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FINANCIAL ECONOMICS | RESEARCH ARTICLE

Regulation's influence on EU banking efficiency: An evaluation post crisis

Edward Bace^{1*} and Ana Ferreira¹

Abstract: This paper examines the impact of regulatory policies on banking market efficiency using a sample of 678 commercial banks from 21 European Union countries for the post-crisis year 2010, controlling for bank-specific and country-specific variables. Data on regulation, supervision and monitoring variables, and activity restrictions are from the most recent Bank Regulation and Supervision Survey database conducted by the World Bank, published 2012. Besides these we incorporate bank size, equity, market share, government ownership, and growth of Gross Domestic Product per capita, employing an Ordinary Least Squares method. Focus is on two alternative measures of banking market efficiency: net interest margin and overhead costs (operating expenses to assets). Elevated levels of these two ratios should indicate a low level of banking efficiency. The evidence suggests that the link between capital regulation and banking efficiency is not robust enough to control for other regulatory variables. Results confirm that activity restrictions have a negative and significant impact on banking efficiency. Policies encouraging official supervisory power do not enhance efficiency of the banking sector. The only approach positively and statistically significantly associated with efficiency is private monitoring. This leads to the suggestion that government regulation and supervision should be more focused on promoting transparency of information.

Subjects: Economics; Finance; Business, Management and Accounting

Keywords: banking; efficiency; regulation; European Union

JEL Classifications: G14; G21; G28

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PUBLIC INTEREST STATEMENT

This article focuses on the important topic of banking efficiency, which has wide-ranging implications for fairness and effectiveness of banking services for customers and other stakeholders. Key determinants of banking efficiency include the quality of banking regulation and supervision in a given jurisdiction, as well as the scrutiny of market participants and investors (private monitoring) in relation to the structure of a banking system. The study presented here concludes that, for banks in the European Union, the most meaningful influence on efficiency is that of private monitoring, which has implications for regulatory and government policy in promoting efficiency of a banking system.

1. Introduction

The global financial crisis has revived the importance of the banking system to the economy. As a result of the crisis, bank regulations have become more stringent to prevent future bank failures and safeguard the economy from negative externalities. In this regard, policymakers concentrate on which regulation is the best to achieve these goals. Thus, different regulatory approaches should be analysed as well as the effects of combining approaches. The most common are capital regulation, activity restrictions, official supervisory power and private monitoring. Following this, the present research studies each of these regulatory measures.

The globalization of banking services, the increasing competition and the technological changes have emphasized the importance of banking efficiency. Since banks act as financial intermediaries between lenders and borrowers, banking efficiency plays a crucial role in the social welfare. It is important that banks work to minimize costs, thus promoting efficient utilization of resources. Therefore, enhancing the efficiency of the banking system is vital to achieve greater social welfare. We rely on two accounting ratios to measure banking efficiency: net interest margin and overhead costs. While imperfect, these measures can signal intermediation inefficiency and excessive market power. Hence, higher net interest margin and higher overhead costs reflect lower levels of banking efficiency.

Nevertheless, banking literature provides conflicting predictions about the impact of bank regulation on banking efficiency. As argued by Barth et al. (2006), the different arguments usually reflect the two divergent views, which are the public interest view and the private interest view. The public interest view supports that government operates to enhance social welfare. The purpose of regulating the banking sector is to promote banking efficiency and prevent bank failure. Conversely, the private interest view states that government uses regulatory policies to satisfy political interests (Shleifer & Vishny, 1998). In line with this argument, regulation may exert adverse effects on banking efficiency.

The most common justification for any regulation stems from market failures due to asymmetries of information, externalities and market power. However, there is still no consensus concerning whether the banks should be regulated, and which regulatory policy generates better results. Some argue that capital regulation decreases the occurrence of bank runs, cushioning the economy from major losses and reduce agency problems between bank owners and depositors, especially through deposit insurance. Others argue that stringent capital requirements encourage risk-taking behaviour (Blum, 1999; Boyd et al., 1998; Furlong & Keeley, 1989). By allowing banks to engage in broader activities, banks may become so important to the economy that they are deemed to be “too big to fail”, thus difficult to discipline. The power enjoyed by such complex banks may impede competition in the banking sector. On the other hand, restricting activities impedes the exploitation of economies of scope and scale (Laeven & Levine, 2007). The official supervisory approach stresses that supervisors have the incentives to ameliorate market failures as a consequence of informational asymmetries. Conversely, proponents of private monitoring claim that official supervisors use their power to benefit themselves. Hence, government regulation that promotes private monitoring in terms of more transparency of information may be the most efficacious approach to enhance banking efficiency.

This study assesses empirically the impact of these regulatory measures on banking efficiency. The sample consists of 678 commercial banks from 21 European Union (EU) countries for the year 2010. The information for the regulatory variables is collected from Bank Regulation and Supervision Survey database conducted by the World Bank (Barth et al., 2004, 2008, 2013a, 2006, 2013b; Cihak et al., 2012), which provides unique information on how banks are regulated around the world. From the four surveys available, we use the data from the last survey, which is the first examination of this kind conducted after the financial crisis. It covers information on banking policies in 125 countries and was completed in 2012. We also follow the indexes aggregating the responses from the survey of Barth et al. (2006), (2013a)).

This study empirically answers the following research question: *What is the impact of bank regulatory policies on banking efficiency?* In addition to the regulatory variables, bank and country-specific control variables are included in our analysis. We incorporate bank size, bank equity, bank market share, government-owned banks and growth of Gross Domestic Product (GDP) per capita. To estimate the empirical models, we employ the Ordinary Least Squares (OLS) method.

The study is organised as follows. Section 2 summarises the relevant banking literature and the main findings along with the hypotheses we aim to test. Section 3 presents the data and methodology, which includes data sources, measurement of the variables, descriptive statistics, and empirical model. Section 4 presents and discusses the empirical results. Section 5 concludes. The last section also discusses limitations and recommendations for future research.

2. Literature review

In this section, we summarize the prior literature related to the effects of Basel II Capital Accord regulations namely, capital requirements (Pillar 1), official supervisory power (Pillar 2) and market discipline (Pillar 3), in addition to activity restrictions on banking efficiency as well as on bank development, soundness, efficiency and risk incentives. Existing theories regarding different regulatory approaches are examined first, followed by the empirical evidence supporting these theories and hypotheses we aim to test.

Theoretical review

2.1. Capital regulation

There is extensive literature focusing on capital regulations emphasising its importance as a key approach to bank regulation. The capital adequacy requirements stipulate the amount of capital that banks need to hold for a certain level and quality of assets. Consequently, it influences the banking-sector efficiency. In the case of bank owners being required to increase the amount of capital at risk, the gains from increased risk would be counterbalanced by the greater likelihood of capital loss. Hence, capital regulation tends to reduce agency problems between bank owners and depositors (Barth et al., 2006; Kaufman, 1992; Keeley & Furlong, 1990). Moreover, two of the primary functions of capital are risk diversification and lower risk-taking. The former considers capital a buffer which protects the assets from being sold or written off at a very low price. An appropriate level of capital safeguards the debt holders and equity holders. The latter implies that, under more stringent capital regulations, bank managers and owners engage in less risky activities (Chortareas et al., 2012). Based on these arguments, capital regulation is expected to enhance banking efficiency.

However, the theory provides conflicting predictions about the positive effects of capital requirements (Santos, 2001). For instance, Barth et al. (2013b) claimed that the arguments in favour are based on the public interest view and the inherent costs of regulating bank capital as higher barriers and higher taxes charged by governments are not considered. The private interest view opposes capital regulation except when the benefits compensate the costs. Furthermore, some authors find that capital regulation increases risk-taking behaviour (e.g. Besanko & Kanatas, 1996; Koehn & Santomero, 1980). According to Blum (1999), stringent capital requirements increase risk-taking behaviour and risk of failure as a result of two effects. First, it lowers profits. If the bank has low profits, the cost of bankruptcy is less costly than the cost of excessive risk-taking. Lastly, it affects the marginal return on risk. In the model presented by the author, the marginal return on risk may increase, and thus the first effect may strengthen, further increasing the risk. Therefore, capital regulation may negatively influence banking efficiency.

Additionally, Pasiouras et al. (2009) highlighted the impact of capital requirements on the quantity and quality of loans, the allocation of asset portfolios and the source of funds. The introduction of regulatory capital requirements on an unregulated banking system may decrease aggregate lending while there is no consensus concerning loan quality (Deli & Hasan, 2017; Kopecky & VanHoose, 2006). Bank managers may also look for other forms of assets rather than

loans, affecting banking efficiency as different assets have different returns and require different management. Despite the advantages of portfolio diversification, little is known about the capacity of banks to manage different assets (VanHoose, 2007). Lastly, capital regulation may influence the decision of banks with respect to the trade-off between debt and equity.

2.1.1. Empirical review

Barth et al. (2004) analysed the effects of bank regulation and supervision on bank development, stability, and performance for 107 countries based on the first survey from 1999 of the Bank Regulation and Supervision Survey database carried out by World Bank. The results indicated that tightening capital requirements lowers the number of non-performing loans (used as a proxy for bank stability) while capital stringency is not robustly linked with banking-sector development and performance as measured by accounting ratios (net interest margin and overhead costs) when controlling for other regulatory and supervisory practices. Likewise, Beck et al. (2006b) addressed the influence of capital regulation on banking system stability using the same data for regulatory measures and found no statistically significant link between the two variables. However, the link is robust when using the capital regulatory index as a control variable for the relationship between bank concentration and fragility.

More recently, Barth et al. (2013b) investigated the impact of regulation, supervision, and monitoring on banking efficiency using the non-parametric Data Envelopment Analysis (DEA) approach for a sample of 4050 banks over 1999–2007. The regulatory and supervision variables are from the first three World Bank surveys of Barth et al. (2004), (2006), (2008). They found that stringent capital requirements are significantly associated with higher levels of banking efficiency and also the possible existence of a connection between banking efficiency and safety. Similarly, Chortareas et al. (2012) provided evidence of a positive and significant relationship between capital regulation and banking efficiency using the DEA approach¹ as well as using accounting ratios: net interest margin and cost-to-income ratio. The study comprised 22 EU countries for the years 2000–2008 using the information on regulatory variables from the World Bank dataset. These findings are consistent with the view that strengthening capital regulation is associated with higher levels of banking efficiency.

Previous studies (Demirguc-Kunt et al., 2008) on the soundness of the banking system have highlighted the importance of regulation and supervision for sounder banks. For instance, Pasiouras et al. (2006) contributed to this area researching the relationship between the Fitch individual bank ratings and bank regulations (World Bank database) with a sample of 857 banks for the year 2004. Their results revealed that lower ratings are attributed to banks operating in markets with tighter capital regulation. Therefore, stringent capital regulation is negatively associated with bank soundness. This is consistent with the argument that banks in countries that promote tighter capital adequacy requirements take on greater risk but inconsistent with the positive influence that capital regulation exerts on bank efficiency.

Regarding risk-taking, Laeven and Levine (2009) conducted a study of 279 banks in 48 countries analysing the risk-taking behaviour by banks, ownership structures and bank regulations. The empirical evidence of their study has shown that the interaction between capital regulations, assessed by minimum capital requirements and capital stringency index, and risk critically depends on the ownership structure of each bank. Thus, while capital regulation decreases risk-taking in widely held banks, it has an adverse effect when the bank has a large owner. This finding confirms that capital stringency reduces the benefits of owning a bank, hence large and powerful owners undertake riskier activities in response to more stringent capital regulations. Moreover, the paper emphasized the importance of including ownership structure in the analysis of the effects of capital regulations on risk-taking behaviour.

In line with previously mentioned studies on banking efficiency and considering the empirical evidence, we aim to test the following hypothesis:

Hypothesis 1: Capital regulation does not have a positive or significant impact on banking efficiency.

2.2. Activity restrictions

Although activity restrictions are not a pillar of Basel II, they have been stressed as fundamental to the study of the impact of regulation on the proper functioning of the banking sector. The question is whether the existence of financial conglomerates² is beneficial to the performance of the banking system. Nevertheless, there is no consensus in theory about the effects of banks engaging in broader activities or restricting their activities.

The information acquired by banks during the lending process may help banks to be more efficient in other activities such as brokering, real estate investment or dealing mutual fund securities. In the same way, by engaging in broader activities, banks acquire information that can be used to improve the process of making loans. Therefore, restricting activities may impede banks from enjoying economies of scale and scope as it limits the exchange of information (Diamond, 1991; Rajan, 1992; Stein, 2002). Moreover, it can lower the franchise value of a bank due to greater difficulty in diversifying revenue streams and thereby narrowing incentives for more efficient conduct. By being responsible for licensing banks and specifying the permitted activities, regulators become more powerful which gives them more opportunities to pursue economic gains (Djankov et al., 2002). Finally, Beck et al. (2006b) presented empirical evidence that tightening activities boosts bank fragility by impeding banks from diversifying portfolio risk. As a consequence of the previous arguments, allowing banks to engage in non-traditional activities is likely to improve banking efficiency.

On the other hand, some (Aron, 1988) argue that expanding the range of financial services may intensify agency problems between owners and shareholders which reduces the market value. Bank managers may engage in broader activities simply because it is more advantageous to them even if it means a lower market value for the financial institution. Therefore, the decision to restrict activities by managers may be due to what benefits them instead of what benefits the firm (Jensen, 1986). Also, moral hazard problems may arise which stimulates risk-taking behaviour (Boyd et al., 1998). Furthermore, it is hard to implement efficient managerial contracts in financial conglomerates as well as handle agency problems (Rotemberg & Saloner, 1994). Another argument is that banks providing a wide range of services may become so important to the economy that they are deemed to be “too big to fail” thus, difficult to discipline. Under these circumstances, activity restrictions may positively affect banking efficiency. According to Laeven and Levine (2007), diversification of activities decreases the market value of the financial conglomerate since the benefits of enjoying economies of scope are not significant enough to offset the negative effects of leading with a variety of activities. Consequently, restricting bank activities may enhance banking efficiency.

Researchers (King and Levine, 1993) focusing on the impact of activity restrictions on banking efficiency and development have concluded mixed results for the association between the two variables. The results are consistent with the view that relaxing restrictions on bank activities improves banking efficiency by increasing opportunities for diversifying sources of income. Barth et al. (2004) found that while regulation of activities negatively affects bank development, there is no robust link between this regulatory measure and net interest margin or overhead costs or non-performing loans. The former finding is notably important since the development of the banking system directly influences economic growth.³ In addition, their study supported that a banking system with greater freedom on activities is less likely to suffer a major crisis. Kim et al. (Role of financial regulation and innovation in the financial crisis, Kim et al., 2013) carried out a study on the role of regulatory measures in the financial crisis⁴ using the surveys on bank regulation for 143 countries. Unlike Barth et al. (2004), they concluded that activity restrictions reduce the likelihood of a banking crisis. Therefore, diversification drives banks to engage in riskier activities, further increasing bank fragility.

Chortareas et al. (2012) confirmed that greater restrictions on bank activities exert a positive impact on net interest margin, cost-to-income ratio and inefficiency, which means an overall

negative impact on banking efficiency. Barth et al. (2013b) also corroborated that stricter restrictions on bank activities are negatively associated with the efficiency of the banking system, using the DEA approach. Moreover, Demirguc-Kunt et al. (2004) investigated the influence of bank regulations on the cost of financial intermediation using as proxies the net interest margin and the overhead expenditures. The sample comprised 1400 commercial banks in 72 countries, from 1995 through 1999. Similar to the studies mentioned above, the regulatory measures were obtained from the World Bank surveys. The results showed that greater activity restrictions are significantly associated with greater net interest margin, consequently greater operational inefficiency and market power. With respect to the soundness of the banking system, Pasiouras et al. (2006) found that lower ratings are allocated to banks operating in markets with stricter activity regulations. Thus, restricting bank activities negatively influence banking efficiency.

Laeven and Levine (2009) proposed in their study that tighter restrictions on bank activities increase risk-taking behaviour when the bank has a sufficiently large owner. If the bank is widely held, the effects of restricting activities on risk are not significant. Since regulation on activities lowers the profits, bank owners may engage in riskier activities to compensate for losses. In this respect, Gonzalez (2005) evaluated the impact of activity restrictions on risk incentives in a study with 251 banks in 36 countries from 1995 to 1999. Nevertheless, the evidence has confirmed that greater regulatory restrictions are related to fewer risk-taking incentives after isolating the relationship between bank charter value⁵ and risk-taking incentives and between regulatory restrictions and bank charter value. The findings support that greater freedom on bank activities promotes risk-taking as it provides banks more opportunities to assume greater risk. Hence, the two studies provided conflicting predictions about the effects of activity restrictions on bank risk.

Considering the empirical evidence presented in previous banking literature on the effects of activity restrictions on banking efficiency, we aim to test the following hypothesis:

Hypothesis 2: Activity restrictions have a negative and significant impact on banking efficiency.

2.3. Official supervisory power

The official supervisory power concerns the degree to which bank supervisors can take actions against bank owners, bank managers and bank auditors in different circumstances. While there is an extensive literature on the importance of empowering official supervision of banks, empirical evidence (Levine, 2005) shows no consensus about the effects on bank performance. Since the costs of supervising banks are excessive, there are few incentives to monitor banks. Proponents of public interest view claim that supervisors have incentives to ameliorate market failures through the monitoring and discipline of banks (Beck et al., 2006a), thus undermining corruption and strengthening the intermediary function of banks. Moreover, the existence of informational asymmetries makes banks vulnerable to contagion risk and possible bank failure. Powerful supervisors can intervene effectively under these circumstances. Besides, with the adoption of deposit insurance, banks may undertake greater risk and depositors may have less incentives to supervise banks. Official supervisors may be capable of preventing such situations (Barth et al., 2004; Beck et al., 2006b). Given the previous arguments, it is expected that official supervisory power enhances banking efficiency.

On the contrary, proponents of private interest view claim that official supervisors use their power for their own interest. As powerful supervisors have access to insider information, they may use it for private and political benefits (Beck et al., 2006b). Political candidates may bribe supervisors to extract votes and donations for their campaign (Djankov et al., 2002; Quintyn & Taylor, 2003). Hence, official supervisory power may be associated with higher levels of corruption, negatively influencing banking efficiency. Additionally, supervisors may pursue private interests instead of public interests to enhance their reputation as being able to monitor banks, especially when there are uncertainties about their capacity to do so (Boot & Thakor, 1993). Thus, powerful

supervisors may adversely affect banking operations. Therefore, official supervisory power may positively or negatively affect the corporate governance of banks, the lending process (by encouraging corruption), and the intermediary function of banks.

Nevertheless, the argument that an independent supervisory entity has positive influence on banking efficiency is consensual among the two opposing views. Being independent, the supervisors are less likely to exert power on banks to serve political and private interests. Thus, independent supervisors could monitor the corporate governance of banks more professionally. Moreover, they may better guide banks by giving them advice on how to improve (Barth et al., 2013b).

The empirical evidence indicates that official supervisory power is not significant in explaining bank performance itself. Barth et al. (2004) found that empowering official supervision of banks is not significantly associated with bank development, bank performance or the number of non-performing loans. The link between supervision and the likelihood of a banking crisis also proved to be non-significant. Similarly, the regressions in the study of Barth et al. (2013b) pointed to an insignificant relationship between official supervisory power and banking efficiency. The study also evaluated the impact of independent supervisory authorities and the interaction between the two variables. Their results suggested that while official supervisory power does not enhance banking efficiency itself, promoting the independence of supervision may strengthen banking efficiency. Furthermore, the interaction term confirmed that empowering official supervision leads to an increase in banking efficiency in countries with greater independence of supervisors. This is consistent with the argument that independent supervisors are less likely to pursue political and private interests rather than social interests, improving the corporate governance of banks.

Levine (2005) assessed the impact of supervision, specifically the official supervisory approach and the private monitoring approach, on banking efficiency measured by overhead costs using the data for the supervisory measures from Barth et al. (2004). The connection between official supervision and overhead costs has proven to be statistically insignificant. The research emphasized that the aim of the official supervisory approach may be to lower bank fragility instead of enhancing bank performance as a possible justification. Notwithstanding the main finding, the data indicated that empowering official supervision intensifies corruption in bank lending. Hence, the data is consistent with the private interest view.

Different results are suggested by Chortareas et al. (2012). The evidence indicated that official supervisory power has a positive impact on banking efficiency, which confirms the predictions of the public interest view. The results held using inefficiency, net interest margin or cost-to-income ratio as independent variables, with coefficients being negatively significant in all regressions. However, when controlling for private monitoring, the impact turned negative. One explanation may be that strengthening official oversight in less developed countries leads to increased government participation and thus undermines the reliability of the lending process.

Beck et al. (2006a) evaluated the association between supervision and corruption in bank lending in a study with 2500 firms from 37 countries using the information on supervision from Barth et al. (2008; 2004; 2006). Corruption in bank lending is proxied by the extent to which bank supervisors' corruption is a barrier for firms to get external finance. The results supported that strengthening official supervisory power is positively and significantly related to higher levels of corruption. This suggests that powerful supervisors do not improve social welfare, they improve their own welfare. Therefore, policies that encourage official oversight to enhance banking efficiency may have opposite outcomes, ultimately increasing corruption in the banking system.

The analysis of Pasiouras et al. (2006) concluded that more powerful supervision is adversely associated with bank ratings. Thereby, countries that promote official supervision to take specific actions on bank managers and owners obtain lower bank ratings. Under these circumstances, official supervisory power is negatively related to the soundness and efficiency of the banking

system and positively related to bank corruption. The study of Demircuc-Kunt et al. (2008) which examined the influence of compliance with the Basel Core Principles on Moody's ratings noted that countries with a higher degree of compliance are better rated, although empowering official supervision per se does not influence bank ratings.

The evidence presented in the literature on the effects of official supervisory approach on banking efficiency is divided into two viewpoints, those that found negative and significant effects and those that found insignificant effects. This leads us to the following hypothesis:

Hypothesis 3: Official supervisory power has a negative impact on banking efficiency.

2.4. Private monitoring

Private monitoring refers to the extent to which banking regulations require banks to disclose accurate and detailed information to the public and improve contract enforcement mechanisms. It is believed that bank supervision should focus on reducing barriers such as the costs of producing and disclosing information. Thus, private investors could monitor more efficiently, strengthening the corporate governance of banks (Hay & Shleifer, 1998). Proponents of the private monitoring approach often express doubts about the effectiveness of the official supervisory approach. Therefore, the arguments in favour of the former approach tend also to be critiques to the latter approach and vice versa (Levine, 2005).

First, as supervisors are not usually bank shareholders, their incentives may conflict with incentives from private investors regarding bank discipline, consequently agency problems may arise (Barth et al., 2013b). Second, supervisors may be driven by self-interests. Politicians and banks may influence official supervisors to act in their own interests by enriching insiders and channelling credit to some specific companies according to the private interest view. Hence, empowering private monitoring over supervisory power may prevent corruption in bank lending from intensifying, improving banking operations at the same time (Beck et al., 2006a). Third, remuneration of supervisors is low in some countries which incentivises them to move to the banking sector. These circumstances may create different motivations for supervisors regarding bank monitoring (Barth et al., 2004). Lastly, while recognizing the existence of market failures that interferes with the effectiveness of private monitoring, Shleifer and Vishny (1998) emphasized that official oversight may have a more significant negative impact on banks due to the great scale of government failures. Following this logic, the benefits of overcoming market failures may not produce sufficient positive effects to promote official supervisory power over private monitoring.

Nevertheless, there are arguments against empowering private monitoring. Private monitoring may not enhance bank performance in countries with less developed legal systems, poor capital markets and ineffective financial accounting policies as people in these countries do not trust in private monitoring. Therefore, they may not be able to benefit from an efficient monitoring with the private sector, but they may benefit from official oversight. Since the banking system is very complex and opaque, even the private sector in more developed countries may find it hard to monitor banks efficiently (Barth et al., 2004). From this standpoint, strengthening private monitoring may lead to bank customers being misled, and consequently deteriorating banking efficiency. Furthermore, costs related to disclosure of accurate information to the public such as enforcement costs, costs to prepare formal disclosure documents and costs of divulging delicate information to competitors are excessive, thus it negatively impacts banking efficiency (Duarte et al., 2008).

While the arguments mentioned above have supported one supervisory approach over the other between official supervision and private monitoring, the two approaches are not mutually exclusive as stated by Levine (2005). Indeed, countries are able to adopt both approaches, that is,

requiring banks to disclose precise information to the public at the same time that official supervisory agencies directly monitor and discipline banks.

Most of the existing studies have concluded that empowering private monitoring in terms of more financial transparency has a good impact on the banking system. For instance, Barth et al. (2004) observed that private monitoring positively influences bank development and negatively influences the amount of nonperforming loans and net interest margin. The study, however, failed to find a strong impact on bank crises when controlling for other variables. Barth et al. (2013b) found that private monitoring exerts positive effects on banking efficiency, specifically they found that strength of external auditor, bank accounting informative and certified audit requirements are related with higher levels of banking efficiency. Similar results were obtained in the study of Levine (2005) which concluded that empowering private monitoring reduces the overhead costs, boosting banking efficiency. One particularity of this study was that the effect lost significance in the regression that included GDP per capita. This means that GDP per capita is highly correlated with the degree of information disclosure. In a broader perspective, the economic development of a country is influenced by the implemented supervisory approach, just as the effectiveness of bank supervision depends on the economic development of the country.

Conversely, Chortareas et al. (2012) provided evidence of a negative relationship between private monitoring and banking efficiency. The results should be interpreted carefully since they used a sub-sample of countries for regressions that included this variable, excluding economically large countries as UK, Germany, France and Spain. A possible reason for this finding is that producing and disclosing information is costly. Hence, banking efficiency may be adversely affected.

Beck et al. (2006a) noticed that empowering private monitoring reduces corruption in bank lending. Their paper also established a positive association between bank lending integrity indicators and the private monitoring approach. Hence, corruption of bank officials is less a barrier for companies to raise capital in countries that promote information provision and countries with developed legal systems and efficient governments. The findings are consistent with the argument that private monitoring reduces bank corruption, enhancing banking efficiency.

Pasiouras et al. (2006) analysed the impact of accounting and disclosure requirements and auditing requirements on bank credit ratings and found that both coefficients appear negative in the regressions. This is inconsistent with studies that indicate that empowering private monitoring enhances bank performance as well as with those that indicate that accounting and auditing systems reduce bank risk (Fernandez & Gonzalez, 2005). Nevertheless, the coefficients are only significant at 10% level, which is consistent with the findings of Barth et al. (2004) regarding the impact of private monitoring on the likelihood of a banking crisis. Additionally, the empirical evidence of Demircuc-Kunt et al. (2008) supported that compliance with dissemination of accurate information is positively associated with bank soundness. Thus, banks in countries that strengthen private monitoring are better rated.

Focusing on the findings of the aforementioned studies about the effects of strengthening private monitoring on banking efficiency, we aim to test the following hypothesis:

Hypothesis 4: Private monitoring does not have a positive or significant impact on banking efficiency.

This study investigates the impact of bank regulatory measures namely, capital regulation, activity restrictions, official supervisory power and private monitoring on banking efficiency in the EU. The methodology we follow is closely related to various research on banking efficiency. To measure banking efficiency, we use two accounting ratios: net interest margin and overhead costs. Likewise,

Barth et al. (2004), Demircuc-Kunt et al. (2004), and Levine (2005) used accounting ratios as opposed to studies that used efficient frontier analysis (Barth et al., 2013b). Chortareas et al. (2012) measured banking efficiency using accounting ratios as well as the DEA technique. Both methods produced the same results. Therefore, we decide to use accounting ratios. However, it is important to emphasize that bank net interest margin and overhead costs are imperfect measures of banking efficiency. In order to overcome this limitation, we control for bank-specific and country-specific variables.

3. Data and methodology

In this section, we present information about the data and the methodology employed in our research. We discuss the data collected, sources and sample selection, the definition of the variables and the descriptive statistics. This is followed by the introduction of the econometric models, description of the estimation procedure and the tests performed to obtain accurate results.

3.1. Data

This study aims to evaluate the impact of bank regulatory measures on banking efficiency. To assemble the cross-section data, we include commercial banks operating in 21 EU countries, namely: Austria, Belgium, Bulgaria, Croatia, Cyprus, Denmark, Finland, France, Greece, Hungary, Ireland, Italy, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia and Spain.

The dataset is compiled from two primary sources, SNL Financial database provided by S&P Global Market Intelligence and World Bank databases. The bank-specific variables: net interest margin, overhead costs, bank size, bank equity and bank market share are obtained from SNL Financial database. The annual growth rate of GDP per capita is obtained from the World Bank World Development Indicators (World Bank, 2010). The regulatory measures: capital regulation, activity restrictions, official supervisory power and private monitoring, as well as the government-owned banks, are obtained from the last survey of the Bank Regulation and Supervision Survey carried out by the World Bank (Barth et al., 2004, 2008, 2013a, 2006, 2013b; Cihak et al., 2012). As the answers from this survey correspond to the year 2010, we collect data for the same year. Moreover, we follow the indexes constructed and made available by Barth et al. (2006) and (2013a), which aggregates the responses to individual questions into indexes.

Since the availability of data varies by country and by bank, we edit the raw data with the purpose of minimising the errors in our analysis. Therefore, our sample comprises only the observations for which all variables are available. The initial sample included 28 EU countries.⁵ The Czech Republic and Sweden did not respond to the survey. Hence, we do not have information on any regulatory variable for these countries. Therefore, they are dropped from our sample, resulting in 1218 banks from 26 countries. After dropping the observations without information for the bank-specific variables, there are 1019 banks from 24 countries, Latvia and Lithuania are excluded. Although the United Kingdom, Germany and Estonia responded to the survey, there are missing values for the regulatory variables. For the United Kingdom, the information is not available for official supervisory power; for Germany, information is not available for activity restrictions; for Estonia, information is not available for private monitoring. Consequently, the final sample used in our study to examine the impact of regulation on banking efficiency consists of 678 banks from 21 EU countries.

3.1.1. Net interest margin and overhead costs

To measure banking efficiency, we use two accounting ratios: net interest margin and overhead costs. We collected data for net interest margin and overhead costs from 2010 since the information for bank regulation is from this year. Net interest margin equals interest income minus interest expense divided by total assets. The net interest margin measures the gap between what banks pay to their lenders and what banks receive from their borrowers, hence it reflects the conventional lending and borrowing operations of the bank. Similar to previous papers, we interpret the net interest margin as a signal of intermediation inefficiency and excessive market power, allowing banks to charge higher interest. Thus, higher values of net interest margin reflect lower levels of banking efficiency.

Overhead costs equal operating expenses divided by total assets. High overhead costs reflect unwarranted managerial perquisites as well as higher market power, which is inconsistent with the efficient intermediation of the banking system. Hence, higher values of overhead costs are associated with lower levels of banking efficiency. It is expected that both dependent variables produce identical results (Barth et al., 2008; Demircuc-Kunt et al., 2004; Levine, 2005).

In our econometric model, we use the logarithm values of both net interest margin (LOGNIM) and overhead costs (LOGOC) with the aim of normalising the distribution of the variables and consequently decrease their fluctuation. Graphically, we can perceive that the distribution of the variables before the logarithm values exhibits high skewness and high kurtosis. Using the logarithm, the values of skewness and kurtosis are closer to the values for the standard normal distribution.

Differences across banks in net interest margin and overhead costs may reflect differences in bank activities, business systems, or asset allocations rather than differences in banking efficiency. In order to mitigate possible interpretational issues with the measures of banking efficiency and be able to find the independent relationship between them and bank regulation, we control for the bank and country-specific variables.

3.1.2. Regulatory variables

With the purpose of evaluating the impact of bank regulation on banking efficiency, we include four regulatory measures in our study, namely, capital regulation, activity restrictions, official supervisory power, and private monitoring. We provide the description of these variables and the range of the corresponding indexes constructed by Barth et al. (2006), (2013a)). The regulatory measures data were collected from the last survey. Hence, it refers to the year 2010.

The capital regulatory variable (CAPREG) is an index that incorporates the initial capital stringency and the overall capital stringency. The initial capital stringency concerns whether the sources of regulatory capital can include assets other than cash, government securities or borrowed funds and whether the regulatory/supervisory authorities verify them. The overall capital stringency concerns whether Basel I is the applied capital adequacy regime, whether the capital requirement reflects market or credit risk, whether market value losses are deducted, and the fraction of revaluation gains permitted. The capital regulatory index ranges from 0 to 10 with higher values indicating greater capital stringency.

The activity restrictions variable (ACTRES) is an index that measures the degree to which banks are allowed to engage in non-traditional activities, specifically, securities, insurance and real estate activities. Securities activities include brokering, underwriting, dealing, and all aspects of the mutual fund industry. Insurance activities include underwriting and selling. Real estate activities include management, investment and development. The activity restrictions index ranges from 4 to 16 with higher values indicating greater restrictiveness.

The official supervisory power variable (SPOWER) is an index that concerns whether official supervisors have the power to act on bank owners, auditors, and managers in different circumstances with the intention of preventing and correcting problems. This includes whether the supervisory authority is allowed to share information with external auditors, declare bank insolvency, supersede the rights of shareholders, change bank managers and directors, build a legal case against auditors in case of negligence, require banks to constitute provisions to cover losses, require banks to reduce or suspend dividends, bonuses and other remunerations and whether auditors are required to report unlawful activities. The official supervisory power index ranges from 0 to 14 with higher values indicating a greater power of supervisory authorities.

The private monitoring variable (PMONIT) is an index that measures the degree to which supervisors require banks to disclose accurate and detailed information to officials and the public, promoting the monitoring of banks by the private sector. It involves whether professional external auditors audit

banks, whether international and domestic rating entities rate banks, whether there is an explicit deposit insurance scheme and the compensation received by insured depositors the last time a bank failed, whether banks are required to produce consolidated accounts and disclose off-balance sheet items, whether accrued or unpaid interest or principal are included in the income statement on performing and non-performing loans, whether bank directors are legal responsible for the accuracy of the information disclosed and whether subordinated debt is allowed. The private monitoring index ranges from 0 to 12 with higher values indicating greater private monitoring of banks.

3.1.3. Control variables

At the bank-level, we use three key control variables: bank size, bank equity and bank market share. At the country-level, we control for the GDP growth and the government-owned banks. We use 2010 values as the data for the regulatory variables corresponds to this year. Since we find the same results when we omit the control variables, endogeneity problems are not biasing our conclusions regarding the effects of bank regulation on banking efficiency.

Bank size (LOGTA) is measured as the logarithm of total bank assets in US dollars. We control for bank size to capture the effect on bank lending behaviour. Moreover, this variable may have a considerable impact on net interest margin and overhead costs in case of increasing returns to scale in the banking industry. Bank equity (EQTA) is measured as the book value of bank equity divided by total bank assets. We use this variable as previous papers (e.g. Berger, 1995) supported that well-capitalised banks face lower bankruptcy costs, hence lower funding costs. Therefore, higher values of bank equity may imply higher net interest margin and overhead costs. Bank market share (MS) equals the total assets of the bank divided by the total commercial bank assets in the country. Banks with greater market share may experience greater market power, consequently greater net interest margin and overhead costs.

Government-owned banks (GOVERN) equals the fraction of the banking system's assets that is held by banks with 50% or more government-ownership. This variable measures the ownership structure of the banking system. La Porta et al. (2002) suggested that government-owned banks tend to allocate resources to benefit politicians and therefore tend to be less efficient. According to this perspective, we expect government-owned banks to exert a positive impact on net interest margin and overhead costs. GDP growth (GDPGR) equals the annual growth rate of GDP per capita. We include this variable to control for business-cycle forces of the macroeconomic environment. Since the demand for financial services depends on the cyclical conditions, GDP growth may have a positive influence on banking efficiency.

3.1.4. Descriptive statistics

This paragraph presents and discusses the key descriptive statistics for the dependent and independent variables used in our regression analysis.

Table 1 shows the summary statistics of all the variables used to study the impact of bank regulatory measures on banking efficiency. The average for the LOGNIM is -4.24 , with a minimum of -11.10 and a maximum of -1.58 . The number of observations of this variable (671) is lower compared to the number of observations of all the other variables (678). The difference refers to the banks from our sample with values of net interest margin equal to 0, since the logarithm of 0 is not computable. The average for the LOGOC is -4.09 , with a minimum of 9.95 and a maximum of -0.42 . Regarding the regulatory variables, CAPREG has an average of 6.70 with a standard deviation of 1.56, a minimum of 4 and a maximum of 9. As the range of this index is from 0 to 10, we can conclude that the 21 EU countries have a medium-high level of capital stringency. For the ACTRES, the average is 6.21 with a standard deviation of 1.7, a minimum of 4 and a maximum of 11. The banks in our sample are less regulated in terms of engaging in securities, insurance, and real estate activities, compared to the capital as the range of the former is from 4 to 16. The average SPOWER is 11.29 with a standard deviation of 1.9, a minimum of 5 and a maximum of 9. Since this index ranges from 0 to 14, we can conclude that the official supervisory authorities in the considered countries have great

Table 1. Descriptive statistics

Variable	Mean	Std. Dev.	Minimum	Maximum	Observations
LOGNIM	-4.24	0.98	-11.10	-1.58	671
LOGOC	-4.09	1.24	-9.95	-0.42	678
CAPREG	6.70	1.56	4	9	678
ACTRES	6.21	1.70	4	11	678
SPOWER	11.29	1.90	5	14	678
PMONIT	8.32	1.06	6	11	678
LOGTA	6.53	1.00	3.42	9.51	678
EQTA	0.12	0.13	-0.01	1.00	678
MS	0.03	0.07	0.00	0.58	678
GOVERN	0.07	0.09	0	0.51	678
GDPGR	0.01	0.02	-0.06	0.05	678

Note: This table presents the mean, standard deviation, minimum, maximum and number of observations of all variables used in this study for a sample of 21 EU countries for the year 2010. Sources: SNL Financial database, World Bank: Bank Regulation and Supervision Survey, and World Bank: World Development Indicators and own calculations. The bank-level variables include logarithm of net interest margin (LOGNIM), logarithm of overhead costs (LOGOC), bank size (LOGTA), bank equity (EQTA) and bank market share (MS). The country-level variables include capital regulation (CAPREG), activity restrictions (ACTRES), official supervisory power (SPOWER), private monitoring (PMONIT), government-owned banks (GOVERN) and annual growth rate of GDP per capita (GDPGR).

power to take actions against bank owners, managers and auditors. Lastly, the average for the PMONIT is 8.32 with a standard deviation of 1.06, a minimum of 6 and a maximum of 11. Given that the range of this index is from 0 to 12 and considering the statistics, we can conclude that the banking regulations in the countries of our sample promote private monitoring of banks. The fact that the countries in our sample promote both official supervisory power and private monitoring is consistent with the theory that the two approaches are not mutually exclusive as discussed in the literature review. Considering the control variables, the average LOGTA is 6.53, with a minimum of 3.42 and a maximum of 9.51. The average for the EQTA is 0.12, with a minimum of -0.01 and a maximum of 1. For the MS, the average is 0.03, the minimum is approximately 0, and the maximum is 0.58, meaning that there is at least one bank in a country that holds more than 50% of the total commercial bank assets in that country. The GOVERN has an average of 0.07, a minimum of 0 and a maximum of 0.51. These statistics reflect that there are one or more countries in our sample without government-owned banks, as well as at least one country where government-owned banks hold more than 50% of total banking assets in that country. The average for the GDPGR is 0.01, with a minimum of -0.06 and a maximum of 0.05, reflecting that there are countries with negative growth rates of GDP per capita and even the highest value reflects positive but low growth rate.

3.2. Model description

To assess the effect of bank regulatory measures on banking efficiency while controlling for bank-specific and country-specific variables, we estimate the following two models:

$$LOGOC_{i,t} = \alpha + \beta_1 CAPREG_t + \beta_2 ACTRES_t + \beta_3 SPOWER_t + \beta_4 PMONIT_t + \beta_5 B_{i,t} + \beta_6 C_t + \varepsilon_i \tag{1}$$

$$LOGOC_{i,t} = \alpha + \beta_1 CAPREG_t + \beta_2 ACTRES_t + \beta_3 SPOWER_t + \beta_4 PMONIT_t + \beta_5 B_{i,t} + \beta_6 C_t + \varepsilon_i \tag{2}$$

Where *i* refers to bank *i*, *t* refers to country *t*, α is the intercept, $B_{i,t}$ is a vector of bank-specific variables for bank *i* in country *t*, C_t is a vector of country-specific variables in country *t* and $\varepsilon_{i,t}$ is the residual. The

measures of banking efficiency are two accounting ratios: the logarithm of net interest margin and logarithm of overhead costs. In model (1), the dependent variable is $LOGNIM_i$ which represents the logarithm of net interest margin for bank i in country t . In model (2), the dependent variable is $LOGOC_i$, which represents the logarithm of overhead costs for bank i in country t . $CAPREG_t$ is the capital regulation variable in country t and θ_1 is the coefficient which explains the effect of capital regulation on banking efficiency. $ACTRES_t$ corresponds to the activity restrictions variable in country t and θ_2 is the coefficient describing the impact of activity restrictions on banking efficiency. $SPOWER_t$ denotes the official supervisory power variable in country t and θ_3 is the effect of official supervisory power on banking efficiency. $PMONIT_t$ is the private monitoring variable in country t and θ_4 describes the influence of private monitoring on banking efficiency. The vectors B_i , and C_t including the bank-specific variables and the country-specific variables, respectively, are defined as follows:

$$B_{i,t} = (LOGTA_{i,t}, EQTA_{i,t}, MS_{i,t})$$

$$C_t = (GOVERN_t, GDPGR_t)$$

The vector B_i contains bank size, bank equity and bank market share. Bank size is proxied by the logarithm of total assets for bank i in country t ($LOGTA_i$). Bank equity is measured as the equity to assets ratio for bank i in country t ($EQTA_i$). Bank market share is assessed by the ratio between the total assets of the bank and the total commercial bank assets in the country for bank i in country t . The vector C_t includes the government-owned banks variable in country t ($GOVERN_t$) and the annual growth rate of GDP per capita in country t ($GDPGR_t$).

Previous to the regression of model 1 and 2, it is necessary to check whether the variables are suitable for our cross-section data and whether the assumptions about our data are fulfilled. Therefore, we examine the graphical distribution and the measures of skewness and kurtosis of the variables. The skewness and kurtosis values for standard normal distribution are 0 and 3, respectively. The only variables whose values are significantly different from the standards are net interest margin and overhead costs. As previously mentioned, we use the logarithm values to solve this problem by normalising the distribution of the variables. From Figures 1 and 2, we can perceive the difference before and after the logarithm values.

In order to regress the models, we use the OLS estimation as the method that best fits our data. Since heteroskedasticity is often a problem in cross-section data, we test both models for the presence of heteroskedasticity using the Breusch–Pagan test. The null hypothesis of the test refers to the presence of homoskedasticity. The p-value for both models equals 0.00, hence, we reject the null hypothesis. Thus, we use the heteroskedasticity-robust standard errors in our regressions.

Figure 1. Histograms of net interest margin and logarithm of net interest margin, Source: the authors.

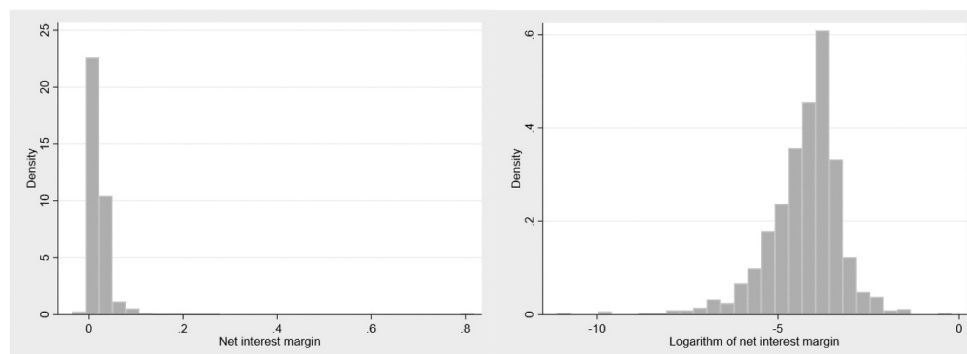
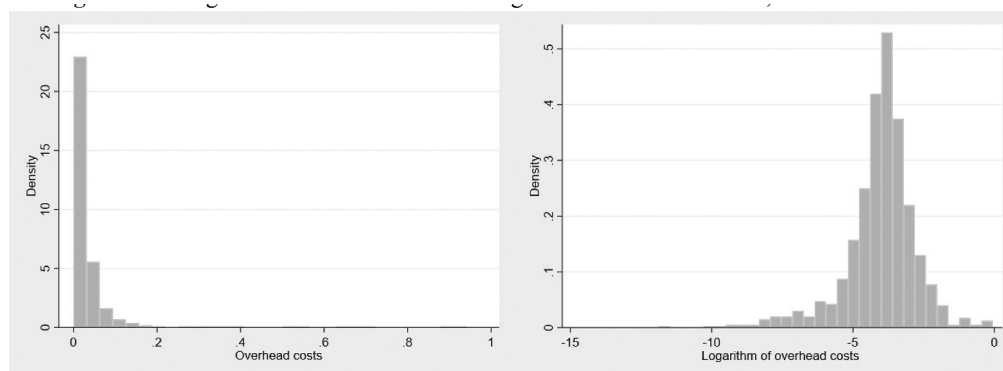


Figure 2. Histograms of overhead costs and logarithm of overhead costs, Source: the authors.



4. Empirical results

In this section, we present and discuss the main results of the estimated regressions. We compare our findings with the expected findings included in our hypotheses, which consider the evidence presented in previous banking literature. Explanations for possible inconsistencies are also examined.

Table 2 presents the regressions results of bank regulation on banking efficiency proxied by the logarithm of net interest margin and overhead costs while controlling for bank-specific and country-specific variables. To recall, we interpret the results as higher values of net interest margin and overhead costs are associated with lower levels of banking efficiency.

Table 2. Regression results		
	(1)	(2)
	LOGNIM	LOGOC
CAPREG	0.0353 (0.0304)	0.0399 (0.0337)
ACTRES	0.161*** (0.0266)	0.175*** (0.0313)
SPOWER	0.0177 (0.0327)	0.0511** (0.0242)
PMONIT	-0.119* (0.0612)	-0.171*** (0.0581)
LOGTA	-0.197*** (0.0493)	-0.445*** (0.0648)
EQTA	0.158 (0.578)	1.154* (0.658)
MS	2.063*** (0.671)	2.247*** (0.619)
GOVERN	0.224 (0.313)	-1.169*** (0.381)
GDPGR	-14.89*** (2.087)	-9.589*** (2.366)
Constant	-3.283*** (0.858)	-1.669** (0.684)

(Continued)

Table 2. (Continued)

	(1)	(2)
Observations	671	678
R-squared	0.130	0.234
F	15.89	20.89

Note: This table exhibits the estimates from OLS regressions of model 1 and 2, explaining the relationship between bank regulation and banking efficiency. The dependent variable of model 1 is logarithm of net interest margin (LOGNIM) and model 2 is logarithm of overhead costs (LOGOC). The independent variables of both models are: capital regulation (CAPREG), activity restrictions (ACTRES), official supervisory power (SPOWER), private monitoring (PMONIT), bank size (LOGTA), bank equity (EQTA), bank market share (MS), government-owned banks (GOVERN) and annual growth rate of GDP per capita (GDPGR). The symbols *, **, *** indicate the statistical significance of the estimated coefficients at the 10, 5 and 1% level, respectively. The robust standard errors are in parentheses below the estimated coefficients. The number of observations, R-squared and F statistic of each regression are also presented in this Table.

Our results do not suggest a strong relationship between capital regulation and banking efficiency. While capital regulation enters positively in both regressions, the coefficient is not statistically significant. This is inconsistent with the expected positive and significant effect of capital regulation on banking efficiency described in hypothesis 1. The results are also inconsistent with previous studies (Barth et al., 2013b; Chortareas et al., 2012) that found a significantly positive impact on banking efficiency. On the contrary, Barth et al. (2004) reported an insignificant link between capital regulation and net interest margin or overhead costs, which supports the results in Table 2.

The results also indicate that restricting bank activities is associated with lower levels of banking efficiency, as confirmed by the positive and significant coefficients at the 1% level. The size of the coefficients is substantial. That is, a one unit increase in activity restrictions increases net interest margin by 17.5% ($100 * (e^{0.161} - 1)$) and overhead costs by 19.1% ($100 * (e^{0.175} - 1)$). Moreover, our findings support hypothesis 2 that activity restrictions have a negative and significant impact on banking efficiency. Similarly, Demirguc-Kunt et al. (2004), Chortareas et al. (2012), and Barth et al. (2013b) provided evidence that greater activity restrictions negatively affect the efficiency of the banking system.

Table 2 regressions show that there is a negative relationship between official supervisory power and banking efficiency, which supports hypothesis 3. The link is significant at the 5% level in the second regression when considering overhead costs as the dependent variable. For the first regression, official supervisory power is not significant in explaining net interest margin. This is in accordance with previous banking literature (Barth et al., 2004, 2013b; Levine, 2005) that found no robust impact of official supervisory power on banking efficiency as well as with Chortareas et al. (2012) that found a positive and significant impact on overhead costs when including the private monitoring variable.

As for the private monitoring variable, the coefficient enters significantly and negatively in both regressions. For the net interest margin regression, the coefficient is significant only at the 10% level, while for the overhead costs it is significant at the 1% level. The coefficients are considerably large, hence a one unit increase in private monitoring decreases net interest margin by 12.6% ($100 * (e^{0.119} - 1)$) and overhead costs by 18.6% ($100 * (e^{0.171} - 1)$). The results confirmed that promoting private monitoring enhances banking efficiency as predicted in our hypothesis 4. This finding is in line with previous studies on banking efficiency (Barth et al., 2004, 2013b; Levine, 2005) that presented empirical evidence in favour of empowering private monitoring. On the other hand, our results are in contrast with the study conducted by Chortareas et al. (2012) that found a positive impact of private monitoring on efficiency levels.

Considering the vector of bank-specific control variables, large banks tend to have lower net interest margin and lower overhead costs. Therefore, bank size is positively and significantly at the 1% level associated with banking efficiency. This may be caused by economies of scale in the banking sector. The finding is in accordance with the evidence presented by Altunbas et al. (2007) and Yildirim and Philippatos (2007) for EU countries. The results for bank equity reveal a positive impact on net interest margin and overhead costs. However, the coefficient is only significant in the second regression at the 10% significance level. This finding confirms that well-capitalised banks have more opportunities for higher net interest margin and overhead costs. Bank market share appears to be an essential driver of banking efficiency as confirmed by the positive and significant coefficients at the 1% level in both regressions. This supports the view that banks with more significant market share experience greater market power and consequently, larger net interest margin and overhead costs.

At the country level, we control for government-owned banks and GDP growth. The government-owned banks positively affect net interest margin and negatively affect overhead costs. Nevertheless, the former relationship is not significant while the latter is significant at the 1% level. The banking literature supports that the presence of the government stimulates corruption in the banking industry, hence promoting banking inefficiency. Our results are inconsistent with this view. Additionally, the annual growth rate of GDP per capita enters negatively in both regressions. The estimated coefficients are significant at the 1% level. This finding indicates that expanding markets, as measured by a higher growth rate, tend to have more efficient banking.

Some of our findings are not consistent with previous literature (Altunbas et al., 2007) on the impact of regulatory measures on banking efficiency, especially regarding capital regulation. Nevertheless, our study differs from the previous ones in a few aspects. First, we are considering the EU countries while most of the studies consider a large cross-country sample. Second, we are using the data from the last survey of the Bank Regulation and Supervision Survey carried out by the World Bank. This is the only study evaluating the impact of bank regulation on banking efficiency using the last survey. For instance, Barth et al. (2013a) and Cihak et al. (2012) presented and discussed the responses to the last survey and compared them to earlier surveys. However, the impact on banking efficiency is not assessed. Lastly, this survey is the first survey conducted after the financial crisis. The global financial crisis has drawn the attention of policymakers to the need to reform banking regulation since it has highlighted problems with the banking sector. Hence, discrepancies with previous studies may exist.

5. Conclusion

The global financial crisis has emphasised the importance of regulatory policies for the proper functioning of the banking system. In this regard, our study contributes to the existing literature by assessing the impact of the Basel II Capital Accord regulations in addition to activity restrictions on banking efficiency. Specifically, we examine the impact of capital regulation, activity restrictions, official supervisory power and private monitoring. In order to do so, we develop a set of hypotheses in line with our predictions considering the existent empirical evidence. We collected data for a sample of 678 banks from 21 EU countries: Austria, Belgium,

Bulgaria, Croatia, Cyprus, Denmark, Finland, France, Greece, Hungary, Ireland, Italy, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia and Spain for the year 2010. We used two alternative accounting ratios to measure banking efficiency, namely net interest margin and overhead costs. We used OLS estimation to regress the empirical models. Also, we employed cross-section data techniques to minimise the errors of our analysis.

The results show that strengthening capital regulation is negatively but not significantly associated with banking efficiency. This finding does not imply that capital regulation is irrelevant for banking efficiency. It merely suggests that the link between capital regulation and banking efficiency is not

sufficiently robust when controlling for other regulatory policies, bank and country characteristics. Regarding activity restrictions, we find that tighter activity restrictions are negatively associated with banking efficiency. By promoting the exchange of information, banks that engage in broader activities such as securities, insurance and real estate investment may benefit from economies of scale and scope, hence enhancing the efficiency levels. Similarly, we find that policies that promote official supervision may have adverse effects on banking efficiency. The results indicate that the official supervisory approach is ineffective in reducing overhead costs. However, the estimated coefficient is not significant enough to explain the behaviour of the net interest margin variable. The empirical evidence supports the private monitoring approach. Countries that require banks to disclose accurate and detailed information to the public tend to have a more efficient banking system. Basel II Capital Accord emphasises the importance of capital regulation, official supervisory power and private monitoring. Nevertheless, our findings incline to the negative aspects of capital regulation and official supervisory power.

Moreover, we find that bank-specific and country-specific control variables help explain banking efficiency. Larger banks with lower market share tend to have higher efficiency levels as confirmed by the significant negative coefficient of bank size and the significant positive coefficient of bank market share. Bank equity appears to be an important driver of banking efficiency only in the second model when overhead costs are used as a proxy. Similarly, government-owned banks variable only influences banking efficiency when considering overhead costs. This finding supports that countries that promote government-owned banks are more effective in reducing overhead costs, thus improving banking efficiency. Additionally, the growth rate of GDP per capita is negatively associated with net interest margin and overhead costs. In this perspective, the banking sector in expanding countries is significantly more efficient.

Our evidence overall suggests that the link between capital regulation and banking efficiency as measured by net interest margin and overhead costs is not robust enough to control for other regulatory variables. The results confirm that activity restrictions have a negative and significant impact on banking efficiency. Also, policies that encourage official supervisory power do not enhance the efficiency of the banking sector. The only approach that is positively and statistically significantly associated with efficiency is private monitoring.

This study may be subject to some limitations, therefore our findings should be interpreted carefully. First, we used cross-section data instead of panel data since information on regulatory measures is collected from the last survey conducted by the World Bank. Thus, the data is only available for one point in time (i.e. Bank, 2010). It is argued that banking efficiency is better estimated with panel data (Coelli et al., 2005). Another limitation of this study is the measures of banking efficiency. The literature on banking efficiency highlights the advantages of efficient frontier approaches compared to traditional accounting ratios (Berger & Humphrey, 1997; Fethi & Pasiouras, 2010). Besides, we consider 21 EU countries. Due to data unavailability, we do not consider all EU countries. As explained in the third section, countries economically large as Germany and the United Kingdom are not included, which could influence our results.

6. Recommendations

Given the negative relationship found between banking efficiency and official supervisory power, the recommendation for policy makers is to re-direct resources away from official supervision and towards private monitoring, a concept that has been promulgated in the Basel II framework. Moreover, supervision should not focus on restricting activities, as this is seen to have a significant and negative impact on banking efficiency. Supervisors should also recognize that, while capital regulation can be important for individual banks, it does very little for banking efficiency, but government-owned banks can contribute to system efficiency.

There are other regulatory policies than those considered in this study, such as financial conglomerate variables, competition, regulatory variables and deposit insurance scheme, which could affect banking efficiency. Larger sample size and additional regulatory variables could be

considered. To further explore implications of regulatory policies, several characteristics of the banking system can be studied such as loan growth and bank competition.

Given the vast scope of banking regulation, many aspects can be explored in the future.

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Notes

1. The study uses inefficiency as proxy for banking efficiency in the DEA approach. Instead of measuring how close the bank is from the non-parametric efficient frontier, the study measures how far it is. By definition, the best practice banks are 100% efficient, therefore inefficiency equals the difference between 100 and the efficiency score.
2. The definition of financial conglomerates adopted in this paper is the same proposed by Laeven and Levine (2007).
3. See, for example, King and Levine (1993) and Levine (1997) for empirical evidence.
4. The study separated financial crisis into three categories: banking crisis, currency crisis and debt crisis. ⁵ Bank charter value is defined as the value that would be foregone in case of closure. The study measures bank charter value with Tobin's Q ratio.
5. The 28 EU countries are: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

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