

# **Cost and profit efficiency in banking: an international comparison of Europe, Japan and USA**

*Economics Letters*, 63 (1999), 39-44

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## **Abstract**

This study analyses the cost and profit efficiency of a sample of 14 countries of the European Union, as well as Japan and the USA. The results obtained show that since the start of the 1990s increasing competition has led to gains in profit efficiency in the USA and Europe but not so in the Japanese banking system. The results also show that the inequalities of profitability between countries would be considerably reduced if inefficiency were eliminated, efficiency gains thus being a very important source of improvement in profitability.

Key words: efficiency, costs, profits, banking systems  
JEL: G21, G28

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## 1. Introduction

One of the most important economic dimensions for ensuring the success of a company is the efficiency with which it uses its resources. Aware of the importance of this subject, recent analyses of the efficiency of banking institutions have given rise to a number of studies centred mostly on cost efficiency (see the survey by Berger and Humphrey, 1997). However, the empirical evidence available has shown that profit inefficiency is of greater quantitative importance than cost inefficiency, which is indicative of the added importance the existence of inefficiencies on the revenue side, either due to the choice of a composition of production that is not the most suitable given the prices of services, or due to the establishment of a bad pricing policy.

In the international context, the few studies made have analysed exclusively technical efficiency or cost efficiency (Alen and Rai, 1997; Fecher and Pestieau, 1993; Pastor et al, 1997, etc.). The problem presented by these studies is that, by centring exclusively on the cost side, the results may be biased by the influence on costs of such diverse factors as different regulatory environments, different intensities of competition, different specialisations/quality of production, etc., which cause bias in the measurement of efficiency. In this sense, the estimation of the alternative profit frontier, to the extent to which it takes into account the different degree of competition and the effect of the composition of output on the revenue side, seems to be a much more suitable way of making comparisons at international level.

To sum up, there are two areas in which the empirical evidence available is very limited: i) the measurement of profit efficiency and its comparison with cost efficiency, and ii) the comparison of the efficiency of the banking sectors of different countries. This is therefore the context of this study, which aims to analyse profit efficiency and cost efficiency in a sample of 16 countries of the OECD, including 14 from the European Union, Japan and the United States.

The paper is structured as follows. Section 2 describes the concepts of cost efficiency and profit efficiency, as well as the specification of the frontier functions estimated. Section 3, after describing the sample used, gives the empirical results in terms of cost and profit efficiencies. Finally, section 4 contains the conclusions of the study.

## 2. Cost vs. profit efficiency

The costs of a bank depend on the vector of output ( $y$ ), on the prices of the inputs ( $w$ ), on the level of inefficiency ( $u$ ) and on a set of random factors ( $v$ ) that incorporates the effect of errors

of measurement of the variables, bad luck, etc. Thus, the cost function is expressed as:

$$[1] \quad C = C(y, w, u, v) = C(y, w) \quad (u + v)$$

Cost efficiency ( $E_c$ ) is the quotient between the minimum costs necessary for producing the output vector  $y$  if the bank were efficient ( $u=0$ ) and the observed costs:

$$[2] \quad E_c = \frac{C}{C} = \frac{C(y, w) \quad (v)}{C(y, w) \quad (u + v)}$$

Profit efficiency is a wider concept than cost efficiency since it takes into account the effects both on costs and on revenues of the choice of a certain vector of production. Following Berger and Mester (1997), we can distinguish two profit functions depending on whether or not we consider the existence of market power in the setting of output prices.

The standard profit function assumes perfect competition in the markets for outputs and inputs. Given the vector of output prices ( $p$ ) and input prices ( $w$ ), the banking firm tries to maximise profits by adjusting the vector of outputs and inputs. Thus, the profit function can be expressed as:

$$[3] \quad \Pi = \Pi(w, p, u, v) = \Pi(w, p) \quad (v - u)$$

so that profit efficiency can be defined as the ratio between the profit obtained by a firm and the maximum that it could achieve if it were efficient:

$$[4] \quad E_\Pi = \frac{\Pi}{\Pi} = \frac{\Pi(w, p) \quad (v - u)}{\Pi(w, p) \quad (v)}$$

The exogenous nature of the price of the output vector in the above concept of profit efficiency has the disadvantage that it implies assuming the non-existence of market power in pricing. If instead of taking this price vector as given, we take as given the vector of output ( $y$ ), we obtain a measurement of alternative profit efficiency by estimating the alternative profit function:

$$[5] \quad \Pi_a = \Pi_a(y, w, u, v) = \Pi_a(y, w) \quad (v - u)$$

This expression is the same as expression [1] but with profits replacing costs as the dependent variable. As indicated by Berger and Mester (1997), alternative profit efficiency is a closer representation of reality whenever the assumption of perfect competition in the setting of prices is questionable or when there are differences of quality/specialisation among the individuals of the

sample.

The problem posed by the estimation of standard profit efficiency is that it requires information on the price of the output vector, which is not available in the statistical source used in this study (Bank Profitability, OECD 1997). For this reason, as well as for those indicated in the above paragraph, only alternative profit efficiency can be estimated in this study.

## **2. Sample used and results**

The sample used consists of the countries of the European Union for which the publication Bank Profitability (OECD) supplies information at aggregate level. Also, in order to make comparisons with the most important non-European banking systems, Japan and the United States have been included in the sample. Specifically, the sample used includes the banking systems of the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Holland, Italy, Japan, Luxembourg, Portugal, Spain, Sweden, UK, Japan and the USA. The period studied is 1984-1995, though in the cases of the USA (1985-95), Italy (1986-95), Germany (1988-95), France and Greece (1989-95) and Holland (1993-95), the information supplied by the OECD covers a shorter period.

The use of data with this degree of aggregation involves assuming that the banking systems of the countries used are representative firms, a reasonable assumption for making comparisons among countries. The advantage of this approach is that we are studying the whole banking sector of each country, instead of only a part, as in other studies which use information on a set of firms that usually represent a small percentage of the banking sector in each country.

This study uses the value added approach of Berger and Humphrey (1992), considering deposits as inputs and outputs at the same time. With this perspective, and conditioned by the disaggregation of the balance sheet and profit and loss account provided by Bank Profitability, three outputs are used: loans, other earning assets, and deposits.

The second type of variables that appear in the cost and profit function is the prices of factors of production. Bearing in mind the approach adopted, in which deposits are treated as both output and input, three prices will be used: the price of labour, price of deposits and price of physical capital.

Both financial and operating costs are included in the estimation of the cost function. In the case of the profit function, two alternative indicators of profitability are used: net income and profit before tax. The procedure used to estimate the efficiency levels is the same as described in Berger and Mester (1997) with two exceptions: i) the functional specification used is the translog, ii) the

frontier functions have been being estimated using the stochastic frontier approach, assuming a half-normal distribution for the inefficiency term.

Figure 1a shows that the average costs of the European and US banking systems are higher than those of Japan, all three showing a clear reduction in average costs since the start of the 1990s. In the case of profitability, a clear reduction can be seen in the case of Japan from the late 1980s. It can also be seen that the profitability levels of the Japanese banking system are well below those of Europe and the USA, a gap opening up between the USA and Europe from the early 1990s.

Figure 1b shows the evolution of cost and profit efficiencies, the former having much greater stability than the latter. The USA gained steadily in profit efficiency from 1986 to 1995, being in fact the second most efficient sector of the sample after the UK. The Japanese banking sector was more volatile, with a steep fall in profit efficiency after 1988, reaching a minimum value of  $-1.007$  in 1995 (unlike cost efficiency, profit efficiency can be negative since firms can throw away more than 100% of their potential profits), in which year its return on equity was  $-5\%$ . Europe shows much more stable behavior in profit efficiency, around an average value of 0.45.

The situation in the last year available shows that the profit efficiency of the European banking sector is in an intermediate position between the USA and Japan, the latter's efficiency level being negative as a consequence of the losses in that year. Since 1989, when the profit efficiency of the USA, Japan and Europe was practically the same, a growing gap has appeared between the USA and Japan as a consequence of the steady gain in efficiency of the US banking sector and the decreasing efficiency of Japan. This behaviour of profit efficiency is very similar to that represented in figure 1a in terms of accounting ratios: loss of profitability in Japan since 1988; moderate gains in profitability in the USA since the early 1990s with stagnation in recent years; and more stable behaviour in the European banking sector with average profitabilities between those of the USA and Japan since 1990.

Figure 2 shows the potential – maximum – profitability that the banking sectors considered would have achieved by eliminating their profit inefficiency. Comparison of this figure with the accounting profitability of figure 1 shows that the differences among countries would have decreased considerably. Thus, the elimination of the inefficiency of the European banks from the early 1990s would have placed it at levels of return on equity similar to those of the USA, producing a clear convergence in profitability.

#### **4. Conclusions**

The aim of this study is to analyse the cost and profit efficiency of the banking sectors of Europe, Japan and the USA using the aggregate information provided by the OECD's Banking Profitability for the period 1984-1995.

Using a stochastic frontier approach, the comparison of profit efficiency of the three banking sectors shows important differences. In the case of the USA, a gain in efficiency occurred from 1986 to 1995. The Japanese banking sector is more volatile, with a steep fall in efficiency from 1988 onwards. Europe shows more stable behavior.

Since the start of the 1990s, the pressure of competition has led to gains in profit efficiency in the USA and Europe, but not in Japan. The elimination of the levels of inefficiency would have enabled the differences of profitability between countries to have been appreciably reduced, inefficiency therefore being a very important potential source of improvements in profitability.

\* The authors gratefully acknowledge the financial support of the CICYT SEC98-0895 and

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