Is labour market regulation of any importance for bank performance in EU?

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Abstract

The European banking industry is undergoing significant structural changes and cost-reduction programs through the introduction of organizational changes and reductions in the number of bank employees. The urgency to reduce operating costs and improve efficiency has been further amplified by the financial crisis. In light of these developments, bank performance has been put at the center of research attention. Yet, the institutional features that affect banks' ability to adjust costs and in particular personnel expenses, which comprise a significant part of banks' cost structure, have not been adequately studied. This paper covers this gap in the literature by investigating on the effect of labor market institutions and regulations on banks' performance. In particular, we examine the impact of labor market regulations on EU-15 cost inefficiency over the period 2004-2010. We employ dynamic panel data models as well as a panel-VAR analysis to take into account endogeneity issues. Results indicate the existence of a negative relationship between bank performance and the liberalization of the EU labor market in the short run. However, when the aggregate labor market regulation index is decomposed into its elements, this effect is not always valid and some variability is present, while over the medium term we mostly observe the opposite effect.

Keywords: *Labor regulation; cost inefficiency; EU banks.*

1. Introduction

Labor market reports for the banking industry have become ever more frequent in recent months. According to Reuters (*16.11.2012*) tens of thousands of bank staff have lost their jobs since 2009, and further layoffs have been announced. In particular, staff-cuts announced since mid-2011 or reported to be in the works at major banks have reached 158,000. This does not come as a surprise, as over the past decade the European banking system has undergone significant structural changes, which have been further precipitated by the financial crisis. As part of this restructuring process, banks have focused their efforts on improving operating performance through reduction of their operating expenses. Indeed, the European banking industry has actively undergone cost-cutting measures to improve its profitability by introducing organizational changes (such as outsourcing), and reducing both branch networks and the number of employees (ECB, 2003). The urgency to reduce costs and improve efficiency has increased in the current difficult economic environment with slow credit growth, high funding costs and increasing non-performing loans, as a result of the financial and the sovereign debt crisis. As a response, banks are increasingly turning to internal costs savings to safeguard their profitability, including staff reductions. Thus, employment issues in the banking industry have gained importance in the aftermath of the financial crisis and as a result of falling profits that followed. In the current juncture, banks have no other option than to reconsider the way they operate and provide financial services. Moreover, the current crisis has clearly highlighted that the cycle of easy credit and growth in lending and revenues of the previous years masked serious underlying problems, including the build-up of highly complex operating models and high cost structures, including personnel expenses.

A significant part of banks' cost structure, which has been at the center of bank managers' cost-cutting efforts, is personnel expenses. Looking at banks' cost structures reveals interesting insights about the share of personnel expenses in banks' total costs. In particular, data for the EU-15 banking systems from the OECD Bank Profitability Report (2010) suggest that personnel expenses comprise a significant part of total cost, ranging from 5 per cent in Luxembourg to about 24 per cent in Greece. Moreover, staff expenses as a per cent of total bank cost have been increasing up to 2004 in most countries, reaching about 35% in Greece, and levels above 25% in Spain, Italy France and Denmark. This trend has been reversed in

2005, when most banking systems exhibit decreasing personnel expenses. Overall, the data suggests that personnel expenses are a significant part of banks' costs and their rationalization has been at the center of managers' efforts over the recent years to reduce costs and increase their efficiency. However, note at the outset, that any effort to manage personnel expenses is unavoidably a function of the general framework of labour market regulation across countries in which banks operate. In particular in EU, and despite the notion of creating a common market, also in labour markets, and thereby enhance the integration process within EU, one can not fail to notice that there exist substantial differences across national borders regarding the underlying labour regulation. Moreover, despite a significant liberalization in European labour markets in all EU countries in recent years, it appears that differences across countries persist (European Commission, 2012).

From the point of view of bank managers, cost control, also in relation to personnel expenses, has emerged as a central objective whilst the utilization of all resources, in particular human resources, in an efficient and effective manner is of paramount importance to banking success (Spong et al., 2005). Moreover, Goddard et al. (2001) argue that: *"(European) banks have sought to improve operating efficiency by reducing staff and other costs. The more banks can adopt best-cost practice, subject to maintaining service quality and customer relationships, the stronger their competitive position and net income-generating capacity"*. In light of these developments, and also in light of significant differences in labor market regulations across the EU, it would be interesting to examine the factors that affect banks' ability to adjust costs, focusing in particular on personnel expenses.

Banks' ability to adjust staff costs and banks' responsiveness to changing circumstances are highly influenced, among other things, by the existence of labor institutions and regulations, which can therefore have significant implications for productivity. According to Boeri et al. (2008) labor market regulations can affect firms' choices over inputs, investments, technology, and output and at the aggregate level may also influence the allocation of resources across firms and sectors of the economy, impacting of growth. Labor market dynamics are influenced by limited wage-setting flexibility, as well as by regulatory constraints on hiring and firing, and by employment protection legislation (EPL). For example, in European countries, EPL typically

requires that termination of individual regular employment contracts be motivated and subject to court appeal, and that collective dismissals be conditional on administrative procedures involving formal negotiations with workers' unions and with authorities (Bertola, 2009). While a number of studies have examined the impact of labor regulations at a macro level (e.g., Botero et al., 2004; Lazear, 1990), there have been very few microeconomic cross-country empirical studies of the impact of labor market rigidities on firm level outcomes (Lafontaine and Sivadasan, 2007). Moreover, the examination of labor regulations has become even more interesting in light of the ongoing labor market reforms, which are a key component of the structural reform agenda in several EU countries, as a result of the sovereign debt crisis.

In light of recent developments and due to the turbulence and change that characterize the banking industry, we believe that this sector is particularly suitable for examining the effect of labor regulation on firm performance. Thus, the aim of this paper is to investigate the effects of labor market regulation on cost efficiency in the European banking industry (EU-15 countries) over the period 2004-2010. Cost efficiency is estimated using the Stochastic Frontier Approach, while as an indicator of labor market regulation we employ the subcomponent of the Fraser Index on Economic Freedom, which measures the liberalization in labor market regulation. This indicator is further decomposed into 6 sub-indicators, which cover various aspects of labor institutions and regulations. This enables us to examine separately the effect of specific features of the labor market on cost efficiency. The relationship between cost efficiency and labor market regulations is estimated within a Panel VAR context, which allows us to estimate the underlying dynamic relationships between inefficiency and regulations without applying any a priori restrictions. As a next step, we also perform a sensitivity analysis and examine whether the relationship between labor regulations and efficiency is influenced by bank-specific characteristics.

A first glimpse at the results shows that there is a negative relationship between bank performance and the liberalization of the EU labor market in the short run. However, when the aggregate labor market regulation index is decomposed into its components, this effect is not always valid, as some variability is also present, while over the medium term we mostly observe the opposite effect. The sensitivity analysis using bank-specific control variables further confirms these findings.

The rest of the paper is structured as follows: Section 2 briefly reviews the different strands of literature that relate to our analysis and presents recent developments in the European labor markets regulation. Section 3 describes the variables and the dataset included in our study, while Section 4 presents the empirical specifications of the models and the main results. Finally, section 5 offers some concluding remarks and possible policy implications.

2. A review of the literature and stylized facts of labor market in the EU

Our study related to various strands of the literature. Foremost, this paper relates to the literature of bank efficiency (for excellent reviews see Berger and Humphrey, 1997; Berger, 2007). A large part of this literature has focused on the European banking system (e.g. Allen and Rai, 1996; Altunbas et al., 2001; Lozano-Vivas et al., 2001, 2002; Maudos et al., 2002; Casu and Molyneux, 2003). One of the common findings of most of the studies on European bank efficiency is the high level of cross-country heterogeneity. In particular, albeit efforts towards greater financial integration most studies find significant cross-country heterogeneity in terms of bank efficiency (e.g. Bikker, 2002; Cavallo and Rossi, 2002; Brissimis et al. 2010). In addition, environmental (country-level) variables have been found to be important factors in explaining such cross-country heterogeneity in bank efficiency across the EU (e.g. Dietsch and Lozano-Vivas, 2000). Among these factors, several studies have focused on the effect of regulation on bank efficiency.

Thus, our study is also related to the strand of the literature that investigates the potential effects of regulation on the performance of financial institutions. For example, Barth et al. (2004) examined bank regulations and supervisory practices in 107 countries and found a positive relationship between private monitoring and bank performance, but no statistically significant relationship between capital stringency, official supervisory power and bank performance and stability. Similarly, Pasiouras (2008) who investigated the impact of several regulations on banks' technical efficiency, found evidence that strict capital adequacy, powerful supervision and market discipline power enhance technical efficiency, but only the effect of market discipline power is statistical significant. On the other hand, Pasiouras et al. (2009) who examined the impact of regulations related to the three pillars of Basel II, as well as restrictions

on bank activities, on bank efficiency, found that banking regulations that enhance market discipline and empower the supervisory power of the authorities have a positive effect on bank efficiency, while stricter capital requirements improve cost efficiency but reduce profit efficiency and restrictions on bank activities have the opposite effect. Finally, in a more recent study, Barth et al. (2010) examined whether bank regulation, supervision and monitoring enhance bank efficiency, based on an unbalanced panel of more than 4,050 bank-observations in 72 countries over the period 1999-2007. They find that tighter restrictions on bank activities are negatively associated with bank efficiency, while greater capital regulation stringency is marginally and positively associated with bank efficiency. They also find that enhanced official supervisory power is positively associated with efficiency only in countries with independent supervisory authorities.

However, all the above-mentioned studies have focused mainly on the effect of bank regulation on efficiency, while the regulatory framework in other areas of the economy, such as labor and other business related legislation, has so far been neglected by the literature. This point is particularly emphasized by Demirguc-Kunt et al. (2004), who investigated the impact of a wider set of regulations on bank net interest margins and overhead costs while controlling for bank-specific characteristics. They find that tighter regulations on bank entry and bank activities boost the cost of financial intermediation, but bank regulations become insignificant when controlling for national indicators of economic freedom or property rights protection. They conclude that bank regulations cannot be viewed in isolation, as they reflect broad, national approaches to private property and competition.

Studies that explicitly focus on the importance of country level institutional or regulatory quality as determinants of bank efficiency are scarce. For example, Lensink et al. (2008) find that although foreign ownership negatively affects bank efficiency, the effect is less pronounced in countries with better regulatory and institutional framework. The authors also find that higher institutional quality in the home country and higher similarity between home and host country institutional quality tend to reduce foreign bank inefficiency. Another study by Hasan et al. (2009) examines the impact of institutional quality on the cost and profit efficiency of the banking sector at the regional level in China and concludes that banks located in regions with higher level of property rights protection and rule of law exhibit higher level of cost efficiency.

Our study is also related to the literature on labor market regulations. Labor market regulation is the subject of much theoretical work as well as of extensive empirical research (Bertola, 2009). In particular, labor market regulations that constrain the ability of firms to adjust employment levels are an important and controversial public policy issue in many countries around the world. The relevant literature has mainly focused on the macroeconomic effects of labor market regulation, and mainly on its impact on output and unemployment (Lazear, 1990; Blanchard and Wolfers, 2000; Botero et al., 2004; Nickell, 1997; Nickell and Layard, 1999; Heckman and Pages, 2003). More specifically, labor regulations are often cited as a determinant of economic performance in OECD countries (e.g. Freeman, 1988; Nickell and Layard, 1999). It appears that the literature (Freeman, 1988; Blanchard and Wolfers, 2000; Nickell, 1997; Nickell and Layard, 1999; Besley and Burgess, 2004) predominantly suggests that a higher degree of labor market regulation induces efficiency loses for firms. This is manifested in rising employment costs as a result of stricter employment protection legislation (Bassanini and Ernst 2002; Scarpetta and Tressel 2004), which in turn, would negatively affect firms' returns with respect to innovation and technology, resulting in declining productivity growth (Malcomson 1997). On the other hand, labor market regulations to the extent that they cause increased wage pressures could result to higher labor productivity due to capital deepening and investment in capital-intensive industries (Autor et al., 2007). Apart from labor regulation per se, Cabellero et al. (2004) argues that the degree of enforcement of labor market regulation also plays a significant role. In particular, the authors find that adjustment costs are greater in countries with more rigid labor regulation, and that these effects are stronger for countries that have better law enforcement. In a more recent work, Almeida and Carneiro (2009) find that the enforcement of labor regulations plays a significant role, as it is found to negatively affect firm size and other firm characteristics.

2.1 Developments in the EU labor market

Over the last decade, the need to improve the functioning of EU labor markets has featured prominently in the priorities of the European Union strategy, and in line with these priorities most EU countries implemented a wide range of labor market reforms. According to the European Commission (2012): "*Since the onset of EMU, there was clear awareness that a*

successful monetary union would have required reforming labor markets where needed in such a way to ease adjustment in the face of asymmetric shocks and to permit a prompt reaction of price competitiveness as a tool to absorb idiosyncratic shocks and favor the correction of macroeconomic imbalances." The need for timely and comprehensive labor market reforms has become even more pertinent in light of the recent sovereign debt crisis in the euro area, especially for countries under IMF/EC/ECB programs.

Against this background, this section provides a short description of the trends and main features of labor market reforms in the EU over the last decade. In order to do so, we employ the Fraser Index of Economic Freedom (Gwartney et. al, 2011), which is an indicator-based database. In particular, we focus on one of the five component of the index, that is, labor market regulations. This index ranges from 0 to 10, with 0 indicating the lowest and 10 the highest degree of liberalization in the labor market. It should be noted that indicator-based databases quantify the degree of stringency and distortions associated with existing regulations and institutions, and provide a synthetic measure of the anti-competitive implications of the existing regulations and institutions (European Commission, 2012). Thus, reforms are measured indirectly by looking at the evolution of the indicator over time.

Figure 1 presents the evolution of the Fraser Index on labor regulation over the period 2000-2010 for all EU-15 countries. Overall, we observe a significant liberalization in European labor markets in all EU countries except from Luxembourg. Consistent with the findings of the OECD (Brandt et al., 2005), there appears to be no clear relationship between the initial conditions of labor market performance and subsequent reform efforts. Some countries have implemented significant reforms even though their initial conditions were already relatively favorable (e.g. Ireland, Netherlands and the UK), while others have taken only modest action despite a poor starting point (Greece, Portugal, Spain). Moreover, according to the European Commission (2012) the distribution of reforms across countries reveals that there is a relatively low degree of synchronization of reforms across countries over the whole decade, which could be explained by the fact that with the exception of the crisis period, reforms are often the response to asymmetric shocks. In addition, cross-country differences may suggest that "… *these differences reflect the fact that the timing of reforms is linked to the interplay between shocks and the typology of existing institutions"* (European Commission, 2012).

(Insert Figure 1 about here)

According to the OECD (2006), EU countries have employed very diverse reform strategies, from comprehensive reforms package, to reforms more narrowly targeted on specific fields where deep action was undertaken, while the intensity of reforms differed markedly across policy fields. This is consistent with the more recent findings of the European Commission (European Commission, 2012). Against this background, we also examine the evolution of the sub-components of the Fraser Index on labor regulation over the period 2000-2010. In particular, the labor market regulations index is decomposed to into the following elements: i) hiring regulations and minimum wage, ii) hiring and firing regulations, iii) centralized collective bargaining, iv) hours regulations, v) mandated cost of worker dismissal and vi) conscription. Note that the sub-components of the labor regulation index also take values from 0 to 10, with higher values suggesting greater economic freedom. In contrast, a low value of this index would imply that market rigidities are in operation.

In more detail, the first subcomponent of Frazer labor market regulation index, "*hiring regulations and minimum wage*", is constructed based on data from the World Bank's Doing Business Difficulty of Hiring Index. This index focuses on the difficulty of hiring and captures some fundamental labor market issues, such as: whether fixed-term contracts allow or do not allow for permanent tasks, the maximum cumulative duration of fixed-term contracts; and the ratio of the minimum wage for a trainee or first-time employee to the average value added per worker. Looking at Figure 2 (*up left*), Austria and Denmark have the more liberalized regulations in the area of hiring and minimum wage, closely followed by Belgium, Ireland and the UK. These countries undertook significant reforms in this field over the period 2000-2010. On the other hand, countries such as Finland, France, Portugal and Spain moved in the other direction and tightened hiring regulations and minimum wage. Overall, we observe significant differences across countries, both with regards to the trend of reforms as well as their direction and their intensity.

(Insert Figure 2 about here)

The second subcomponent of the Fraser Labor Index is "*hiring and firing regulations*" and is constructed using a survey with questions directed to business executives from each country.

The main question relates to the issue of whether labor market regulations hinder the hiring and firing of workers. A low score of one would imply great rigidities and a high value of ten would imply flexibility. The original data source is the Global Competitiveness report, which is published annually by the World Economic Forum. As we can see from Figure 2 (*up right*), there is a trend towards higher liberalization in hiring and firing regulations in most countries (except from Luxembourg, Portugal and Spain), although progress over the period 2000-2010 has been limited. The relatively slow progress and low initial levels of this indicator suggest that there may be room for additional liberalization in this area.

Looking at the third subcomponent of the Fraser Labor Index, "*centralized collective bargaining*" refers to country level industrial relations. It is constructed using the Global Competitiveness Report and is based mainly on whether the wages are set by a centralized bargaining process or up to each individual company. As we can observe from Figure 2 (*middle left*), there are diverging trends across countries, with about half of EU Member States exhibiting a trend towards higher centralization over time and the other half moving a more liberalized bargaining framework.

The fourth subcomponent of the Fraser labor Index, "*hours regulations*" is derived from the World Bank's Doing Business Rigidity of Hours Index. This index depends on various issues including: restrictions on night work; restrictions on weekly holiday work; 5.5 work week; 50 hours or more, including overtime, work week so as to respond to a seasonal increase in production; and 21 working days or fewer paid annual vacation. Looking at Figure 2 (*middle right*), we observe a trend towards more liberalization over the period 2000-2010 across all countries but Greece and Spain. Ireland has the most liberalized framework, followed by Austria, Belgium, Denmark, Finland, Germany, Italy and the UK.

An index measuring the "*mandated cost of worker dismissal*" comprises the fifth subcomponent of the Fraser Labor Index and is derived from the World Bank's Doing Business database. In particular, it captures the cost of the advance notice requirements, severance payments, and penalties due when dismissing a redundant worker. As we can see in Figure 2 (*down left*), the vast majority of countries (except from Greece) exhibits significant progress in liberalizing mandated dismissal costs over the examined period. Furthermore, seven countries (Austria, Belgium, Denmark, Finland, Italy, Netherlands and Sweden) achieved the

maximum score of 10 for this indicator in 2010.

Finally, the sixth subcomponent of the Fraser Labor Index captures the existence "*conscription*". If conscription is present then labor market rigidities are in operation, implying further anomalies in the labor market. Looking at Figure 2 (down right), we observe significant variation across countries.

3. Variables and data

3.1 Efficiency estimation – definition of inputs and outputs

For the estimation of cost efficiency we opt for the Stochastic Frontier Approach developed by Aigner et al. (1977) and Meeusen and Van den Broeck (1977) (see Annex 1 for details). This approach involves the estimation of a cost function, assuming a composite error term, which is disentangled in two components: one that corresponds to the classical error term and one that captures inefficiency. For the definition of inputs and outputs we follow Sealey and Lindley (1977) and employ the intermediation approach. More specifically, we specify two outputs, loans and other earning assets (government securities, bonds, equity investments, CDs, T-bills, equity investment etc.). Labor and deposits are the input variables, whereas their prices are calculated as the ratio of personnel expenses to total assets and the ratio of total interest expenses to total deposits and short-term funding, respectively. Physical capital and equity are specified as fixed netputs. Total cost is defined as the sum of overheads (personnel and administrative expenses), interest, fees and commission expenses.

3.2 Control Variables

A number of control variables are included in our analysis in order to account for individual bank characteristics, such as bank size, credit risk and profitability. These variables are: the logarithm of total assets, the net interest margin and the loan loss provisions ratio.

Bank Size: Although banks in the EU-15 banking systems have similar organizational structure and objectives, they vary significantly in size. Therefore, we include the logarithm of total

assets in order to account for the size of each bank. Bank size is also a proxy for economies or diseconomies of scale and can lead to either higher or lower costs for banks. If large banks exercise market power, they may increase the costs for the sector through slack and inefficiency. In a similar vein, small banks operating mostly in local markets may have access to ''soft'' information about local conditions, engage in relationship lending and become more efficient than large banks (Berger, 2007). On the other hand, if the size of a bank reflects market selection and consolidation through survival of more efficient banks, market consolidation could be associated with lower costs and larger banks may be more cost efficient (Mester 1993). Empirical evidence on the relationship between bank size and efficiency is inconclusive (see for example Altunbas et al., 2001; Carbo et al., 2002; Bikker, 2002; Maudos and De Guevara, 2007).

Credit risk: Managing credit risk is an important part of banking operations. Changes in credit risk may reflect changes in the quality of a bank's loan portfolio (Cooper et al., 2003) and may affect bank performance. As a proxy for credit risk we use the ratio of loan loss provisions to gross loans. The relationship between inefficiency and credit risk could be positive according to the '*bad management*' or the '*bad luck*' hypotheses developed by Berger and DeYoung (1997), or negative if the '*skimping*' hypothesis applies.

Profitability: Despite the rising importance of fee-based income as a proportion of total income, net interest margins (NIM) remain one of the principal elements of bank net cash flows and profits (Hanweck and Ryu, 2005). Thus, we employ net interest margin as a traditional measure of bank performance, which is based on accounting data. This captures banks' primary intermediation function and serves as an indicator of the profitability of the banking industry.

3.3 Dataset and descriptive statistics

Bank-level data for the estimation of cost efficiency are obtained from the Fitch IBCA-Bankscope database. Our dataset includes commercial, savings and cooperative banks in the EU-15 countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the UK) over the period 2004-2010. After removing errors and related inconsistencies, we result with an unbalanced

sample of 3,046 banks and 18,652 bank/year observations.

Labor regulation is measured by one of the components of the Fraser Index of Economic Freedom and in particular by the labor market regulation index. Moreover, this index is decomposed to into the five sub-indexes, measuring: i) hiring regulations and minimum wage, ii) hiring and firing regulations, iii) centralized collective bargaining, iv) hours regulations, v) mandated cost of worker dismissal and vi) conscription. The labor regulation index (as well as its components) ranges from 0 to 10, with higher values indicating a more liberal regulatory environment.

Table 1 presents some descriptive statistics at the country-level for all variables included in our analysis. A comparison of the country-level means reveals some important differences regarding costs, output and input prices, as well as labor regulation variables. In particular, the average cost to assets ratio for all EU-15 countries stands at about 4%, ranging from 3.39% in Ireland to 5.10% in Denmark. Regarding bank outputs, we observe that loans still comprise the largest proportion of banks' balance sheets. In detail, the average loans to assets ratio for EU-15 countries stands at about 58%, which is higher than the average ratio of other earning assets of about 38%. Only in Belgium, Luxembourg and the UK other earning assets comprise a larger proportion of banks' balance sheet than loans. Significant variation across countries is also observed with regards to input prices. In particular, the price of labor, as proxied by the ratio of personnel expenses to total assets, ranges from 0.49% in Ireland to 1.81% in Denmark, while the price of deposits ranges from 1.71 % in Sweden to 4.45% in the Netherlands. In terms of capitalization, the average equity to assets ratio for the whole region stands at about 9%, ranging from 6.49% in Luxembourg to 14.02% in Sweden. Control variables also exhibit significant variation across countries. For example, we observe that the average bank in the UK is much larger in terms of total assets that the average European bank, while on the other hand the average bank in Austria and in Germany is much smaller. With regards to the ratio of loan loss provisions to loans, Finland exhibits the lowest average ratio, while Ireland stands at the other side of the spectrum. As far as net interest margin is concerned, it ranges from 1.08 in Ireland to 3.65 in Denmark, while the average for the EU-15 countries stands at 2.57.

(Insert table 1 about here)

Table 1 also presents the average cost inefficiency by country over the period 2004-2010, as estimated using a Stochastic Frontier Approach. Our results are in line with the vast majority of the literature that estimates the average cost inefficiency of EU countries in the range of 0.15 to 0.20 (see for example Allen and Rai,1996; Cavallo and Rossi, 2001; Bos and Schmiedel, 2003; Casu and Girardone, 2004; Maudos and De Guevara, 2007). In particular, the average cost inefficiency level for all EU-15 countries is estimated at 0.16, ranging from 0.14 in Germany to 0.28 in Ireland. Looking at the evolution of cost inefficiency over time (Table 2), we observe that for the EU-15 region as a whole average cost inefficiency increases over time up to 2008, when it reaches its maximum average value and decreases in 2009, though this downward trend is short-lived as it is reversed in 2010, when cost inefficiency starts increasing again. The increase in cost inefficiency in 2010 is mainly driven by German and Italian banks, which dominate our sample. Moreover, cross-country analysis reveals different patterns in the evolution of inefficiency scores over time across countries (Table 2). For the majority of countries we observe a clear upward trend in cost inefficiency from 2004 to 2008, when average inefficiency reaches its peak, with the exemption of Germany and Italy. On the other hand, most countries exhibit a downward trend in cost inefficiency after 2008, except from Germany, Greece, Italy and the UK. In addition, we observe that the efficiency gap, measured as the difference between the most and the least cost efficient banking system, seems to have narrowed over time. In detail, the efficiency gap initially decreases, but widens significantly from 2005 to 2008, although this trend is completely reversed thereafter.

(Insert table 2 about here)

Tables 1 and 2 also provide descriptive statistics for the labor market regulation variables. We observe that the overall labor market regulation index exhibits significant variation across countries. Looking at the evolution of the overall labor market regulation index over time, we observe that the UK appears to have consistently the less rigid and more liberalized labor market across EU-15 countries, followed by Ireland and Denmark. On the other hand, Germany and Greece appear to have the most rigid labor market regulations, although Germany exhibits significant improvement in 2009. It should be noted that in the last year of our sample, Greece, Spain and Portugal present the lowest scores among EU-15 countries in terms of the overall labor market regulation index, indicating highly regulated labor markets. Thus, it is not

surprising that labor market liberalization is a central feature in the recent structural reform efforts that have been initiated almost simultaneously in the Eurozone periphery economies.

4. Results and Discussion

4.1 Dynamic Panel Data Estimation

As a first step, we opt for the Arellano and Bover (1995) dynamic panel data estimation method. The dynamic panel analysis employs instrumental variables, thus dealing with potential endogeneity bias. The model takes the following general form:

(1)

where $Inef_{it}$ is cost inefficiency of bank i in year t, Z_{it} is a vector of bank specific control variables and $Lreg_{it}$ is a vector of labor market regulation indexes.

We estimate four alternative models. In the first specification (column 1 of table 3), we include the overall labor market regulation index. Overall, we observe the lagged inefficiency is significant at the 1% significance level and has the highest magnitude among all variables, suggesting that the chosen dynamic specification is appropriate in the context of the present analysis. Bank specific variables such as total assets, loan loss provisions, and net interest margin take the expected sign, but only the coefficient of total assets, which captures bank size, is statistically significant. Our results suggest that bank size has a positive effect on cost inefficiency.

An interesting result is the positive sign of the labor regulation coefficient, which is statistically significant at the 1% level. This result implies essentially that greater labor market liberalization would increase bank inefficiency. The labor economics literature provides mixed evidence with regards to the impact of labor regulation on economic performance (Bassanini et al., 2009). Our results show that in a firm, where it takes considerable time for the employees to acquire all necessary skills, greater freedom in, for example, hiring would harm bank performance. This is consistent with the findings of Black and Lynch (1996), who found that the knowledge and

skills of employees through training activities are important to firm performance. In addition, Autor et al., (2007) argue that labor market regulations that enhanced wage pressures would induce higher labor productivity due to capital deepening and investment in capital-intensive technologies, whilst Storm and Naastepad (2009) and Deakin and Sarkar (2008) show that labor regulation has positive effects on productivity growth in OECD countries and France and Germany.

However, in order to get a more accurate assessment of the importance of labor market regulation for bank performance, we re-estimate the above equation using the decomposition of the aggregate labor regulation index. In particular, in the remaining specifications (columns 2 - 4 of Table 3) we estimate the specific effects of the subcomponents of the labor index on cost inefficiency. Our results present a mixed picture, with half of the subcomponents of the labor market regulation index asserting a positive impact on bank inefficiency whereas the other half asserts a negative impact. More specifically, the minimum wage and the cost of dismissal have a negative effect on bank inefficiency, though only the latter is statistically significant (see 2nd column of Table 3). In addition, the hiring and firing regulation (see column 3 of Table 3) carries a negative sign and is statistically significant. This evidence suggests that lowering both the minimum wage and hiring and firing cost would increase bank performance along the lines of Bassanini and Ernst (2002) and Scarpetta and Tressel (2004). This evidence suggests that lowering both the minimum wage and hiring and firing cost would increase bank performance along the lines of Bassanini and Ernst (2002) and Scarpetta and Tressel (2004), and as a result would boost employment. In fact, in recent years euro-area countries, notably Greece and Portugal, that have received financial assistance from the so called troika (IMF, European Commission and ECB) have been strongly advised to lower minimum wages and substantially reduce hiring and firing cost as part of strong conditionality aiming at restoring and enhancing their competitiveness to the levels of high flyers such as Germany. Incidentally, Germany, a traditional export oriented and highly competitive economy, has been the first euro area country that felt the full force of credit crunch back in 2008, and it has opted to weather out its impact through a rigorous labour market reform that also included lowering minimum wages. The reported results insinuate the importance of labor market regulation for bank performance,

whilst imply that examining the effects of labor market regulation is a rather complex and evolving issue and one should investigate such effects within a dynamic framework.

(Insert table 3 about here)

4.2 Panel Vector Autoregression (VAR) Analysis

As a second step, we opt for a more flexible framework using a panel-VAR analysis. Essentially all variables in the panel-VAR enter as endogenous so as to resolve the direction of causality among them. In particular, we examine the underlying causality links between cost inefficiency and labor regulation using a first order 4x4 panel-VAR model:

$$, \ i=1,\ldots, N, \ t=1,\ldots,T. \qquad (2)$$

where X_{it} is a vector of four random variables, including cost inefficiency ($inef_{it}$), and labor market regulation indexes. First, we estimate a panel VAR regression that includes cost inefficiency (*INEF*) and the overall Fraser index of labor regulation (*LR*). Second, the overall Fraser labor regulation index is decomposed into its different components, which are then grouped into two categories and are included in two different panel VAR models; one that incorporates the variables that are based on hard data (the minimum wage, the cost of hiring, and the cost of dismissal) and a second one that includes the variables based on soft data (hiring and firing regulations, centralized collective bargaining and conscription).

For simplicity reasons we assume that in the above panel-VAR, Φ is an 4x4 matrix of coefficients, μ_i is a vector of m individual effects and $e_{i,\,t}$ are *iid* residuals. Along with the composite index of Frazer labor regulation (LR_{it}) we also include two control variables: total assets ($lnta_{it}$) and the loan loss provisions to loans ratio ($llpsgl_{it}$). In particular, the panel-VAR model takes the following form:

(3)

The moving averages (MA) form of the model sets $inef_{it}$, $lnta_{it}$, $llpsgl_{it}$ and LR_{it} equal to a set

of present and past residuals e_1, e_2, e_3 and e_4 from the panel-VAR estimation:

(4)

Under the endogeneity assumption the residuals will be correlated and therefore the coefficients of the MA representation are not interpretable. As a result, the residuals must be orthogonal. We orthogonalize the residuals by multiplying the MA representation with the Cholesky decomposition of the covariance matrix of the residuals. The orthogonalized, or structural, representation is:

(5)

and

(6)

where P is the Cholesky decomposition of the covariance matrix of the residuals:

(7)

We introduce fixed effects in the above panel-VAR model to ensure heterogeneity in the levels, denoted μ_i. In addition, as in Love and Zicchino (2006) we are forward mean-differenced the data following the Helmert procedure (Arellano and Bover, 1995). Last we employ Monte Carlo simulations to estimate standard errors for the impulse response functions (IRFs).

4.2.1 Results of Panel VAR Analysis

As a first step, we test for the optimal lag order for the right-hand variables in the system of equations of panel-VAR following Lutkepohl, (2005). This procedure takes several steps. First, we use the Arellano-Bond GMM estimator for the lags of j=1,2 and 3. Then, we estimate the Akaike Information Criterion (AIC) to choose the optimal lag order. Based on this criterion for this data set we opt for one-year lag (which is the optimal lag order). Similar optimal lag order is also suggested by the Arellano-Bond AR tests. In order to test for autocorrelation we

perform Sargan tests. The Sargan test shows that for the one-year lag the null hypothesis is not rejected.

4.2.1.1 IRFs and VDCs: cost inefficiency and overall labor regulation index

The impulse response functions (IRF) derived from the unrestricted panel-VAR for cost inefficiency (*INEF*) and the overall labor market regulation variable (*LR*) are presented in Figure 3. The plots show the response of each variable in the panel-VAR to its own innovation and to the innovations of the other variables. In the first row, the second diagram on the right presents the response of inefficiency to a one standard deviation shock in labor market regulation.

(Insert Figure 3 about here)

The graph shows that the response of inefficiency to *LR* is positive over the first three years and then converges to equilibrium. The present dynamic analysis shows that indeed the impact of labor regulation on bank inefficiency is positive, in line with the above results of the dynamic panel analysis, but it does not remain stable over time and loses strength before becoming zero. Theoretically, there are four potential ways in which labor market regulation can affect inefficiency (Bassanini et al., 2009). From employer's point of view, increasing employment protection could either improve economic performance by giving an incentive to firms to invest in labor saving technology and innovate, or, on the other hand, increasing employment protection could induce them to innovate less, especially in more risky technologies. From the employees' point of view, higher employment protection might induce them to invest in firm specific knowledge, improving their productivity. On the other hand, tenure may induce employees to be less motivated for further gaining specialized skills in order to raise their productivity. Our results indicate that a higher degree of labor market liberalization increases cost inefficiency. This is also consistent with the findings of Storm and Naastepad (2009), who argue that a regulated and '*rigid*' industrial relations system promotes labor productivity growth in twenty OECD countries. In addition, Deakin and Sarkar (2008) show that labor regulation with regards to strengthening dismissal laws has positive effects on productivity growth in

France and Germany, while strengthening of dismissal controls has a positive effect on productivity growth in the United States over the long-term (from the 70s to mid-2000s).

The reported result could also be attributed to the fact that the knowledge and skills of employees through training activities are important to firm performance (Black and Lynch, 1996). Related to this line of argument, Wasmer (2006) uses a matching model to show that employment protection, by reducing turnover and labor mobility, shifts human capital accumulation towards specific skills. In particular, workers are induced to invest in firm specific skills when the employment relationship is expected to last. This kind of specialization improves their productivity. By contrast, workers tend to invest much more in general skills when they perceive a high risk of losing their jobs, as in the absence of employment protection. Furthermore, Auer (2007) argues that strict employment protection, and labor market regulation more generally, reduces excessive labor turnover, facilitates the reallocation of resources into activities having above-average productivity growth, and generates high-quality job matches. Likewise, significant employment security together with a compressed wage structure provides workers with insurance against, ex ante, wage risk (Agell, 1999), thereby stimulating investment in education by workers, which has a strong positive impact on productivity growth.

Moreover, and specific to the banking sector, a higher degree of labor market liberalization that increases turnover and labor mobility may negatively impact relationship lending in banking, which is based on the personal interaction and relationship between customers and bank employees, thus negatively affecting bank efficiency.

(Insert Table 4 about here)

Table 4 presents the variance decomposition (VDC) estimations. These results are consistent with the impulse response functions (IRFs) and provide further evidence of the effect of labor regulation on the variation in cost inefficiency. Specifically, around 2% of forecast error variance of cost inefficiency after 10 and 20 years is explained by disturbances in the labor regulation index.

4.2.1.2 IRFs and VDCs: cost inefficiency, overall labor regulation index and bank specific control variables

Figure 4 presents the impulse response functions (IRF) for cost inefficiency, labor regulation, as well as bank-specific control variables, as derived from panel-VAR analysis. The first row shows the response of inefficiency to a one standard deviation shock in bank's size as measured by the log of total assets, credit risk as proxied by the loan loss provisions ratio, profitability as measured by the net interest margin, as well as the labor market regulation index.

(Insert Figure 4 about here)

Figure 4 shows that a shock in bank specific variables (i.e., total assets, the loans loss provisions ratio and the net interest margin) asserts a negative impact on inefficiency. In particular, a shock in bank size asserts a positive and significant effect on bank inefficiency after three periods. This medium term response of bank inefficiency to bank size shock is in line with the dynamic panel analysis and suggests that an increase in bank size would raise inefficiency in the very short term (possibly through slack and the exercise of market power). Regarding credit risk, we find evidence of a negative relationship between the loan loss provisions ratio and bank inefficiency in line with the '*skimping*' hypothesis of Berger and DeYoung (1997), though this relationship is reversed towards the end of the six years period and becomes positive (in line with the 'bad management' or the 'bad luck' hypotheses). Moreover, we find that the net interest margin asserts a negative impact on bank inefficiency.

A shock in labor regulation asserts a positive impact on inefficiency for two to three periods, and converges to zero thereafter, confirming our previous findings of the dynamic panel analysis. Thus, as also reported above, a greater degree of labor market liberalization increases bank inefficiency. This could be attributed to increasing training costs in the banking industry. However, it is worth noting that after three periods the response of bank inefficiency in a one standard deviation shock in labor market regulation turns negative, suggesting that for longer time horizons a higher degree of labor liberalization reduces bank inefficiency in line with Saint-Paul, (2002), Michie and Sheehan, (2003) and Bassanini et al., (2009). This result does not come as a surprise as it is often quoted that labor market reforms towards liberalization (European Commission, 2012) could be costly in the short run, but an economy would rip the benefits in the long run. This could indicate that structural reforms, due to this trade off, should

be implemented in full and without delay in good times. However, it is usually only too often the case that in good times it is hardly visible the necessity to change.

Table 5 presents the variance decomposition estimations. Results are consistent with the impulse response functions and provide further evidence on the importance of labor regulation in explaining the variation in cost efficiency. Specifically, around 0.6% of forecast error variance of cost inefficiency after 10 years is explained by disturbances in the overall labor regulation index. The variance decomposition analysis reveals that the index of profitability is quite important, as the net interest margin explains 6.5% of the forecast error variance of inefficiency after ten periods.

(Insert Table 5 about here)

4.2.1.3 IRFs and VDCs for the subcomponents of LR: minimum wage, cost of hiring and cost of dismissal

Next we present results of IRFs and VDCs for the subcomponents of the aggregate labor regulation index. In particular, Figure 5 shows the IRFs for the panel-VAR estimation of cost inefficiency, the minimum wage index, the cost of hiring index and the cost of dismissal index. The effect of a one standard deviation shock of the minimum wage index on inefficiency is negative over the whole period, reaches a pick after two periods and converges towards equilibrium thereafter. A similar picture emerges regarding the shock of the cost of hiring variable on inefficiency, which reaches its peak after three periods before returning to steady path. These IRFs results highlight the variability of responses of bank inefficiency to shocks in specific labor market characteristics. In particular, in line with Bassanini et al., (2009) a higher degree of labor market liberalization, in terms of a lower minimum wage, could lead banks to invest in labor saving technology and innovate, thus increasing performance. This result is also valid when examining the impact of the cost of hiring variable on cost inefficiency. In this case, a lower cost of hiring makes it easier for banks to adjust their labor force according to the optimal level so as to enhance efficiency. However, looking at the response of bank inefficiency to a shock in the cost of dismissal, IRFs show that inefficiency increases as a result of an increase in market liberalization, in terms of cost of dismissal.

(Insert Figure 5 about here)

Table 6 presents the variance decomposition estimations, which are consistent with the impulse response functions. Specifically, around 5% of forecast error variance of bank inefficiency after 10 years is explained by the cost of hiring, while the minimum wage and the cost of dismissal variables explain much less of the forecast error variance of inefficiency.

(Insert Table 6 about here)

4.2.1.4 IRFs and VDCs for the subcomponents of LR: hiring and firing regulation, collective bargaining and conscription

Figure 6 presents IRFs for the panel-VAR estimation of inefficiency and the subcomponents of the aggregate labor regulation, which are based on survey data, namely: hiring and firing regulation, collective bargaining and conscription. The first row shows the response of inefficiency on a one standard deviation shock in bank size, collective bargaining, hiring and firing regulations and conscription. We observe that a standard deviation shock in the collective bargaining index as well as in the hiring and firing regulation variable asserts a negative impact on bank inefficiency, though for the latter the response becomes positive towards the end of the period. In contrast, the effect of a shock in conscription (*Co*) is positive. These results confirm the variability of the response of bank inefficiency in the subcomponents of labor market regulation in line with the results of the previous section. As proposed by Nickell and Layard, (1999) and Besley and Burgess, (2004) labor market regulation would induce efficiency loses for firms as rising hiring and firing costs, stricter employment protection legislation in general, would reduce banks' returns. Bassanini et al., (2009), along these lines, argue tenure could imply complacent as employees could be less motivated to gain specialized skills and thus raise their productivity.

(Insert Figure 6 about here)

Table 7 presents the variance decomposition estimations, which confirm the results of the impulse response functions. Specifically, 3% (1.3%) of forecast error variance of inefficiency after 10 years is explained by conscription (collective bargaining), whilst 0.6% of inefficiency

after 10 years is due to hiring and firing regulation.

(Insert Table 7 about here)

5. Conclusion

This is the first paper to examine the impact of labor regulation on bank performance. It does so in the context of the EU-15 banking system over the 2004-2010 using the Fraser index for labor regulation. The labor economics literature (Lazear, 1990; Blanchard and Wolfers, 2000; Botero et al., 2004; Nickell, 1997; Nickell and Layard, 1999; Heckman and Pages, 2003) provides mixed evidence with regards to the impact of labor regulation on economic performance, whilst the bank performance literature fail to examine the importance of labor regulation.

The results of our analysis show that, the effects of labor regulation and its underlying components on the performance of the EU-15 banking industry vary in sign and over. Overall, our findings suggest that labor market liberalization reduces bank efficiency. This is in line with Storm and Naastepad (2009) who provide evidence that a relatively regulated and '*rigid*' industrial relations system promotes labor productivity growth in twenty OECD countries. However, when looking at the subcomponents of labor market regulation index we find evidence that liberalization in the minimum wage and the cost of hiring and firing improves bank performance, a finding which is in line with Nickell and Layard, (1999) and Heckman and Pages, (2003). Finally, Impulse Response Functions show that once we count for bank specific variables greater freedom in labor markets reduces bank inefficiency in the medium term, that is, after 4 to 6 years. Our analysis suggests that the relationship between cost efficiency and labor market regulations is a complex one, which warrants further investigation.

Overall, in terms of policy implications, our results indicate a trade-off between labor market liberalization at the aggregate level and bank performance in the very short run. This implies that reforming labor markets towards greater freedom could impose some cost in terms of performance in the very short run, although in the medium term, specific subcomponents of the labor market regulation index, such as minimum wage reforms and reforms that reduce the cost

of hiring, would enhance bank performance.

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Figure 1: Fraser Index – Labor regulation in the EU (2000-2010)

Source: Fraser Institute, Economic Freedom Network.

Figure 2: Fraser Index – sub-components of the labor regulation index in the EU (2000-2010)

Source: Fraser Institute, Economic Freedom Network. **Note**: Data for Fraser Index – Mandated cost of dismissal are for 2002 for all countries. Data for Luxembourg are for 2003 (due to data availability issues).

Table 1: Descriptive statistics for the period 2004-2010

	Cost, Inputs, Outputs, Netputs							Control Variables			Ineffic iency	Labor regulation						
Country	**C/A**	**y_1/A**	**y_2/A**	**p_1**	**p_2**	**n_1/A**	**n_2/A**	**TA**	**LLPs/GL**	**NIM**	**Cinef**	**LR**	**MW**	**HF**	**CCB**	**Chr**	**CDIS**	**Co**
Austria	4.16	56.12	39.33	1.28	2.47	7.80	1.60	3.47	0.88	2.28	0.16	0.60	0.96	0.42	0.26	0.69	0.98	0.30
Belgium	4.13	46.40	50.10	0.82	3.24	7.54	0.48	37.70	0.47	1.87	0.23	0.68	0.89	0.29	0.41	0.63	0.88	1.00
Denmark	5.10	60.84	31.74	1.81	2.48	13.31	1.31	8.29	1.29	3.65	0.18	0.74	1.00	0.78	0.57	0.80	1.00	0.30
Finland	4.24	59.04	33.32	1.13	3.39	7.50	0.66	37.80	0.16	1.40	0.21	0.51	0.53	0.42	0.35	0.63	0.80	0.30
France	4.68	62.90	32.18	1.26	3.13	8.96	0.66	62.20	0.54	2.24	0.21	0.56	0.33	0.26	0.63	0.40	0.72	1.00
Germany	4.63	57.41	37.96	1.44	2.55	6.49	1.45	3.67	0.89	2.60	0.14	0.41	0.65	0.24	0.32	0.53	0.40	0.33
Greece	4.75	66.55	24.33	1.25	3.04	8.29	1.40	22.10	1.13	2.97	0.18	0.44	0.58	0.31	0.37	0.34	0.78	0.23
Ireland	3.39	52.64	43.98	0.49	3.69	8.35	0.28	56.20	2.55	1.48	0.28	0.75	0.89	0.42	0.39	1.00	0.83	1.00
Italy	4.16	67.49	26.78	1.37	3.17	11.44	1.62	5.62	0.59	3.03	0.17	0.62	0.65	0.25	0.37	0.63	0.96	0.88
Luxembourg	4.28	24.15	71.10	0.78	3.28	6.49	0.41	8.31	1.02	1.08	0.23	0.57	0.31	0.38	0.59	0.40	0.64	1.00
Netherlands	4.66	53.69	39.53	0.79	4.45	7.49	0.55	97.40	0.31	1.55	0.24	0.67	0.80	0.32	0.41	0.60	0.87	1.00
Portugal	5.05	59.83	39.91	1.14	3.99	10.06	0.97	17.30	0.83	2.51	0.20	0.52	0.65	0.26	0.56	0.54	0.13	1.00

Spain	3.53	68.89	25.80	0.93	2.49	8.97	1.98	25.50	0.66	2.26	0.16	0.53	0.22	0.29	0.56	0.60	0.49	1.00
Sweden	3.70	76.43	21.63	1.23	1.71	14.02	0.79	8.25	0.33	2.96	0.19	0.52	0.75	0.29	0.36	0.60	0.80	0.30
UK	4.30	39.39	54.93	0.98	3.19	10.32	0.63	104.00	1.34	2.07	0.22	0.82	0.89	0.54	0.80	0.90	0.81	1.00
EU-15	**4.04**	**57.40**	**37.78**	**1.11**	**2.72**	**9.14**	**0.99**	**12.30**	**0.87**	**2.57**	**0.16**	**0.60**	**0.67**	**0.37**	**0.46**	**0.62**	**0.74**	**0.71**

Note: Figures are in means over the period 2004-2010. C/A=total cost to total assets (in %); y_1/A=net loans to total assets (in %); y_2/A=other earning assets to total assets (in %); p_1=price of labor (in %); p_2=price of deposits (in %); n_1/A= equity to total assets (in %); n_2/A= fixed assets to total assets (in %); TA= total assets in billion euros; LLPs/GL= loan loss provisions to gross loans (in %); NIM= net interest margin (in %); inef= cost inefficiency estimated using the Stochastic Frontier Approach; LR = overall regulations index; MW: hiring and minimum wage regulation, HF: hiring and firing regulation, CCB: centralized collective bargaining, CDIS: dismissal cost, Chr: mandated hiring cost; Co: Conscription. Higher values for labor regulation imply a more liberal regulatory environment. **Sources**: Fitch-IBCA database for all bank-specific variables and own estimations and the 2011 version of the Fraser Index of Economic Freedom for labor regulation variables.

Table 2: Cost inefficiency and labor regulation index in EU-15 countries over time

		2004	2005	2006	2007	2008	2009	2010
Austria	*CINEF*	0.158	0.148	0.137	0.153	0.178	0.172	0.167
	LR	0.599	0.591	0.615	0.607	0.592	0.621	0.633
Belgium	*CINEF*	0.218	0.234	0.235	0.239	0.232	0.217	0.211
	LR	0.658	0.664	0.658	0.686	0.690	0.739	0.738
Denmark	*CINEF*	0.157	0.157	0.158	0.155	0.199	0.206	0.197
	LR	0.726	0.743	0.742	0.747	0.747	0.747	0.746
Finland	*CINEF*	0.196	0.162	0.137	0.196	0.243	0.239	0.231
	LR	0.484	0.484	0.496	0.508	0.506	0.555	0.563
France	*CINEF*	0.213	0.203	0.195	0.213	0.233	0.209	0.197
	LR	0.546	0.551	0.549	0.543	0.562	0.592	0.583
Germany	*CINEF*	0.141	0.129	0.129	0.137	0.138	0.134	0.148
	LR	0.369	0.394	0.393	0.389	0.394	0.528	0.535
Greece	*CINEF*	0.152	0.138	0.145	0.175	0.237	0.188	0.190
	LR	0.415	0.401	0.439	0.466	0.443	0.450	0.436
Ireland	*CINEF*	0.242	0.248	0.281	0.294	0.317	0.310	0.264
	LR	0.740	0.748	0.748	0.754	0.758	0.777	0.793
Italy	*CINEF*	0.267	0.188	0.193	0.181	0.154	0.151	0.167
	LR	0.535	0.649	0.640	0.617	0.630	0.676	0.648
Luxembourg	*CINEF*	0.190	0.201	0.224	0.255	0.287	0.226	0.210
	LR	0.641	0.580	0.564	0.548	0.529	0.552	0.555
Netherlands	*CINEF*	0.133	0.171	0.217	0.254	0.302	0.265	0.234
	LR	0.656	0.667	0.668	0.662	0.670	0.674	0.672
Portugal	*CINEF*	0.222	0.198	0.178	0.223	0.226	0.199	0.177
	LR	0.533	0.526	0.527	0.529	0.518	0.516	0.467
Spain	*CINEF*	0.132	0.139	0.147	0.162	0.203	0.168	0.160
	LR	0.543	0.533	0.536	0.530	0.514	0.505	0.472
Sweden	*CINEF*	0.213	0.200	0.165	0.160	0.230	0.199	0.186
	LR	0.518	0.506	0.518	0.507	0.513	0.537	0.643
UK	*CINEF*	0.204	0.204	0.220	0.224	0.221	0.215	0.225
	LR	0.845	0.847	0.837	0.793	0.798	0.819	0.824

EU-15	*CINEF*	0.153	0.153	0.153	0.160	0.165	0.157	0.164
	LR	0.587	0.592	0.595	0.592	0.591	0.619	0.621

Note: CINEFF= cost inefficiency estimated using the Stochastic Frontier Approach; LR = overall labor market regulation index. Figures are in means and scaled from 0 to 1. Higher values denote a more liberal regulatory environment and a less efficiency banking system for LR and CINEFF, respectively.
Source: Own estimations and the 2012 version of the Fraser Index of Economic Freedom.

Table 3: Dynamic panel Var – Cost inefficiency and the Fraser Index

	(1)	(2)	(3)	(4)
VARIABLES	INEF	INEF	INEF	INEF
$Inef_{t-1}$	0.5563713***	0.5798287***	0.5204806***	0.5252715***
	(0.018283)	(0.0192794)	(0.0185461)	(0.0196711)
ln*TA*	0.0089461***	0.0038318	0.0159421***	0.0148404***
	(0.0022317)	(0.002435)	(0.0024269)	(0.0026867)
LLPsGL	0.0005472	0.0006248	0.0008296	0.0009734*
	(0.0005543)	(0.0005598)	(0.0005471)	(0.0005468)
NIM	-0.0022437	-0.0019531	-0.0050688***	-0.004666***
	(0.0016297)	(0.0017661)	(0.0016513)	(0.0017488)
LR	0.0023681***			
	(0.0009682)			
MW		-0.0016139		-0.004663***
		(0.0017089)		(0.0017577)
CDIS		-0.0106076***		-0.012039***
		(0.0014753)		(0.001487)
CHR		0.0067176***		0.002168
		(0.0011528)		(0.0013099))
HF			-0.0115547***	-0.005476***
			(0.0017797)	(0.0020448)
CCB			0.0016843	-0.0030864
			(0.0026305)	(0.0026961)
Co			0.0034381***	0.011287***
			(0.0007566)	(0.0014762)
Constant	-0.0346736	0.0539801	-0.120489***	-0.0586477
	(0.0309549)	(0.0353304	(0.0347688	(0.0405227)
Observations	12610	12610	12610	12610
Wald X^2 (5)	1721.17	1712.26	1725.33	1902.13
Number of Banks	2941	2941	2941	2941

Note: The table reports the dynamic panel data (DPD) based on the estimation of Arelano and Bover (1995). The dependent variable is cost inefficiency as derived from the SFA model. As independent variables we employ *MW* that counts for the minimum wage, C*DIS* the cost of dismissal, *CHR* the cost of hiring, *HF* the hiring-firing regulation, *CCB* the centralized collective bargaining, and *CO* the conscription regulation. The sample period is from 2004-2009. ***, ** and * indicate 1%, 5% and 10% significance levels respectively. Robust Standard errors are in parentheses.
Source: Own estimations.

Table 4: Variance decompositions (VDCs): cost inefficiency and labor regulation

	s	*inef*	*LR*
inef	10	0.98367191	0.01632809
LR	10	0.00261602	0.99738398
inef	20	0.98052197	0.01947803
LR	20	0.00276684	0.99723316

Note: inef is inefficiency, LR is labor regulation. s: notes the number of time periods ahead.
Source: Own estimations.

Table 5: Variance decompositions (VDCs): inefficiency, bank size, credit risk, profitability and labor regulation

	s	*inef*	*lnta*	*llpsgl*	*nim*	*LR*
inef	10	0.92042026	0.00657719	0.00143786	0.06587219	0.00569251
lnta	10	0.00849446	0.86318653	0.00103546	0.11827068	0.00901287
llpsgl	10	0.00580216	0.04651514	0.92081542	0.00098782	0.02587922
nim	10	0.02329166	0.11474245	0.00199375	0.73063055	0.12934154
LR	10	0.00315124	0.03181001	0.00034312	0.06127678	0.90341885
inef	20	0.9188869	0.006777	0.00144007	0.06590182	0.00699422
lnta	20	0.0084719	0.8597305	0.00105382	0.11910958	0.0116342
llpsgl	20	0.00580288	0.04652834	0.92049605	0.00104134	0.02613139
nim	20	0.02316764	0.11424942	0.00198704	0.72649184	0.13410407
LR	20	0.00330476	0.03711652	0.00038034	0.06716604	0.89203233

Note: inefficiency (*inef*), total assets (*lnta*), loan loss provisions (*llpsgl*), net interest margin (*nim*), and labor regulation (*LR*). *s: notes the number of time periods ahead.* **Source**: Own estimations.

Table 6: Variance decompositions (VDCs): inefficiency, minimum wage, cost of hiring, and cost of dismissal

	s	*inef*	*lnta*	*MW*	*Chr*	*CDIS*
inef	10	0.89306291	0.0562887	0.00014452	0.04452915	0.00597473
lnta	10	0.89306223	0.05628897	0.00014463	0.04452916	0.00597502
MW	10	0.89306183	0.05629049	0.00014464	0.04452701	0.00597604

Chr	10	0.89306087	0.05629299	0.00014467	0.04452375	0.00597772
CDIS	10	0.89306445	0.05628542	0.00014447	0.04453235	0.00597331
inef	20	0.89306262	0.05628924	0.00014455	0.04452814	0.00597546
lnta	20	0.89306262	0.05628924	0.00014455	0.04452814	0.00597546
MW	20	0.89306262	0.05628924	0.00014455	0.04452814	0.00597546
Chr	20	0.89306262	0.05628924	0.00014455	0.04452814	0.00597546
CDIS	20	0.89306262	0.05628923	0.00014455	0.04452814	0.00597546

Note: inefficiency (*inef*), minimum wage (*MW*), cost of hiring (*Chr*), cost of dismissal (*CDIS*), and lnta is the logarithm of total assets. s*: notes the number of time periods ahead.* **Source**: Own estimations.

Table 7: variance decompositions (VDCs): inefficiency, total assets, collective bargaining, hiring and firing regulation and conscription

	s	***inef***	***lnta***	***ccb***	***HF***	***Co***
inef	10	0.94929	0.00028	0.01342	0.00676	0.03025
lnta	10	0.00843	0.88098	0.03620	0.03563	0.03877
ccb	10	0.07010	0.00912	0.73502	0.08504	0.10072
HF	10	0.03717	0.05027	0.43393	0.45452	0.02410
Co	10	0.00882	0.02728	0.11480	0.40527	0.44383
inef	20	0.94146	0.00090	0.01493	0.01082	0.03189
lnta	20	0.00916	0.86272	0.04780	0.04192	0.03841
ccb	20	0.06855	0.00985	0.71326	0.09349	0.11486
HF	20	0.03814	0.04899	0.43404	0.44115	0.03768
Co	20	0.01277	0.03146	0.16125	0.38958	0.40495

Note: inefficiency (*inef*), total assets (lnta), collective bargaining (ccb), hiring and firing regulation (HF), and conscription (Co). s*: notes the number of time periods ahead.* **Source:** Own estimations.

Figure 3: Impulse response function (*IRFs*): inefficiency and labor regulation

Note: inef denotes cost inefficiency, LR denotes overall Frager labor market regulation index. Dashed lines are 5% S.E. on each side generated by Monte Carlo with 50 replications. **Source:** Own estimations.

Figure 4: Impulse response function (IRFs): inefficiency, total assets, loan loss provisions ratio, net interest margin and labor regulation (*LR*).

Note: the variables in the IRFs are: inefficiency (*inef*), total assets (*lnta*), loan loss provisions (*llpsgl*), net interest margin (*nim*), and labor regulation (*LR*). Dashed lines are 5% S.E. on each side generated by Monte Carlo with 50 replications. **Source:** Own estimations.

Figure 5: Impulse response function (IRFs): inefficiency, minimum wage, cost of hiring and cost of dismissal

Note: inefficiency (*inef*), minimum wage (*MWg*), cost of hiring (*Chr*), cost of dismissal (*CDIS*), and labour regulation (*LR*). Dashed lines are 5% S.E. on each side generated by Monte Carlo with 500 replications. **Source:** Own estimations.

Figure 6: Impulse response function (IRFs): inefficiency, bank size, collective bargaining, hiring and firing regulation and conscription

Note: total assets (*lnta*), collective bargaining (*ccb*), hiring and firing regulation (*HF*), and conscription (Co) Dashed lines are 5% S.E. on each side generated by Monte Carlo with 500 replications. **Source:** Own estimations.

ANNEX 1

Figure A1: Staff costs (in % of total cost) by country over time

Source: OECD Bank Profitability Report (2010).

ANNEX 2

Cost efficiency estimation using stochastic frontier analysis (SFA)

To estimate cost efficiency, we employ the Stochastic Frontier Approach developed by Aigner et al. (1977) and Meeusen and Van den Broeck (1977). We assume the following specification for the cost frontier:

$$TC_{it} = f(P_{it}, Y_{it}, N_{it}) + v_{it} + u_{it} \quad \text{(A1)}$$

where TC_{it} is the total cost for bank *i* at year *t*, *P* is a vector of input prices, *Y* is a vector of outputs and N is a vector of fixed netputs. The Stochastic Frontier Approach assumes that the error term is disentangled in two components: the first one, v_i, corresponds to the random fluctuations and is assumed to follow a symmetric normal distribution around the frontier, while the second one, u_i, accounts for the firm's inefficiency that may raise costs above the best-practice level and is assumed to follow a truncated-normal distribution.

To empirically estimate the cost frontier, we employ the following translog specification:

$$\ln TC_i = \alpha_0 + + \ + \tfrac{1}{2} + \tfrac{1}{2}$$

$$+ + + \tfrac{1}{2} +$$

$$+ \tfrac{1}{2} + + u_i + v_i \quad \text{(A2)}$$

where *t* is a time trend and D_i is a vector of country dummies, used to capture country-level heterogeneity both in terms of the general macroeconomic environment but also in terms of the banking industry of each country. Standard linear homogeneity and symmetry restrictions are imposed in all quadratic terms in line with economic theory. Equation (A2) is estimated via a maximum likelihood procedure parameterized in terms of the variance parameters = +and γ= /. Bank-specific inefficiency estimates are calculated using the distribution of the inefficiency term conditional to the estimate of the composite error term following Jondrow et al. (1982).

ANNEX 3

Table A1: Cost Frontier Estimates

Variable	Coefficient	St. Err.	P-values
Constant	-3.27533***	0.0515	0.000
$\ln p_1$	0.57099***	0.0135	0.000
$\ln p_2$	0.42901***	0.0135	0.000
$\ln y_1$	0.66805***	0.0138	0.000
$\ln y_2$	0.69742***	0.0109	0.000
$\ln n_1$	-0.36165***	0.0167	0.000
$\ln n_2$	0.01953**	0.0086	0.023
$\ln p_1^2$	0.13121***	0.0026	0.000
$\ln p_2^2$	0.13121***	0.0026	0.000
$\ln p_1 \ln p_2$	-0.13121***	0.0026	0.000
$\ln y_1^2$	0.09495***	0.0014	0.000
$\ln y_2^2$	0.11044***	0.0013	0.000
$\ln y_1 \ln y_2$	-0.18780***	0.0020	0.000
$\ln p_1 \ln y_1$	-0.03868***	0.0014	0.000
$\ln p_2 \ln y_1$	0.03868***	0.0014	0.000
$\ln p_1 \ln y_2$	-0.04623***	0.0017	0.000
$\ln p_2 \ln y_2$	0.04623***	0.0017	0.000
$\ln n_1^2$	-0.10795***	0.0056	0.000
$\ln n_2^2$	0.00701***	0.0014	0.000
$\ln n_1 \ln n_2$	-0.02193***	0.0017	0.000
$\ln n_1 \ln y_1$	0.07915***	0.0032	0.000
$\ln n_1 \ln y_2$	0.06289***	0.0024	0.000
$\ln n_1 \ln p_1$	0.09409***	0.0028	0.000
$\ln n_1 \ln p_2$	-0.09409***	0.0028	0.000
$\ln n_2 \ln y_1$	0.01093***	0.0013	0.000
$\ln n_2 \ln y_2$	0.00383***	0.0012	0.001
$\ln n_2 \ln p_1$	0.00695***	0.0014	0.000
$\ln n_2 \ln p_2$	-0.00695***	0.0014	0.000
t	-0.02014***	0.0052	0.000
t^2	-0.00162**	0.0007	0.013
$t \ln p_1$	0.00924***	0.0010	0.000
$t \ln p_2$	-0.00924***	0.0010	0.000
$t \ln y_1$	0.00057	0.0009	0.530
$t \ln y_2$	-0.00101	0.0007	0.161
$t \ln n_1$	0.00221**	0.0011	0.036
$t \ln n_2$	0.00137**	0.0006	0.030
D_{AU}	-0.04004***	0.0040	0.000
D_{BE}	0.08214***	0.0113	0.000
D_{DK}	0.00722	0.0072	0.314
D_{FI}	0.04401*	0.0229	0.055

D_{FR}	0.03266***	0.0062	0.000
D_{GR}	0.11080***	0.0142	0.000
D_{IE}	-0.04080*	0.0210	0.053
D_{IT}	-0.15786***	0.0039	0.000
D_{LU}	0.15813***	0.0087	0.000
D_{NL}	0.08651***	0.0138	0.000
D_{PT}	0.02693**	0.0127	0.034
D_{ES}	0.02658***	0.0058	0.000
D_{SE}	0.02912***	0.0083	0.001
D_{UK}	0.09042***	0.0074	0.000
λ	3.36912***	0.0606	0.000
sigma-squared	0.24069		
Sigma(v)	0.06849		
Sigma(u)	0.23074		
log likelihood	8830.122		
Observations	18652		

Note: Parameters estimates of the translog cost function under the stochastic frontier approach; ***, ** and * indicate 1%, 5% and 10% significance levels respectively. **Source:** Own estimations.