How the environment determines the efficiency of banks: a comparison between French and Spanish banking industry*

Michel Dietsch
Université Robert Schuman de Strasbourg, France

Ana Lozano Vivas
Universidad de Málaga, Spain

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1. Introduction

To understand the process of financial integration and convergence in Europe, it is necessary to know more about the competitiveness and the efficiency of banks in different European countries. However, cross-countries comparisons have to take into account the potential differences coming from some country-specific aspects of the banking technology, on one hand, and from the environmental and regulatory conditions, on the other hand. In particular, the economic environment are likely to differ significantly across countries and these differences could induce important differences of bank efficiency through different channels. For instance, differences of the income per capita, or differences of the density of population across countries could produce significant differences in the nature of the household's demand for banking products and services.

In this paper, we focus on two countries, France and Spain, and we try to deepen the analysis of the influence of the environment conditions on the cost efficiency of the French and Spanish banking industries. As pointed out by Berger and Humphrey (1996), this issue is not addressed in the international banking efficiency literature. From our point of view, cross-country comparison of efficiency requires to define properly a common frontier which incorporates the country-specific environmental conditions. Moreover, the integration of environmental variables in the analysis would allow to verify the degree of similarity between banking technology.

Three categories of environmental variables are taken into account: the main macroeconomic which determine the banking products demand characteristics conditions, the structure and regulation of the banking industry, and the accessibility of banking services.

Our results suggest that, before the introduction of environmental variables, the cost efficiency scores of Spanish banks were quite low, compared to those of the French banks. However, when the environmental variables were included in the model, the differences between the two countries banking industries reduced significantly. So, our results

demonstrate that the environmental variables appear to play a significant role in the explanation of the different efficiency scores between the two countries. More precisely, our results show that the Spanish banks seem to suffer excess costs, or structural disadvantages, in order to adjust to some environmental compared to French banks, such as the lower density of population, the lower income level of their customers or the lower rate of financial intermediation.

A brief survey of the previous literature about cross-country comparisons of efficiency is presented in Section 2. The methodology for evaluating the cross-country efficiency when the particular environmental conditions of each country are taken in account is presented in Section 3. The data and the specification of inputs, outputs and environmental variables are described in Section 4. Section 5 presents the empirical results, and, finally, we provide some concluding remarks in Section 6.

2. Previous literature in international comparison of banking efficiency

In anticipation of the expected lowering of barriers to competition among financial institutions within the European Monetary Union (EMU), many EMU countries have recently experienced consolidation of their domestic banking industry. One reason for this consolidation is the belief that larger banks will be better able to adjust to the needs of the customers when they will be allowed to set up branches in any other country, subject only to the regulations of their home country. As domestic markets become more competitive, current differences in costs and productive efficiency among the banking industries of EMU countries will largely determine each country banking structure and future competitive viability. Thus, it is important to know how different or similar are current banking costs and productive efficiency between countries in order to predict the effects of the expected increase in cross-border competition.

There appears to be only six studies in the efficiency literature that attempts to determine and compare banking performances differences across-countries. Four of them

used nonparametric approaches while two used parametric approaches. In Berg, Forsund, Hjalmarson, and Suominen (1993), DEA analysis were relied upon to capture the differences in efficiency between Norway, Sweden, and Finland, first by defining separate frontiers for each country and comparing the countries pairwise based on each country's frontier; and then defining a "common" frontier for doing the comparison among countries. Berg, Bukh and Forsund (1995) follow up the study by adding Denmark to the countries sample. The same four countries were investigated in Bergendahl (1995), using mixed optimal strategy for defining the efficient frontier.

Fecher and Pestieau (1993) and Pastor, Perez, and Quesada (1995) applied DFA and DEA analysis to 11 OECD countries and 8 developed countries, respectively. The two studies pooled the cross-country data in order to define a common frontier. The former study found reverse results to these obtained by the Berg and al., and Bukh and al. studies taking the same set of countries.[1]

Allen and Rai (1996) by using DFA and SFA carry out a systematic comparison of X-inefficiency measures across 15 developed countries distinguished by different regulatory environments. To do so, the countries were classified, previously, into two groups -- universal and separated banking countries, respectively--delineated by their regulatory environment. Universal banking countries permit the functional integration of commercial and investment banking while separated banking countries do not. Once the inefficiency levels of those groups of banks were measured, the regularities in the inefficiency measures were investigated by regressing the firm specific inefficiency measures against various bank and market characteristics.

The main caveat of these cross-country studies is that the common frontier is built under the belief that the differences in efficiency across countries only come from

[1]See Berger and Humphrey (1996) for giving the details of the methodologies and results obtained on those studies.

bank managerial decisions.[2] That is, they are assuming that the mean difference in efficiency is located in differences of technologies. However, it is possible that the underlying technologies of the banking services productions in Europe and other developed countries are quite similar. Thus, the differences in efficiency across countries have to take into account the way in which banking services are produced. This production process is determined by country-specific differences—that are almost always excluded from cost and efficiency analyses—and not only by technology differences. Just as different relative prices of capital and labor inputs will result in different intensity of the use of these inputs in the production process, if the bank minimize costs and if the technology is constant, different national environments will result in different observed inputs, liabilities, and assets mixes and number of branches, again if the technology for producing banking services is constant. If the country-specific variables are an important factor in the explanation of the efficiency differences, then the frontier we obtain if we neglect this factor will generate an overestimation of the inefficiency levels.[3]

If the regulatory and economic environments faced by financial institutions are likely to differ importantly across countries, the cross-country comparisons of the preceding papers are difficult to interpret. It is because in these papers the specification of the common frontier is not correct due to the fact that they do not take into account the influence of the country-specific environmental variables that will justify the use of a common frontier in cross-country comparisons of efficiency.

Here, we propose to compare the cost efficiency of the banking industries in France and Spain, introducing in the cost frontier estimations the appropriate environmental

[2]Although Allen and Rai's paper takes into account the regulatory environments in the distinction between groups of countries in order to compare the inefficiency levels, they specified banks variables and not country variables in order to explain the differences in efficiency.

[3]Pastor et al., 1995, did corrections on efficiency measures by introducing the services provided to customers by the branch network and the degree of solvency determined by the capital ratio. Although it is well known that adding a restriction when it is using DEA increases (or leaves unaltered) the efficiency of all and every bank in the sample, they found that the relative efficiency of the countries banks improved. So, the economic environment of each country is an important explanation of the inefficiencies differences across countries and their integration will permit to avoid that the choice of the technology base influences the results when a common technology base is used for comparisons between countries.

variables, so that the cross countries comparisons of efficiency would not be determined by the technology of one of the countries. That is, our goal is to permit the proper comparison of banking efficiency across countries by using a global best-practice econometric frontier, from which the banks in each country would be compared against the same standard.

3. Methodology

The technology of the banks can be defined as the set of the specific methods that the banks use to combine financial and physical inputs in order to produce a certain amount of banking services, such as liquidity and payment services, portfolio services, loans services. Those methods are diversification, pooling of risk, financial information collection and evaluation, risk management, and so on.

More or less, the methods used by banks are the same in large industrial countries. So, there is a presumption that the technology should be the same in countries like France and Spain. However, the environmental conditions faced by financial institutions are likely to differ importantly. For instance, the average level of wealth, and the saving behavior of economic agents could be different in countries like France and Spain. The differences in the taxation of saving products could persist across countries in Europe, even if banks could now supply the same products all around Europe. The bankruptcy loan is still different from one country to another, so that the efficiency of the loans contracts differs across countries, and so on.

With the aim of addressing the deficiencies found in the methodology applied in the intercountry efficiency comparisons that exist in the literature, we propose here an alternative methodology. In this alternative methodology, the specific environmental conditions of each country play an important role in the definition and specification of the common frontier of different countries.

Common frontier and international comparisons: control for technology

As we pointed out above, we will consider that the differences in efficiency between the banking industries of France and Spain are largely determined by country-specific differences, more than by technology differences. So, the first step of the analysis, in our alternative methodology, is to verify whether, or not, the technology is the same in the two banking industries.

We test the similarity between banking technologies by introducing country-specific environmental variables. The reason is that we assume that these variables are major factors explaining the differences of the banking costs across countries. So, we need to identify properly these variables in order to be able to identify the complete set of factors which influence the banking costs.

The simple test we used is the following. In a first step, we specify and estimate separate cost functions for each country—in our particular case we have two equations, one for France and one for Spain—including the environmental variables as control variables. The two equations model is the following:

$$C_{it}^{c}=C(Y_{it}^{c}\ P_{it}^{c}\ Z_{t}^{c}) \qquad (1)$$

where, C is the cost vector; Y is the output vector; P is the input prices vector; Z is the vector of country-specific variables—these variables will take equal value for each bank of each country by year: i=l,...,n, is the index of banks; t=l,...,T, refers to years; and c=1, 2, refers to the two countries.

In order to test the similarity of technologies, we impose cross-equation equality restrictions on each parameter of each country cost frontier, but such restrictions were not imposed on the parameters of the country-specific environmental variables.[4] These

[4]For the estimation of these two cost equations we used a subset of banks belonging to each country. We choose these banks in terms of their efficiency levels. That is, first we estimated the internal efficiency of the banking industry of each country using DFA and then we selected the most efficient banks in each country in such a manner that each subset of bank for each country has the same number of observations. This was necessary in order to impose the cross-equations restrictions.

restrictions permit to define properly the set of environmental variables which explain the differences in banking costs across countries, as well as to identify the underlying common banking technology that exists in the banking industries of the two countries we consider. Indeed, if most or all of the cross-equation equality restrictions on the technology parameters are insignificant, then we will have identified the correct set of country-specific environmental variables which determine costs, and, by the same way, the common underlying banking technology of different countries.

After having identified the common frontier, the bank efficiency for each country can be measured. To do this, a common stochastic cost frontier is estimated, holding constant the country-specific environmental factors at their respective mean values for each country:

$$C_{it}=C(Y_{it}, P_{it}, Z_t^c) \qquad (2)$$

The international comparison proposed here will permit the proper comparison of banking efficiency across countries, namely one that is not influenced by the technology of the benchmark country.

Cost specification and Distribution-free model

In this study, estimates of X-efficiency for Spanish and French banking industries were generated using the DFA. The DFA specifies a functional form for the frontier and separates the specific distributions for the inefficiencies and random errors. We used a translog specification and estimated separate cost functions for each of the five years 1988 to 1992 for the country cost frontiers as well as for the common frontier. We estimated the cost frontier jointly with the factor share equations obtained by applying Shephard's lemma.[5] Thus, the complete model was the following:

[5]However as noted by Berger (1993), forcing the shares to be consistent with the cost equation implies that the input mix reacts consistently to relative prices changes, that is that X-inefficiencies are only technical in nature. This assumption is probably too strong, although the introduction of the factor share equations surely improve the precision of the estimates. So, we ran the model alternatively with OLS and with iterative SUR without restrictions on the constant terms in the share equations and the results were very similar.

$$\ln C = \alpha + \sum_j \beta_j \ln Y_j + 1/2 \sum_j \sum_k \beta_{jk} \ln Y_j \ln Y_k + \sum m \gamma_m \ln P_m + 1/2 \sum_m \sum_n \gamma_{mn} \gamma_{mn} \ln P_m \ln P_n + \sum_j \sum_m \rho_{jm} \ln Y_j \ln p_m + \ln x + \ln \varpi \quad (3)$$

$$S_m = \gamma_m + \sum_j \rho_{jm} \ln Y_j + \sum_{mn} \gamma_{mn} \ln P_m + \ln \upsilon_m \quad (4)$$

In this model, C represents the total of operating and financial (interests) costs.[6] The Y_j (j=l,2,3) represent the banking products. The P_m (m=l,2,3) refer to the input prices.[7] S_m are the share of costs paid to input m.[8] The term lnx is the systematic error component which appears as a X-inefficiency factor, and lnω is a random error term. The term lnx is an error term which may be correlated with the other $\ln \upsilon_n$ and lnω terms.[9]

The banking outputs and inputs used in this study are as result of following the value added approach of Berger and Humphrey (1992). In the value added approach, all items on both sides of the balance sheet may be identified as outputs or inputs depending on their contribution to the generation of bank value added. Accordingly, we specified three variable outputs: loans (composed of the value of home loans and other loans), produced deposits (the sum of demand, saving, and time deposits), and other productive assets (the sum of all existing deposits with banks, short-term investments, and other investments). Prices for three variable inputs were also specified: labor, physical capital, and deposits (capturing the interest cost of deposits).

The prices of inputs were computed by using the data of the banks themselves. For

[6]That assumes that the banks try to minimize total costs and not only to minimize operating costs.

[7]The definition of the estimated common cost frontier corresponds to the equation system (3)-(4), where the equation (3) contains as additional dependent variables the vector of country-specific variables pointed in the equation (2).

[8]The share equations sum to one, so the physical capital share equation was omitted from the estimation.

[9]Standard symetry and input prices homogeneity constraints are imposed on the total cost function (3).

instance, the price of labor was estimated by using the information relative to the wages and taxes associated to the use of labor as they appeared in the banks accounts. Consequently, because we used the prices paid by bank for each factor of production, inefficiencies associated with overpayments to real or financial factors can not be evaluated by our approach. That could be a source of underestimation of the inefficiencies for banks paying factors at higher prices than the market prices.

To compute inefficiencies by using DFA the estimate of inefficiency for each firm in a panel data set is determined as the difference between the average residual of each firm and the average residual of the firm on the frontier. That is, the average of the annual residuals for each bank i is computed and it served as an estimate of $\ln x_i$ for that bank, given that the annual random error terms $\ln \upsilon_{it}$ tend to average to zero over the period. This average residual of each bank i is used in the computation of X-efficiency. The efficiency score is given by the following equation:

$$\text{X-EFF} = \exp(\ln x_{min} - \ln x_i),$$

where $\ln x_{min}$ is the minimum $\ln x_i$, i.e. the average residual for the bank with the lowest average cost residual which is assumed to be the completely efficient bank. Therefore, X-EFF is an estimate of the ratio of predicted costs for the most efficient bank to predicted costs for any bank. It is just like measuring X-efficiency by the ratio of predicted costs for the most efficient bank to predicted costs for each bank. Nevertheless, this measure of efficiency is not completely correct if the random error terms $\ln \upsilon$ do not cancel out each other fully during the period. As noted by Berger (1993), this error is likely to be larger for banks near the extremes of the average residual. These banks may have experienced good (bad) luck over the entire period. Consequently, the minimum average residual, which serves here as a benchmark for the calculus of the X-efficiency, could be overestimated. To treat this problem, we have computed truncated measures of X-efficiency, where the value of average residual of the qth ((1-q)th) quantile was given to each observation for which the value of the average residual is below (above) the qth ((1-q)th) quantile value. We have used three values of q: 1%, 5%, and 25%.

4. The Data and Variables

Data.

The data are annual accounting data over the 1988-1992 period for commercial and savings banks[10] in France and Spain. It is important to emphasize that, in each country, banks are competing in the same markets and for the same customers. They have in each country quite similar access to the capital markets. In Spain and France, financial innovation and deregulation that generated an increase of competition in the banking industry appeared during the mid-eighties.[11] Therefore, the period of this study was a period of rapid technological changes in the production of financial and banking services during which the banks had to make strategic decisions to adjust to the new environment and the new competition. In particular, the banks began to reduce the number of employees and tried to adjust to the new environment in substituting capital for labor, specially in France.

Only banks that were in existence for all 5 years were kept in the sample. The final sample used in this study contains 223 French banks and 101 Spanish banks[12].

Variable outputs and inputs.

Table 1 presents the average values of bank outputs and inputs prices (converted in U.S.dollars)[13] over the period 1988-1992 in each country. We observe that the average

[10]By the First and Second Banking European Directives, these three categories of banks are now submitted to the same regulation.

[11]During these years, new short-term securities were introduced, money market was modernized and it was left open to non-financial firms, new derivatives markets were created, interest rate controls were abolished and, finally, capital controls were suppressed.

[12]Data come from official sources: Anuario de la Confederación de Cajas de Ahorros y del Consejo Superior Bancario, and Commission Bancaire. For the purpose of this study, the three French largest banks were excluded of the French sample, as their size would dominate the scale and distort the estimations. The smallest banks and the foreign banks were also excluded from the French and Spanish samples.

[13]All variables initially measured in domestic currencies - including outputs, inputs prices or environmental variables - were converted into a common currency, following the purchasing power parity hypothesis. Here, we chose the U.S. dollar.

size of the total balance sheet and the loans portfolio are very similar. This is due to the fact that our sample contains a lot of regional medium-sized banks. However, the average size of deposits differ across countries. One reason is that in France the time deposits interest rate regulation created an incentive in favor of other liquid investments, such as investments in mutual funds and money market deposits (the so-called OPCVM). So, French banks have to substitute money markets liabilities and bonds to time deposits in order to finance loans.

Table 1 :

Average values of banking costs, products and inputs prices in France and Spain

	FRANCE	SPAIN
Total costs	263.4	368.5
Total assets	3462.2	3822.4
Y_1 : deposits	1193.5	2610.0
Y_2 : loans	1609.5	1756.6
Y_3 : other earning assets	1187.0	1100.7
P_1: price of labor	36056	31897
P_2: price of physical capital	1.34	0.56
P_3 : price of financial capital	5.17	7.83
Number of banks	223	101

Values in thousands of U.S. dollars

The prices of inputs differ from one country to the other. In particular, we observe that both the labor price and the physical capital price are higher in France. This is mainly the consequence of the differences in the structure and regulation of the labor market and the real estate markets. However, due to the increase of competition in the deposits markets in Spain, the average cost of bank liabilities is higher in this country over the period. That is part of the explanation of the difference in total costs. Indeed, financial costs represent more than two third of total banking costs in Spain.

Environmental variables.

The environmental variables selected and used in order to identify the common frontier are macroeconomic variables as well as variables which explain the peculiar features of each country banking industry, such as regulatory conditions, banking structure and accessibility of banking services. We categorised those variables in three groups (Table 2). The first group is called "Main conditions" and includes a measure of the density of population, the income per capita, and the density of demand of each country. These indicators describe the main conditions in which banks exert their activities. The density of population is measured by the ratio of inhabitants per square kilometer. We assume that banking services supply in areas of low population density would generate higher banking costs, and at the same time would impede banks to obtain high efficiency levels. On the other hand, the income per capita of a country--measured as the ratio of Gross National Product per number of inhabitants--affects numerous factors related to the demand and supply for deposits and loans. Countries with higher income per capita are expected to have a banking system that operates in a mature environment resulting in more competitive interest rates, profit margins and efficiency levels. Finally, the density of demand, measured by the ratio of deposits by square kilometer, is assumed to be a relevant feature determining efficiency. Banks which operate in markets with a lower density of demand would likely incur higher expenses, ceteris paribus.

The second category of environmental variables is called "Bank structure and regulation" and contains variables describing the structure and regulation of the banking industry in each country such as the degree of concentration, the average capital ratio, and the intermediation ratio of the banking industry of each country. The concentration of the banking industry is measured by the Herfindahl index defined as the sum of squared market shares of assets of all banks in each country. In analyzing market structure we consider each country to be a market. Since banks operate exclusively throughout each country and since entry has until recently been restricted by national borders, a national market is appropriate. We expect that higher concentration would be associated with higher costs as well as lower costs. If higher concentration is a result of the market power, concentration

and costs go in the same way. However, it could be possible that higher concentration would be associated with lower costs if the concentration is the result of either superior management or greater efficiency of the production processes. As proxy of regulatory conditions we define the average capital ratio, measured by equity capital as a fraction of total assets. Usually, lower capital ratio imply higher risk taking and greater leverage which could result in increased borrowing costs, leading to lower efficiency levels. The last variable included into the second group of environmental variables is the intermediation ratio, defined as the ratio of total deposits over total loans. By using this variable, it is possible to capture the differences between the two domestic banking industries in terms of their ability to convert deposits into loans. As higher the intermediation ratio is, as higher would be the banking industry costs.

Finally, the third category of environmental variables refers to the accessibility of the banking services for customers, measured by the number of branches by square kilometer. This variable is used as a measure of branch density that takes in account the space dimension for each national market. It is also a good indicator of the potential overcapacity of the branch network in each country. This variable could measure the degree of competition in the banking market. Indeed, before the banking deregulation of the mid-eighties, the competition between banks took mainly the form of a non-price competition and during that period the banks compete by increasing their number of branches. This non-price competition strategy appeared in France as well as in Spain.

Table 2 :

Average values of environmental variables in France and Spain

	FRANCE	SPAIN
Main conditions		
Density of population / km2	104	77
GNP / nb of inhibitants ($)	9.747	9.375
Deposits / km2	0.832	0.647
Bank structure and regulation		
Herfindhal index of concentration	0.182	0.183
Average capital ratio (%)	3.54	9.94
Intermediation ratio : Deposits / Loans	0.58	1.49
Accessibility of banking services		
Number of branches / km2	0.0474	0.0994

Sources: Bank Profitabiltity, OECD, Main Economic Indicators, OECD, Eurostat, Anuario Estatistico (INE).

Table 2 contains the average of the environmental variables over 1988-1992 period for France and Spain. The arithmetic means of these variables suggest large differences in terms of the main conditions of banking activities across countries. In particular, the density of population and the income per capita are higher in France than in Spain. Table 2 also shows that the density of demand is higher in France than in Spain. So, we could infer from this information that it could be more costly to run banking activities—that is, to collect a given level of resources, or to manage a given assets portfolio—in Spain than in France.

On the other hand, the mean values of the variables belonging to the structure of banking industry and regulation group show that there are quite important differences in the bank structure as well as the regulation conditions between France and Spain. In

particular, the capital ratio is very different. This difference could be due to the fact that during the period of our study—which precede the effective introduction of the capital ratio international regulation—the solvency constraints imposed by the Spanish banking authorities obliged Spanish banks to maintain a higher level of capital ratio, compared to that of French banks. Another difference between the two domestic banking industries come from the fact that the intermediation ratio is higher in Spain than in France. That means that Spanish banks have to collect a higher level of costly deposits (in terms of operating costs) in order to lend the same amount of loans. In these conditions, it seems more expensive to exert banking activities in Spain than in France, ceteris paribus. However, the degree of concentration of the banking industry is quite the same in the two countries.

Finally, the accessibility of banking services is higher in Spain than in France. That is consistent with the previous observation concerning the density of population and the amount of deposits by km^2. So, the conditions in which Spanish banks operate seem to produce higher level of operating costs. However, again, we should emphasize the fact that the number of branches could be an indicator of the competition imperfectness in banking markets.

5. Empirical Results

Our empirical exercise starts with the measurement of efficiency scores of each French and Spanish banks from its own national frontier—that is, assuming that the technology used for the banks in each country is different. These results are summarized in Table 3. They show that on average the level of efficiency is the same in France and Spain. This average efficiency level is around 88% over the 1988-1992 period. In other words, French and Spanish banks are on average equally efficient in their respective countries. However, given these results, it is not possible to predict what will happen if the banks would decide to operate in the other country. That is, it is not possible to conclude whether the French or Spanish banks will reach the same efficiency level in the other

country than they get in their own country. To answer this question, we have to measure efficiency scores from a common frontier, and for that purpose we defined the common frontier by following the traditional approach. We measured the efficiency levels of each country banks from a common frontier by pooling the data set of the banks of the two countries, Table 4. The results show that while the average efficiency level of the French banks appear to be 58%, the Spanish banks are operating with an average efficiency level of only 9%. This surprising result is in accordance with our assumption that if the country-specific variables are an important factor in the explanation of the efficiency differences, then the frontier we build while neglecting this factor will generate an overestimation of the inefficiency levels.

Table 3 : X-Efficiency Estimates in France and Spain 1988-1992

Separate Cost Frontiers

X-Efficiency Score	*France*	*Spain*
X-Eff (truncation at 0.01)	0.775	0.854
X-Eff (truncation at 0.05)	0.881	0.883
X-Eff (truncation at 0.25)	0.960	0.961

Table 4 : X-Efficiency Estimates in France and Spain 1988-1992

Common Cost Frontier without Environmental Variables

X-Efficiency Score	*France*	*Spain*
X-Eff (truncation at 0.01)	0.478	0.073
X-Eff (truncation at 0.05)	0.581	0.093
X-Eff (truncation at 0.25)	0.772	0.169

So, in order to build properly the common frontier, we have to take into account not only the potential differences coming from some country-specific aspects of the banking technology but also those coming from environmental and regulatory conditions. This procedure would permit us to verify whether the wide difference of efficiency levels observed when we use a common frontier without environmental variables comes from a misspecification of the common frontier, or not. In order to define this common frontier, first, we tried to select the correct set of environmental variables. That will also help to test the equality of the technologies used by the two banking industries.

We started with a set of 18 environmental variables. The final set of significant environmental variables includes 7 variables. Three of them belong to the mean indicators groups: density of population, income per capita and density of demand. Three other variables describe the structure of the industry: degree of concentration, average capital ratio and intermediation ratio. The accessibility of services is measured by the number of branches per km^2. At the same time, this set allows us to identify the underlying common banking technology. Indeed, when those environmental variables were introduced in the separate cost functions of each country and the cross-equation equality restrictions on each parameter of each country cost frontier were imposed, we verified that most of these restrictions appeared to be insignificant—as we assumed in a previous section. That means that not only we have identified the correct set of country-specific environmental variables, but also the common underlying technology of different countries.

By introducing those variables in the cost equation, holding constant their mean values for each country, and estimating this common frontier, we obtained correct measures of banking efficiency level in France and Spain. The results are shown in Table 5. Two important points should be emphasized about these results. The first is that, on average, the French banks seem to be more efficient than the Spanish banks. While the French banking industry reaches an average efficiency score of around 88%, the Spanish banking industry score is around 75%. The second is that if we compare the results of Table 4 with the results of Table 5, we can see that the environmental variables play an important role in the explanation of the differences of the banking costs in France and Spain. When we

introduce those variables in the common frontier, the efficiency levels improve significantly in both countries.

Table 5 : X-Efficiency Estimates in France and Spain 1988-1992

Common Cost Frontier with Environmental Variables

X-Efficiency Score	*France*	*Spain*
X-Eff (truncation at 0.01)	0.779	0.647
X-Eff (truncation at 0.05)	0.888	0.748
X-Eff (truncation at 0.25)	0.969	0.884

The influence of the environmental variables seems in general to conform to the expectations (Table 6). All the coefficients on the environmental variables in the estimation of the cost function are significant at the 1% level of confidence. That proves the effectiveness of the role of such variables. First, we consider the role of the "main conditions" or macroeconomic conditions. Contrary to the expectations, the sign of the coefficient of the density of population variable is positive. That shows that a higher density contributes to increase banking costs, instead of to decrease them, as expected. The reason could come in part from the characteristics of the banking competition. In particular, if banks compete by opening more branches, for strategic reasons, that could create an inflation of the bank operating costs. Moreover, in this form of non price competition, banks should have to open branches in large cities where the real estate is most costly and the salaries higher. The sign of the income per capita is also positive, which shows that the higher is the development level of the economy, the higher are the operating and financial costs that the banks suffer when supplying a given level of services. The sign of the density of the demand is negative. The explanation could be that it is likely more costly to give satisfaction to a less important demand of banking services, because that demand is less informed and less concentrated. Another argument is that a more important demand permits banks to extract higher scale and scope economies.

Table 6 : The expected and observed influence of the environmental variables on the banking costs

	Main Indicators			Structure and competition of the banking industry			Accessibility
	Density of pop.	Income per capita	Density of demand	Concentra-tion index	Capital ratio	Inter-mediatio n ratio	Number of branches per km2
Expected	-	-	-	+ or -	-	+	+
Observed	+	+	-	+	-	+	+
Country*	France	France	France	equal	Spain	Spain	Spain

* Country where the level of the indicator is the highest

Second, we consider the variables describing the structure and competition of the domestic banking industry. We observe that the banking costs are increasing with the degree of imperfection of the banking competition. In particular, the sign of the Herfindhal index variable is positive. If we take that index as a measure of the market power of banks, the positive sign tends to demonstrate that higher market power induces banks to spend more in staff or personal expenses. On the other hand, the sign of the intermediation rate variable is positive, showing that a greater amount of deposits by unit of loans induce logically an increase of banking costs. And finally, the sign of the capital ratio is negative showing that it is less costly to produce banking services if the banks are better capitalized. As mentioned before, one explanation could come from the existence of a negative relationship between bank risk and bank borrowing costs.

Third, we consider the accessibility of the banking products for the customers. The observation shows that the sign of this variable is positive. The lower the density of bank

branches is, the lower the banking costs are.

All these results could help to explain why Spanish banks are suffering higher costs and appear significantly less efficient when their average efficiency levels were obtained without taking into account the environmental conditions. For instance, the higher number of branches as well as the higher intermediation ratio in Spain compared to France seem to be the main explanations of the higher bank costs and lower efficiency level in Spain. Another explanation comes from the lower density of demand. That could create a cost disadvantage for Spanish banks, as this factor is negatively related to banking costs. On the contrary, some factors which tend to increase costs are more present in France than in Spain, as, for instance, the higher level of income per capita or the higher density of population. However, we have shown previously that these factors reveal the role played by the imperfections of the competitive process on the banking costs. If it is true that a less competitive industry tends to increase costs, it is difficult to say which one of the two banking industries is the less competitive. In fact, our results do not permit us to give a complete explanation of the banking costs differences between the two countries. They just verify some current assertions.

6. Conclusion

In this paper, we verify that the specific environmental conditions of each country are an important factor in the explanation of the banking efficiency differences between French and Spanish banks. Moreover, we show that neglecting these variables could induce to an important misspecification of the cost frontier and an overestimation of the bank cost inefficiency.

Estimating a common frontier and using DFA to measure efficiency scores of French and Spanish banks, our results show that when the common frontier is defined without environmental variables, the cost efficiency scores of Spanish banks are quite low, compared to those of the French banks. However, when the environmental variables are

included in the common frontier these differences are significantly reduced. Moreover, all environmental variables we include in the specification of the cost function appeared to exert a significant influence on banking costs and efficiency scores.

Our final results suggest that, on average, French banks seem to be more efficient than the Spanish banks. Interestingly, this difference in efficiency between countries are greater when the country-specific environmental conditions are not taken into account. Moreover, we found that the banks which suffer worst conditions to develop their activities reach a more significant improvement in their average efficiency scores after incorporating the influence of these conditions in the measurement of efficiency. Looking at specific-environmental conditions we observe that Spanish banks operate with a higher number of branches and higher intermediation ratio, and have lower density of demand than French banks. Additionally, we found that Spanish banks reach higher improvement in the average efficiency scores than French banks, when the specific environmental conditions with which they are operating are taken into account. However, at this stage, our results do not permit us to give a complete explanation of the banking costs differences between the two countries.

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