Does Corporate Governance Support Efficiency in Banking Business? Evidence from European Systemic Banks

*Iustina Alina BOITAN – Dan Costin NIŢESCU**

Abstract

The paper addresses bank governance and efficiency in an integrated manner, providing new findings and insight for future policy. The analysis gravitates around a representative set of financial institutions, comprising of all the Global Systemically Important Financial Institutions currently monitored by the European Banking Association. The empirical study had been developed on several complementary stages. Firstly, we applied a non-parametric approach to compute the technical efficiency which indirectly measures banks' managerial efficiency in conducting the banking business. Secondly, we performed a panel data regression to uncover whether banks' managerial efficiency is determined by boards of directors characteristics in terms of size, independence and gender diversity. Thirdly, we employed a panel data regression with fixed effects to assess if managerial efficiency and board's features have an impact on several bank-level and banking system-level financial indicators. The findings show that managerial efficiency and banking indicators are determined by boards' characteristics.

Keywords: *corporate governance, management efficiency, GSIFIs, Data Envelopment Analysis, panel regression*

JEL Classification: C23, C61, G21, G32

Introduction

Post crisis developments within the regulatory frame determined structural changes in banking business, from the new tasks and responsibilities of the boards, to the internal control systems and processes, risk management functions, operations, business models and practices. New mechanisms developed at the European and global level related to supervision, resolution, business planning continuity, money laundering, deposit guarantee schemes, involve new and

* Iustina Alina BOITAN – Dan Costin NIŢESCU, The Bucharest University of Economic Studies, Faculty of Finance and Banking, 5 – 7 Mihail Moxa Street, District 1, 010961 Bucharest, Romania; e-mail: iustina.boitan@fin.ase.ro; dan.nitescu@fin.ase.ro

challenging set of responsibilities for banks' governance structures. Risk management and compliance functions increased their roles within the banking business. Capital allocation and planning, technological development and the highly increased presence of ITC critical infrastructures, the flow and quality of information in and outside the banks represent other key points for banks' governance systems.

Banking relevant indicators such as performance indicators, solvency indicators, capital planning indicators, indicators related to balance sheet's structure, and liquidity indicators reflect a new approach regarding the efficiency of a bank, the challenges that the bank faces both in building profitable and sustainable business and managing the evolving risks. The boards of the banks should develop and calibrate risk management capabilities in accordance with the risks they are going to undertake, related to the size of the bank, complexity and operations, having a clear focus in building adequate and preventive mechanisms.

The structure and composition of the boards, their diverse range of skills, knowledge, experience, and perspective are considered to be very important for the efficiency of a bank's business. Especially within the post crisis environment, due to a more complex and interconnected operating banking environment, boards should evaluate risks related also to the management's business strategy, the efficiency being highly related both with the performance and with an adequate system of risk management and compliance. Relevant authorities[1] have made important steps in drafting and implementing the new frame on bank corporate governance, compliance and risk management.

In accordance with the Basel Committee on Banking Supervision (2015), corporate governance represents "a set of relationships between a company's management, its board, its shareholders and other stakeholders which provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance. It helps define the way authority and responsibilities are allocated and how corporate decisions are made".

Due to the significant role played by the banks within economies and societies, effective corporate governance is relevant both for every banking organization and for the financial system as a whole. Corporate governance should determine the allocation of authority and responsibilities in an adequate manner, to protect the interests of all stakeholders (such as depositors, shareholders/investors, employees, bank management). A bank facing internal problems, which are not tackled accordingly within its corporate governance structures, may export the problems to other banks, to the banking sector and to the economy. Effective

[1] Basel Committee for Banking Supervision within the Bank for International Settlements, Organization for Economic Cooperation and Development, the European Central Bank and European National Central Banks, Federal Reserve

corporate governance, by establishing control functions and aligning corporate activities and behavior, represent a key point also for supervisors, emphasizing the need to have the appropriate levels of checks and balances within each bank. The financial crisis reflected the importance of preventing financial instability, the need to increase individual resilience and accountability for every banking organization, but also the strong inter-linkages between macro and micro objectives, policies and instruments.

Our research aim is to uncover and analyze the inter-linkages between the governance structure of a bank and selected relevant banking indicators, both at bank-level and banking system-level. In a nutshell, our strong motivation in drafting this paper was driven also by the complexity of the approached topic, which impacts the activity of the large banks and the European economy, as well as by the potential positive effects upon using the results of our empirical study within banks' future strategies and future policy actions.

Governance features, such as board structure and composition, contribute to the design and implementation of the bank strategy, to supporting risk management in the bank, but also to build a sustainable banking business, which delivers performance to the shareholders, to the customers and to the society. As the stability of the financial system depends on the stability of each banking institution, the analysis presents comparative results among peer banks, emphasizing complex relationships and synergies, best practices to be followed. Keeping in mind that the European economy is mainly funded through the banking[2] channel, our analysis is relevant as it focuses on the most important banking institutions which exhibit transnational activity. Our contribution adds value to the ongoing policy concerns which emphasize the need of developing relevant European banking players and strengthening their resilience, to support the European economy and to compete at the global stage, with US and China.

Our empirical study comprises three parts and employs specific instruments and methods. The novelty of our paper relies in empirically investigating a topical issue, namely the assessment of banks' governance efficiency and its further impact on financial indicators belonging to the individual bank, but also to the entire banking system of the country of residence. A second novel feature of our research resides in performing the analysis exclusively for the most representative European banks, which are included by the European Banking Authority into the Global Systemically Important Financial Institutions[3] (GSIFIs) category. Existing studies focusing on a European perspective of banks' corporate governance are still scarce, mainly country-level studies, and they do not address simultaneously

[2] The European economy is mainly funded through the banking channel, compared with the US economy that is mainly funded through capital markets.

issues related to board size, board independence and board gender diversity. Our research study involves quality information-gathering, calibrates a mix of methods and instruments (Data Envelopment Analysis, panel data regressions), by using a relevant panel of 283 observations, within a time frame of 10 years (2007 – 2016), including a number of 29 Global Systemic Financial Institutions.

The remaining part of the paper is structured as follows: the second section briefly reviews existing research in the field, the third section presents the three research directions envisaged, the sample of variables and describes the methodological steps, the fourth, fifth and sixth sections discuss the empirical findings, while the last one includes our concluding remarks.

1. Literature Review

Our research is based on a three pillar empirical study, including bank governance and board structures, analysis of the selected banks' most relevant indicators, in order to reflect bank's efficiency and benchmarking against peer groups of banks. Relevant literature was considered, that addresses simultaneously or separately issues related to the areas mentioned above.

Kirkpatrick (2009) emphasizes that "failures and weaknesses in corporate governance arrangements which did not serve their purpose to safeguard against excessive risk taking in a number of financial services companies were significantly contributing to the financial crisis". The study also reflects that potential governance failures at the largest banks can have serious consequences for the industry as a whole, as well as the economy.

Having as starting point previous studies in governance (e.g. Caprio, Laeven and Levine, 2007), the analysis performed by Adams and Mehran (2012) employs a sample of banking data on over 34 years to examine the relationship between banks' board structure and performance. The results indicated that board independence has no influence on bank performance. Other studies on bank performance (e.g. Hermalin and Weisbach, 2003, p. 20) emphasize that "board composition does not seem to predict corporate performance, while board size has a negative relationship to performance."

An inverted relation between bank performance and board size and between the proportion of non-executive directors and performance is found by de Andres and Vallelado (2008). Their results show that "bank's board composition and size are related to directors' ability to monitor and advice management and that

[3] Within the European Union approach, Global Systemically Important Banks (G-SIBs) are determined based on four main criteria: a) size, b) cross-jurisdiction activity, c) complexity, and d) substitutability. The list of G-SIBs is published annually by the Financial Stability Board (FSB). The G-SIBs must maintain a higher capital level – capital surcharge – compared to other banks.

larger and not excessively independent board might prove more efficient in monitoring and advising functions, and create more value".

Pathan and Faff (2013) studied whether board structure specific features (in terms of board size, independence and gender diversity) exhibited by large US bank holding companies are able to determine bank performance. The study concludes that both board size and independent members are negatively related with bank performance, while gender diversity improves bank performance.

Other research paper (Pathan and Skully, 2010) that examined the trends of boards of directors (board size, composition, and CEO duality) for a sample of 212 US bank holding companies emphasized that board size recorded a decreasing trend over the time period considered for large and medium-sized banks, while it remained relatively stable for small banks.

Previous literature on bank governance suggested that the same regulation has different effects on bank risk taking, depending on the bank's corporate governance structure (Laeven and Levine, 2009). The study also reflects that the relation between bank risk and capital regulations, deposit insurance policies, and restrictions on bank activities depends critically on each bank's ownership structure.

Post crisis research studies are trying to identify the influence of banks' governance structures on the main indicators related to the capital of the bank, their contribution to systemic risk through individual risk-taking. Angeloni (2017) mentioned that "the relations between capital levels, risk and governance become more complex". This approach allows for a dynamic analysis of other prudential standards (on liquidity, credit allocation and provisioning, distribution of resources) whose accomplishment is subordinated to supporting and preserving banks' solvency, capital being considered a core measure of a bank's solvency.

Other studies (Srinivas, Fromhart and Goradia, 2017) emphasize that banks have developed risk management capabilities and have begun to use measurement tools and analytics not only for compliance, but also to build their future strategy. The ongoing evolution in banking risk environment (cybercrime risk, conduct risk, model risk, third-party risk) is creating new challenges and priorities for banks' governance. De Andres and Vallelado (2008) point out that in an environment characterized by limited competition, tight regulation, and higher informational asymmetries banks' boards become an important mechanism for corporate governance, as their specialized knowledge of the banking business and specific risks enables them to better design the banking business conduct and monitor executive managers.

As the selected literature reflects, there are complex synergies and correlations between governance, risks, specific indicators at bank and banking system levels. Due to the changes of the regulatory and supervisory frameworks within the post crisis environment, new mechanisms, instruments and tools were developed

in order to improve governance, as the first line of defense for the safety and soundness of banks. As governance structures contribute significantly to tailoring banks' strategy, our paper proposes an integrated mechanism to assess the role of corporate governance in supporting efficiency in banking business.

Relevant aspects from the literature review, related to specific parts of our empirical study are included also within the following parts of the paper, some of them revealing empirical findings that are in line with our own results.

2. Overview of Research Methodology and Data

Our study follows three complementary research directions: (i) estimation of the bank governance quality for a set of representative European banks; (ii) investigation on whether banks' managerial efficiency is determined by the intrinsic features exhibited by the board of directors' composition (board size, number of women holding a position within the board, number of independent board members); (iii) assessment of the impact exerted by banks' managerial efficiency on a series of bank-level and banking system-level indicators.

The above mentioned research directions are based both on economic theory, previous studies and current concerns and challenges faced by financial market participants and authorities. Our research extends the literature, by examining the role and determinants of large banks' governance mechanisms in a new approach, based on a three pillar empirical study, mixing quantitative instruments and methods used in other relevant studies.

The analysis covers the timeframe 2007 – 2016 and focuses exclusively on those Global Systemically Important Financial Institutions whose activity is also monitored by the European Banking Authority (EBA), by means of regular stress-tests. The list of the 29 GSIFs considered is presented in Table 1 below.

T a b l e 1

GSIFIs Monitored by EBA

Country	GSIFIs name
Austria	ERSTE Bank
Belgium	KBC
Denmark	Danske Bank
France	BNP Paribas, Credit Agricole, SocieteGenerale, BPCE
Germany	Bayern LB, Commerzbank, Deutsche Bank, LBBW
Italy	Intesa San Paolo, Unicredit
Netherlands	ABN AMRO, ING Bank, Rabobank
Norway	DNB
Spain	Santander, BBVA, La Caixa, Sabadell
Sweden	Nordea, SEB, Handelsbanken, Swedbank
UK	Barclays, HSBC, RBS, Standard Chartered

Source: <http://www.eba.europa.eu/risk-analysis-and-data/global-systemically-important-institutions/2017>.

The paper gravitates around estimating a proxy for sound banking governance, as it is widely accepted that managerial quality of banks' boards of directors is a qualitative variable, being difficult to be observed and measured in an objective, accurate manner. To address this drawback, economic literature (Hahn, 2009) proposes the use of the term managerial efficiency, as a quantitative proxy variable. The best suited technique for computing efficiency, which has been used too in this study, is represented by Data Envelopment Analysis (DEA). The next two research directions addressed within the paper rely on a panel data approach, to account for both a temporal and spatial dimension. Methodological details are discussed in the following, while the results obtained in each stage of the analysis are presented in the subsequent sections of the paper.

The first part of the study employs a non-parametric method called Data Envelopment Analysis (DEA), as economic literature emphasizes its suitability for empirical analyses aiming at quantifying qualitative factors or variables. The results obtained by running DEA are represented by technical efficiency scores, computed for each institution included in the sample. They allow the classification of institutions into fully efficient and inefficient ones, the comparison between institutions in order to identify proper peers and help shaping the efficiency frontier. According to Řepková (2014, p. 590), this DEA feature emphasizes its further use as a decision-making tool, as "knowing which efficient banks are most comparable to the inefficient bank enables the analyst to develop an understanding of the nature of inefficiencies and reallocate scarce resources to improve productivity". Hahn (2009, p. 74) adds that efficiency, as a measure of productive efficiency, acts as "an appropriate yardstick of management quality".

The outcome of applying DEA is called technical efficiency due to methodological specificities of non-parametric techniques such as DEA which focus on technological optimization, meanwhile parametric methods rely on economic optimization (Banerjee, 2012, p. 7). More specifically, DEA research assumptions investigate whether an institution exhibits an input wastage by relying on too many inputs for producing a given level of outputs (it indicates which institutions should minimize the use of input variables in order to become efficient) or whether it is producing fewer outputs given the level of inputs (points out which institutions should maximize the amount of outputs obtained to become efficient).

The technical efficiency scores are computed individually for each institution in the sample, by solving a linear optimization problem which mathematically aggregates multiple inputs and outputs. In a simplified approach, technical efficiency is computed as the ratio of the weighted sum of outputs generated by an institution to the weighted sum of inputs used.

Technical efficiency is a scalar metric whose values range between 0 (the worst performance) and 1 (the best performing institution). Achieving a score of 1 indicates that the institution is positioned on the efficiency frontier and is called fully efficient, acting as a benchmark for the inefficient ones. A score less than 1 suggest a state of inefficiency, whose level might be computed as the difference between 1 and the technical efficiency score.

Therefore, the efficiency frontier is defined as the optimal input-output combination belonging to the most efficient institutions in the sample. A research conducted by the International Monetary Fund (2007, p. 11) indicates that DEA technique "exploits information on the input-output mix of individual entities to construct an efficient frontier enveloping the data, and then uses the frontier as a benchmark to assess various efficiency indicators for individual entities".

In order to assess banking performance in terms of efficiency, economic literature has developed three approaches which account for a different interpretation of banking behavior:

(i) the production approach claims that banks' aim is to produce financial services. Consequently, banks are viewed as financial institutions making use of various labor and capital resources to provide different products and services to customers (Yang, 2009), such as loans, deposits and other financial products/ services. Boďa and Zimková (2015) argue that this approach helps explaining banks' financial behavior from a microeconomic standpoint. The typical input variables used in production approach are represented by labor costs (personnel expenses) and operating costs, while output variables comprise deposits, loans and other earning assets (Hahn, 2009; Yang, 2009; Varias and Sofianopoulou, 2012; Repková, 2013; Boďa and Zimková, 2015).

(ii) the intermediation approach assumes that banks are financial intermediaries which collect and use financial resources (represented by liabilities) for providing financing to households, companies or other financial institutions. According to Boďa and Zimková (2015) this asset-oriented approach is "consistent with the macroeconomic view of commercial banks". Traditionally, inputs are represented by deposits, labor and capital and outputs comprise loans and investment.

(iii) the profit-oriented approach assumes that bank's primary aim is maximizing profit. Therefore, the outcome of the efficiency analysis resides in measuring the monetary effects of the financial intermediation function (Boďa and Zimková, 2015). The input variables are represented by interest expenses and non-interest expenses, while outputs comprise interest and non-interest revenues or various profit measures.

In our study we developed and tested an output-oriented DEA model, with variable returns to scale and a single-input multiple-output specification within a production approach framework. We preferred the production approach as it best matches the purpose of the study in terms of assessing banks' boards managerial efficiency. By designing the banking business strategy, the business lines of activity, the territorial spread of the banking network and general risk profile, bank's board implicitly sets benchmarks related to operating or administrative expenses and labor expenses. Consequently, by relying on these two key input variables bank's board further shapes the desired range of financial products and services provided, in terms of both asset and liability items.

The output oriented model indicates whether an institution is able to achieve maximum possible outputs by relying on given inputs. Or, as Coelli (1996, p. 7) states, the efficiency score to be estimated provides an answer to the question "by how much can output quantities be proportionally expanded without altering the input quantities used?".

We relied on a variable return-to-scale (VRS) as existing research in the field of banking argues that it is a more realistic assumption considering the banking industry features and dynamics, which cannot operate always at an optimal scale due to regulatory constraints, imperfect competition. VRS means that an increase of inputs with a given amount may trigger greater or smaller than equiproportionate increases of outputs (Titko and Jureviciene, 2014, p. 1127). From the standpoint of Nenovsky et al. (2008, p. 19) a VRS-model is more indicated when estimating "the large banks and the total banking system's average efficiency, because the increasing competition, technology improvement and regulatory changes affect the banks' behavior and impede some of them from operating at their optimal level".

The above mentioned features (production approach, output oriented model) of the DEA model to be tested have been chosen due to the specificity of our analysis which is meant to assess whether a banking business is conducted efficiently by the board of directors. In other words, managerial efficiency is measured as board's ability to efficiently use the given production inputs so as to obtain maximum of results. By defining a particular business strategy and establishing thresholds for bank's overall risk profile, for its profitability indicators, for achieving a desired market share or territorial coverage the board has most control over bank's input indicators which have to be configured and sized appropriately.

A similar viewpoint is expressed by Tanna, Pasiouras and Nnadi (2011, p. 10) which claim that "in principle, efficiency can be improved by management exercising better control over the use of resources and technology, and this may be attributed to good governance associated with active monitoring and advice given by the board of directors in the design and implementation of strategies".

However, the specificity of banking business doesn't allow banks to rapidly change the size of their input indicators (number of bank branches, number of employees). That's why on short term banks have to use a given quantity of human and fixed capital resources in order to produce as much output as possible.

By assessing, in a comparative fashion, the degree of managerial efficiency depicted by each GSIFI in the sample, we aimed at identifying the best performers in terms of governance model. Consequently, the GSIFIs placed on the efficiency frontier should serve as a benchmark of best practice for other banks in the sample and not only.

For the purpose of this study, we collected data and used a balanced panel of 283 observations, with annual frequency belonging to the 29 GSIFIs in the sample. Data were extracted manually from banks' annual reports (income statements and balance sheets) for the period 2007 to 2016. We relied on annual reports published by banks as there is no other database providing the detailed micro-level information we needed.

According to the production approach model specification, the input variables are represented by labor costs (employees' expenses) and fixed capital costs (administrative expenses), meanwhile the three output variables are represented by loans provided to customers, deposits collected from customers and financial assets held by the bank.

The selection of input and output variables is supported also by several references in the field. For instance, Hahn (2009) relies on a balanced panel of annual report data (income statement and balance sheet) collected from 747 Austrian banks. The inputs are represented by personnel expenses and capital costs (expenses for equipment), while outputs include loans, deposits and other earning assets. Varias and Sofianopoulou (2012) considered the largest 19 Greek banks and employed a production approach model in which inputs used are personnel expenses, non-personnel expenses and interest expenses while outputs comprise loans, deposits and other earning assets (stocks, bonds, income from rental property, certificates of deposit). Boďa and Zimková (2015) employ too balance-sheet items taken from annual reports disclosed by 11 Slovak banks and set up a model in which inputs are operating expenses and outputs are represented by deposits, loans and net interest income.

The next step after defining the input and output variable to be included in the DEA analysis is to verify whether the data fulfills a goodness-of-fit criterion. A rule of thumb in any empirical investigation relies on computing the degrees of freedom to ensure sample's adequacy and the robustness of further computations. Varias and Sofianopoulou (2012) indicate that the number of banks in the sample has to comply with the following constraint:

$$n \geq \max \{i \times o, 3(i + o)\}$$

where

- n – the number of banks in the sample,
- i – the number of input variables,
- o – the number of output variables.

A second DEA methodological requirement, called the homogeneity principle, implies that all institutions in the sample have to be homogeneous in terms of the size of their activity, of the nature of the operations they perform, and the conditions under which they operate (Haas and Murphy, 2003, p. 530), otherwise the efficiency estimates may be due to these underlying differences rather than to technical inefficiency. Consequently, all the input and output variables have been standardized so as to smooth their levels and rescale them in the range 0 – 1. The formula applied is $(x - x_{min})/(x_{max} - x_{min})$ where x stands for each variable considered (in line with the research of Smets 1985; Moesen and Cherchye, 1998).

Our DEA model follows the specification proposed by Banker, Charnes and Cooper (1984) as it allows the use of variable returns of scale. The mathematical optimization model which is aimed at maximizing the results or outputs is:

$$\boldsymbol{max\ \theta = \alpha + s + e}$$

with the restrictions:

$$\sum_{k} \boldsymbol{\mu_k\ y_{ik} = \alpha y_{i0} + s_i},\ \ \boldsymbol{i = 1,\ 2,\ \ldots I}$$

$$\sum_{k} \boldsymbol{\beta_k\ x_{ik} = x_{j0} - e_j},\ \ \boldsymbol{j = 1,\ 2,\ \ldots J}$$

$$\boldsymbol{s_i \geq 0,\ \ i = 1,\ 2,\ \ldots I}$$

$$\boldsymbol{e_j \geq 0,\ \ j = 1,\ 2,\ \ldots J}$$

$$\boldsymbol{\beta_k,\ \mu_k \geq 0,\ k = 1,\ 2,\ \ldots n}$$

where

- $\boldsymbol{\theta}$ – the efficiency score computed for each bank,
- n – the number of banks included in the analysis,
- I – the number of outputs,
- J – the number of inputs,
- μ – the weight of each output variable, for each bank in the sample,
- β – the weight of each input variable, for each bank in the sample,
- y – vector of output variables,
- x – vector of input variables,

α – parameter that reflects the value with which the vector of the output variables increases, while keeping relatively constant the level of the input variables,
s – parameter that measures deficiencies in obtaining the output variable i,
e – parameter reflecting the excessive use of input j.

The following two research directions are employing a panel data regression framework. The choice for this method is based on several reasons. The main advantage is that panel datasets exhibit both a cross-section and a time dimension which increases the number of available observations in the sample and hence provides reliable estimates. In our case, the cross-section or spatial dimension is represented by annual data for 29 European systemic banks, while the time dimension covers the period ranging from 2007 to 2016. Secondly, panel regressions are more suitable for the investigation of specific patterns at individual, micro-level with an increased focus toward models of individual behavior (Greene, 2003) which is the case in our study. In addition, econometric theory (Roberts and Whited, 2012; Wooldridge, 2003) argues that the statistical accuracy of estimates might be distorted by the presence of endogeneity and proposes the use of panel regressions to mitigate this drawback. Our study witnesses the presence of one of the sources of endogeneity, represented by computational inaccuracies due to the use of proxy variables, such as indexes, composite indicators or the efficiency score which are usually designed to measure difficult to quantify variables.

The second research direction investigates the influence exerted by the board of directors' structure (board size, number of women holding a position within the board, number of independent board members) on banks' managerial efficiency level.

The general structure of the panel data regression used for checking whether banks' board of directors' composition determines a statistically significant impact on the managerial quality as measured by technical efficiency is the following:

$$E_{i,t} = a0 + a1B_{i,t} + a2W_{i,t} + a3I_{i,t} + a4C_{i,t} + \delta_i + \theta_t + \varepsilon_{i,t}$$

where E represents the technical efficiency scores previously computed by means of DEA, B is the number of board members (in natural logarithm), W stands for the share of women nominated in the board of directors in the total board members, I represents the share of independent board members in the total board members and C is a control variable represented by the natural logarithm of GSIFIs total assets. The δ_i is the unobservable bank-specific (cross-section) effect and θ_t is the time-specific effect, with time periods t = 2007 … 2016, and banks i = 1, 2, …, 29 while $\varepsilon_{i,t}$ is the classical disturbance term.

The third research direction performs a comprehensive investigation of the impact exerted by banks' managerial efficiency as well as board of directors' structure (in terms of size and composition) on several core bank-level and banking system-level financial indicators related to profitability, solvency, liquidity, credit risk, the territorial coverage of a bank network and the degree of banking system's concentration. The panel data regression has the following general structure:

$$D_{i,t} = a0 + a1E_{i,t} + a2B_{i,t} + a3W_{i,t} + a4I_{i,t} + a5C_{i,t} + \delta_i + \theta_t + \varepsilon_{i,t}$$

where D is the dependent variable represented alternatively by a given financial indicator, E stands for the technical efficiency scores previously computed by means of DEA, B is the number of board members (in natural logarithm), W stands for the share of women nominated in the board of directors in the total board members, I represents the share of independent board members in the total board members and C is a control variable for banks' size represented by the natural logarithm of GSIFIs total assets. The δ_i is the unobservable bank-specific (cross-section) effect and θ_t is the time-specific effect, with time periods $t = 2007 \ldots 2016$, and banks $i = 1, 2, \ldots, 29$ while $\varepsilon_{i,t}$ is the classical disturbance term.

All variables included in the study, accompanied by a brief description and the data sources are synthesized in Table 2.

The results of our empirical study are structured in three parts, following the three main research directions defined at the beginning of the paper. Specific discussions are included in every session, adding also results and relevant aspects from other studies in a comparative manner.

3. Assessment of Banks' Managerial Quality – a DEA Approach

The efficiency scores have been computed for the entire time span, for a balanced panel of bank-level data, in order to gain a simoultaneous insigth on both an individual GSIFI's managerial performance across the ten years, but also on the performance recorded by other banks in the sample, in a comparative fashion. The result is represented by the development of a pooled efficiency frontier, in which each bank has been treated as a different entity for each of the ten years considered.

Another result of DEA is that each inefficient bank is assigned a specific set of benchmark or peer banks, represented only by the efficient ones, which depict a similar structure of input-output variables with the inefficient bank. Thus, the results generated by performing the analysis are two-fold, consisting in the computation of technical efficiency for each GSIFI and the identification of the most appropriate efficient peers for each inefficient GSIFI. These results have been summarized in Table 3 below.

T a b l e 2

Variables Employed and Source of Data

Variable name	Description	Data availability	Source
Staff costs and administrative expenses	the core part of operational expenses, comprising employee expenses and non-interest expenses		GSIFIs annual reports
Total assets	log (total assets) indicates bank's size		
Return on equity ROE	a profitability indicator computed as the profit attributable to shareholders divided by shareholders' equity		
Tier 1 capital ratio	solvency indicator		
Non-performing loans ratio in total loans	any loan that is more than 90 days past due or is impaired, as share of total loans		
Share of loans to customers in total assets	indicator depicting the structure of bank's financial position		
Share of financial assets in total assets	indicator depicting the structure of bank's financial position		
Loan-to-deposit ratio	indicator of bank's liquidity position; values exceeding 1 indicate that loans are not fully covered by deposits		
Number of board members	–		
Number of women in bank's board	–		
Number of independent board members	members of bank's board of directors which don't hold any executive position within the bank, being independent in relationship with the bank		
ATMs per 100,000 adults	banks' territorial network spread, which facilitates customers' access to money	2011 – 2015	World Bank, Financial Inclusion Indicators database
Bank branches per 100,000 adults	indicator reflecting the territorial spread of bank units		
Getting credit: Distance to frontier	Index computed by World Bank which assesses the ease of getting credit, by relying on the strength of legal rights index and the depth of credit information index		
Bank regulatory capital to risk-weighted assets	solvency ratio computed for the entire banking system	2010 – 2016	IMF, Financial Soundness Indicators
Non-performing loans to total loans	credit quality indicator of the entire banking system		
Return on equity ROE	profitability indicator of the entire banking system		
Return on assets ROA	profitability indicator of the entire banking system		
Households' composite cost of borrowing	represents the interest rate for new loans to households meant for house purchase	2007 – 2014	European Central Bank, Statistical Data Warehouse
Herfindahl index for credit institutions	a metric computed in order to assess banking system's degree of concentration		
Number of bank employees	indicator related to banks' size and territorial coverage		

Source: Authors, data collected from the sources above mentioned.

Table 3

The Results of DEA Analysis

GSIFI name	Average efficiency score	Maximum efficiency score	Minimum efficiency score	Observations
ERSTE Bank	0.1979	0.236	0.16	
KBC	0.2262	0.25	0.202	
Danske Bank	0.4621	0.544	0.407	
BNP Paribas	0.926	1	0.809	Efficient in 4out of 10 years. Acts as a peer for other banks in the sample in 181 cases.
Credit Agricole	0.715	0.838	0.63	
SocieteGenerale	0.5522	0.643	0.472	
BPCE	0.6584	0.751	0.579	
Bayern LB	0.5687	1	0.301	Fully efficient only in 2011. Acts as a peer for other banks in the sample in 25 cases.
Commerzbank	0.3947	0.542	0.268	
Deutsche Bank	0.8405	1	0.721	Efficient in 2out of 10 years. Acts as a peer for other banks in the sample in 48cases.
LBBW	0.6002	0.843	0.416	
Intesa San Paolo	0.4723	0.504	0.441	
Unicredit	0.6032	0.69	0.53	
ABN AMRO	0.4641	0.591	0.268	
ING Bank	0.7663	0.985	0.68	
Rabobank	0.5888	0.619	0.52	
DNB	0.4634	0.57	0.311	
Santander	0.8112	0.9	0.734	
BBVA	0.5514	0.97	0.418	
La Caixa	0.5357	1	0.387	Efficient in 2010. Acts as a peer for other banks in the sample in 139cases.
Sabadell	0.2406	0.415	0.075	
Nordea	0.6752	0.747	0.536	
SEB	0.3953	0.457	0.316	
Handelsbanken	0.6858	0.775	0.581	
Swedbank	0.4975	1	0.314	Efficient in 2012. Acts as a peer for other banks in the sample in 3cases.
Barclays	0.7176	0.926	0.593	
HSBC	0.643	0.96	0.387	
RBS	0.6518	1	0.392	Efficient in 2out of 10 years. Acts as a peer for other banks in the sample in 115cases.
Standard Chartered	0.2912	0.376	0.21	

Source: Authors own processing, based on results obtained by using DEAP software.

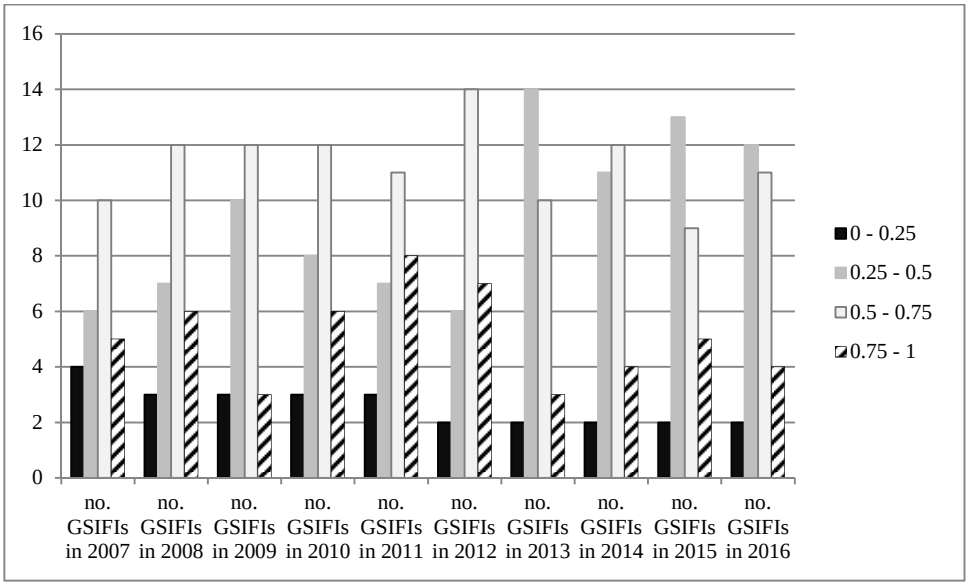
A first observation is that only 6 out of the 29 GSIFIs proved to be fully efficient during the timeframe 2007 – 2016 (2 from Germany, 1 from France, Spain, Sweden, and respectively from UK). Most banks have acted efficiently in 2008 (3 GSIFIs), followed by 2010 and 2011 (2GSIFIs), all the other years witnessing only one case of technical efficiency. The various degrees of bank inefficiency might be explained by the bad management hypothesis launched by Berger and DeYoung (1997), which claim that poor managerial skills are reflected in low cost efficiency, low profitability and weak loan portfolio management.

The GSIFIs that lie on the efficiency frontier have no peer because they exhibit the best managerial performance, but they became benchmarks or peers for the remaining inefficient ones. BNP Paribas acts as a peer in 181cases, followed by La Caixa in 139 cases and RBS (115 cases). According to the results, in order to follow the best performers in terms of governance, the other GFISIs should put more talent and better aggregate their resources, based on the input factors (labor costs and fixed capital costs), to maximize in a sustainable manner the output factors (loans provided to customers, deposits from customers and financial assets held by the bank).

By looking at the 10-year average of efficiency scores it can be noticed that the lowest average score has been recorded by ERSTE Bank (0.1979), meaning that on average it uses efficiently only 19.79% of its inputs. It should increase the amounts of the three outputs by 80.21% without modifying the level of inputs. At the opposite are two GSIFIs whose efficiency scores ranged almost always very close to the best practice frontier, namely BNP Paribas with an overall average of 92.6% and Deutsche Bank with 84.05%. Therefore, in order to become efficient, they should have increased their outputs by an average of 7.4% and respectively by 15.95%. By persistently being placed in the close proximity of the efficiency frontier, they validate the suitability and quality of the governance model implemented by the board.

G r a p h 1

GSIFIs Distribution by Year and Range of Efficiency Scores



Source: Authors, based on DEA estimation of efficiency scores.

Graph 1 illustrates the fluctuation recorded in the number of GSIFIs during 2007 – 2016, by considering an efficiency score cut-off of 0.25. Most efficiency scores lie in the range 0.5 – 0.75, in all the ten years considered, with a maximum of 14 GSIFIs out of 29 recorded in 2012. The next efficiency range which is best represented in terms of the number of banks is 0.25 – 0.5. It also experienced the widest change in terms of the number of banks whose scores positioned in this range, from 6 GSIFIs in 2007 and 2012 up to 14 in 2013. Therefore, most of the time European large banks have experienced modest and medium managerial efficiency. The remaining two efficiency ranges do not exhibit sharp changes in the number of banks and the drop is less pronounced.

4. The Impact of Board Structure on Banks' Managerial Efficiency

The second research direction aims at uncovering whether banks' managerial efficiency is determined by the intrinsic features exhibited by the board of directors' structure (board size, number of women holding a position within the board, number of independent board members). To investigate the impact exerted by board's size and composition on managerial efficiency we employed a panel data regression.

To verify if the fixed effects model is suitable for modeling our data we tested for the presence of fixed effects in terms of both period effects and cross-section effects. The redundant fixed effects test didn't show the presence of any fixed effects, consequently it has been estimated a panel regression with the Generalized Least Squares (GLS) method and cross-section weights, to account for the presence of cross-section heteroskedasticity. Further, in order to test results' goodness-of--fit it has been applied two statistical tests. The robustness of standard errors has been checked by re-estimating the previous specification with the White cross--section test, while the stability of estimated parameters has been assessed by performing Wald coefficient tests. Table 4 synthesizes the results obtained.

T a b l e 4

Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOARD SIZE	–0.084	0.009	–8.804	0.000
SHARE OF WOMEN	–0.240	0.071	–3.385	0.001
INDEPENDENT MEMBERS	0.224	0.029	7.810	0.000
LN(ASSETS)	0.128	0.004	31.507	0.000
	R-squared	0.217	Mean dependent var	0.821
	Adjusted R-squared	0.208	S.D. dependent var	0.556
	S.E. of regression	0.195	Sum squared resid	10.661
	Durbin-Watson stat	0.495		

Source: Authors, by using Eviews software.

The results show that all the explanatory variables are highly statistically significant for a probability of 1%. The increase of board size and of women share in bank's board determines a decrease of managerial efficiency meanwhile the other two variables exhibit a positive effect on efficiency. The positive influence exerted by independent board members on banks' technical efficiency might be due to their various academic and professional backgrounds and expertise, covering main fields of the financial sectors, corporate sectors, or working in academia. Increased board diversity might be beneficial for shaping bank's business conduct. Some studies (de Andres and Vallelado, 2008) warn that excessively independent boards might decrease the efficiency of bank governance, as they may lack the in-depth knowledge of the banking business and risks.

Despite the scarcity of the economic literature addressing the relationship between banks' efficiency and board of directors' specific indicators, our results are partially confirmed by the study of Tanna, Pasiouras and Nnadi (2011) which examined this topic for UK banks. Their findings revealed that larger boards and an increased proportion of independent directors in total board's members positively contribute to increased efficiency. Another similar study belongs to Agoraki, Delis and Staikouras (2010) which have investigated a sample of 57 large European commercial banks over the period 2002 – 2006.They found a negative relationship between banks' efficiency and both board size and the number of non-executive directors. These mixed, apparently conflicting results might be explained by relying on the findings of de Andres and Vallelado (2008). They document the presence of a trade-off between the advantages and disadvantages of having a larger board size, claiming that the upper limit which ensures good governance, efficiency and returns is of around 19 directors.

5. The Effect of Managerial Efficiency and Board Structure on Financial Indicators

The third research direction aimed at investigating whether banks' managerial efficiency as well as the board of directors' structure in terms of size and composition might exert an influence on a comprehensive dataset of bank-level and banking system-level financial indicators related to profitability, solvency, liquidity, credit risk, the territorial coverage of a bank network and the degree of banking system's concentration. Our research attempt is in line with previous analyses, in terms of continuity and development of new findings. For instance, according to Hahn (2009) management efficiency is one of the most important bank-specific factors that positively impact bank's international activities.

The reason for our analysis is to complement and expand the existing findings. Our documentation process revealed that studies focusing on a European perspective of banks' corporate governance are still scarce, mainly country-level studies. Due to data availability, some of them do not address simultaneously issues related to board size, independence and gender diversity. Also, most of them are attempting to explain the relationship between governance indicators and a small, restricted set of banking indicators, usually financial performance ones, by neglecting the broad typology of bank-related and prudential indicators.

The selection of alternative dependent variables against which the governance explanatory variables have been regressed relies on previous research in this field as well as on current regulatory and supervisory concerns. We run 16 panel regressions, by changing each time only the dependent variable. Each regression had been tested for the presence of fixed effects in terms of both period effects and cross-section effects.

Most of them exhibit both types of fixed effects meanwhile two of them show no fixed effects being estimated with the Generalized Least Squares method and cross-section weights, to account for the presence of cross-section heteroskedasticity. The results have been summarized in Table 5.

The overall picture reveals that efficiency scores as a proxy of managerial efficiency, gender diversity (larger share of women in the board) and independent members exert a statistically significant impact on 6 financial indicators, while board size influences only 3 out of 16 indicators. Most indicators are bank-related ones and to a smaller extent banking system-ones. This finding confirms the economic intuition that changes in bank governance features are triggering effects mostly on individual, bank-level indicators.

Managerial efficiency has a positive and statistically significant influence on indicators related to balance sheet's structure (the share of financial assets in total assets and the share of loans in total assets), on the liquidity indicator (loan--to-deposit ratio), on the cost of borrowing at banking system's level and on the aggregate number of bank branches per 100,000 adults. In other words, GSIFIs efficiency is synonymous with an increase of the main components of their asset side (provision of loans to customers, investments in financial assets held for various purposes), with greater territorial spread of bank units which facilitate the reaching of customers, with increases of the interest rate charged for loans. However, greater efficiency is susceptible to amplify GSIFIs exposure to liquidity risks, because increases of loan-to-deposit ratio indicate that banks cannot cover only from deposits the financing provided, they have to rely also on borrowings. In case of unforeseen withdrawals requested by customers the bank might not hold enough liquidity. A negative relationship is established between

GSIFIs efficiency and the Herfindahl index of banking system concentration, meaning that GSIFIs act as a benchmark for other banks operating in the country of residence which will try to expand their asset side and increase their market share. On a medium term this path will contribute to lowering the concentration within national banking systems.

T a b l e 5

Panel Regression Results for Each Alternative Dependent Variable

Dependent variable	**Explanatory variables**				
	Technical efficiency	*Board size*	*Share of women*	*Independent members*	*Bank size*
ROE	416.168 (2 707.635)	5.867 (2 435.104)	–9 152.84** (4 673.719)	1 310.829 (3 205.183)	–2 461.2 (2 521.452)
Tier 1	0.284785 (1.433)	–2.251 (1.288)	–4.608* (2.473)	2.133* (1.696)	–1.301 (1.334)
Share of financial assets in total assets	14.051*** (2.889)	–0.032 (1.323)	9.103** (4.584)	3.850* (2.244)	2.570*** (0.678)
Loan-to-deposit ratio	262.46*** (44.543)	37.5736 (41.032)	–45.1619 (64.949)	–6.8162 (53.551)	–361.07*** (41.178)
Share of loans to customers in total assets	37.844*** (5.691)	3.597 (5.242)	0.902 (8.298)	–8.399 (6.841)	–53.160*** (5.261)
Non-performing loans ratio in total loans	–1 239.63 (1 012.17)	417.08 (935.47)	3 078.64*** (1 489.25)	–784.80 (1 210.56)	–54.63 (1 043.50)
Herfindahl index	–0.011* (0.006)	–0.002 (0.006)	0.008 (0.012)	–0.007 (0.009)	0.044*** (0.007)
ROE at banking system level	–1.234 (3.127)	3.389 (2.817)	2.400 (5.555)	9.932** (5.033)	2.053 (2.630)
ROA at banking system level	–0.096 (0.203)	0.205 (0.183)	–0.019 (0.360)	0.636* (0.327)	0.049 (0.171)
Tier 1 at banking system level	1.796 (1.565)	–1.296 (1.409)	–0.182 (2.779)	–3.008 (2.518)	–1.648 (1.316)
Non-performing loans ratio at banking system level	–1.089 (0.803)	–0.481 (0.723)	3.863*** (1.427)	1.161 (1.292)	0.591 (0.675)
Households' composite cost of borrowing	1.487*** (0.360)	1.216*** (0.351)	–2.725** (1.409)	–0.336 (0.625)	0.185 (0.125)
Number of bank employees	0.032 (0.036)	0.024 (0.037)	–0.013 (0.072)	0.034 (0.051)	–0.047 (0.043)
ATMs per 100,000 adults	5.110 (4.115)	–8.408** (3.970)	1.118 (7.834)	–14.185** (6.735)	–2.637 (4.556)
Bank branches per 100,000 adults	4.531* (2.637)	–4.725* (2.544)	–1.532 (5.020)	–10.427** (4.316)	–3.739 (2.920)
Getting credit: Distance to frontier	–5.521 (3.397)	2.343 (3.277)	–4.037 (6.468)	6.750 (5.560)	–1.308 (3.762)

Notes: *** estimated coefficient significant at 1 percent; ** significant at 5 percent; * significant at 10 percent; standard errors depicted in parentheses.

Source: Authors, based on Eviews software package results.

Increases of board of directors' size seem to be compatible with an environment characterized by rising cost of borrowing charged to households, but also to decreases in the number of ATMs per 100,000 adults and bank branches per 100,000 adults. Larger boards might behave in more precautionary manner as

regards the expansion of the territorial network of a bank. We found no statistical relationship between board size and profitability indicators, a result confirmed by García-Olalla and Clifton (2018) in a two-fold analysis (before and after the 2008 financial crisis).

A higher share of women in banks' boards seems to contribute to decreases in the level recorded by the profitability ratio ROE and by the tier 1 capital ratio, but to increases of the share of non-performing loans both at bank level and banking system level. This result is in line with the empirical findings of Lu and Boateng (2017) which argue that women directors exert a negative and statistically significant effect on UK banks' performance, expressed as ROA and financial leverage.

A study performed for US commercial banks whose boards comprise a large share of women found that those banks tended to be smaller in size, somewhat less profitable and prone to larger expenditure (Colby, 1993). A similar research direction had been investigated by Mateos de Cabo, Gimeno and Nieto (2009) for a sample of European banks. They found that women presence in boards increases in the case of banks operating in dynamic and competitive markets. Secondly, it seems that women are excluded from boards which promote higher risk-taking or a friendly board.

Increased board independence, represented by a large share of independent members in total board members, exerts a positive and significant influence on banking system's profitability indicators (ROA and ROE) and on bank-level indicators related to tier 1 capital ratio and the share of financial assets in total assets. However, it seems that increased board independence, as well as increased board size, exerts a negative impact on the number of ATMs per 100,000 adults and bank branches per 100,000 adults. Although economic literature is the field of debates related to the proper board size (de Andres and Vallelado, 2008) and number of independent members, consensus raises in terms of the fresh perspective on bank challenges brought by independent board members and the diversity of opinions which counteracts the risk of group thinking (Lautenschläger, 2018).

As regards our control variable, it seems that increases in bank size determine a rise of the financial assets portfolio held by GSIFIs and a decrease of the loans provided to customers, indicating an orientation towards an investment-type behavior to the detriment of the basic financial intermediation behavior. Positive effects are exerted on the liquidity indicator, whose values improve (lower values of the loan-to-deposit ratio) with increases of total assets. Larger GSIFIs size is positively associated with increases of the concentration and competition in the banking system (Herfindahl index).

Conclusions

Our research paper integrates a three level empirical study, based on an interconnected set of methods and instruments. The paper adds to the bank governance literature by examining the bank governance quality for a set of 29 representative European banks (GSIFIs) and investigating on whether banks' managerial efficiency is determined by the intrinsic features exhibited by the board of directors' composition (board size, number of women in the board, number of independent board members). The results generated by performing the data envelopment analysis reflect both the computation of technical efficiency for each bank and the identification of the most appropriate efficient peers for each bank considered as inefficient, in accordance with the applied model.

According to the results, all the selected banks should maximize the amount of outputs obtained, to become more efficient. As some of the efficiency scores registered lie very close to the best practice frontier, several banks are performing better, by using more talent in aggregating and controlling their input factors (labor costs and fixed capital costs), and increasing their output factors (loans, deposits and financial assets). The findings show that some banks are placed on the efficient (best practice) frontier and therefore their business and corporate governance model might constitute a benchmark for their peers.

By conducting a first panel regression analysis, we document that larger boards and increased gender diversity negatively contribute to increases of managerial efficiency, although the influence exerted is small. The effect of increasing the number of independent directors appointed in the board and respectively the bank size is positively associated with managerial efficiency of large banks. Our results challenge the general perception that increased gender diversity contribute to increase of managerial efficiency.

The paper also discusses the results of the second panel regression analysis, showing that the explanatory variables considered exert an influence on banks' profitability, solvency, liquidity, credit risk indicators, as well as on banks' territorial spread and banking system's degree of concentration.

Our research reflects that, as a consequence of the increased board independence, represented by a large share of independent members in total board members, a positive and significant influence is registered by banking system's profitability indicators (ROA and ROE) and by bank-level indicators related to tier 1 capital ratio and the share of financial assets in total assets. We do find evidence for a negative relationship established between GSIFIs efficiency and the Herfindahl index of banking system concentration, meaning that GSIFIs act as a benchmark for other banks operating in the country of residence, which will try to expand their asset side and increase their market share.

The results of the study are robust for all three research directions, with respect to different estimation specifications. Furthermore, the study's findings are important for policy makers, when examining governance in banking, the implementation of the regulatory changes and reforms, but also for supervisors when examining efficiency drivers for the banking business. Additionally, the results are important for investors and for the boards of the banks, when drafting new strategies, in accordance with the relevant evolutions.

Our research provides valuable insight for bank management, which is accountable for the safety and soundness of the large banks, in order to improve oversight and increase their outputs, to become more efficient and to bring value for the shareholders, employees and society. Understanding why some of their competitors or peers are more efficient, how close or how far is placed each banking institution from a relevant benchmark, what results/indicators/correlations may be considered as best practice based on scientific work and research, will support bank management in improving the quality of its decisions, both at micro and macro levels. This contribution may also impact the further managerial efficiency of the banks.

The results of our empirical study contribute to a better understanding for the investors, which are investing their financial resources or their customer's resources in buying shares of various large banks. Our research presents methods to select and gather relevant information and data from the public annual reports of GSIFIs and other financial databases, in order to better analyze, compare the complex operations, activities and results of GSIFIs and improve the decision making in building sustainable investments and portfolios. This may affect and catalyze the transfer of best practices, from the most efficient institutions to the other institutions.

Our findings provide relevant input for policy makers, within the implementation of the regulatory changes, impacting each banking institution as well as banking systems, but also for supervisors, when examining efficiency drivers for the banking business. The financial crisis reflected that micro prudential policy is not enough. The safety and soundness of each bank does not determine implicitly, the safety and soundness of the banking system. Although essential, governance aspects were often not reflected and integrated in a sustainable manner in public policies and surveillance mechanisms. Inter-linkages, interactions, various economic cycles, impact of different supervisory tools and measures, amplify relationships and even conflicts between micro and macro-level policies. In this respect, analyzes of the complementarities, clarification of the mandates at micro and macroeconomic level, assessments for the quality of the bank governance, connected with the relevant indicators reflecting banks' and banking system's activity, assessment of various risks, coordination between micro and macro policies, represent key points for more efficient banks and banking systems, impacting customers and societies.

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