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*Thanks for financial support are due to Instituto Valenciano de Investigaciones Económicas (IVIE), which Financial Economics research area is sponsored by Caja de Ahorros del Mediterráneo and CICYT PB94-1523. Authors also thank the comments received at the Workshop "Eficiencia en Banca" organized by the IVIE, "XIX Simposio de Analisis Económico" organized by the Instituto de Analisis Económico, and the "Fourth European Workshop on Efficiency and Productivity Measurement" organized by the Center for Operations Research and Econometrics. Our special thanks to Knox Lovell and Finn Førsund for their helpful comments on an earlier draft. Remaining errors are ours.

**Pastor J.M., Universitat de Valencia. Pérez F. and Quesada J., IVIE & Universitat de Valencia.

Editor: **Instituto Valenciano de Investigaciones Económicas, S.A.**
Primera Edición Noviembre 1995.
ISBN: 84-482-1163-4
Depósito Legal: V-4450-1995
Impreso por Copisteria Sanchis, S.L.,
Quart, 121-bajo, 46008-Valencia.

# EFFICIENCY ANALYSIS IN BANKING FIRMS: AN INTERNATIONAL COMPARISON

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## ABSTRACT

The intensive process of financial European integration, together with the profound transformation and deregulation that has taken place in the Spanish Banking System, justifies the evaluation of its efficiency in comparison with that of other banking systems. In this context, the aim of this study is to analyze the productivity, efficiency and differences in technology of several banking systems. Using a non-parametric approach together with the Malmquist index, we compare the efficiency, productivity and differences in technology of different European and US banking systems for the year 1992.

Finally, for a subsample of banks belonging to the same group of countries, using real as opposed to nominal quantities of labor, we introduce corrections on efficiency measures, by introducing the services provided to customers by the branch network and the degree of solvency determined by capital ratio. When we consider these other features in computing efficiency, we find significant changes in the ranking of particular banks according to efficiency.

KEYWORDS: Data Envelopment Analysis, Productivity, Banking Systems.

## RESUMEN

El intenso proceso de integración financiera europea, junto con la profunda transformación y desregulación que ha tenido lugar en el Sistema Bancario Español, justifica la evaluación de su eficiencia en comparación con otros sistemas bancarios de su entorno. En este contexto, el propósito del presente estudio ha sido analizar las diferencias en productividad, eficiencia y tecnología de varios sistemas bancarios. Mediante el uso conjunto de una técnica frontera no paramétrica y el índice de Malmquist se analizan las diferencias de productividad, eficiencia y tecnología de diferentes sistemas bancarios europeos y el sistema bancario norteamericano.

Finalmente, para una submuestra de bancos pertenecientes al mismo grupo de países y utilizando magnitudes físicas de empleo en lugar de nominales, se introducen algunas correcciones en las medidas de eficiencia al considerar los servicios provistos por las oficinas a la clientela y el grado de solvencia de las empresas, determinado por el coeficiente de solvencia. Cuando se calculan las medidas de eficiencia considerando estas características, se encuentran cambios significativos en la ordenación de los bancos de acuerdo con su eficiencia.

PALABRAS CLAVE: Análisis de Envolvimiento de los datos, productividad, Sistema Bancario.

## 1. INTRODUCTION

Efficiency analysis of financial institutions has received increasing attention from specialists in recent years. The intensive process of financial European integration, together with the profound transformation that has taken place in the Spanish Banking System (SBS) justifies the evaluation of its efficiency in comparison with that of other banking systems. After a period of intensive and continuous liberalization, the SBS has become a much more competitive market. At least three causes can be identified behind this process. First, the disappearance of a number of regulatory limitations like entry barriers, interest rate controls by the Bank of Spain, compulsory investment coefficients to underprice the cost of financing the public deficit, limits on branch expansion, high reserve requirement coefficients, etc. Second, the eruption of new financial intermediaries carrying out similar functions to those traditionally associated to banks. Thirdly, a disintermediation process giving markets a growing role in allocating financial funds.

The existing literature on SBS efficiency has centered traditionally on the analysis of scale and scope economies under the implicit assumption that all firms are efficient. On the contrary, very few studies have focused on efficiency analysis, in spite of the fact that the greatest potential gains on costs are obtained by eliminating existing inefficiencies rather than trying to reach the adequate size and scope of financial intermediaries[(1)]. Furthermore, there exist very few studies where SBS efficiency is compared with the efficiency of other banking systems[(2)].

The results on efficiency analysis carried out for the US case show significant discrepancies with respect to the average inefficiency levels estimated. The reasons for such discrepancies must be attributed to differences in the type of data, methods, as well as the particular variables used in the analysis.

The aim of this study is to analyze productivity, efficiency and differencies in technology in the SBS, using a non parametric approach, carrying out a comparison with other countries for the year 1992. This paper introduces some innovative elements into the studies done on Spain. The most relevant is the decomposition of the differences in productivity of different banking systems into differences in levels of efficiency (catching-up)

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[(1)]Exceptions are Doménech (1992), Grifell, Prior & Salas (1992), Grifell & Lovell (1993) and Pérez & Pastor (1994).

[(2)]An exception is Pastor, Pérez & Quesada (1994).

and distances between the frontiers themselves.

## 2. EFFICIENCY MEASURES BASED ON THE PRODUCTION FRONTIER.

Traditionally, computed efficiency indicators are based on the alternative use of production, cost or profit frontiers. The frontier can be defined in each case, for a set of observations, assuming that it is not possible to find any observation above the frontier (in the case of the production and profit functions) or below it (in the case of the cost function).

More specifically, the definition of the production frontier is associated with the maximum attainable level of output, given a level of inputs, or the minimum level of inputs required to produce a given output. The profit frontier is associated with the maximum level of profits that can be obtained given a set of output and input prices. Since our purpose is the analysis of both the technical efficiency and the differences in productivity, and not that of the allocative efficiency, a production frontier will be used(3).

The common characteristic of these three frontiers is *optimality*. They are derived from a maximum or minimum condition under given conditions on technology and prices describing a *frontier or a boundary*. Efficiency level estimations are based on the distance from each observation to such a frontier. There are different techniques employed in estimating the frontier. These are based on parametric methods (when some hypotheses are introduced on the frontier functional form, based on their properties) and in non-parametric methods (when observational criteria based on programming techniques are used to construct the frontier). The models can also be classified by the way they deal with the error term. If they do not recognize the presence of an error term, so that all firms lie below the frontier, the model is called deterministic. Alternatively, the presence of an error term gives rise to the stochastic models. Additionally, models are recognized as mathematical if (linear or cuadratic) programming is used or, alternatively, as econometric models.

(3)The use of the cost and profit frontiers makes possible the study of the firm efficiency in both its technical and allocative components. For the cost frontier, the knowledge of input prices is necessary; whereas, in the case of the profit frontier, input and output prices are needed. In some cases, this higher requirement of information becomes an additional inconvenience.

In this study we estimate the productive change through the use of Malmquist indexes. These indexes use the notion of *distance function*, so that a previous estimation of the corresponding frontier is required. Such an estimation is carried out by using *Data Envelope Analysis (DEA)*, a non-parametric deterministic frontier method based in matematical linear programming.

## 3. METHODOLOGY

Using a linear programming technique -DEA- we are able to compute a *production function* frontier as the superior envelope of the data. DEA calculates an indicator of efficiency for each firm, measured as the distance that separates it from the frontier. On the other hand, relative productivity is analyzed using the Malmquist index, which allows us to compute the differences in productivity between two firms belonging to different banking systems.

The indexes that have been used most frequently in literature to analyze productive change are those of Fischer (1922), Törnqvist (1936) and Malmquist (1953). The benefits in using indexes like those of Fisher and Törnqvist lie in that they do not require the estimation of the technology; in fact, only quantities of outputs and inputs, as well as prices, are needed.

On the other hand, the main drawback presented by the Malmquist index is that it requires the estimation of the production frontier(4). However, this method has three interesting features. First, contrary to the other two methods, it does not require a cost minimizing or profit maximization condition. Second, it does not require any data on prices. This is convenient for those cases in which there are data problems and/or the presence of market power makes their use inadvisable. Lastly, it allows the decomposition of productive change into technical efficiency (catching-up) and technical change (frontier shifts), the main objective of our study(5).

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(4)However, Caves, Christensen and Diewert (1982) show that under general given conditions, the geometric average of the two Malmquist productivity indexes is equal to the quotient between the Törnqvist indexes of outputs and inputs, which require data on outputs, inputs and prices, but not on technology.

(5)See Grifell and Lovell (1993).

Moorsteen (1961) was the first author to use Malmquist's idea, initially conceived in the consumer context, to compare the input of one firm in two different moments of time, and to compute the maximum factor by which the inputs of one period might be reduced in such a way that it could still produce the observed level of output corresponding to the other period.

On the other hand, Caves et al. (1982) adapted the problem of a firm observed in two different periods of time to that of two firms observed simultaneously, establishing the relationship between the Malmquist and Törnqvist indexes. They developed the Malmquist productivity index with two approaches. The first approach defines the differences in productivity as the differences in the maximum reachable output given some input levels. It is called the *output based Malmquist productivity index*. Alternatively, the *input based Malmquist productivity index* measures the differences in productivity as differences in the minimum level of inputs that make possible the production of some given output levels. Caves et al. (1982) show that both indexes give identical results only when returns to scale are constant.

This study makes use of the input based Malmquist productivity index(6). There are two reasons for doing so. First, it provides the best intuition for potential savings by cutting out the excessive use of inputs. Second, as mentioned by Färe and Lovell (1978), under less restrictive conditions on the production function, Farrell's measure of input savings has more properties than the one associated with increases in output(7).

Caves et al. (1982) used the concept of distance function, although without establishing a connection with the efficiency measures of the Farrell type(8). In particular, they assumed that firms were efficient, that is, that they always operated on the frontier. It was Berg, Forsund and Jansen (1992) who related the two concepts and allowed for the presence of existing inefficient observations. For that particular reason, the concept of *technological frontier* is substituted by *technology*, so that in order to carry out reasonable comparisons between firms, they must be adjusted first to the corresponding frontier.

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(6)Berg, Førsund and Jansen (1992) also use this approach. Grifell and Lovell (1993) use the output-based index.

(7)More specifically, both measures are equal under constant returns to scale, but have the same properties only if the production function is homogeneous of degree one. Otherwise, Farrell measures associated to potential input savings are preferred.

(8)See Farrell (1957).

### 3.1. Technology Characterization

Let us assume that the transformation function that describes the technology of banks is:

$$F_i(y^i,x^i)=0 \qquad i=1,..,S \tag{1}$$

where $y^i=(y_1^i,...,y_N^i) \in R_N^+$ is the output vector, $x^i=(x_1^i,...,x_M^i) \in R_M^+$ denotes the input vector corresponding to country i, and S is the number of banking systems considered.

Technology can be represented in a more convenient way through the *"input distance function"* used by Caves et al. (1982):

$$D^i(y^j,x^j)=Max_{\mu_{ij}}\left[\mu_{ij}:\ F_i(y^j,x^j/\mu_{ij})=0\right] \qquad i,j=1,...,S \tag{2}$$

Where the scalar $\mu_{ij}$ is the maximum reduction of the input vector of the firm of country $j$ ($x^j$), the resulting deflated input vector ($x^j/\mu_{ij}$) and the output vector ($y^j$) are on the frontier of the banking system of country $i$.

If $i=j$ we are comparing each firm with all firms in the same banking system, so that the input distance function is $D^i(y^i,x^i)\geq 1$. This distance is equal to one when the evaluated firm is efficient and, therefore, on the frontier.

On the contrary, if $i\neq j$ the distance function can take values less than one, since observation $j$ belongs to a different banking system than the one of reference ($i$).

### 3.2. The Malmquist index

The Malmquist index of productivity based on inputs[9], taking the technology of the banking system of country $i$ as reference to compare two banks belonging to countries 1 and 2 is defined as:

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[9] This index is going to be used throughout this study and henceforth will be referred to simply as the Malmquist index.

$$M_i(y^2,x^2,y^1,x^1)=\frac{D^i(y^1,x^1)}{D^i(y^2,x^2)} \tag{3}$$

$M_i > 1$ indicates a higher productivity of the firm in country 2 than that in country 1, since the reduction of the input vector of the firm in country 1 necessary to reach the frontier of country $i$ is higher than that corresponding to the firm belonging to country 2. On the other hand, $M_i < 1$ implies that the productivity of the bank in country 2 is inferior to that of the bank in country 1.

One of the main virtues of the Malmquist index is that it can be decomposed into two parts: the catching-up effect and the distance between the frontiers considered[10].

$$M_i(y^2,x^2,y^1,x^1)=\frac{D^i(y^1,x^1)}{D^i(y^2,x^2)}=\frac{D^1(y^1,x^1)}{D^2(y^2,x^2)}\cdot\frac{\dfrac{D^i(y^1,x^1)}{D^1(y^1,x^1)}}{\dfrac{D^i(y^2,x^2)}{D^2(y^2,x^2)}} \tag{4}$$

The first quotient represents the relative efficiency of the firms in countries 1 and 2, while the second term shows the relative distance of the frontiers of countries 1 and 2 with respect to country $i$.

If the efficiency of the banking systems in country 1 and 2 is equal, the first term will be equal to 1 and the productivity difference represented by $M_i$ will be explained only by the distance between their respective frontiers. On the contrary, if the second term is 1 (both frontiers are exactly the same), the productivity differences in the banking systems 1 and 2 estimated by $M_i$ will be explained only by the differences in their actual levels of efficiency (catching-up).

In all other cases, the differences in productivity reflected by $M_i$ will be a combination of differences in efficiency with differences in the frontiers.

Färe and Lovell (1978) formalized the existing relationship between the distance function based on inputs and the Farrell measures of input savings $E_{ii}(y^i,x^i)$, and they showed that the distance function is equal to the inverse of the Farrell measure of input savings:

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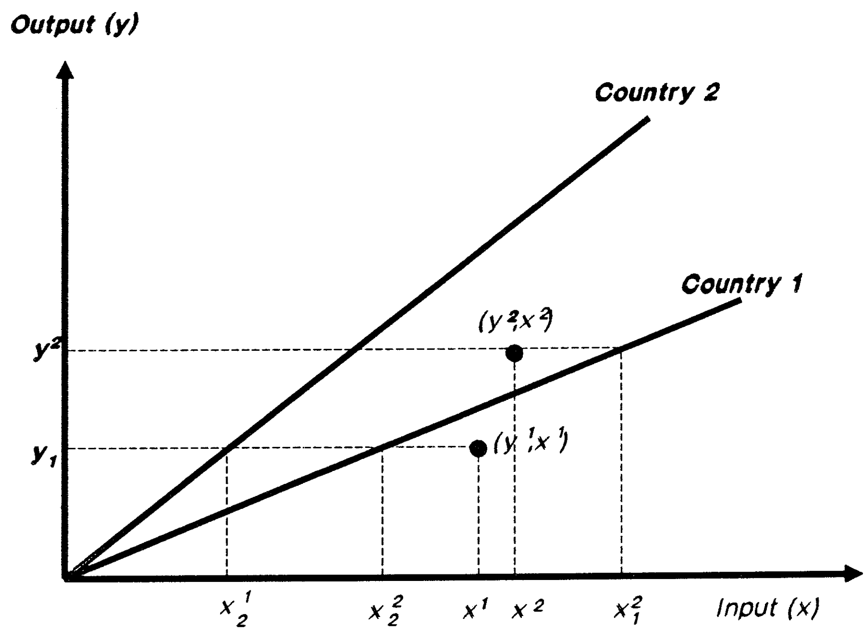
[10] See Nishimizu & Page (1982), Berg, Førsund & Jansen (1991) and Grifell & Lovell (1993).

$$D^i(y^i,x^i)=\left[E_{ii}(y^i,x^i)\right]^{-1} \tag{5}$$

To illustrate all the concepts mentioned above, let us assume the most simple case of production of only one output with only one input (see figure 1). Consider two combinations representing two banks belonging to two countries 1 and 2 $(y^1,x^1)$ and $(y^2,x^2)$. Farrell efficiency measure (the inverse of the distance function) is computed by comparing each observation with the corresponding frontier. In this way we obtain the following ratios, where the subindex indicates the frontier of reference: $E_{11}=x_1^{\,1}/x^1$, $E_{22}=x_2^{\,2}/x^2$, $E_{12}=x_1^{\,2}/x^2$, $E_{21}=x_2^{\,1}/x^1$.

**Figure 1**




Given that under constant returns to scale $x_1^{\,2}/x_1^{\,1}=y^2/y^1$ the Malmquist index, taking as reference country 1 (i=1) can be described as:

$$M_1(y^2,x^2,y^1,x^1)=\frac{D^1(y^1,x^1)}{D^1(y^2,x^2)}=\frac{E_{12}}{E_{11}}=\frac{\frac{x_1^2}{x^2}}{\frac{x_1^1}{x^1}}=\frac{\frac{y^2}{x^2}}{\frac{y^1}{x^1}} \tag{6}$$

The Malmquist index can be reduced in this case as a simple ratio between productivity indexes of the two firms in countries 1 and 2.

For this simple example, the decomposition of the Malmquist index into the catching-up effect (MC) and the distance between frontiers (DF) can be expressed as:

$$M_1(y^2,x^2,y^1,x^1)=\frac{E_{12}}{E_{11}}=\frac{E_{22}}{E_{11}}\cdot\frac{E_{12}}{E_{22}}=MC(y^2,x^2,y^1,x^1)\cdot DF(y^2,x^2,y^1,x^1) \tag{7}$$

where the catching-up or difference in efficiency levels of countries 1 and 2 would be[11]:

$$MC(y^2,x^2,y^1,x^1)=\frac{E_{22}}{E_{11}}=\frac{\frac{x_2^2}{x_2}}{\frac{x_1^1}{x_1}} \tag{8}$$

and the distance between the frontiers of the two countries could be expressed as [12]:

$$DF(y^2,x^2,y^1,x^1)=\frac{E_{12}}{E_{22}}=\frac{\frac{x_1^2}{x^2}}{\frac{x_2^2}{x^2}}=\frac{x_1^2}{x_2^2} \tag{9}$$

In figure 2 we observe the difference between the assumption of constant returns to scale (frontier OF) and variable returns to scale (frontier ABCDE). Farrell measure based on inputs is obtained as the horizontal distance that separates each firm from the corresponding frontier for each year. The *global technical efficiency* measure of input savings for firm $h$ can be expressed as:

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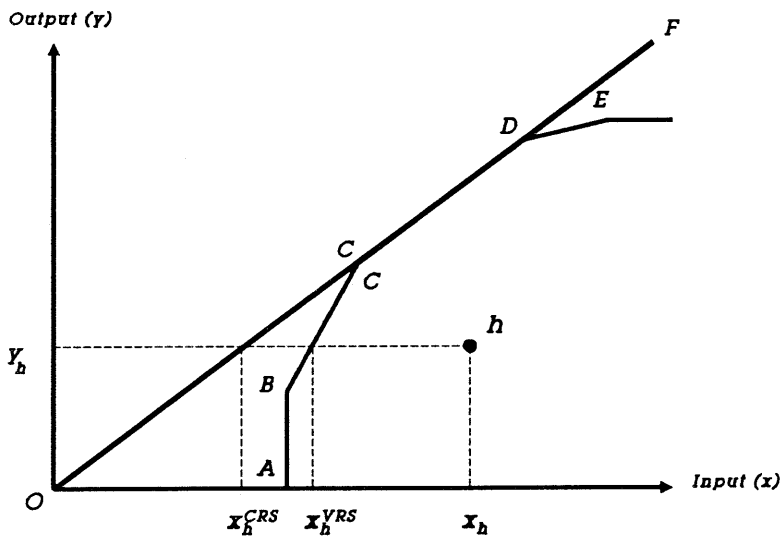
[11]Note that according to the situation reflected in figure 1 this expression would be less than one, indicating that the bank in country 2 is less efficient than the bank in country 1, comparing both to their own banking systems.

[12]In figure 1 this distance is greater than one, an indication that the frontier of the banking system of country 2 is above the frontier of country 1. The global result is a productivity index less than one, meaning higher productivity for country 2.

$$E^h = \frac{x_h^{CRS}}{x_h} \qquad (10)$$

However, it is possible to consider that one part of this global technical inefficiency may be due to the fact that firms operate at a suboptimal scale (scale inefficiency), the rest being pure technical inefficiency. The procedure to decompose the global technical efficiency (E) into *scale efficiency* (ES) and *pure technical efficiency* (ETP) is based on comparisons of Farrell measures obtained under constant, nonincreasing and variable returns to scale. If all three measures coincide, the firms are operating at an optimal scale, and otherwise, on a suboptimal scale.

**Figure 2**




The Farrell measure can then be expressed as the product of the pure technical efficiency and the scale efficiency:

$$E^h = \frac{x_h^{CRS}}{x_h} = \frac{x_h^{VRS}}{x_h} \cdot \frac{x_h^{CRS}}{x_h^{VRS}} = ETP^h \cdot ES^h \qquad (11)$$

where the pure technical efficiency, assuming variable returns to scale, is:

$$ETP^h = \frac{x_h^{VRS}}{x_h} \tag{12}$$

the scale efficiency being

$$ES^h = \frac{x_h^{CRS}}{x_h^{VRS}} \tag{13}$$

## 4. MALMQUIST INDEX COMPUTATION

For the computation of the distance function we rely on the Farrell measures obtained by using *data envelopment analysis* (DEA). This technique elaborates a frontier of reference through methods of linear programming. The frontier is composed of efficient banks and linear combinations of them. Efficiency measures are based on the distance that separates each firm from this frontier. This distance is measured through the potential input savings or through the potential increase in outputs. We selected the first measure for the reasons given above.

In this study we compute the frontiers of reference imposing constant returns to scale. However, DEA easily allows for variable returns by introducing an additional restriction on the sum of the weights of each firm as will be seen below. Nevertheless, since Malmquist indexes estimate the productive change that has occurred over a period of time by comparing firms at one moment of time with frontiers at other moments of time, the assumption of constant returns to scale (CRS) is sufficient to assure a solution to the problem[13].

In general, the problem faced by a firm belonging to country $j$, with respect to the frontier of reference composed by $H$ firms in country $i$ that produce $N$ outputs using $M$ inputs, may be stated as:

[13]The introduction of the assumption of variable returns to scale has caused problems only for some large banks whose Farrell measures were extremely high. This fact favors the assumption of constant returns to scale.

$$Min_{\mu} \quad E_{ij}^{h} \qquad h=1,...,H_i \ \forall i \ ; \quad i,j=1,...,S$$

$$s.a.$$

$$\sum_{h=1}^{H} \mu_h \cdot y_{nh}^{\ i} \geq y_{nh}^{\ j} \qquad n=1,...,N \quad outputs \tag{14}$$

$$\sum_{h=1}^{H} \mu_h \cdot x_{mh}^{\ i} \leq E_{ij}^{\ h} \cdot x_m^{\ j} \qquad m=1,...,M \quad inputs$$

$$\mu_h \geq 0$$

Solving the problem for each of the $H$ firms, we achieve the corresponding estimates of Farrell measures $E_{ij}$, whose inverse is equal to the distance function. The introduction of the additional restriction $\sum_{h=1}^{H} \mu_h = 1$ allows us to generalize the problem to the case of variable returns to scale (VRS).

Obviously, if i=j we are comparing a firm with its own banking system, so that $E_{ii} < 1$ indicates that it is possible to reduce the use of inputs in a $(1-E_{ii})\%$ and produce the same outputs through efficiency improvements that have been proven attainable by other firms.

On the contrary, if $i \neq j$ we are comparing a firm of banking system j with the frontier of reference of country $i$, so that either $E_{ij} > 1$ or $E_{ij} < 1$ may occur. The first inequality means that the firm in country j is more efficient than any firm of country $i$ (even those on the frontier). In this case, the firm in country j would find itself in a situation above the frontier of country $i$. The opposite case, $E_{ij} < 1$, would mean that observation $j$ is below the frontier of reference of country $i$.

## 5. DATA

The data used are those of the IBCA panel[14]. The deterministic nature of the technique used implies that we do not consider the possibility that a random term may bias the results when the observations of some of the firms -by their own nature, by specialization or by random causes- could otherwise be considered atypical.

The need to establish domestic and international comparisons, together with the availability of labor employment data, imposed certain restrictions in obtaining a domestic and internationally homogeneous sample of banks in terms of specialization.

Obviously, if what we want is the measurement of bank efficiency through the distance that separates them from the production function, we should consider only those firms that share the same technology to produce the same output vector (specialization). This consideration requires the choice of some level of specialization. We have included commercial banks and rejected savings, public, industrial, development, regional and UK building societies, as well as merchant banks.

The data refer to non-consolidated bank income and balance sheet accounts corresponding to 1992. Finally the sample is formed by a study of the following banks: 168 in the US, 45 in Austria, 59 in Spain, 22 in Germany, 18 in UK, 31 in Italy, 17 in Belgium and 67 in France[15].

## 6. SELECTED VARIABLES: INPUTS AND OUTPUTS

The choice of output and input variables is the first difficult question that must be addressed by any study on banking. Such a choice will be influenced by the selected concept of banking firm, by the particular question under consideration and, also, by the availability

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[14]See IBCA Ltd.

[15]We exclude a great number of banks belonging to all countries for which we do not have information on the income account. We thank J.P. Abraham, F. Cesarini, E. Gardener, P. Heiss and L. Schuster for their helpful coments about the firms we had to include and exlude in the sample.

of reliable information.

The main discrepancies between authors refer to the role of deposits and, more specifically, whether they should be treated as inputs or outputs. The answer to this question has been multiple. Some studies treat them as inputs[16], as outputs[17], or simultaneously as inputs and outputs[18].

Recently, new studies have tried to solve the problem of identifying the role of deposits in very different ways. Thus, Berger, Hancock & Humphrey (1993) avoid the problem of identification by analyzing firm efficiency through the profit function. Fixler & Zieschang (1993) use a method that allows them to establish whether a financial product is an input or an output according to its net contribution to firm income. If the return on a financial product is greater than its opportunity cost, the financial instrument is considered an output, otherwise it is considered an input. Unfortunately these methodologies, if applied to the Spanish banking system, require unavailable statistical information.

This study considers the bank as a firm that produces a flow of services out of the consumption of inputs. This flow of services, associated both to items of the asset as well as of the liability side, would be the *ideal* measure of output. Some authors measure this flow of services by the number of checks drawn, or by the number of cash withdrawals, or by the number of loan operations, etc. Unfortunately, we do not have available data for these variables. Furthermore, this approach would be acceptable only if the ratio between the number of operations in relation to the number of accounts was similar for all firms and over a period of time[19]. Additionally, it is not satisfactory to give the same treatment to accounts of different size[20].

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[16]See Mester (1989), and Elyasiani & Mehdian (1990a), (1990b) and (1992), where the *intermediation approach* is followed. The firm uses inputs (deposits) to produce outputs (loans).

[17]See Berger & Humphrey (1993), Berg, Førsund & Jansen (1992), Ferrier & Lovell (1990), and Rangan, Grabowski, Aly & Pasurka (1988).

[18]See Humphrey (1992), and Aly, Grabowski, Pasurka & Rangan (1990).

[19]However, over the last years there has been an increase in the general use of banking services, checks drawn, credit cards, cash cards, etc.

[20]Grifell & Lovell (1993) in a study refering to Spanish savings banks, use the number of accounts as a measure of output, without considering their size. Grifell, Prior & Salas (1992) avoid this problem by using information on the average size of the accounts. In our study, changes in the way information is reported do not allow us to compute the average size of accounts.

For all reasons mentioned above, this study uses the *added value approach*[21], according to which all items on both sides of the balance sheet may be identified as inputs or outputs. Unfortunately we do not have available accounting information to be able to compute the added value of the main items on the balance sheet, so we have to rely on other studies that use such information. Berger & Humphrey (1993), using information from the *Functional Cost Analysis* (FCA), find that the items that generate more added value are (demand, savings and time) deposits and loans, so that these are considered outputs.

The choice of deposit and loan nominal volumes as measurements of banking output is made under the assumption that these are proportional to the number of transactions and the flow of services to customers on both sides of the balance sheet. This approach, however, raises the problem of not capturing the function of deposits as instruments for raising loanable funds. Humphrey (1992) specifies the deposits as inputs and outputs simultaneously to capture the double side of deposits, including the variable financial costs in the estimation of the translog function. However, this procedure, although acceptable in a translog specification, is not appropriate in a DEA approach.

The introduction of the number of branches as an additional output variable would be convenient if we wanted to capture the flow of services produced by a bank. The consideration of the number of branches can also correct any biases that might arise if some banks captured deposits offering high interest rates instead of providing services through a dense branch network. Not including the quality of the services provided by banks in terms of proximity to their customers would underestimate the estimates of efficiency of banking systems with a well developed network[22].

Similarly, lack of data on the number of employees for the whole sample has made us approximate the quantity of the labor input by personnel expenses[23]. In this way, prices and quantities are mixed together. At a domestic level, assuming there is no market power in the labor market, the measurement of labor in nominal terms would be even more convenient when we are estimating efficiency, since we would be correcting labor by productivity as reflected in wages. In this way, differences in efficiency would be attributable

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(21)See Berger & Humphrey (1993) and Berger, Hanweck & Humphrey (1987).

(22)As explained later, we introduce the informational content of branches as an additional constraint in the optimization process carried out to compute efficiency scores for a subsample of the data bank.

(23)Berg et al. (1992), Forsund, Hjalmarson and Suominen (1993) also use this approach.

to firm management. If wage differentials are not due to different labor quality but to market imperfections, then our measurement of labor will overestimate the efficiency of the firms that hire labor at lower wages.

International comparisons, however are subjected to the problem of measuring labor by personnel comparisons. Labor market segmentation does not allow the interpretation of wage differentials as quality heterogeneity. Consequently, there will exist a bias in the distance function, undervaluing the position of the frontier and, therefore, the productivity of those banking systems with higher wages[(24)].

In sum, we may find differences in productivities that are not due to different positions of the frontiers and/or different levels of efficiency. They may contain elements like accounting errors in measuring variables, wage differentials, different regulation, distinct densities of demand, etc. Some, but not all, of these elements may be corrected[(25)] and we should keep this in mind when we interpret the measurements of the distance to the frontier.

The numerous accounting criteria used in the seven countries considered limit the choice of input and output variables. To eliminate this bias we have chosen broad definitions of variables as presented by IBCA. Taking into account the factors mentioned above the output vector is formed by: $y_1$=loans, $y_2$=other productive assets[(26)], $y_3$=deposits[(27)]. The input vector is formed by two variables: $x_1$=non interest expenses, $x_2$=personnel expenses.

## 7. STRUCTURAL INEFFICIENCY

The problem addressed in this section, considered by Farrell (1957), is the aggregation of individual measurements of efficiency. Given that a banking system may be

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(24)The importance of this bias can be approximated through the comparisons of these results with those obtained using the number of employees in the section below.

(25)In fact, this is one of the objectives of this paper.

(26)It includes all existing deposits with banks, short-term investments, other investments, and equity investments.

(27)Deposits include customer and short-term funding = demand+savings+time+interbank+other.

considered as a group of banks that produce the same output, we might think that the efficiency of a banking system is nothing but a weighted average of the individual measures obtained from the comparison with a common isoquant.

Farrell asserts that this statement is true with some qualifications. The strict convexity of the isoquant guarantees that any linear combination of points on the isoquant (efficient points) lies above it[28]. Consequently, the efficiency of the banking system will always be lower than the weighted sum of the efficiency measures and will be smaller the higher the dispersion.

Farrell referred to the efficiency measure obtained for the whole banking system in relation with the isoquant formed by all banks as structural efficiency[29]. Farrell was conscious that this measure of structural efficiency was not appropriate to establish international comparisons, since it was not obtained by comparing each industry with the best international isoquant but with the firms integrating the industry. He concludes that to carry out such comparisons it is necessary to provide comparisons between the different isoquants. Such an objective is attempted in this paper. The measure of structural efficiency is represented in table 1 as medium bank efficiency.

## 8. TECHNICAL EFFICIENCY: DOMESTIC RESULTS

The results for the medium bank, the simple average of banks and the weighted (by assets) average of banks under variable and constant returns to scale are presented in table 1. Our comments will refer only to the weighted mean of banks. Relatively similar comments are applicable to the medium bank in which the whole banking system is treated as an aggregate unique bank. Results change more significantly if we use the simple average of banks treating all banks belonging to a system equally. As shown in the table for constant returns to scale, France has the banking system with the highest efficiency level (0.950), followed by Spain (0.822), Belgium (0.806), Italy (0.773), Germany (0.650), US (0.624),

[28]That is to say, the sum of two efficient firms always gives way to an inefficient firm.

[29]Basically, the structural efficiency of one industry is higher under the following circumstances: when firms operate at an optimal scale, when inefficient firms are either expelled from the market or transformed, and when the optimum is reached in the short run.

Austria (0.608) and UK (0.537). The second column shows the efficiency scores assuming variable returns to scale. The efficiency levels of some of the banking systems change substantially from CRS to VRS, an indication of the existence of scale inefficiencies. This is the case of Austria, Germany, the US and Italy. The banking systems from Belgium, Spain, the UK and France have smaller scale inefficiencies (SE). The values of the weighted average are, with the exception of the US, greater than the simple average. This indicates that the large banks are more efficient than the small ones.

TABLE 1

| | MEDIUM BANK | | | AVERAGE | | | WEIGHTED AVER. | | |
|---|---|---|---|---|---|---|---|---|---|
| | CRS | VRS | SE | CRS | VRS | SE | CRS | VRS | SE |
| United States | 0.541 | 0.602 | 0.898 | 0.635 | 0.704 | 0.901 | 0.624 | 0.811 | 0.769 |
| Spain | 0.764 | 0.776 | 0.984 | 0.716 | 0.790 | 0.905 | 0.822 | 0.894 | 0.918 |
| Germany | 0.504 | 0.816 | 0.617 | 0.593 | 0.720 | 0.824 | 0.650 | 0.936 | 0.694 |
| Italy | 0.662 | 0.684 | 0.967 | 0.711 | 0.825 | 0.861 | 0.773 | 0.926 | 0.832 |
| Austria | 0.507 | 0.507 | 0.998 | 0.541 | 0.699 | 0.773 | 0.608 | 0.929 | 0.654 |
| United Kingdom | 0.265 | 0.267 | 0.992 | 0.494 | 0.536 | 0.921 | 0.537 | 0.548 | 0.980 |
| France | 0.856 | 0.856 | 0.999 | 0.672 | 0.673 | 0.999 | 0.950 | 0.951 | 0.999 |
| Belgium | 0.631 | 0.649 | 0.972 | 0.673 | 0.769 | 0.874 | 0.806 | 0.924 | 0.872 |

## 9 PRODUCTIVITY, CATCHING-UP DISTANCE TO THE FRONTIER: INTERNATIONAL RESULTS.

In the application of the Malmquist index to analyze the international differences in productivity we have taken the Spanish banking system as the technology of reference. As shown in equation (3) we compare the factors by which inputs in banking systems belonging to two countries can be reduced and still produce at the same level as the Spanish banking system. This allows us to establish cross country relative productivity ratios as shown in table 2. The results for the medium bank, the simple, and the weighted average of banks appear in the table[30]. Our comments will refer only to the section that uses the weighted average of banks.

[30]Weights on banks are their size as measured by assets. Only results under CRS are reported since the assumption of VRS produced unsatisfactory outcomes.

The fourth column on section C of table 2 contains the results of comparing the productivity of the Spanish banking system with that of the other countries. The value of the index equal to 0.68, corresponding to the USA, means that the US system is more productive than the Spanish, requiring only 68 per cent of the inputs required by Spanish banks. The relative values of productivity show the Austrian as the most productive sector (0.27), followed by those of Italy (0.35), Germany (0.38), Belgium (0.42), USA (0.68), UK (0.69), France (0.70) and Spain (1.0). It is interesting to note the poor performance of the Spanish banking sector in terms of relative productivity. The Austrian banking sector, as an average, only requires almost one fourth of the inputs used by the Spanish banks. Similarly, any other banking system can be compared with the rest of the banking sectors by reading horizontally the column containing the Malmquist index *M*. Values above unity mean higher productivity of the banking sector heading the column, and values under unity mean lower productivity.

The fifth and sixth columns in section C of table 2 contain the decomposition of the Malmquist index into its two multiplicative components as shown by equation (4) above, namely, the catching up effect *MC* (relative efficiency) and the distance to the frontier or technological parameter *DF*. A low value for the catching up effect means that the weighted average of the banks belonging to a particular country shows a relatively higher efficiency score than Spain. In other words, the set of banks lie relatively far from their own efficiency frontier if compared with those of Spain. A coefficient lower than one in column 5 of the table (France = 0.86) means a higher efficiency level in France than in Spain. On the contrary, values greater than one (UK =1.49, Austria = 1.35, USA = 1.31, Germany = 1.26, Italy 1.06) mean lower levels of efficiency in declining order of the countries of comparison.

The relative position of the efficiency frontier of each country is shown in column 6 by the factor measuring the distance between each of the frontiers and that of the country of reference, namely, Spain. A value smaller than one means that the country of comparison enjoys a more productive frontier than Spain. The value is nothing but a factor saving parameter by which the inputs of Spain can be multiplied and still produce the same level of output. According to the values shown in the table, Austria has the frontier in the highest position (0.20), followed by Germany (0.30), Italy (0.33), UK (0.46), US (0.52), France (0.8) and Spain (1.0).

It is interesting to note how the decomposition of the Malmquist index gives rise to distinct combinations for different banking systems. Thus, for example, Spain performs poorly in the Malmquist index but, as shown by the low value of the catching up effect

# TABLE 2
## Malmquist Index Decomposition
## International Comparisons

Section (a): MEDIUM BANK

| | USA | | | SPAIN | | | GERMANY | | | ITALY | | | AUSTRIA | | | UNITED KINGDOM | | | FRANCE | | | BELGIUM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF |
| USA | 1.00 | 1.00 | 1.00 | 0.71 | 1.41 | 0.50 | 1.57 | 0.93 | 1.68 | 1.10 | 1.22 | 0.90 | 1.49 | 0.94 | 1.59 | 0.87 | 0.49 | 1.76 | 0.94 | 1.58 | 0.60 | 1.38 | 1.17 | 1.18 |
| SPAIN | 1.40 | 0.71 | 1.98 | 1.00 | 1.00 | 1.00 | 2.20 | 0.66 | 3.33 | 1.55 | 0.87 | 1.79 | 2.10 | 0.66 | 3.16 | 1.21 | 0.35 | 3.49 | 1.32 | 1.12 | 1.18 | 1.94 | 0.83 | 2.35 |
| GERMANY | 0.64 | 1.07 | 0.59 | 0.45 | 1.51 | 0.30 | 1.00 | 1.00 | 1.00 | 0.70 | 1.31 | 0.54 | 1.05 | 0.99 | 1.06 | 1.81 | 0.53 | 3.44 | 0.60 | 1.70 | 0.35 | 0.88 | 1.25 | 0.70 |
| ITALY | 0.91 | 0.82 | 1.11 | 0.65 | 1.15 | 0.56 | 1.42 | 0.76 | 1.87 | 1.00 | 1.00 | 1.00 | 1.35 | 0.77 | 1.77 | 0.78 | 0.40 | 1.95 | 0.85 | 1.29 | 0.66 | 1.25 | 0.95 | 1.31 |
| AUSTRIA | 0.67 | 1.07 | 0.63 | 0.48 | 1.51 | 0.32 | 0.95 | 1.01 | 0.95 | 0.74 | 1.31 | 0.57 | 1.00 | 1.00 | 1.00 | 0.58 | 0.52 | 1.11 | 0.63 | 1.69 | 0.37 | 0.39 | 1.25 | 0.32 |
| UNITED KINGDOM | 1.16 | 2.03 | 0.57 | 0.82 | 2.87 | 0.29 | 0.55 | 1.90 | 0.29 | 1.28 | 2.49 | 0.51 | 1.73 | 1.91 | 0.90 | 1.00 | 1.00 | 1.00 | 1.09 | 3.22 | 0.34 | 1.60 | 2.38 | 0.67 |
| FRANCE | 1.06 | 0.63 | 1.68 | 0.76 | 0.89 | 0.85 | 1.66 | 0.59 | 2.82 | 1.17 | 0.77 | 1.51 | 1.58 | 0.59 | 2.67 | 0.92 | 0.31 | 2.95 | 1.00 | 1.00 | 1.00 | 1.47 | 0.74 | 1.99 |
| BELGIUM | 0.72 | 0.86 | 0.84 | 0.52 | 1.21 | 0.43 | 1.13 | 0.80 | 1.42 | 0.80 | 1.05 | 0.76 | 2.53 | 0.80 | 3.16 | 0.63 | 0.42 | 1.49 | 0.68 | 1.35 | 0.50 | 1.00 | 1.00 | 1.00 |

Section (b): AVERAGE

| | USA | | | SPAIN | | | GERMANY | | | ITALY | | | AUSTRIA | | | UNITED KINGDOM | | | FRANCE | | | BELGIUM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF |
| USA | 1.00 | 1.00 | 1.00 | 0.45 | 1.13 | 0.40 | 2.06 | 0.93 | 2.21 | 3.78 | 1.12 | 3.38 | 5.80 | 0.85 | 6.80 | 1.27 | 0.78 | 1.63 | 3.36 | 1.06 | 3.17 | 5.35 | 1.06 | 5.05 |
| SPAIN | 2.21 | 0.89 | 2.49 | 1.00 | 1.00 | 1.00 | 4.56 | 0.83 | 5.50 | 8.37 | 0.99 | 8.43 | 12.82 | 0.76 | 16.97 | 2.80 | 0.69 | 4.06 | 7.44 | 0.94 | 7.92 | 11.83 | 0.94 | 12.60 |
| GERMANY | 0.49 | 1.07 | 0.45 | 0.22 | 1.21 | 0.18 | 1.00 | 1.00 | 1.00 | 1.84 | 1.20 | 1.53 | 0.36 | 1.10 | 0.32 | 1.63 | 0.83 | 1.95 | 1.63 | 1.13 | 1.44 | 2.59 | 1.13 | 2.29 |
| ITALY | 0.26 | 0.89 | 0.30 | 0.12 | 1.01 | 0.12 | 0.54 | 0.83 | 0.65 | 1.00 | 1.00 | 1.00 | 1.53 | 0.76 | 2.01 | 0.33 | 0.70 | 0.48 | 0.89 | 0.95 | 0.94 | 1.41 | 0.95 | 1.49 |
| AUSTRIA | 0.17 | 1.17 | 0.15 | 0.08 | 1.32 | 0.06 | 2.81 | 0.91 | 3.09 | 0.65 | 1.31 | 0.50 | 1.00 | 1.00 | 1.00 | 0.22 | 0.91 | 0.24 | 0.58 | 1.24 | 0.47 | 0.07 | 1.24 | 0.06 |
| UNITED KINGDOM | 0.79 | 1.29 | 0.61 | 0.36 | 1.45 | 0.25 | 0.61 | 1.20 | 0.51 | 2.99 | 1.44 | 2.08 | 4.58 | 1.09 | 4.18 | 1.00 | 1.00 | 1.00 | 2.65 | 1.36 | 1.95 | 4.22 | 1.36 | 3.10 |
| FRANCE | 0.30 | 0.94 | 0.31 | 0.13 | 1.06 | 0.13 | 0.61 | 0.88 | 0.69 | 1.13 | 1.06 | 1.06 | 1.72 | 0.80 | 2.14 | 0.38 | 0.73 | 0.51 | 1.00 | 1.00 | 1.00 | 1.59 | 1.00 | 1.59 |
| BELGIUM | 0.19 | 0.94 | 0.20 | 0.08 | 1.06 | 0.08 | 0.39 | 0.88 | 0.44 | 0.71 | 1.06 | 0.67 | 13.65 | 0.80 | 16.97 | 0.24 | 0.74 | 0.32 | 0.63 | 1.00 | 0.63 | 1.00 | 1.00 | 1.00 |

Section (b): WEIGHTED AVERAGE

| | USA | | | SPAIN | | | GERMANY | | | ITALY | | | AUSTRIA | | | UNITED KINGDOM | | | FRANCE | | | BELGIUM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF | M | MC | DF |
| USA | 1.00 | 1.00 | 1.00 | 0.68 | 1.31 | 0.52 | 1.79 | 1.04 | 1.72 | 1.93 | 1.23 | 1.56 | 2.50 | 0.97 | 2.57 | 0.99 | 0.88 | 1.12 | 0.98 | 1.52 | 0.65 | 1.63 | 1.29 | 1.27 |
| SPAIN | 1.46 | 0.76 | 1.93 | 1.00 | 1.00 | 1.00 | 2.62 | 0.79 | 3.30 | 2.83 | 0.94 | 3.01 | 3.66 | 0.74 | 4.94 | 1.44 | 0.67 | 2.15 | 1.44 | 1.16 | 1.24 | 2.39 | 0.98 | 2.44 |
| GERMANY | 0.56 | 0.96 | 0.58 | 0.38 | 1.26 | 0.30 | 1.00 | 1.00 | 1.00 | 1.08 | 1.19 | 0.91 | 0.71 | 1.07 | 0.67 | 1.81 | 0.85 | 2.14 | 0.55 | 1.46 | 0.38 | 0.91 | 1.24 | 0.74 |
| ITALY | 0.52 | 0.81 | 0.64 | 0.35 | 1.06 | 0.33 | 0.93 | 0.84 | 1.10 | 1.00 | 1.00 | 1.00 | 1.29 | 0.79 | 1.64 | 0.51 | 0.71 | 0.72 | 0.51 | 1.23 | 0.41 | 0.85 | 1.04 | 0.81 |
| AUSTRIA | 0.40 | 1.03 | 0.39 | 0.27 | 1.35 | 0.20 | 1.40 | 0.93 | 1.50 | 0.77 | 1.27 | 0.61 | 1.00 | 1.00 | 1.00 | 0.39 | 0.91 | 0.44 | 0.39 | 1.56 | 0.25 | 0.27 | 1.33 | 0.20 |
| UNITED KINGDOM | 1.01 | 1.13 | 0.89 | 0.69 | 1.49 | 0.46 | 0.55 | 1.18 | 0.47 | 1.96 | 1.40 | 1.40 | 2.53 | 1.10 | 2.29 | 1.00 | 1.00 | 1.00 | 1.00 | 1.73 | 0.58 | 1.66 | 1.46 | 1.13 |
| FRANCE | 1.02 | 0.66 | 1.55 | 0.70 | 0.86 | 0.80 | 1.82 | 0.68 | 2.66 | 1.96 | 0.81 | 2.42 | 2.54 | 0.64 | 3.98 | 1.00 | 0.58 | 1.73 | 1.00 | 1.00 | 1.00 | 1.66 | 0.85 | 1.96 |
| BELGIUM | 0.61 | 0.78 | 0.79 | 0.42 | 1.02 | 0.41 | 1.09 | 0.81 | 1.35 | 1.18 | 0.96 | 1.23 | 3.73 | 0.75 | 4.94 | 0.60 | 0.68 | 0.88 | 0.60 | 1.18 | 0.51 | 1.00 | 1.00 | 1.00 |

M: Malmquist Index MC: Relative Efficien DF: DIstance Between frontiers (avalue of 1 when almost all other countries have values greater than one), this is not due so much to a lack of efficiency in its banking system but, instead, to a great technological disadvantage (a value of 1 when all other countries have values much lower than 1). On the opposite side, the UK performs relatively better on the technical aspect (0.46) than on efficiency terms (1.49). A similar decomposition is found in Austria and Germany, and to a lesser degree in the US and Italy. France, on the other hand, shows a more compensated decomposition of the productivity Malmquist index. Any two countries in the sample can be compared in table 2 under each of the three ways of measuring the aggregate behavior of the sector.

Figure 3 and 4 show the results of table 2 corresponding to the medium bank and the weighted average of banks. The different decomposition by country of the Malmquist index into the two components of catching up and technological effects appears clearly in the graphs.

On the whole, the Spanish Banking System, although quite efficient, shows a very low degree of productivity. At least two reasons might explain such a poor performance. First, the measurement of output does not include the set of services (like the convenience of the proximity to the customer) provided by a dense network of branches throughout the country. Second, the fact that banks keeping a high level of capitalization -through the use of their own resources- may not signify the excessive use of one productive factor but, on the contrary, the provision of a good characteristic, namely, solvency. In addition to this, the possibility of using data on labor employment measured in physical units as opposed to personnel expenses, led us to the completion of an additional exercise consisting in constructing a common efficiency frontier for a subsample of the eight countries under consideration.

We did not have available data on the number of branches and the number of employees for the whole sample. These data restrictions reduced our sample to 52 banks from Spain, 5 from Austria, 5 from France, 6 from Gernany, 9 from Italy, 7 from UK, 24 from the US and 15 from Belgium. This subsample, although made up in some countries by a reduces number of banks, includes the main institutions, that is, those banks which might compete internationally.

The interest in carrying out this exercise lies in how some environmental factors (branch network and solvency ratios) imposed by competition and risk may influence relative efficiency. We try to correct for these factors as in Pastor, Pérez and Quesada (1994).

Figure 3
Decomposition of the Malmquist Index
Medium Bank

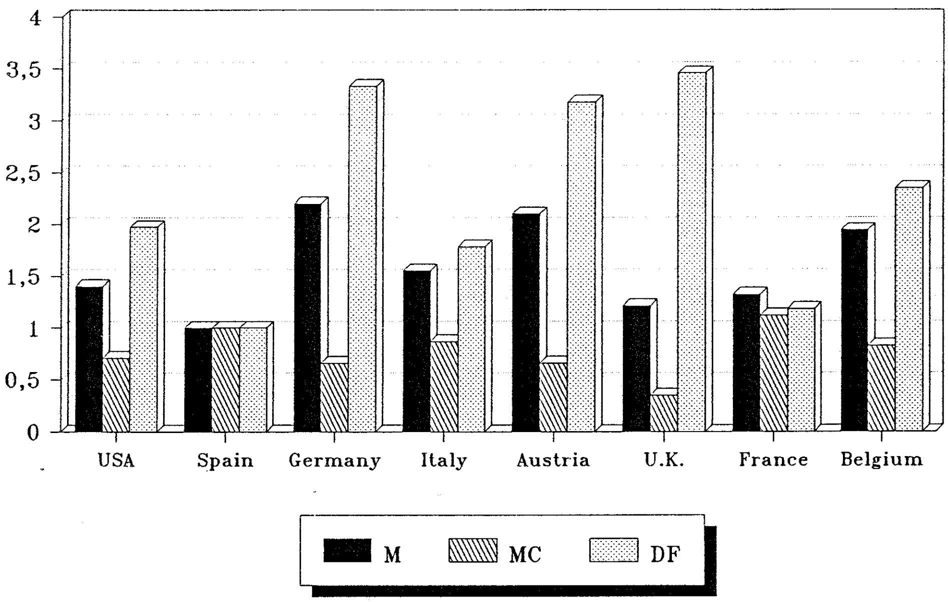
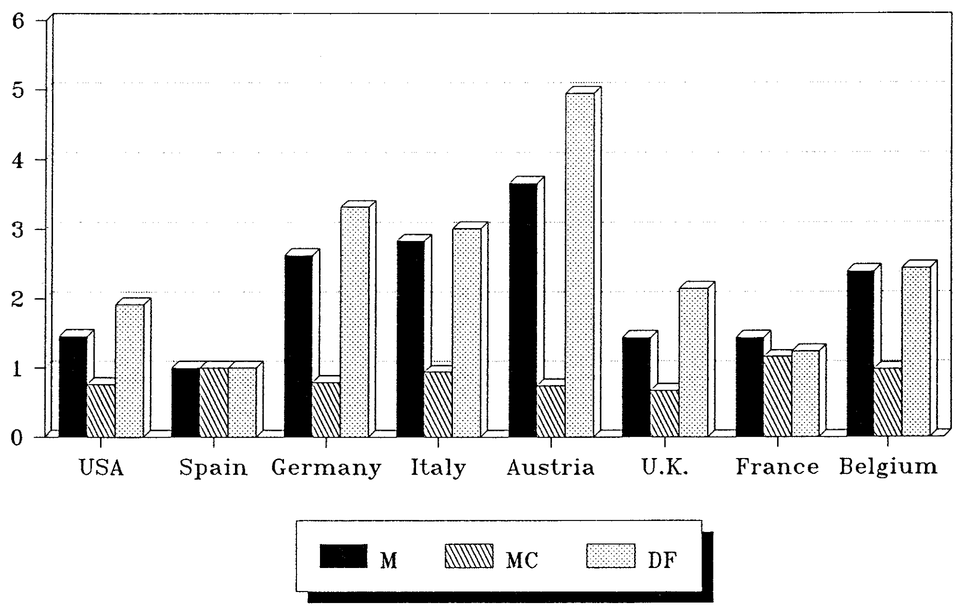



Figure 4
Decomposition of the Malmquist Index
Weighted Average by total assets



By constructing a common efficient frontier for this subsample and computing an efficiency index by countries -without introducing any further restriction on the number of branches or the use of their own resources- we find the relative position of all banking systems (see first column on table 3). Spain appears above the UK and the USA, and the Belgium and Austrian systems appear as the most efficient ones. The change in results is due either to the change in the size and composition of the sample or to the use of physical units in measuring labor. In order to analyze the efficiency of the services provided by the branch network, we add a restriction to the optimization problem. More specifically, for each bank in the sample we compute the maximum reduction in the use of inputs that figure 1 and 2 could obtain when using the most efficient linear combination of one or more efficient banks which requires, additionally, the provision of a number of branches at least as large as the number of branches of the bank under consideration. Column 2 in table 3 presents the results. It is well known that adding a restriction increases (or leaves unaltered) the efficiency of each and every bank in the sample, but it is interesting to emphasize the spectacular improvement of the relative efficiency of the Spanish banks. Only the Belgian system also shows a significant, although smaller, improvement. The efficiency of all other banking systems remains quite stable.

The last correction introduced into the efficiency analysis is the use of capital as a way of improving solvency ratios. A similar exercise carried out by adding the corresponding restriction for the use of capital gives the results shown on column 3 in table 3. This time, this restriction does not change things for the Spanish or the Belgium banking systems but substantially improves the relative efficiency of the banking sector in France and, to a lesser degree, that of Italy and the US. The last row of the table reports the standard deviation of the efficiency values under the three hypotheses: no correction, correction for the number of branches, and correction for both the number of branches and the capital ratio. The values show a reduction in the degree of dispersion of the efficiency values, meaning a more homogeneous set of institutions once we correct for factors that may be determined, or at least conditioned, by the economic environment, and not simply by bank managerial decisions.

**TABLE 3**
**EFFICIENCY SCORES**

| | Efficiency Score | Efficiency Score (Branches) | Efficiency Score (Branches & Equity) |
|---|---|---|---|
| USA | 0.338 | 0.351 | 0.394 |
| SPAIN | 0.399 | 0.632 | 0.637 |
| GERMANY | 0.616 | 0.631 | 0.635 |
| ITALY | 0.517 | 0.558 | 0.596 |
| AUSTRIA | 0.733 | 0.753 | 0.758 |
| UK | 0.333 | 0.375 | 0.375 |
| FRANCE | 0.535 | 0.555 | 0.662 |
| BELGIUM | 0.787 | 0.842 | 0.843 |
| Standar Dev. | **0.1603** | **0.1577** | **0.1507** |

Table 4 contains the efficiency values corresponding to each of the 116 commercial banks, in decreasing order of the uncorrected measure of efficiency (see column 1). Four out of the six fully efficient banks, and seven out of the ten most efficient ones are from Belgium. Austrian, German and Italian banks (in this order) are located in the top half of the table, while those of the US and UK are in the lower part. Column 2 contains the efficiency values when we add the restriction on the number of branches. All the fully efficient banks remain fully efficient and four more from Austria, Belgium and Spain become fully efficient. The improvement of the efficiency of the weighted average of the Spanish banks can be seen again bank by bank. Their efficiency scores improve in a very significant way. For example Banco Gallego jumps from the 49th position in the ranking to the top of the list.

Column 3 contains the double correction of efficiency for branches and for the use of capital, an indicator of the degree of bank solvency. Table 5 reorders the banks using their corrected efficiency. The improvement of the relative position of the Spanish banks is clear by comparing tables 4 and 5. The same can be said looking at graphs 3-5, where we plot the relationship between efficiency and size of all the banks in the sample.

## TABLE 4 (i)
## EFFICIENCY RANKING

| Country | Rank | Bank's names | Total Assets | Efficiency | Efficiency (Branches) | Efficiency (Bran. & Equity) |
|---|---|---|---|---|---|---|
| GERMANY | 1 | BAYERISCHE VEREINSBANK | 10,347 | 1.000 | 1.000 | 1.000 |
| BELGIUM | 2 | CREDIT COMMUNAL DE BELGIQUE | 7,091 | 1.000 | 1.000 | 1.000 |
| AUSTRIA | 1 | GIROCREDIT BANK AKTIENGESELLSCHAFT DER | 3,200 | 1.000 | 1.000 | 1.000 |
| BELGIUM | 2 | SOCIETE NATIONALE DE CREDIT A | 1,798 | 1.000 | 1.000 | 1.000 |
| BELGIUM | 3 | CREDIT LYONNAIS BELGIUM | 1,446 | 1.000 | 1.000 | 1.000 |
| BELGIUM | 4 | BANQUE PARIBAS BELGIQUE | 1,442 | 1.000 | 1.000 | 1.000 |
| AUSTRIA | 5 | BANK FUR ARBEIT UND WIRTSCHAFT | 2,065 | 0.996 | 1.000 | 1.000 |
| BELGIUM | 6 | KREDIETBANK | 6,477 | 0.918 | 1.000 | 1.000 |
| BELGIUM | 7 | BANQUE INDOSUEZ BELGIQUE | 479 | 0.908 | 0.908 | 0.957 |
| BELGIUM | 8 | BANQUE COMMERCIALE DE BRUXELLES | 22 | 0.898 | 0.898 | 0.898 |
| GERMANY | 9 | BERLINER BANK (C.) | 4,335 | 0.829 | 0.829 | 0.851 |
| USA | 10 | REPUBLIC NB OF NY < REPUBLIC NEW YORK | 3,423 | 0.766 | 0.766 | 0.766 |
| ITALY | 11 | BANCO DI NAPOLI | 8,580 | 0.725 | 0.797 | 0.815 |
| BELGIUM | 12 | GENERALE BANK | 8,564 | 0.709 | 0.804 | 0.804 |
| ITALY | 13 | ISTITUTO BANCARIO SAN PAOLO DI TORINO | 11,866 | 0.645 | 0.678 | 0.750 |
| SPAIN | 14 | BANCO EXTERIOR DE ESPANA | 3,816 | 0.641 | 0.716 | 0.716 |
| AUSTRIA | 15 | BANK AUSTRIA AG | 5,461 | 0.635 | 0.645 | 0.647 |
| AUSTRIA | 16 | CREDITANSTALT-BANKVEREIN | 5,159 | 0.616 | 0.639 | 0.654 |
| FRANCE | 17 | CREDIT COMMERCIAL DE FRANCE (C.) | 7,045 | 0.607 | 0.607 | 0.795 |
| GERMANY | 18 | COMMERZBANK | 12,158 | 0.603 | 0.621 | 0.621 |
| UK | 19 | BANK OF SCOTLAND (C.) | 4,738 | 0.595 | 0.619 | 0.619 |
| FRANCE | 20 | CREDIT LYONNAIS (C.) | 40,348 | 0.582 | 0.582 | 0.756 |
| BELGIUM | 21 | CREDIT GENERAL SA DE BANQUE | 592 | 0.574 | 0.614 | 0.614 |
| ITALY | 22 | BANCO DI SICILIA | 4,198 | 0.569 | 0.624 | 0.646 |
| SPAIN | 23 | BANCO DEL COMERCIO | 682 | 0.568 | 0.697 | 0.699 |
| GERMANY | 24 | DRESDNER BANK | 14,111 | 0.528 | 0.551 | 0.552 |
| FRANCE | 25 | SOCIETE GENERALE (C.) | 29,556 | 0.527 | 0.539 | 0.644 |
| GERMANY | 26 | BFG BANK (C.) | 4,078 | 0.526 | 0.526 | 0.571 |
| FRANCE | 27 | BANQUE NATIONALE DE PARIS (C.) | 32,643 | 0.512 | 0.573 | 0.600 |
| ITALY | 28 | CREDITO ITALIANO | 7,911 | 0.505 | 0.536 | 0.536 |
| BELGIUM | 29 | BANQUE BRUXELLES LAMBERT | 7,608 | 0.490 | 0.564 | 0.564 |
| GERMANY | 30 | DEUTSCHE BANK | 23,408 | 0.484 | 0.503 | 0.503 |
| SPAIN | 31 | B.N.P. ESPANA | 395 | 0.458 | 0.560 | 0.560 |
| SPAIN | 32 | BANCO COMERCIAL TRANSATLANTICO | 696 | 0.451 | 0.557 | 0.557 |
| ITALY | 33 | BANCA NAZIONALE DELL'AGRICOLTURA | 3,088 | 0.447 | 0.486 | 0.493 |
| SPAIN | 34 | BANCO CENTRAL HISPANO AMERICANO COMBINEI | 8,295 | 0.445 | 0.708 | 0.708 |
| USA | 35 | NBD BANK, NA < NBD BANCORP INC | 2,782 | 0.444 | 0.509 | 0.509 |
| SPAIN | 36 | BANCO DEL DESARROLLO ECONOMICO ESPANOL | 41 | 0.442 | 0.482 | 0.786 |
| ITALY | 37 | BANCA COMMERCIALE ITALIANA | 8,985 | 0.438 | 0.471 | 0.471 |
| ITALY | 38 | CARIPLO | 9,700 | 0.433 | 0.483 | 0.599 |
| UK | 39 | ROYAL BANK OF SCOTLAND GROUP (C.) | 6,090 | 0.430 | 0.460 | 0.460 |
| ITALY | 40 | BANCA NAZIONALE DEL LAVORO | 9,120 | 0.421 | 0.433 | 0.449 |
| SPAIN | 41 | BANKINTER | 1,221 | 0.416 | 0.618 | 0.634 |
| USA | 42 | CHEMICAL BANK < CHEMICAL BANKING CORP | 12,493 | 0.410 | 0.410 | 0.459 |
| USA | 43 | MORGAN GUARANTY TC OF NY < MORGAN, J.P. | 8,793 | 0.405 | 0.405 | 0.405 |
| SPAIN | 44 | BANCO BILBAO VIZCAYA | 7,530 | 0.401 | 0.580 | 0.580 |
| SPAIN | 45 | BANCO DE SIMEON | 107 | 0.383 | 0.742 | 0.742 |
| SPAIN | 46 | BANCO DE FOMENTO | 312 | 0.382 | 0.651 | 0.651 |
| SPAIN | 47 | BANCO GALLEGO | 147 | 0.371 | 1.000 | 1.000 |
| USA | 48 | BANK OF NEW YORK < BANK OF NEW YORK, INC | 4,200 | 0.371 | 0.396 | 0.396 |
| SPAIN | 49 | BANCO SANTANDER | 5,271 | 0.370 | 0.610 | 0.631 |
| SPAIN | 50 | BANCO DE GALICIA | 183 | 0.367 | 0.793 | 0.794 |
| USA | 51 | CLYDESDALE BANK (C.) | 1,101 | 0.366 | 0.486 | 0.486 |
| SPAIN | 52 | BANCO DE VASCONIA | 125 | 0.365 | 0.874 | 0.874 |
| SPAIN | 53 | BANCO DE CASTILLA | 252 | 0.365 | 0.840 | 0.851 |
| SPAIN | 54 | BANCO POPULAR ESPANOL | 1,672 | 0.364 | 0.690 | 0.691 |

## TABLE 4 (ii)
## EFFICIENCY RANKING

| Country | Rank | Bank's names | Total Assets | Efficiency | Efficiency (Branches) | Efficiency (Bran. & Equity) |
|---|---|---|---|---|---|---|
| SPAIN | 57 | BANCO EUROPEO DE FINANZAS | 30 | 0.363 | 0.363 | 0.363 |
| SPAIN | 58 | BANCO DE GESTION E INVERSION FINANCIERA | 66 | 0.357 | 0.493 | 0.493 |
| SPAIN | 59 | BANCO DE ALICANTE SA | 126 | 0.357 | 0.760 | 0.760 |
| SPAIN | 60 | BANCO DE VITORIA | 147 | 0.355 | 0.678 | 0.680 |
| FRANCE | 61 | BANQUE INDOSUEZ (C.) | 7,593 | 0.353 | 0.353 | 0.377 |
| SPAIN | 62 | BANCO MERIDIONAL | 112 | 0.349 | 0.862 | 0.862 |
| SPAIN | 63 | BANCO DE CREDITO Y AHORRO | 123 | 0.343 | 0.673 | 0.673 |
| SPAIN | 64 | BANCO DE ANDALUCIA | 338 | 0.342 | 0.732 | 0.732 |
| UK | 65 | NATIONAL WESTMINSTER BANK (C.) | 24,848 | 0.340 | 0.379 | 0.379 |
| AUSTRIA | 66 | BARCLAYS BANK, S. A. E. | 670 | 0.337 | 0.576 | 0.576 |
| UK | 67 | BARCLAYS (C.) | 25,536 | 0.336 | 0.362 | 0.364 |
| SPAIN | 68 | BANCO DE MURCIA | 56 | 0.335 | 0.859 | 0.859 |
| USA | 69 | CHASE MANHATTAN BANK NA < CHASE | 8,534 | 0.333 | 0.334 | 0.334 |
| SPAIN | 70 | BANCO DE VALENCIA | 285 | 0.329 | 0.791 | 0.796 |
| SPAIN | 71 | BANCO PASTOR | 969 | 0.324 | 0.578 | 0.578 |
| SPAIN | 72 | BANCO ESPANOL DE CREDITO | 4,912 | 0.323 | 0.620 | 0.624 |
| USA | 73 | BANKERS TRUST COMPANY < BANKERS TRUST | 6,396 | 0.319 | 0.319 | 0.825 |
| SPAIN | 74 | BANCO DE MADRID | 451 | 0.315 | 0.617 | 0.617 |
| SPAIN | 75 | BANCO DE GRANADA | 135 | 0.313 | 0.942 | 0.942 |
| SPAIN | 76 | BANCO DE CREDITO CANARIO | 36 | 0.309 | 0.712 | 0.712 |
| SPAIN | 77 | BANCO SABADELL | 1,144 | 0.307 | 0.452 | 0.452 |
| SPAIN | 78 | BANCO DE EUROPA | 77 | 0.306 | 0.744 | 0.744 |
| SPAIN | 79 | BANCO ATLANTICO | 861 | 0.306 | 0.458 | 0.458 |
| SPAIN | 80 | BANCO GUIPUZCOANO | 371 | 0.304 | 0.554 | 0.554 |
| USA | 81 | CITIBANK NA < CITICORP | 18,780 | 0.301 | 0.301 | 0.312 |
| USA | 82 | FIRST UNION NB FL < FIRST UNION CORP | 3,184 | 0.299 | 0.339 | 0.339 |
| SPAIN | 83 | BANCA CATALANA | 812 | 0.295 | 0.559 | 0.559 |
| USA | 84 | FIRST NB OF CHICAGO < FIRST CHICAGO CORP | 3,650 | 0.294 | 0.294 | 0.375 |
| SPAIN | 85 | BANCO URQUIJO | 546 | 0.290 | 0.453 | 0.453 |
| SPAIN | 86 | BANCO DE CREDITO BALEAR | 88 | 0.290 | 0.872 | 0.888 |
| USA | 87 | YORKSHIRE BANK (C.) | 748 | 0.288 | 0.404 | 0.404 |
| BELGIUM | 88 | BANKUNIE | 62 | 0.285 | 0.680 | 0.680 |
| SPAIN | 89 | BANCAPITAL | 48 | 0.275 | 0.275 | 0.280 |
| BELGIUM | 90 | BANK VAN ROESELARE | 276 | 0.274 | 0.338 | 0.338 |
| UK | 91 | MIDLAND (C.) | 10,551 | 0.269 | 0.328 | 0.328 |
| BELGIUM | 92 | BANK J. VAN BREDA & CO. | 141 | 0.269 | 0.286 | 0.286 |
| SPAIN | 93 | BANCO NATWEST ESPANA | 326 | 0.268 | 0.444 | 0.444 |
| SPAIN | 94 | BANCO ZARAGOZANO | 541 | 0.267 | 0.591 | 0.603 |
| SPAIN | 95 | BANCO DIRECTO | 27 | 0.262 | 0.262 | 0.262 |
| USA | 96 | BANK OF AMERICA NT & SA < BANKAMERICA | 15,296 | 0.261 | 0.292 | 0.292 |
| SPAIN | 97 | BANCO DE EXTREMADURA | 51 | 0.260 | 1.000 | 1.000 |
| UK | 98 | LLOYDS BANK (C.) | 9,527 | 0.252 | 0.313 | 0.313 |
| USA | 99 | MELLON BANK NA < MELLON BANK CORP | 3,392 | 0.251 | 0.275 | 0.275 |
| SPAIN | 100 | BANCO INDUSTRIAL DEL MEDITERRANEO | 26 | 0.251 | 0.598 | 0.633 |
| ITALY | 101 | BANCO AMBROSIANO VENETO | 3,048 | 0.250 | 0.343 | 0.377 |
| USA | 102 | FIRST NB OF BOSTON < BANK OF BOSTON CORP | 2,928 | 0.249 | 0.267 | 0.267 |
| SPAIN | 103 | ABEL MATUTES TORRES BANCO DE IBIZA | 59 | 0.247 | 0.693 | 0.772 |
| SPAIN | 104 | BANCO DE JEREZ | 72 | 0.246 | 0.681 | 0.681 |
| SPAIN | 105 | BANCO HERRERO | 322 | 0.244 | 0.522 | 0.531 |
| USA | 106 | NATIONSBANK OF TEXAS NA < NATIONSBANK | 4,033 | 0.239 | 0.251 | 0.251 |
| SPAIN | 107 | BANC CATALA DE CREDIT | 144 | 0.239 | 0.543 | 0.546 |
| BELGIUM | 108 | BANQUE NAGELMACKERS | 141 | 0.230 | 0.337 | 0.337 |
| SPAIN | 109 | BANCO DE ASTURIAS SA | 76 | 0.225 | 0.738 | 0.738 |
| SPAIN | 110 | BANCO INVERSION | 25 | 0.221 | 0.323 | 0.355 |
| SPAIN | 111 | BANKOA | 63 | 0.213 | 0.497 | 0.503 |
| UK | 112 | TSB GROUP (C.) | 4,871 | 0.199 | 0.303 | 0.303 |
| BELGIUM | 113 | EUROPABANK | 45 | 0.189 | 0.235 | 0.235 |
| SPAIN | 114 | BANCO LUSO ESPANOL | 61 | 0.181 | 0.296 | 0.296 |
| USA | 115 | CO-OPERATIVE BANK (C.) | 535 | 0.165 | 0.212 | 0.212 |
| SPAIN | 116 | BANCO MAPFRE | 73 | 0.132 | 0.500 | 0.534 |

## 10. CONCLUDING REMARKS

We have compared the efficiency of different European and US banking systems. We find the values of the efficiency parameters for different countries to be quite different. France, Spain and Belgium appear as the countries with the most efficient banking systems, whereas the UK, Austria and Germany show the lowest efficiency levels. We have found some evidence of scale inefficiencies in the Austrian, German and US banking systems and almost no trace of scale inefficiency in France and the UK.

As for productivity, Malmquist indexes of comparison show ratios of productivity that reach values of up to 4 to 1. More specifically, the set of Austrian banks could reduce up to four times their use of factors and still reach the same level of output as the Spanish banks. Banking systems can be classified by productivity into two groups: Austria, Italy, Germany and Belgium belong to the more productive one, and the USA, the UK, France and Spain to the less productive one. By decomposing the Malmquist productivity index into the two components of catching up and distance to the frontier we find banking systems with very different combinations of both factors. Some countries (Spain, France) have banking systems showing, simultaneously, relatively high efficiency and a relatively low level of technology, whereas other countries (Austria, Germany) combine a very productive technology with a low level of efficiency.

Finally, for a subsample of banks belonging to the same group of countries, using real as opposed to nominal quantities of labor, we introduce 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. Once we take into consideration these other features in computing efficiency, we find significant changes in the ranking of particular banks by efficiency. In particular, Spanish banks perform better when branch services are included in the analysis.

**TABLE 5 (i)**
**EFFICIENCY RANKING**

| Country | Rank | Bank's names | Total Assets | Efficiency | Efficiency (Branches) | Efficiency (Bran. & Equity) |
|---|---|---|---|---|---|---|
| GERMANY | 1 | BAYERISCHE VEREINSBANK | 10,347 | 1.000 | 1.000 | 1.000 |
| BELGIUM | 2 | CREDIT COMMUNAL DE BELGIQUE | 7,091 | 1.000 | 1.000 | 1.000 |
| BELGIUM | 3 | KREDIETBANK | 6,477 | 0.918 | 1.000 | 1.000 |
| AUSTRIA | 4 | BANK FUR ARBEIT UND WIRTSCHAFT | 2,065 | 0.996 | 1.000 | 1.000 |
| BELGIUM | 5 | SOCIETE NATIONALE DE CREDIT A | 1,798 | 1.000 | 1.000 | 1.000 |
| BELGIUM | 6 | CREDIT LYONNAIS BELGIUM | 1,446 | 1.000 | 1.000 | 1.000 |
| BELGIUM | 7 | BANQUE PARIBAS BELGIQUE | 1,442 | 1.000 | 1.000 | 1.000 |
| SPAIN | 8 | BANCO GALLEGO | 147 | 0.371 | 1.000 | 1.000 |
| SPAIN | 9 | BANCO DE EXTREMADURA | 51 | 0.260 | 1.000 | 1.000 |
| AUSTRIA | 10 | GIROCREDIT BANK AKTIENGESELLSCHAFT DER | 3,200 | 1.000 | 1.000 | 1.000 |
| BELGIUM | 11 | BANQUE INDOSUEZ BELGIQUE | 479 | 0.908 | 0.908 | 0.957 |
| SPAIN | 12 | BANCO DE GRANADA | 135 | 0.313 | 0.942 | 0.942 |
| BELGIUM | 13 | BANQUE COMMERCIALE DE BRUXELLES | 22 | 0.898 | 0.898 | 0.898 |
| SPAIN | 14 | BANCO DE CREDITO BALEAR | 88 | 0.290 | 0.872 | 0.888 |
| SPAIN | 15 | BANCO DE VASCONIA | 125 | 0.365 | 0.874 | 0.874 |
| SPAIN | 16 | BANCO MERIDIONAL | 112 | 0.349 | 0.862 | 0.862 |
| SPAIN | 17 | BANCO DE MURCIA | 56 | 0.335 | 0.859 | 0.859 |
| SPAIN | 18 | BANCO DE CASTILLA | 252 | 0.365 | 0.840 | 0.851 |
| GERMANY | 19 | BERLINER BANK (C.) | 4,335 | 0.829 | 0.829 | 0.851 |
| USA | 20 | BANKERS TRUST COMPANY < BANKERS TRUST | 6,396 | 0.319 | 0.319 | 0.825 |
| ITALY | 21 | BANCO DI NAPOLI | 8,580 | 0.725 | 0.797 | 0.815 |
| BELGIUM | 22 | GENERALE BANK | 8,564 | 0.709 | 0.804 | 0.804 |
| SPAIN | 23 | BANCO DE VALENCIA | 285 | 0.329 | 0.791 | 0.796 |
| FRANCE | 24 | CREDIT COMMERCIAL DE FRANCE (C.) | 7,045 | 0.607 | 0.607 | 0.795 |
| SPAIN | 25 | BANCO DE GALICIA | 183 | 0.367 | 0.793 | 0.794 |
| SPAIN | 26 | BANCO DEL DESARROLLO ECONOMICO ESPANOL | 41 | 0.442 | 0.482 | 0.786 |
| SPAIN | 27 | ABEL MATUTES TORRES BANCO DE IBIZA | 59 | 0.247 | 0.693 | 0.772 |
| USA | 28 | REPUBLIC NB OF NY < REPUBLIC NEW YORK | 3,423 | 0.766 | 0.766 | 0.766 |
| SPAIN | 29 | BANCO DE ALICANTE SA | 126 | 0.357 | 0.760 | 0.760 |
| FRANCE | 30 | CREDIT LYONNAIS (C.) | 40,348 | 0.582 | 0.582 | 0.756 |
| ITALY | 31 | ISTITUTO BANCARIO SAN PAOLO DI TORINO | 11,866 | 0.645 | 0.678 | 0.750 |
| SPAIN | 32 | BANCO DE EUROPA | 77 | 0.306 | 0.744 | 0.744 |
| SPAIN | 33 | BANCO DE SIMEON | 107 | 0.383 | 0.742 | 0.742 |
| SPAIN | 34 | BANCO DE ASTURIAS SA | 76 | 0.225 | 0.738 | 0.738 |
| SPAIN | 35 | BANCO DE ANDALUCIA | 338 | 0.342 | 0.732 | 0.732 |
| SPAIN | 36 | BANCO EXTERIOR DE ESPANA | 3,816 | 0.641 | 0.716 | 0.716 |
| SPAIN | 37 | BANCO DE CREDITO CANARIO | 36 | 0.309 | 0.712 | 0.712 |
| SPAIN | 38 | BANCO CENTRAL HISPANO AMERICANO COMBINEI | 8,295 | 0.445 | 0.708 | 0.708 |
| SPAIN | 39 | BANCO DEL COMERCIO | 682 | 0.568 | 0.697 | 0.699 |
| SPAIN | 40 | BANCO POPULAR ESPANOL | 1,672 | 0.364 | 0.690 | 0.691 |
| SPAIN | 41 | BANCO DE JEREZ | 72 | 0.246 | 0.681 | 0.681 |
| SPAIN | 42 | BANCO DE VITORIA | 147 | 0.355 | 0.678 | 0.680 |
| BELGIUM | 43 | BANKUNIE | 62 | 0.285 | 0.680 | 0.680 |
| SPAIN | 44 | BANCO DE CREDITO Y AHORRO | 123 | 0.343 | 0.673 | 0.673 |
| AUSTRIA | 45 | CREDITANSTALT-BANKVEREIN | 5,159 | 0.616 | 0.639 | 0.654 |
| SPAIN | 46 | BANCO DE FOMENTO | 312 | 0.382 | 0.651 | 0.651 |
| AUSTRIA | 47 | BANK AUSTRIA AG | 5,461 | 0.635 | 0.645 | 0.647 |
| ITALY | 48 | BANCO DI SICILIA | 4,198 | 0.569 | 0.624 | 0.646 |
| FRANCE | 49 | SOCIETE GENERALE (C.) | 29,556 | 0.527 | 0.539 | 0.644 |
| SPAIN | 50 | BANKINTER | 1,221 | 0.416 | 0.618 | 0.634 |
| SPAIN | 51 | BANCO INDUSTRIAL DEL MEDITERRANEO | 26 | 0.251 | 0.598 | 0.633 |
| SPAIN | 52 | BANCO SANTANDER | 5,271 | 0.370 | 0.610 | 0.631 |
| SPAIN | 53 | BANCO ESPANOL DE CREDITO | 4,912 | 0.323 | 0.620 | 0.624 |
| GERMANY | 54 | COMMERZBANK | 12,158 | 0.603 | 0.621 | 0.621 |
| UK | 55 | BANK OF SCOTLAND (C.) | 4,738 | 0.595 | 0.619 | 0.619 |
| SPAIN | 56 | BANCO DE MADRID | 451 | 0.315 | 0.617 | 0.617 |
| BELGIUM | 57 | CREDIT GENERAL SA DE BANQUE | 592 | 0.574 | 0.614 | 0.614 |
| SPAIN | 58 | BANCO ZARAGOZANO | 541 | 0.267 | 0.591 | 0.603 |
| FRANCE | 59 | BANQUE NATIONALE DE PARIS (C.) | 32,643 | 0.512 | 0.573 | 0.600 |
| ITALY | 60 | CARIPLO | 9,700 | 0.433 | 0.483 | 0.599 |
| SPAIN | 61 | BANCO BILBAO VIZCAYA | 7,530 | 0.401 | 0.580 | 0.580 |

TABLE 5 (ii)
EFFICIENCY RANKING

| Country | Rank | Bank's names | Total Assets | Efficiency | Efficiency (Branches) | Efficiency (Bran. & Equity) |
|---|---|---|---|---|---|---|
| SPAIN | 62 | BANCO PASTOR | 969 | 0.324 | 0.578 | 0.578 |
| AUSTRIA | 63 | BARCLAYS BANK, S. A. E. | 670 | 0.337 | 0.576 | 0.576 |
| GERMANY | 64 | BFG BANK (C.) | 4,078 | 0.526 | 0.526 | 0.571 |
| BELGIUM | 65 | BANQUE BRUXELLES LAMBERT | 7,608 | 0.490 | 0.564 | 0.564 |
| SPAIN | 66 | B.N.P. ESPANA | 395 | 0.458 | 0.560 | 0.560 |
| SPAIN | 67 | BANCA CATALANA | 812 | 0.295 | 0.559 | 0.559 |
| SPAIN | 68 | BANCO COMERCIAL TRANSATLANTICO | 696 | 0.451 | 0.557 | 0.557 |
| SPAIN | 69 | BANCO GUIPUZCOANO | 371 | 0.304 | 0.554 | 0.554 |
| GERMANY | 70 | DRESDNER BANK | 14,111 | 0.528 | 0.551 | 0.552 |
| SPAIN | 71 | BANC CATALA DE CREDIT | 144 | 0.239 | 0.543 | 0.546 |
| ITALY | 72 | CREDITO ITALIANO | 7,911 | 0.505 | 0.536 | 0.536 |
| SPAIN | 73 | BANCO MAPFRE | 73 | 0.132 | 0.500 | 0.534 |
| SPAIN | 74 | BANCO HERRERO | 322 | 0.244 | 0.522 | 0.531 |
| USA | 75 | NBD BANK, NA < NBD BANCORP INC | 2,782 | 0.444 | 0.509 | 0.509 |
| SPAIN | 76 | BANKOA | 63 | 0.213 | 0.497 | 0.503 |
| GERMANY | 77 | DEUTSCHE BANK | 23,408 | 0.484 | 0.503 | 0.503 |
| SPAIN | 78 | BANCO DE GESTION E INVERSION FINANCIERA | 66 | 0.357 | 0.493 | 0.493 |
| ITALY | 79 | BANCA NAZIONALE DELL'AGRICOLTURA | 3,088 | 0.447 | 0.486 | 0.493 |
| USA | 80 | CLYDESDALE BANK (C.) | 1,101 | 0.366 | 0.486 | 0.486 |
| ITALY | 81 | BANCA COMMERCIALE ITALIANA | 8,985 | 0.438 | 0.471 | 0.471 |
| UK | 82 | ROYAL BANK OF SCOTLAND GROUP (C.) | 6,090 | 0.430 | 0.460 | 0.460 |
| USA | 83 | CHEMICAL BANK < CHEMICAL BANKING CORP | 12,493 | 0.410 | 0.410 | 0.459 |
| SPAIN | 84 | BANCO ATLANTICO | 861 | 0.306 | 0.458 | 0.458 |
| SPAIN | 85 | BANCO URQUIJO | 546 | 0.290 | 0.453 | 0.453 |
| SPAIN | 86 | BANCO SABADELL | 1,144 | 0.307 | 0.452 | 0.452 |
| ITALY | 87 | BANCA NAZIONALE DEL LAVORO | 9,120 | 0.421 | 0.433 | 0.449 |
| SPAIN | 88 | BANCO NATWEST ESPANA | 326 | 0.268 | 0.444 | 0.444 |
| USA | 89 | MORGAN GUARANTY TC OF NY < MORGAN, J.P. | 8,793 | 0.405 | 0.405 | 0.405 |
| USA | 90 | YORKSHIRE BANK (C.) | 748 | 0.288 | 0.404 | 0.404 |
| USA | 91 | BANK OF NEW YORK < BANK OF NEW YORK, INC | 4,200 | 0.371 | 0.396 | 0.396 |
| UK | 92 | NATIONAL WESTMINSTER BANK (C.) | 24,848 | 0.340 | 0.379 | 0.379 |
| ITALY | 93 | BANCO AMBROSIANO VENETO | 3,048 | 0.250 | 0.343 | 0.377 |
| FRANCE | 94 | BANQUE INDOSUEZ (C.) | 7,593 | 0.353 | 0.353 | 0.377 |
| USA | 95 | FIRST NB OF CHICAGO < FIRST CHICAGO CORP | 3,650 | 0.294 | 0.294 | 0.375 |
| UK | 96 | BARCLAYS (C.) | 25,536 | 0.336 | 0.362 | 0.364 |
| SPAIN | 97 | BANCO EUROPEO DE FINANZAS | 30 | 0.363 | 0.363 | 0.363 |
| SPAIN | 98 | BANCO INVERSION | 25 | 0.221 | 0.323 | 0.355 |
| USA | 99 | FIRST UNION NB FL < FIRST UNION CORP | 3,184 | 0.299 | 0.339 | 0.339 |
| BELGIUM | 100 | BANK VAN ROESELARE | 276 | 0.274 | 0.338 | 0.338 |
| BELGIUM | 101 | BANQUE NAGELMACKERS | 141 | 0.230 | 0.337 | 0.337 |
| USA | 102 | CHASE MANHATTAN BANK NA < CHASE | 8,534 | 0.333 | 0.334 | 0.334 |
| UK | 103 | MIDLAND (C.) | 10,551 | 0.269 | 0.328 | 0.328 |
| UK | 104 | LLOYDS BANK (C.) | 9,527 | 0.252 | 0.313 | 0.313 |
| USA | 105 | CITIBANK NA < CITICORP | 18,780 | 0.301 | 0.301 | 0.312 |
| UK | 106 | TSB GROUP (C.) | 4,871 | 0.199 | 0.303 | 0.303 |
| SPAIN | 107 | BANCO LUSO ESPANOL | 61 | 0.181 | 0.296 | 0.296 |
| USA | 108 | BANK OF AMERICA NT & SA < BANKAMERICA | 15,296 | 0.261 | 0.292 | 0.292 |
| BELGIUM | 109 | BANK J. VAN BREDA & CO. | 141 | 0.269 | 0.286 | 0.286 |
| SPAIN | 110 | BANCAPITAL | 48 | 0.275 | 0.275 | 0.280 |
| USA | 111 | MELLON BANK NA < MELLON BANK CORP | 3,392 | 0.251 | 0.275 | 0.275 |
| USA | 112 | FIRST NB OF BOSTON < BANK OF BOSTON CORP | 2,928 | 0.249 | 0.267 | 0.267 |
| SPAIN | 113 | BANCO DIRECTO | 27 | 0.262 | 0.262 | 0.262 |
| USA | 114 | NATIONSBANK OF TEXAS NA < NATIONSBANK | 4,033 | 0.239 | 0.251 | 0.251 |
| BELGIUM | 115 | EUROPABANK | 45 | 0.189 | 0.235 | 0.235 |
| USA | 116 | CO-OPERATIVE BANK (C.) | 535 | 0.165 | 0.212 | 0.212 |

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