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Research Department
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Cross-Border Performance in European Banking

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The views expressed are those of the authors and do not necessarily correspond to the views of the Bank of Finland

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Abstract

Recent cross-country comparisons of bank efficiency have been based on pooled estimates of banks across countries and have typically assumed a common frontier and that differences in performance among banks are primarily due to disparities in certain country-specific aspects of banking technology. This paper argues that such comparisons of performance must take into account cross-country differences in economic conditions, demographics, and regulatory structures (environmental factors). Using a sample of banks from ten leading European countries, this paper provides detailed evaluations of the efficiency of banks in each country that operate both within and outside their own environments. The results indicate that adverse (advantageous) environmental conditions are a positive (negative) factor for the home banking industry and that technical efficiency is a significant deterrence to foreign competition.

Key words: efficiency, technology, competition, regulation

Eurooppalaisten pankkien kansainvälinen tehokkuus

Suomen Pankin keskustelualoitteita 24/2000

Iftekhar Hasan – Ana Lozano-Vivas– Jesús T. Pastor
Tutkimusosasto

Tiivistelmä

Viimeaikaiset tutkimukset eri maiden pankkisektorin tehokkuudesta perustuvat yhdistetystä pankkiaineistosta saatuihin arvioihin pankkien teknologiasta (kustannusfunktioista). Näissä tutkimuksissa oletetaan tyypillisesti, että tehokkain saavutettavissa oleva tuotantotekniikka on pankeille yhteinen ja että pankkien tehokkuuserot johtuvat joistakin määrittelemättömistä maakohtaisista tekijöistä. Tässä tutkimuksessa väitetään, että tehokkuusvertailuissa on otettava huomioon myös erot maiden taloudellisissa tilanteissa, väestörakenteissa ja sääntelyjärjestelmissä (eli ympäristötekijöissä). Euroopan kymmenen keskeisen maan pankeista koostuvan havaintoaineiston perusteella tässä tutkimuksessa arvioidaan yksityiskohtaisesti kunkin maan pankkien tehokkuutta niiden omassa ympäristössä ja sen ulkopuolella. Tulosten mukaan haitalliset ympäristötekijät ovat kilpailuetuja kotimaan pankkisektorille ja tekninen tehokkuus on avainasemassa ulkomaisen kilpailun uhan torjunnassa.

Asiasanat: tehokkuus, pankkiteknologia, kilpailu, sääntely

Contents

1 Introduction

In recent years, banking sectors in most European countries have been subjected to deregulatory initiatives and policy changes under the auspices of European Union (EU). With banking integration as a goal, the European Commission implemented two banking directives, which aim to liberalize the capital movements among member countries. It is widely agreed that such initiatives will significantly affect the degree of actual and potential cross-border competition in the integrated banking sector.[1] Expecting a new cross border integrated environment, banking authorities at the national level, initiated different liberalization processes – a gradual lifting of interest rate restrictions, credit controls and (in some cases) entry of new banks – aiming to improve bank performance, and thus better prepare for new customers and competitive markets.[2]

Following the Second Directive of the Union, the efficient banks in member countries are hopeful to use their competitive advantage in the new setting of free mobility – subject to the regulation of home country – without much difficulty. By granting a single passport for financial services, such directives provide an incentive for harmonization in the integrated market. Despite the enormous potential, the immediate effect of the Directive has been limited to increased consolidation of banks and banking markets at the local level and a modest evidence of cross-country banking mostly in retail banking.[3] This observed lack of integration of national markets could be explained by the lack of ample information available to banks to better understand their ability to transform their domestic comparative advantage or niche in foreign countries.

Given the key objective of the EU Banking Directives has been to foster competition, the current differences in performance and productive efficiency among the banking sectors of member countries will largely determine or influence the future of the banking structure and competitive viability in respective countries. Therefore it is important to know the true differences or similarities of bank performance and efficiency among countries in order to better predict and/or prepare effectively for the cross-border market and competition.[4] Such understanding would allow individual banks to bench mark their performance and operating strategy in a foreign country.

Most international comparative analyses on bank efficiency so far have focused primarily on determining the relative differences in performances across banking industries. These papers estimate differences in efficiency across countries building a common frontier by pooling all the cross-country banks and assuming that banking efficiency disparity between countries are only due to

[1] See De Bandt and Davis (2000), and Molyneux, Lloyd-Williams, and Thornton (1994).

[2] The adoption of EU banking directives with their provision for mutual recognition, home country supervision and the elimination of capital requirements for branches within EU countries has also impacted the domestic competitive conditions.

[3] See Berger et al. (2000) for details on intra-EU acquisitions and domestic consolidations. Gual (1999) provides that banking competition in Europe focused mostly on variable costs would expect a process of national concentration without generating in the medium term a significant increase of EU wide concentration.

[4] Altunbas and Chakravarty (1998) stressed on the importance of understanding the underlying differences in the banking structure across Europe.

some country-specific aspects of the banking technology.[5] In other words, the existing studies of bank productivity and efficiency in a cross-national scenario use a standard approach that assumes a common efficient frontier for all firms, regardless of their home country.

Some recent studies attempted to control for local differences (Pastor, Lozano-Vivas, and Pastor (1997), Dietsch and Lozano-Vivas (2000)) by introducing frontier estimates which incorporate country-specific environmental conditions that account for cross-country distinctions in demographics, regulations and economic conditions. These authors show that if such country-specific environmental conditions are not accounted for, the relative efficiency of firms is, usually, misstated. Recognizing the importance of such adjustments for diverse environments, this paper analyzes bank performance in the context of the integrated EU market and its member countries. Using a Data Envelopment Analysis (DEA) model, this paper expands and improves on existing methodologies used in studying inter-country banking efficiency behavior by defining an approach that can successfully predict what the efficiency of institutions in one country would be if they were operating in another country. This is the first such systematic multi-country analysis of average bank efficiency which analyzes the potential cross-country performance by countries of the integrated European Union.

Overall, the evidence indicates that average bank from Spain, Denmark, Portugal and Belgium are predicted to maintain their high domestic efficiency scores if they decide to expand business beyond their borders to any of the other European countries. The evidence also indicates that adverse local environmental conditions in Spain, Portugal and Denmark make it harder for banks from other countries to establish and perform well in these markets.

The paper is structured as follows: Section 2 describes the literature on efficiency of foreign banks and cross-country comparisons. Section 3 presents the methodology that predicts the mean cross-border efficiency behavior of European banks. The description of the data and the specification of variables are reported in Section 4. Section 5 presents the empirical results followed by the conclusions in section 6.

2 Relevant literature

The X-efficiency literature on cross-country comparisons of banking institutions has two perspectives. One deals with comparison of foreign-owned banks with domestic-owned banks in the context of a single country. The other concentrates on cross-country comparisons among banking institutions. In the first category, the local business environmental factors are ignored as banks compete in the same market within the country. Most of the studies in the literature under this category are based on the U.S. market, and compare domestic-owned and foreign-owned banks (Hasan and Hunter (1996), Mahajan, Rangan, and Zardkoohi (1996), DeYoung and Nolle (1996), Chang, Hasan, and Hunter (1998), and Peek, Rosengren, and Kasirye (1999)).

[5] Berg, Førsund, Hjalmarson, and Suominen (1993); Fecher, and Pestieau (1993); Berg, Bukh, and Førsund (1995); Bergendahl (1995); Allen and Rai (1996); Pastor, Pérez and Quesada (1997), Bikker (1999), and Dietsch and Weill (2000).

Overall evidence portrays foreign-owned banks as relatively less efficient compared to their domestic counterparts. These papers concluded that in general the foreign banks' capacity to transfer their unique ability and management skills in a different country is outperformed by the advantages associated with performing business in the home country. However, these findings are not uniform for similar comparisons in non-U.S. settings. Comparing acquiring institutions in Europe, Vander Vennet (1996) did not find significant differences in cost efficiency between foreign-owned and domestic-owned institutions involved in such transactions. The author further reported that over the period, foreign-owned banks tend to grow as more efficient institutions. Once adjusted for production technology differences (Mester (1993)), by estimating separate frontiers for foreign-owned and domestic-owned banking institutions in Spain, Hasan and Lozano-Vivas (1998) found no significant differences between the two groups.

Berger et al. (2000) extended this literature by comparing foreign-owned and domestic-owned banks in several countries. Their paper stresses the importance of disaggregated and separate frontier estimations based on the nations of origin. Evidence indicates no clear-cut dominance – "home field advantage" – for local banks relative to the foreign banks' – "global advantage" – ability to transfer their unique management efficiency abroad. An in-depth analysis of banks by foreign nation of origin portrays mixed results where foreign-owned and domestic-owned banks both outperform each other under some categories or groupings.

In the second category of this literature, most papers focus on the efficiency of banks in multi-country comparisons. These papers trace variability in bank performance across nations by setting a common frontier for all institutions. This assumes that any differences in efficiency between countries can be explained by country-specific banking technology (Fecher and Pestieau (1993), Berg, Førsung, Hjalmarsson and Suominen. (1993), Berg, Bukh and Førsung (1995), Allen and Rai (1996), Ruthenberg and Elias (1996), Pastor, Perez, Quesada (1997), and Bikker (1999)). Most of these studies are based on European institutions however the results did not produce any definite status or trends of bank efficiency of European nations. As mentioned earlier, these initiatives also did not adjust for country specific local environmental conditions or norms.

Recently, Dietsch and Lozano-Vivas (2000) analyzed banking sectors in France and Spain and defined a common frontier that incorporates the country-specific environmental conditions. The authors pointed out that the standard approach could misstate the relative efficiency of firms from different countries, because it does not account for cross-country differences in demographic, regulation and economic conditions that are beyond the control of firm managers. They also show how efficiency scores obtained from the standard approach are artificially low (high) for firms that operate under bad (good) home country conditions. Following a similar approach, this paper extends and improves on existing methodologies used in inter-country banking efficiency studies by defining an approach that can successfully predict the efficiency behavior (scores) of the average bank from one country 'i' when it is assumed to be operating in another country 'j'.

3 Methodological issue

To predict the cross-country efficiency behavior (scores) of banks,[6] first we attempt to define the efficiency of each country's banking industry in a cross-national scenario.

At first, we evaluate the technical efficiency of the banking industry of different countries by means of a DEA model. Initially, we consider 'n' basic banking inputs and 'm' basic banking outputs for each bank and apply the Banker, Charnes, and Cooper (1984) input-oriented model, BCC. The mathematical formulation of this model is

$$\begin{aligned} \underset{\theta,\tau}{\text{Min}}\ \theta \text{ subject to } \quad & Y\tau \geq Y_0 \\ & X\tau \geq X_0 \\ & e\tau = 1 \\ & \tau = \theta_n, \end{aligned}$$

where Y is the matrix of output-vector; X is the matrix of input-vector; (X_0,Y_0) is the unit being rated; e^{τ} denotes a row-vector of 1's; τ is the vector of intensity variables; and θ is the so called efficiency score – a quantity vector between 0 and 1 – if θ is lower that 1, a proportional reduction of all inputs is needed in order to reach the efficient frontier. This reduction is exactly given by $(1–\theta)X_0$, which means that the projected unit given by $(\theta X_0, Y_0)$ is efficient in the sense of Debreu-Farrell or DEA weakly-efficient. No further radial reduction of all inputs is possible given the present amount of outputs. It is possible that, in order to be Koopmans – or DEA – efficient, further individual reduction in some inputs and/or augmentation in some outputs is needed. To evaluate these mix-inefficiencies we need to resort to a more complex BCC model, where a non-Archimedean element in the objective function is multiplied by the sum of the slack variables. However, if the slack variables are not important, we do not need to further pursue this model.[7] The model defined is called the "basic DEA" model.

The model so far incorporates only banking variables; thus the measure reflects a bias with regards to the "basic efficiency" of banks. This means that in cross-country comparison, the efficiency measure continues to be influenced by the environmental conditions of a bank's respective country. Let us denote two sub-indexes 'i' and 'j', associated with two specific countries, and θ_{ib}, the basic efficiency scores associated with country 'i'.

In a second stage, a model called "Complete DEA" model, is developed in order to disentangle the pure efficiency component from the effect of the environmental factors in respective countries. Following Dietsch and Lozano-Vivas (2000), we define a common frontier that accounts for differences in cross-country banking technology as well as the differences in country-specific environmental conditions. Since the regulatory and economic environmental conditions banks face are very different in each country, the proper comparison of

[6] Cross-country banking activity means average bank from one country to be operating in another country. Actually, we calculate the average efficiency scores of the country, which we call average bank behavior.

[7] This is exactly what happens with the data in this paper – the amount of any slack value is always less than 5 % of the corresponding variable value.

banking efficiency across countries requires the definition of a common frontier incorporating environmental conditions. Therefore, banks in each country would be compared against the same standard. This complete model considers both the banking variables and the environmental factors as inputs and outputs.

There are several ways to evaluate the influence of environmental variables in a DEA framework (see Rouse, 1996). Here, we propose the simplest method of considering environmental factors in DEA. That is, we incorporate environmental variables directly into the "basic DEA" model. It is known that adding variables to the DEA model raises the efficiency scores; our method of adding each environmental factor guarantees that only the efficiency scores of banks from countries with bad environmental conditions can change. This approach has a pre-requisite: we must know in advantage the type of influence of each environmental variable on the efficiency scores. In other words, each uncontrolled factor must have an influence of known orientation.

To consider the environmental variables as inputs or outputs of our model we just reverse their conditions: for example, if a given environmental variable is an input type variable ("less means better") we consider it as an output in our model (see Cooper and Pastor, 1996). Moreover, all environmental variables are treated as non-discretionary variables (Banker and Morey, 1986). The mathematical formulation of this model is

$$\begin{aligned} \min_{\theta,\tau} \theta \text{ subject to } \quad & Y\tau \geq Y_0 \\ & Z\tau \geq Z_0 \\ & X\tau \geq X_0 \\ & e\tau = 1 \\ & \tau \geq \theta_n, \end{aligned}$$

where Z denotes the matrix of selected environmental variables, and Z_0 is the corresponding vector of the unit being rated. Note that we consider all the environmental variables on the output side. This is because any non-discretionary input can be transformed into a non-discretionary output just by reversing its sign and translating it. This procedure assumes that all the environmental factors are treated as non-discretionary. The results obtained from this model are giving us the "pure technical efficiency" of each country 'i', θ_{ic}.

Based on these two models, we propose the following methodology to undertake a systematic analysis of the efficiency position for each European Banking industry if average banks decide to operate in any other foreign country. Since the basic and the complete models constitute the two nested DEA models, it is well known that $\theta_{ib} \leq \theta_{ic}$. In fact we can write $\theta_{ib} = \lambda_i(\theta_{ic})$, with λ_i being a positive number less or equal than 1 which accounts for the "negative" influence exerted by the environmental conditions of country 'i' on the pure technical efficiency score. If all countries have the same environmental conditions, then their underlying banking systems could be compared on an equal footing, that is, by means of θ_{ic}. Since this is obviously not the case we have to resort to the basic efficiency if we want to know the behavior of the average bank in a certain country, given the environmental restrictions of that country. Therefore, we are able to predict the efficiency behavior of the average bank from country 'i' if it would operate in country 'j'. In fact, the average basic efficiency scores, which

would correspond to the average bank from country 'i' if it would operate in country 'j', is $\lambda_j(\theta_{ic})$.

4 Data and variables

Data: In our empirical study we use 1993 data of 10 European banking industries for the definition and selection of the banking outputs and inputs. The data were obtained from the BankScope International Bank Database. The lack of a consistent and accurate data on labor across countries imposes certain restrictions on the ability to obtain a homogenous sample of domestic and international banks in terms of specialization. In our comparison we consider a sample of commercial banks in each country.

We analyze the banking industries of Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Portugal, Spain and United Kingdom (UK). Our study is limited to these countries due to the scarcity of accurate data for a number of countries and for certain samples of banks.[8] As a result, after carefully checking the data for consistency, we have usable data for 612 commercial banks belonging to 10 European countries: 24 Belgian, 29 Danish, 150 French, 203 German, 26 Italian, 68 Luxemburgian, 22 Dutch, 17 Portuguese, 28 Spanish and 45 British institutions.

The data for the definition of the environmental variables were gathered from *Bank Profitability and Main Economic Indicators* (OECD), *Eurostat* (Money and Finance), *Anuario Estadístico del Instituto Nacional de Estadística* (INE) and *Boletín del Banco de España*. All variables presented in value terms of local currencies were converted into a common currency (U.S. dollar) using the purchasing power parity hypothesis.

Input and output variables: In the banking literature, there have been considerable disagreements regarding the "proper" definition of inputs and outputs. Here, we follow the value-added approach (Berger and Humphrey (1992)) to identify bank outputs. We specify three outputs: y_1 = loans, y_2 = deposits,[9] and y_3 = other earning assets.[10] In the value-added approach, all items on both sides of the balance sheet may be identified as outputs depending on their contribution to the bank's generation of added value. In a value-added context, deposits typically account for over half of the total capital and labor expenses at banks and so, in this sense, output services are clearly being produced. We consider labor and physical capital as inputs. Due to lack of direct measures, these input variables are represented by appropriated proxy variables: x_1 = personnel expenses composed of all costs associated with employee wages and related expenses, and x_2 = non-interest expenses excluding personnel expenses.

Environmental variables. The environmental variables used in this paper are macroeconomic variables and other variables explaining the particular features of

[8] The selected sample can be considered as representative, given that it includes almost all the banks classified as commercial banks in IBCA Ltd data base.

[9] Deposits were defined as produced deposits (the sum of demand, savings, time, and other deposits).

[10] Earning assets were defined as the sum of all existing deposits with banks as well as short-term and other investments.

the banking industry of the respective countries. These features include economic conditions, accessibility to banking services and regulatory conditions.[11]

The first environmental variable income per capita, IC, of a country, is defined as the ratio between Gross National Product over the number of inhabitants. IC affects numerous factors related to the demand and supply of banking services (mainly deposits and loans). Countries with higher IC are assumed to have a banking system operating in a mature environment and resulting in more competitive interest rates and profit margins. At the same time, these mature banking systems are likely to exert more activity.

The second environmental factor, SC, or salary per capita, is an indicator of each country's economic performance. It is reasonable to hypothesize that high levels of SC indicate high quality and potential high productivity of the labor force, which should improve bank efficiency. The population density, PD, is measured by the ratio of inhabitants per square kilometers. We assume that high levels of PD should make retail distribution of banking services less costly, which should improve bank efficiency. The density of demand, DD, measured by the ratio of deposits by square kilometer, is assumed to be a relevant feature in determining bank efficiency. Banks, which operate in markets with a lower density of demand, incur higher expenses and may impose a ceiling on the efficiency level attainable by their branches.

The above four environmental variables reflect the main economic conditions in which banks exert their activities. Additionally, we define a set of environmental variables that refer to the accessibility of banking services for customers. Income per branch, IB, and deposit per branch, DB, are considered usual measures of the relative efficiency of banking industries. We assume that the higher the bank's IB or DB, the higher the banking efficiency levels will be. Branches per capita, BC, are an indicator of banking services. High levels of BC imply high costs of providing banking services.[12] Additionally, the variable called branch density, BD, is defined as the number of branches per square kilometer, and is an indicator of the space dimension for each national market.[13] High levels of BD indicate over dimension of the banking network and high operating banking costs, which should reduce banking efficiency.

Finally, we use the average capital and profitability ratios as indicators of regulatory and competitive conditions, respectively, of a country's banking industry. The average capital ratio is used as a proxy for regulatory conditions and is measured by equity over total assets, EOTA. Usually, a lower EOTA leads to lower efficiency levels, because less equity implies higher risk taken and greater leverage. Finally, the profitability ratio is defined as average return over equity, ROE, and is used as an indicator of the competitiveness in each banking industry. The predicted relationship between ROE and efficiency is positive in a competitive scenario, i.e. the larger the profits, the higher the efficiency.

The use of environmental factors within DEA models requires knowledge of the influence of the environmental variables on efficiency scores. If we presume that the higher (lower) the value of an environmental variable, the higher (lower) the efficiency scores from the complete model, then we can say that the environmental variable is an output type variable. On the other hand, if the

[11] It is necessary to point out that our goal is not a micro level study but to determine the national average efficiency levels. So that, macroeconomic explanatory variables would become relevant.
[12] The variable BC has been defined as branch per 10,000 inhabitants.
[13] See Fuentelsaz and Salas (1991).

opposite relationship holds, we say that the environmental variable is an input type variable.[14] Consequently, IC, SC, PD, DD, IB, DB, EOTA, and ROE are classified as output type variables, while BC, and BD is considered as input type variables. Following Cooper and Pastor (1996), the first 8 environmental factors must be introduced as non-discretionary inputs and the last 2 factors as non-discretionary outputs in a DEA model.

In order to define the complete model, first, we consider the whole set of 10 environmental variables. We implement a forward procedure (Pastor et al. (1999)) in order to incorporate only the influential environmental variables into our basic model. This procedure concludes that DD, EOTA, IB, and SC are the pertinent influential environmental variables in the complete model. Consequently, in total, the complete model contains 9 variables that include 2 basic inputs, 3 basic outputs and 4 more non-discretionary inputs corresponding to the above environmental variables DD, EOTA, IB and SC.[15]

Table 1 contains the average value of the influential environmental variables. Overall, the values of these variables suggest large differences among countries in terms of the particular economic, banking accessibility and regulatory conditions. Particularly, Luxembourg has high levels of salary per capita and density of demand. However, Portugal and Spain have the lowest level of these main economic conditions. Thus, it may be harder to perform banking activities in Portugal or Spain than in Luxembourg. In terms of the variables which refer to the accessibility of banking services for customers, Belgium and Spain appear to have conditions requiring high levels of bank operating costs given the level of accessibility of banking services for customers. Finally, the mean value of the capital ratio shows that there are important differences among countries in terms of particular solvency constrains imposed by the banking authorities of each country.

Table 1. **Summary statistic for environmental variables by country, 1993**

Country	SC	DD	IB	EOTA
Belgium	30759	5.1403	0.0088	0.0398
Denmark	20617	1.3945	0.0320	0.0593
France	26964	0.9689	0.0328	0.0427
Germany	24197	3.2902	0.0256	0.0430
Italy	27038	1.5369	0.0317	0.0944
Luxembourg	28925	55.149	0.0324	0.0260
Netherlands	27588	5.6392	0.0296	0.0428
Portugal	13425	0.5611	0.0329	0.1437
Spain	23022	0.6538	0.0120	0.0962
U.K.	23107	1.9059	0.0689	0.0395

[14] We use the environmental variables as categorical variables in our DEA model. Therefore, those variables are organized as follows: a categorical input of the model corresponds to an output-factor. For the analysis of categorical variables in DEA see Banker and Morey (1986).

[15] The results of implementing this procedure is contained in the previous paper by Pastor, Lozano-Vivas, Pastor, 1997.

5 Empirical results

We start our empirical exercise by defining a common frontier based on the standard approach, i.e. building a common frontier by pooling the data set of the banks of all countries and considering a DEA model with 2 banking inputs and 4 banking outputs. This approach does not incorporate the country-specific environmental conditions of respective countries. Table 2 reports the bank efficiency scores for each of the sample countries by using this basic model, i.e., without taking into account the specific environmental conditions of each country. The results show that Luxembourg gets the highest average basic efficiency scores, around 49.5 % with Portugal, Spain and Denmark posting the lowest scores, around 15.9 %, 18.9 % and 19.9 %, respectively.

Table 2. **Basic efficiency scores**

Country	Average θ_{ic}	Std.
Belgium	42.20	28.47
Denmark	19.91	13.86
France	24.23	24.26
Germany	26.67	18.49
Italy	25.43	19.98
Luxembourg	49.49	25.67
Netherland	37.38	25.32
Portugal	15.99	15.63
Spain	18.91	15.06
U.K.	22.08	20.85

However, to properly define a common frontier, potential differences explained by the environmental factors should be accounted for. As we pointed out before, after implementing a forward procedure in order to incorporate only the influential environmental variables into our basic model, only DD, EOTA, IB, and SC are selected as pertinent influential environmental variables in the complete model. Consequently, in total, the complete model contains 9 variables that include 2 basic inputs, 3 basic outputs and 4 more non-discretionary inputs corresponding to the above environmental variables. We present results of such an appropriate model in Table 3 where the average pure technical efficiency scores for each country is obtained by means of the complete model.[16] When we introduce these variables into the model, the average efficiency scores improve markedly in almost all the countries with respect to the average efficiency scores of the basic model (Table 2). Moreover, comparison of the new results with the average basic efficiency scores of Table 2 shows that the worse the country-specific conditions, the more improvement in the average efficiency scores. For example, by observing the average rank position of the countries in terms of environmental conditions (Table 1) Luxembourg, the Netherlands, Italy and Belgium take the first, second, third and fourth places, respectively. The average improvement in their efficiency scores is around 12 %. However, Denmark and

[16] The results about the basic and pure technical efficiency scores are contained in the previous study by Pastor et al. 1997.

Spain, which are ranked on the bottom, obtain an improvement of around 60 % in their average efficiency scores.

Table 3. **Pure technical efficiency scores**

Country	Average θ_{ic}	Std.
Belgium	79.32	25.50
Denmark	75.45	15.79
France	40.98	27.85
Germany	57.87	24.11
Italy	33.10	22.20
Luxembourg	62.30	23.58
Netherland	51.75	27.35
Portugal	79.87	21.99
Spain	82.14	14.93
U.K.	58.65	30.15

After obtaining the average basic and pure technical efficiency scores for each country, we focused on determining the cross-country bank performance i.e. efficiency when the average countries' bank decides to operate in each other's territory. Following the methodology described in section 3, we obtain the efficiency of average bank of a particular country, which expect to do business in a foreign country given the environmental conditions in such country. Table 4 contains those results about average efficiency of the average bank in foreign countries.

Table 4. **Efficiency of the average banks in foreign countries**

Movement of the banks to country j	Belgium λ_i=1/1.88	Denmark λ_i=1/3.79	France λ_i=1/1.69	Germany λ_i=1/2.17	Italy λ_i=1/1.30	Luxemb. λ_i=1/1.26	Netherl. λ_i=1/1.38	Portugal λ_i=1/4.99	Spain λ_i=1/4.34	UK λ_i=1/2.66
Belgium	**42.20**	20.93	46.90	36.56	60.94	63.01	57.29	15.88	18.26	29.86
Denmark	40.14	**19.91**	44.61	34.77	57.97	59.94	54.50	15.11	17.37	28.40
France	21.80	10.81	**24.23**	18.89	31.48	32.55	29.60	8.20	9.43	15.43
Germany	30.79	15.27	34.22	**26.67**	44.46	45.97	41.80	11.59	13.32	21.79
Italy	17.61	8.73	19.57	15.25	**25.43**	26.29	23.91	6.63	7.62	12.46
Luxemb.	33.14	16.44	36.84	28.71	47.86	**49.49**	45.00	12.47	14.34	23.45
Netherl.	27.53	13.66	30.60	23.85	39.76	41.11	**37.38**	10.36	11.91	19.48
Portugal	42.49	21.08	47.22	36.81	61.36	63.45	57.69	**15.99**	18.39	30.07
Spain	43.70	21.68	48.57	37.86	63.11	65.25	59.33	16.44	**18.91**	30.92
UK	31.20	15.48	34.68	27.03	45.06	46.59	42.36	11.74	13.50	**22.08**

The diagonal of Table 4 represents the average efficiency scores for each country's banking industry operating in its own market, given their particular environmental conditions, i.e. the average basic efficiency scores. The column estimates show the potential efficiency of other average countries' banks operating in the column country. For example, the 2nd column of the table depicts the efficiency scores of the average Belgian banks in Belgium and the efficiency scores that average banks from other countries will get if they decide to assert their banking activity in Belgium.

From Table 4, columns 3, 9 and 10 show the lowest efficiency scores levels. Since such columns contain information about the average efficiency scores levels that any European country will reach if it operates banks in Denmark, Portugal or Spain, respectively, these results suggest that to establish banking activity in Denmark, Portugal or Spain, will apparently be hard for any European country. This difficulty is due to the adverse environmental conditions that are typical in

these countries. Additionally, it seems that on average the Belgian, Danish, Portuguese and Spanish banks have the highest average efficiency scores in their countries, compared with others countries' banks operating in Belgium, Denmark, Portugal and Spain. Moreover, they also have maintained a high level of scores if they decide to move to any other European countries. The average Italian banks have the lowest efficiency scores level across the board. These results are in accordance with the results obtained from the complete model, i.e. the pure technical efficiency.

Overall, we are able to distinguish three different results portrayed by combining the information from Table 3 and 4. (i) Countries with adverse environmental conditions for banking business (given the low value that λ_j takes), yet whose banks reach high levels of average pure technical efficiency (given the high value that the efficiency level on Table 3 takes). Such is the case of Portugal, Spain, and Denmark. (ii) Countries with advantageous environmental conditions (high value of λ_j), but their banking sector does not necessarily perform very efficiently on the home front e.g., Italy and France. Finally, (iii) Countries with good environmental conditions whose banking industries at the same time operate with high pure technical efficiency levels e.g., Luxembourg, Belgium, Germany, and the Netherlands.

In the first case reveals that if average banks from any of the European countries decide to perform banking activities in Portugal, Spain or Denmark, it will operate with lower average basic efficiency levels relative to its own efficiency levels in the domestic market. This result suggests that an adverse environmental condition could be an exogenous good competitive strategy for the home banking industry.

In the second case, we observe that in terms of basic efficiency scores, Italian and French banks are dominated in their own domestic markets by other European banking industries. This suggests that advantageous environmental conditions are helpful for superior banking activity for all, but the home country banks' own efficiency disadvantages could make the home banking industry experience even more competition.

Finally, the third case suggests that advantageous environmental conditions in countries like Luxembourg, Netherlands, Belgium or Germany provide opportunities for foreign banks to perform efficiently on their own turf. However, the efficiency level of home banking industries dominates the banking industries involved in cross-border activities only in the cases where the home banking industry account with higher pure technical efficiency than the foreign banking industries. Therefore, it is apparent that being very technical efficient could be an effective strategy to deter foreign competition.

As we analyzed the cross-country average bank efficiency scores among European banks when they decide to operate in each other's territory, we also recognize the importance of understanding and investigating the individual influence of the factors associated with environmental conditions. In other words, understanding the marginal influence of environmental variables used to explain pure technical efficiency levels obtained across border.

The procedure used for selecting the environmental variables permits us to determine the influence exerted by each of the variables in the banking performance. Table 5 contains such information, where the value of λ_j by column gives information about the accumulate influence of environmental variables in each particular country. We observe that each environmental variable seems to

play a particular role in the improvement of average efficiency scores of each country. For example the environmental variable DD is which exercises a more negative influence in the environment of Luxembourg and Netherlands. However, for Belgium, France, Italy, Portugal, Spain and UK it is the variable IB. On the other hand, SC is a major factor for Denmark and Germany.

Given this information, we evaluate how each of these variables affects the performance of average banks in foreign countries. Tables 6, 7 and 8 contain such information. Interestingly, the environmental variables which seem to play the most important role in explaining the cross country efficiency behavior are related to the main economic conditions and the accessibility of banking services of each country. This suggests that for cross-border competition in Europe, banks would need important adjustments in their behavior to compete with local banking institutions.

Table 5. **Influence exerted by each environmental conditions of country 'i' (λ_j) in pure efficiency**

	Belgium	Denmark	France	Germany	Italy	Luxemb.	Netherl.	Portugal	Spain	UK
DD	1/1.14	1/1.66	1/1.28	1/1.46	1/1.03	1/1.19	1/1.23	1/1.31	1/1.33	1/1.27
DD+IB	1/1.88	1/1.86	1/1.62	1/1.69	1/1.30	1/1.19	1/1.38	1/4.97	1/4.21	1/1.57
DD+IB+EOTA	1/1.88	1/1.87	1/1.69	1/1.70	1/1.30	1/1.26	1/1.38	1/4.97	1/4.32	1/2.66
DD+IB+EOTA+SC	1/1.88	1/3.79	1/1.69	1/2.17	1/1.30	1/1.26	1/1.38	1/4.99	1/4.34	1/2.66

Table 6. **Efficiency of the banks in foreign countries under the influence of DD environment**

Movement of the banks to country j	Belgium λ_j=1/1.14	Denmark λ_j=1/1.66	France λ_j=1/1.28	Germany λ_j=1/1.46	Italy λ_j=1/1.03	Luxemb. λ_j=1/1.19	Netherl. λ_j=1/1.23	Portugal λ_j=1/1.31	Spain λ_j=1/1.33	UK λ_j=1/1.27
Belgium	**42.20**	29.03	37.65	33.01	46.79	40.50	39.18	36.79	36.23	37.95
Denmark	28.95	**19.91**	25.78	22.60	32.04	27.73	26.83	25.15	24.81	25.98
France	27.13	18.63	**24.23**	21.18	30.03	25.99	25.14	23.61	23.26	24.35
Germany	34.11	23.43	30.38	**26.67**	37.76	32.68	31.62	29.69	29.24	30.62
Italy	23.09	15.86	20.56	18.03	**25.43**	22.12	21.40	20.09	19.79	20.72
Luxemb.	51.46	35.34	45.84	40.18	56.96	**49.49**	47.70	44.79	44.11	46.20
Netherl.	40.33	27.70	36.92	31.49	44.64	38.64	**37.38**	35.10	34.57	36.21
Portugal	18.32	12.58	16.32	14.31	20.28	17.55	16.98	**15.99**	15.71	16.45
Spain	22.03	15.13	19.62	17.20	24.39	21.11	20.42	19.17	**18.91**	19.78
UK	24.51	16.83	21.83	19.14	27.12	23.48	22.71	21.33	21.01	**22.08**

Table 7. **Efficiency of the banks in foreign countries under the influence of DD and IB environment**

Movement of the banks to country j	Belgium λ_j=1/1.88	Denmark λ_j=1/1.86	France λ_j=1/1.62	Germany λ_j=1/1.69	Italy λ_j=1/1.30	Luxemb. λ_j=1/1.19	Netherl. λ_j=1/1.38	Portugal λ_j=1/4.97	Spain λ_j=1/4.21	UK λ_j=1/1.57
Belgium	**42.20**	42.65	48.96	46.93	61.02	66.66	57.48	15.96	18.85	50.52
Denmark	19.77	**19.91**	22.94	21.99	28.59	31.23	26.93	7.47	8.83	23.67
France	20.82	20.04	**24.23**	23.16	30.11	32.89	28.36	7.88	9.30	24.93
Germany	23.94	24.19	27.78	**26.67**	34.62	37.82	32.61	9.05	10.69	28.66
Italy	17.56	17.74	20.37	19.53	**25.43**	27.73	23.91	6.64	7.84	21.02
Luxemb.	31.43	31.76	36.47	34.96	45.53	**49.49**	42.81	11.89	14.04	37.63
Netherl.	27.50	27.79	31.91	30.59	39.76	43.44	**37.38**	10.40	12.28	32.92
Portugal	42.28	42.72	49.05	47.02	61.13	66.78	57.59	**15.99**	18.88	50.62
Spain	42.34	42.79	49.13	47.10	61.22	66.88	57.68	16.01	**18.91**	50.70
UK	18.50	18.69	21.46	20.57	26.75	29.22	25.20	7.00	8.26	**22.08**

Table 8. **Efficiency of the banks in foreign countries under the influence of DD, IB and EOTA environment**

Movement of the banks to country j	Belgium λ_j=1/1.88	Denmark λ_j=1/1.87	France λ_j=1/1.69	Germany λ_j=1/1.70	Italy λ_j=1/1.30	Luxemb. λ_j=1/1.26	Netherl. λ_j=1/1.38	Portugal λ_j=1/4.97	Spain λ_j=1/4.32	UK λ_j=1/2.66
Belgium	**42.20**	42.42	46.93	46.66	61.02	62.95	57.48	15.96	18.36	29.82
Denmark	19.85	**19.91**	22.08	21.95	28.70	29.61	27.04	7.51	8.64	14.03
France	21.80	21.91	**24.23**	24.11	31.52	32.52	29.70	8.25	9.49	15.41
Germany	24.06	24.19	26.77	**26.67**	34.80	35.90	32.78	9.10	10.47	17.01
Italy	17.60	17.69	19.58	19.46	**25.43**	26.26	23.98	6.66	7.66	12.44
Luxemb.	33.14	33.32	36.86	36.65	47.92	**49.49**	45.14	12.54	14.42	23.42
Netherl.	27.52	27.66	30.60	30.42	39.79	41.05	**37.38**	10.41	11.97	19.44
Portugal	42.28	42.50	46.02	46.75	61.13	63.07	57.59	**15.99**	18.40	29.88
Spain	43.45	43.67	48.33	48.04	62.82	64.82	59.18	16.43	**18.91**	30.70
UK	31.20	31.36	34.70	34.50	45.12	46.55	42.50	11.80	13.58	**22.08**

6 Conclusions

The increased intra-national and cross-border consolidations of financial intermediaries around the world have attracted the attention of policy makers, researchers, and managers regarding the competitive status, strategy and performance among institutions in the new environment. Such an issue is more pertinent in the European context given all the recent initiatives undertaken for an integrated and harmonized union. Most cross-country comparisons of bank performance to date have ignored the existence of unique economic, regulatory, supervisory, and demographic, (i.e., environmental) conditions in each country in evaluating relative bank performance.

This paper takes a systematic and detailed empirical initiative to quantify bank efficiency conditions for each European banking industry if it begins to operate in any other foreign country. First, the paper attempts to evaluate the efficiency scores of banking industries operating in their own respective countries. Later, improving on traditional models, the paper uses a common frontier to control for the environmental conditions of each country. Such incorporation of local conditions provides a fair comparison of different banking systems by reporting efficiency scores for average bank in each country operating in other countries.

Overall, the results based on cross-country efficiency scores suggest that the banks from Spain, Denmark, Portugal and Belgium are relatively more efficient in their own respective countries and successful in maintaining high levels of scores if they decide to move to any other sample European country. This also means that it would be harder for banks from other countries to establish profitable networks in Spain, Portugal or Denmark due to adverse environmental conditions. Incidentally, the banks from France and Italy are found to be less efficient institutions across the board.

From a competitive point of view the results suggest that an adverse (advantageous) environmental condition could be an exogenous good (bad) competitive strategy for the home banking industry. Moreover, being technical efficient enough seems to be a good strategy to deter foreign competition.

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