328	0.846	1.114**	0.742	0.236	0.396	0.970**
2002	0.183	0.514	0.437	0.684	0.450	0.683	1.134**	0.754	0.279	0.412	0.977**
2003	0.259	0.570	0.414	0.801	0.366	0.756	1.138**	0.723	0.381	0.419	1.077**
2004	0.293	0.524	0.577	0.861	0.419	0.671	1.099**	0.742	0.328	0.373	1.067**
2005	0.349	0.537	0.369	0.887	0.377	0.629	1.134**	0.742	0.236	0.321	1.008**
2006	0.210	0.711	0.651	0.936	0.473	0.832	1.163**	0.771	0.293	0.284	1.012**
2007	0.347	0.807	0.653	0.853	0.482	0.773	1.101**	0.800	0.382	0.322	0.996**
2008	0.378	0.793	0.676	0.700	0.563	0.839	1.161**	0.675	0.322	0.356	1.083**
2009	0.340	0.813	0.617	0.646	0.549	0.830	1.107**	0.636	0.293	0.287	0.991**
2010	0.337	0.751	0.632	0.522	0.532	0.821	1.120**	0.612	0.312	0.231	0.824
2011	0.372	0.572	0.600	0.351	0.675	0.883	1.012**	0.642	0.175	0.245	0.687
2012	0.330	0.612	0.611	0.412	0.542	0.831	0.878	0.712	0.126	0.237	0.642
2013	0.292	0.580	0.583	0.380	0.522	0.800	0.825	0.728	0.129	0.245	0.670
2014	0.241	0.502	0.487	0.312	0.450	0.719	0.811	0.682	0.114	0.197	0.682
2015	0.301	0.528	0.579	0.402	0.428	0.813	0.967	0.645	0.286	0.224	0.788
2016	0.297	0.531	0.517	0.378	0.502	0.825	0.895	0.604	0.247	0.249	0.795

**Note:** The table presents estimates of competition ( $\theta$ ) for 11 emerging European markets over the period 2000-2016. A value of  $\theta$  statistically equal to one implies monopoly practices, while a value equal to zero implies competitive conditions. Lower values suggest increased competition and higher values increased market power. \* indicates that the hypothesis of perfect competition is not rejected at the 5 per cent level of statistical significance and \*\* indicate that monopolistic conditions are not rejected at the 5 per cent level.

Regarding market power, the estimations are mixed, with the majority of countries reflecting neither monopolistic nor competitive behavior. The emerging European banking systems have inherited from the previous centrally-planned economies a considerable volume of nonperforming loans. In these countries banking laws were generally developed to promote sound banking practices among existing and new market players, and increase the efficiency of delivering intermediation services. Most of these banking sectors share common structural characteristics as they follow similar development paths during the transition period. Moreover, virtually all of these banking systems experienced periods of insolvency and crisis in the mid-1990s that necessitated efforts, often more than once, to recapitalize and restructure the banks (Bonin, Hasan and Wachtel, 2005).

Bad debt problems and corporate defaults were the major reasons of banking crises in the region, which reduced a bank's assets and affected their lending behavior due to the preference to hold government securities or liquid assets on their balance sheets. The cost of overcoming the banking crisis has been significant in all these countries. The highest costs were observed in Romania (estimates ranging from around 8% of GDP), in Croatia (30 % of GDP) and Bulgaria (up to 75% of GDP between 1991 and 1998).

It is noteworthy that, ever since, changes have been made in the regulatory frameworks and the privatization of the banking sector, as remedies for the banking crises. Regulatory changes mainly involved improvements in banking supervision, while the privatization of the banking sector was carried out mainly through sales to foreign banks. The expansion of foreign banks in the acceded area has mostly come from Western European banks which in a short time period managed to dominate the emerging European banking systems.

Significant steps have been taken towards the improvement of the banking legislation. There have been continuous amendments on banking supervision regulative system aiming at its harmonization with the EU regulative regime and the international standards of effective supervision. These laws have increased the appeal of the emerging European banking system for foreign investment, reinforced prudent standards and practices in the banks' operations, enhanced corporate governance, and improved efficiency in banking operations and supervision. However, it is important to recognize that it is not legislation on its own that really matters, but the actual implementation of reforms.

The main motive behind the privatization of state-owned banks was the desire to enhance competition and efficiency in the banking sector

through increased foreign and domestic participation, while the banking crises that affected the region during this period have basically accelerated the privatization process. For instance, beginning in 1995 with virtually no holdings in Croatia, foreigner investors had acquired about 84% of banking assets by 2000 and, by 2002, all of the ten largest banks in the country were in majority foreign owned (EBRD, 2004).

As it concerns our dataset, the average ratio of total revenue to assets indicates the low significance of non-interest income sources in total operating revenue. The operational expenses variable reflects over-employment in credit institutions in those countries. Implementing new technology has been a major factor responsible for the reduction in operational expenses. The average equity-to-assets is higher than the European average, due mainly to the ongoing restructuring process of the state-owned institutions, the relatively low credit expansion, the riskiness of assets and the banks' compensation for poor access to other sources of funds. Although the high ratio may be reassuring in terms of sound financial management, it also confirms the existence of high-risk lending operations and the high degree of liquid and non-banking items on banks' balance sheets.

The low level of loans to total assets combined with the need for new investments and the boost in household consumption, could incur considerable high rates of credit expansion in the future. Sluggish credit growth can be partially attributed to inadequate legal protection for lenders, lack of credit history for most companies and scarcity of adequate risk management techniques. The relatively slow growth may also have been delayed by the prolonged process of cleaning up the banks' portfolio (Cottarelli, Dell and Vladkova-Hollar, 2005). Yet, given the associations that have often been identified between as underlying between lending booms and financial stability, an uncontrollable credit expansion could be unwanted.

However, the period of expansion taking place in Europe up until it was interrupted by the outbreak of the financial crisis in 2007. The disintermediation process was driven by the development of new technologies, deregulation in the sector, and increased non-bank competition, which affected the banking business. The crisis reshaped the environment in a way that will affect the features of the banking business and its income structure. With the regulatory changes implemented, a scenario of lower profitability has emerged in which there will be a structural change in the income structure (Maudos, 2017).

## V. Estimation and results

The aim of this paper is mainly to present an empirical specification of the determinants of profitability in the emerging European banking sector for the period 2000-2016. In this section, we investigate whether profitability is affected by (i) bank-specific and/or (ii) regulatory and other macroeconomic indicators. In Model (4), in both tables 3 and 4, the Herfindahl-Hirschman index is included as a market structure variable.

To determine whether our instruments are valid in the system GMM approach, we use the specification tests proposed by Arellano and Bond (1991) and Arellano and Bover (1995). First, we apply the Sargan test, a test of over-identifying restrictions, which tests the overall validity of the instruments. Second, we test whether the differenced error term is second-order serially correlated. First-order autocorrelation, AR1, could be expected in the first differences of the errors; however, higher order autocorrelation would indicate that some lags of the dependent variable are in fact endogenous, thus bad instruments. In all estimated equations the test for AR2 rejects the presence of second-order autocorrelation. Moreover, the Sargan test indicates that the model is not over-identified.

To assess the robustness of the links between bank-specific factors, regulations, market structure, and macroeconomic indicators we apply different versions of the model, where variables are gradually included in the models, in order to check whether they retain their sign and significance in different models. Table 3 reports the empirical results where ROA is the dependent variable. The positive impact of equity capital implies that banks characterized by high levels of capital manage to perform in higher levels of profitability. Cost efficiency measures management flexibility to adjust costs to changes in the business development characterized by revenues and increases profitability.

The positive effect of bank size possibly illustrates the fact that large banks offer safety of transactions in relatively risky banking sectors, such as the ones of the emerging European markets, as well as economies of scale that result in higher profitability. When, ownership variables are included in our estimation models we do not observe considerable diversification in the results. The entry of foreign banks has played an important role in the bank reform process by increasing levels of efficiency, hence superior profits.<sup>10</sup> We find a positive and

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10. Foreign banks headquartered in developed nations may have additional advantages over domestic institutions in developing nations. These may include managerial expertise and experience, a well-developed business plan, superior access to capital, ability to make larger loans, a seasoned labor force, market power over suppliers, and so forth.

TABLE 3. Determinants of profitability in the emerging European banking systems (dep. variable: ROA)

	(1)	(2)	(3)	(4)
Lagged dep. Variable	0.318***	0.221***	0.422***	0.125***
Market power ( $\theta$ )	0.212***	0.193***	0.277***	
Herfindahl-Hirschman index				0.142***
Income Structure	-0.073***	-0.049**	-0.056**	-0.047*
Default risk (non-performing loans/total loans)	-0.107**	-0.151**	-0.128*	-0.215*
Portfolio performance(loans/total assets)	0.289***	0.245**	0.328***	0.241***
Leverage (equity/total assets)	0.112**	0.132**	0.175**	0.138**
Liquidity risk (liquid assets/total assets)	0.083	0.048*	0.065	0.128
Management Quality (earning assets/total assets)	0.052	0.089	0.228	0.183
Overhead expenses (overhead expenses/total assets)	-0.029**	-0.015*	-0.042**	-0.035**
Bank size	0.288***	0.241***	0.241***	0.225***
GDP growth rate	0.108***	0.143***	0.128***	0.122***
Interest rate	-0.024*	-0.032*	-0.047*	-0.025*
Foreign ownership		0.047**	0.017**	0.040**
Public ownership		-0.095***	-0.028***	-0.034***
Domestic ownership		0.014	0.083	0.025
EU Membership	0.087***	0.028***	0.072***	0.069***
Crisis	-0.241***	-0.224***	-0.289***	-0.241***
EBRD		0.081**		
Capital requirements index	0.042***		0.121***	0.118***
Supervisory power index	-0.027*		-0.038*	-0.045*
Activity restrictions index	0.057**		0.095**	0.042**
Market discipline index	0.029*		0.035**	0.025**

(Continued)

TABLE 3. (Continued)

	(1)	(2)	(3)	(4)
Observations	3794	3416	3742	3712
Wald (p-value)	0.000	0.000	0.000	0.000
AR(1) (p-value)	0.000	0.000	0.000	0.000
AR(2) (p-value)	0.607	0.458	0.542	0.587
Sargan (p-value)	0.325	0.357	0.309	0.410

Note: crisis: dummy variable that takes value 1 for the years 2007-2016; EU membership: dummy variable that takes value 1 if the country is a member of the eurozone. The Wald-test and its associated p-value denote the goodness of fit of the regressions, AR1 and AR2 are the tests for first and second order autocorrelation and Sargan is the test for overidentifying restrictions. The tests reject the hypotheses for second order serial correlation and overidentifying restrictions. The table reports coefficients, with \*, \*\*, \*\*\* representing significance at the 10, 5 and 1%, respectively. All models include country and time dummy variables.

TABLE 4. Determinants of profitability in the emerging European banking systems (dep. variable: ROE)

	(1)	(2)	(3)	(4)
Lagged dep. Variable	0.324***	0.312***	0.241***	0.267***
Market power ( $\theta$ )	0.187**	0.174**	0.192**	
Herfindahl-Hirschman index				0.105**
Income Structure	-0.032**	-0.045**	-0.012**	-0.028**
Default risk (non-performing loans/total loans)	-0.201**	-0.248***	-0.185**	-0.127**
Portfolio performance(loans/total assets)	0.188*	0.165*	0.208***	0.242***
Leverage (equity/total assets)	0.084**	0.065***	0.077**	0.062**
Liquidity risk (liquid assets/total assets)	0.028	0.054	0.012	0.025
Management Quality (earning assets/total assets)	0.115	0.040*	0.044	0.015*
Overhead expenses (overhead expenses/total assets)	-0.052**	-0.087**	-0.064***	-0.055***
Bank size	0.212***	0.207***	0.149***	0.099***
GDP growth rate	0.041***	0.016***	0.059***	0.022***
Interest rate	-0.028*	-0.064*	-0.017*	-0.032*
Foreign ownership		0.118**	0.154***	0.097***
Public ownership		-0.078***	-0.123*	-0.107*
Domestic ownership		0.049	0.130	0.058
EU Membership	0.125***	0.131***	0.157***	0.118***
Crisis	-0.088**	-0.065***	-0.179***	-0.136***
EBRD		0.155***		
Capital requirements index	0.154**		0.126**	0.152**
Supervisory power index	-0.062***		-0.053***	-0.047***
Activity restrictions index	0.051***		0.038**	0.085**
Market discipline index	0.085***		0.126**	0.118**

(Continued)



TABLE 4. (Continued)

	(1)	(2)	(3)	(4)
Observations	3825	3520	3710	3728
Wald (p-value)	0.000	0.000	0.000	0.000
AR(1) (p-value)	0.000	0.000	0.000	0.000
AR(2) (p-value)	0.530	0.457	0.581	0.380
Sargan (p-value)	0.224	0.314	0.676	0.554

**Note:** crisis: dummy variable that takes value 1 for the years 2007-2016; EU membership: dummy variable that takes value 1 if the country is a member of the eurozone. The Wald-test and its associated p-value denote the goodness of fit of the regressions, AR1 and AR2 are the tests for first and second order autocorrelation and Sargan is the test for overidentifying restrictions. The tests reject the hypotheses for second order serial correlation and overidentifying restrictions. The table reports coefficients, with \*, \*\*, \*\*\* representing significance at the 10, 5 and 1%, respectively. All models include country and time dummy variables.

significant association between market power and profitability that is robust across all specifications (the results remain qualitatively unchanged when a concentration measure is applied). Our results support the collusion hypothesis (or structure conduct performance hypothesis), where concentration leads to a lower level of competition and higher bank performance.

Capital requirements appear to be an effective tool in reinforcing profitability, while supervisory power hypothesis has a negative effect. The impact of the activities restrictions index is significant, indicating that there is a positive effect of activity restrictions on profitability. A potential explanation for this finding is that as the integration of financial services is restricted, banks focus on the loan market in order to compensate for the forgone non-interest income. As it was expected, the crisis seems to have significantly decreased profits, while in the examined countries the accession to the eurozone has served as a stability mechanism. Our findings show that an increase in the share of non-interest income has a negative impact on profitability. This result indicates that during a crisis, income from the traditional intermediation business has regained importance. Finally, higher economic growth is associated with higher returns whereas our results show a negative and statistically significant effect of short-term interest rate on profitability.

The results in table 4 present the estimations when we use ROE as a measure of profitability. The coefficient on the lagged dependent variable is highly significant indicating a considerable level of persistence in profitability. The positive impact of equity capital implies that banks characterized by high levels of capital tend to have higher returns as they represent safer institutions. This effect could also be associated with the pressure generated by solvency regulations (see also Carbo and Rodriguez, 2007). The significance of equity-to-assets variable is relatively important considering that capital adequacy ensures systemic stability and maintains depositor confidence. On the same line with the results in table 3, higher supervisory power results in lower profits. Consistent with the private monitoring hypothesis, regulatory proposals and previous studies on corporate governance, financial disclosures and other incentives that enhance market discipline can be an effective tool in increasing profits. When depositors exert “market discipline”, this may enable the bank to lower its deposit funding costs, leading to higher profitability.

During the period under investigation there was a notable entry of foreign banks. A higher presence of foreign (state-owned) banks in the market seems to result in higher (lower) profitability which suggests a number of benefits from the entry of foreign banks in emerging markets (Demirgüç-Kunt and Serven, 2009). The presence of foreign banks is often associated with a more stable lending environment, as well as

superior managerial experience and risk management. Furthermore, we once again confirm that a positive and significant association exists between market power and profitability that is robust across all specifications (the results remain qualitatively invariable when a concentration measure is applied).

When we use EBRD we conclude that the effect of reform is positive to profits. Default risk has a negative and statistically significant relationship with profits, indicating the risk premium set by the banks over the net interest margin, in order to compensate for cases of non-repayment or default of a loan. In addition, Portfolio performance, used as a proxy for capturing the bank's capability in matching the needs for deposit and loan services, has a positive and significant effect on profits. Finally, GDP growth once again enters with a positive sign and statistically significant magnitude whereas the evidence on the negative relationship between the monetary policy tool, i.e. the short term interest rate, and banks' profitability falls within the predictions made.

## **VI. Conclusions**

In this paper, an empirical framework was developed in order to investigate the effect of bank-specific, macroeconomic determinants and regulatory environment on the profitability of European banks for the period 2000-2016. Evidently, the regulatory framework plays a crucial role. According to the results obtained above, a significant part of profitability is explained by bank-specific characteristics such as portfolio performance, default risk and leverage, while focusing on traditional activities can enhance profitability during crisis. In both estimations, bank profitability is positively and significantly affected by internal determinants (the proportion of loans in the asset composition, the quality of the credit portfolio, the financial leverage of the bank, and the operational expenses). The positive effect of bank size illustrates the fact that large banks have higher returns as a compensation for customers' worries regarding the safety of transactions in relatively risky banking sectors, such as the ones of the emerging European markets. The restructuring that some European banking sectors have suffered in order to address the recent crisis has increased the degree of market power, thus promoting the profitability of banks at the expense of competition. Finally, the diversification of banking income should be a proactive response to maintain profitability, however a negative relationship points out the underdeveloped alternative solutions.

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## Appendix A.

Structure of regulatory variables	
Capital Requirements	This variable is determined by adding 1 if the answer is yes to questions 1-6 and 0 otherwise, while the opposite occurs in the case of questions 7 and 8 (i.e. yes=0, no =1). (1) Is the minimum required capital asset ratio risk-weighted in line with Basle guidelines? (2) Does the ratio vary with market risk? (3-5) Before minimum capital adequacy is determined, which of the following are deducted from the book value of capital: (a) market value of loan losses not realized in accounting books? (b) unrealized losses in securities portfolios? (c) unrealized foreign exchange losses? (6) Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? (7) Can the initial or subsequent injections of capital be done with assets other than cash or government securities? (8) Can initial disbursement of capital be done with borrowed funds?
Market discipline	This variable is determined by adding 1 if the answer is yes to questions 1-7 and 0 otherwise, while the opposite occurs in the case of questions 8 and 9 (i.e. yes=0, no =1). (1) Is subordinated debt allowable (or required) as part of capital? (2) Are financial institutions required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries? (3) Are off-balance sheet items disclosed to public? (4) Must banks disclose their risk management procedures to public? (5) Are directors legally liable for erroneous/misleading information? (6) Do regulations require credit ratings for commercial banks? (7) Is an external audit by certified/licensed auditor a compulsory obligation for banks? (8) Does accrued, though unpaid interest/principal enter the income statement while loan is non-performing? (9) Is there an explicit deposit insurance protection system?

(Continued)

**Appendix A. (Continued)**

	Structure of regulatory variables
Official disciplinary power	<p>This variable is determined by adding 1 if the answer is yes and 0 otherwise, for each one of the following fourteen questions: (1) Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank? (2) Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud, or insider abuse? (3) Can supervisors take legal action against external auditors for negligence? (4) Can the supervisory authorities force a bank to change its internal organizational structure? (5) Are off-balance sheet items disclosed to supervisors? (6) Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses? (7) Can the supervisory agency suspend director's decision to distribute dividends? (8) Can the supervisory agency suspend director's decision to distribute bonuses? (9) Can the supervisory agency suspend director's decision to distribute management fees? (10) Can the supervisory agency supersede bank shareholder rights and declare bank insolvent? (11) Does banking law allow supervisory agency or any other government agency (other than court) to suspend some or all ownership rights of a problem bank? (12) Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency (other than court) supersede shareholder rights? (13) Regarding bank restructuring &amp; reorganization, can supervisory agency or any other government agency (other than court) remove and replace management? (14) Regarding bank restructuring &amp; reorganization, can supervisory agency or any other government agency (other than court) remove and replace directors?</p>
Restrictions on banks activities	<p>The score for this variable is determined on the basis of the level of regulatory restrictiveness for bank participation in: (1) securities activities (2) insurance activities (3) real estate activities (4) bank ownership of non-financial firms. These activities can be unrestricted, permitted, restricted or prohibited that are assigned the values of 1, 2, 3 or 4 respectively. We use an overall index by calculating the average value over the four categories.</p>

**Note:** The individual questions and answers were obtained from the World Bank database developed by Barth, Caprio and Levine (2001, 2006, 2008) and Cihak et al. (2012). See also, Agoraki, Delis and Pasiouras (2011).

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