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Cost and profit efficiency of French Commercial banks: Domestic versus Foreign Banks

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Abstract

The purpose is to investigate the efficiency levels of commercial domestic versus foreign banks in France by comparing the use of basic accounting ratios and the stochastic cost and profit frontier analysis (SFA). We analyze the profit and cost efficiency of domestic and foreign banks operating in France using unbalanced sample, including 62 domestic and 40 foreign banks over the period 2000-2007. We show that foreign banks exhibit higher cost and profit efficiency than domestic banks. This finding goes against previous empirical literature, concluding on advantage of cost efficiency for domestic banks in developed countries such as France (Berger et al. (2000)). However, the comparison between the cost efficiency and the profit efficiency scores, suggests that foreign banks are better managed in terms of profit efficiency mainly due to higher cost efficiency. On the other side, profit efficiency of domestic banks, was due to higher revenue efficiency. This suggests that French domestic banks operate with excessive margins.

Classification JEL : G21 ; C23 ; D24

Keywords: efficiency, domestic banks, foreign banks

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1. Introduction

The gradual liberalization of financial markets that started in the mid-1980s in France increased competition from non-banks, such as mutual funds and insurance companies, but more especially, it stimulated competition from markets. Furthermore, the transposition of the 1988s European Directive on the free movement of capital into national law eliminated lending restrictions and currency controls and removed many of the administrative barriers that had compartmentalized credit institutions' business in European countries. This had a particularly big impact on traditional banking intermediation business. It gave rise to disintermediation in lending and an alignment of bank lending rates and terms on those of the market. The financial intermediation ratio, which measures the proportion total lending to non-financial agents obtained from resident financial intermediaries, fell from 71% in 1978 to less than 41% in 2001. Under these circumstances, ownership structures have changed radically, with a smaller number of credit institutions and the emergence of diversified international groups. Up until the beginning of the 1980s, the number of credit institutions grew, as many foreign banks arrived on the French market and new institutions were created to specialize in specific business lines and types of financing. After that, one of the main changes in the French banking industry was a substantial decrease in the population of banks. At the same time, the number of foreign owned banks in France rose between 1984 and 2001, where foreign institutions have a strong presence.

Greater openness of the French banking market is the direct result of deregulation of a system that had long enjoyed protection. Opening it up to competition attracted growing numbers of foreign banks. In 2000, the cross-border take over of Credit Commercial de France by the UK's HSBC group marked the start of a truly international phase in the restructuring of French banking. Deregulation of banking systems frequently includes increased openness to foreign-owned banks, with the intention of improving the competitiveness and efficiency of the financial system. However, *Weill (2006b)* precise, that reduced performance of French banks allows the entry of foreign banks in France, since foreign banks are able to significantly affect the performance of domestic banks. It means, weak results of French banks signify the possibility of easier entries of foreign banks on the French market.

This study compares the efficiency of foreign-owned banks operating in France with French domestic banks of the French banking system. The objective is to determine if foreign banks were more efficient than domestic banks during our estimation period of 2000-2007. Thus, the purpose is to investigate the efficiency levels of commercial domestic versus foreign banks in France by comparing the use of basic accounting ratios and the stochastic cost and profit frontier analysis (SFA). To our knowledge, none of previous studies during the period 2000-2007, have used the concept of profit efficiency nor have they addressed issues of foreign ownership specifically for the French banking market. We analyze the profit and cost efficiency of domestic and foreign banks operating in France using unbalanced sample, including 62 domestic and 40 foreign banks over the period 2000-2007.

The outline of this paper is as follows. Section 2 will provide an overview of previous studies that have considered; (i) the efficiency of the French banking system and (ii) the efficiency of foreign banks. Section 3 will discuss the data and methodology employed, while the fourth section will discuss the results. The final section will provide conclusions and directions for further research.

2. Literature review

There are two streams of literature that are relevant to this study, (i) those dealing with bank efficiency in France, and (ii) those comparing foreign bank efficiency with domestic bank efficiency.

2.1. French bank efficiency studies

The literature on efficiency started to be applied to banks only during the 90s, but a reduced number of studies focused on the efficiency of French banks. We can however distinguish two categories: studies that focus entirely on French banks; and studies consisting of international comparisons of bank efficiency.

Specifically for french banking efficiency, studies were performed by *Dietsch (1996)*, *Dietsch & Weill (1999)* and *Weill (2006b)*. *Dietsch (1996)* performs the first analysis on the efficiency of French banks. The author uses a parametric method (the Free Distribution Approach,

DFA) and estimates the cost efficiency of 375 commercial and savings banks, over the period 1988-1992. The results show the existence of an average cost efficiency of 56.1% and 70.7%, with a truncation of 1% and, respectively, 5%. The analysis of the relationship between the cost efficiency and the risk-taking supports the assumption that less efficient banks take excessive risks. *Dietsch & Weill (1999)* use a nonparametric method, the DEA technique, for measuring the technical efficiency of 93 French deposit banks in 1994. The average scores vary between 78% and 91%, depending on the retained productive combination. The inputs are: personnel expenses, interest expenses relative to total borrowed funds and other non-financial expenses; the outputs are: credits, demand deposits, savings and other remunerated assets. The analysis of the determinants of French banks' efficiency shows the lack of a clear relationship with the size and the existence of a negative relationship with the risk-taking. Finally, *Weill (2006b)* analyzes the evolution of cost efficiency of 93 French banks, over the period 1992-2000. The author uses two parametric approaches to calculate the cost efficiency scores: the Stochastic Frontier Approach (SFA) and a system of equations composed of a Fourier-flexible cost function and its associated input cost share equations derived using the Sheppard's lemma. The results show an increase in cost efficiency between 1992 and 2000, the average scores going from 77.20% to 83.98%. According to the Rosse-Panzar test of competition, the increase in efficiency is not related to the increase in competition. *Weill (2006b)* equally tests for the convergence in French banks' efficiency, showing its existence over the period 1992-2000; this translates the catching-up process of the least efficient banks over the last decade.

Besides studies entirely orientated toward French banks, an important number of international comparisons of banks' efficiency exist. Two categories of international comparisons can be distinguished: those estimating a national frontier for each country (*Berger et al.(2000)*, *Dietsch & Weill (2000)* and *Weill (2004)*), opposed to those estimating common frontiers to several countries as a whole (*Allen & Rai (1996)*, *Pastor, Pérez and Quesada (1997)*, *Chaffai & Dietsch (1999)*, *Dietsch & Lozano-Vivas (2000)*, *Altunbas et al. (2001)*, *Chaffai, Dietsch and Lozano-Vivas (2001)*, *Lozano-Vivas, Pastor and Hasan (2001)* and *Vander Venet (2002)*). A reference from the first category is the analysis of *Berger et al.(2000)*. The authors use the Stochastic Frontier Approach (SFA) and estimate the cost and production frontiers for five countries (France, Germany, Spain, the United Kingdom and the United States), separately for each country, over the period 1993-1998 for the US and, respectively, 1992-1997 for the European economies. The results

show an average cost efficiency of 70.9% in France, 79.3% in Germany, 91.5% in Spain, 79.1% in the United Kingdom and 77.4% in the United States. A brief presentation of these studies was presented in table 1 where the results of the large majority of studies consist of an average efficiency score between 70% and 80%. Also, for estimating the efficiency of French banks, both parametric (SFA and DFA) and nonparametric (DEA) methods have been used.

Table 1: Analyzes on international comparisons of French banks efficiency

Authors	Characteristics (approach, estimated frontier, period)	Estimation of the average annual efficiency (France)
International comparisons (national frontier)		
Berger & al (2000)	DFA, cost and profit frontier, 215 banks, 1992-1997	70,9%
Dietsch & Weill (2000)	SFA and DFA, cost frontier, 190 banks, 1993-1997	82,12% (DFA) and 89,25% (SFA)
Weill (2004)	SFA, DEA and DFA, cost frontier, 135 banks, 1992-1998	70,58% (SFA), 49,76% (DFA) and 40,16% (DEA)
International comparisons (common frontier)		
Allen & Rai (1996)	SFA and DFA, cost frontier, 32 french banks, 1988-1992, frontier estimated for 15 developed countries	73,4% (small banks) and 84,3% (big banks)
Pastor & al (1997)	DEA, production frontier, 1992	95%
Chaffai & Dietsch (1999)	SFA, cost frontier, 1992-1996	74% (frontier Cobb-Douglas), 83% (frontier translog)
Dietsch & Lozano-Vivas (2000)	DFA, cost frontier, 223 banks, 1988-1992, frontier estimated for France and Spain	77,5%
Altunbas & al (2001)	SFA, cost frontier, 426 banks, 1989 and 997, frontier estimated for all EU countries	71,2% (1989) et 75,6% (1997)
Chaffai & al (2001)	SFA, production frontier, 1993-1997	French banks might increase their productivity by 20% (without differences in environment) and, respectively, by 18% (with differences in environment), by using the technology of German banks
Lozano-Vivas & al (2001)	DEA, production frontier, 150 banks, 1993, frontier estimated for 10 European countries	24,23% (without considering the differences in environment) and 40,98% (when considering the differences in environment)
Maudos & al (2002)	DFA, cost frontier, 142 banks, 1993-1996	62%
Vander Vennet (2002)	SFA, cost and profit frontier, 1995-1996	70,8% (cost efficiency) and 67,1% (profit efficiency) for specialized banks

2.2. Foreign versus domestic bank efficiency studies

In recent years, research on the efficiency of domestic versus foreign banks has expanded. This section reviews some of the main articles in this field. The literature on foreign banking suggests that foreign banks may be less subject to domestic credit allocation rules than domestic banks and domestic banks may have informational advantages relative to foreign banks (*Demircuc-Kunt, A., Huizinga, H. (2001)*).

Berger and Humphrey (1997) survey 130 efficiency studies of financial institutions, of which a few address the impact of foreign ownership. They suggest that a general conclusion regarding the efficiency effect of foreign ownership cannot be drawn based on the available empirical literature. The relative efficiency of foreign vs. Domestic ownership appears to depend on host and home country conditions. *Berger et al. (2000)*, for instance, provide empirical evidence that foreign banks in transition and developing markets show higher efficiency than their domestically-owned counterparts. On the other hand, foreign banks in developed countries exhibit lower efficiency in comparison to domestic banks. They perform an analysis of cross-border banking efficiency in France, Germany, Spain, the United Kingdom, and the United States during the 1990s. On average, they find that domestic banks in these countries have both higher cost efficiency and higher profit efficiency than foreign banks operating in the country. However, the authors also find, after disaggregating their results, that domestic banks are more efficient than foreign banks from most foreign countries, that these are about equally efficient as foreign banks from some foreign countries, but are less efficient than foreign banks from one (the US) of the foreign countries. Thus, the relative efficiency of foreign vs. domestic ownership appears to depend on host and home country conditions. *Berger et al. (2000)* differentiate between home field advantages and global advantages. The global advantage hypothesis states that foreign banks might benefit from competitive advantages relative to their domestically-owned peers. Foreign-owned banks use more advanced technologies due to a stiff home market competition. Foreign banks might also become more competitive when compared to domestic banks due to an active market for corporate control in the home country, and because they have access to an educated labor force that is able to adapt new technologies. Similarly, *Havrylchuk (2006)* suggests that foreign banks might profit from better risk management, and reliance on modern information technologies. The home field advantage hypothesis predicts foreign banks to suffer from disadvantages when compared to domestic banks. Foreign-controlled banks are assumed to perform less well than domestically controlled banks due to higher costs of providing the same financial services or due to lower revenues.

Table 2, which surveys more recent literature, confirms this conclusion. The table shows that foreign banks in transition and developing markets show higher efficiency than their

domestically-owned counterparts. On the other hand, foreign banks in developed countries exhibit lower efficiency in comparison to domestic banks.

Table 2: Summary of the findings on the efficiency of foreign banks

Authors	Characteristics (country, period, estimated frontier)	Empirical findings
Berger et al (2000)	France, Germany, Spain, UK and USA, 1993-1998, DFA	Domestic banks are more efficient than foreign banks in developed countries
Isik et Hassan (2002)	Turkey, 1988-1992 and 1996, DEA	Foreign banks seem to be significantly more efficient than their domestic peers
Jemric et Vujcic (2002)	Croatia, 1995-2000, DEA	Foreign banks are significantly more efficient than domestic banks
Miller et Parkhe (2002)	12 EU countries Arg., UK, Switz., Australia, US, Japan, Canada, Chile, India..., 1989-1996, SFA	US-owned banks are more X-efficient than other foreign-owned banks in bank-oriented financial systems, but less X-efficient in capital-market oriented systems
Nikiel et Opiela (2002)	Poland, 1997-2000, DFA	Foreign banks are more cost efficient and less profit efficient than other banks
Hasan et Marton (2003)	Hungary, 1993-1997, SFA	Foreign banks and banks with higher foreign ownership involvement are associated with lower inefficiency
Weill (2003)	Czech Republic and Poland, 1997, SFA	Foreign banks are more cost efficient than domestic banks. This advantage does not result from differences in the scale of operations or the structure of activities
Green et al (2004)	Nine European transition nations, 1995-1999, System of equations	Foreign banks are not more efficient than domestic banks. Foreign ownership does not significantly reducing banks costs
Sturm et Williams (2004)	Australia, 1988-2001, DEA	New foreign banks are more input efficient than domestic banks, mainly due to their superior scale efficiency
Bonin et al (2005)	11 European transition nations, 1996-2000, SFA	Foreign-owned banks are more cost efficient than other private banks
Fries et Taci (2005)	15 European transition nations, 1994-2001, SFA	Privatized banks with majority foreign ownership are the most efficient and those with domestic ownership are the least
Havrylchuk (2006)	Poland, 1997-2001, DEA	Foreign banks are more efficient than domestic-owned banks
Zajc (2006)	Six CEE nations, 1995-2000, SFA	Foreign banks are less cost efficient than domestic banks
Weill (2006a)	Czech Republic and Poland, 1997, DEA	Foreign banks are more cost efficient than domestic banks.
Lensink et al (2008)	105 countries, 2095 banks, 1998-2003, SFA	Foreign ownership negatively affects bank efficiency. However, in countries with good governance this negative effect is less pronounced. Also higher quality of the institutions in the home country and higher similarity between home and host country institutional quality reduce foreign bank inefficiency
Berger et al (2009)	38 Chinese banks, 1994-2003, SFA	Big Four Chinese banks are the least efficient. Foreign banks are most efficient, and minority foreign ownership is associated with significantly improved

3. Methodology

3.1. Research Design

Cost and profit efficiency measure how well a bank is predicted to perform relative to a best-practice bank producing the same outputs under the same environmental conditions. We start from the assumption that the underlying technologies of the domestic and foreign banking service productions in France are quite similar. This assumption allows us to correctly define a common frontier. Pooling all banks would implicitly assume that efficiency differences across banks are attributed, entirely, to managerial decisions within banks regarding the scale and mix of inputs. In other words, a common frontier is based on the belief that efficiency differences across banks are mainly attributable to managerial decisions within banks. Banking technology can be defined as the set of specific methods that banks use to combine financial and physical inputs to generate a certain amount of banking services, such as liquidity and payment services, portfolio services and loan services. These methods are diversification, risk pooling, financial information collection and evaluation, risk management, and so on. So there is a presumption that the technology used by domestic and foreign banks in France should be the same. However, the bank-specific variables are taken into account because we believe that these variables are major factors in explaining the differences in the banking cost and profit. Thus, we use the common frontier approach to compare the domestic and foreign banks of French banking industry, because we believe that efficiency differences between banks are determined by bank specific differences rather than by technological ones (Dietsch et Lozano-Vivas (2000)).

To measure the cost and profit efficiency of French banks we employ the stochastic frontier approach (SFA), as developed by Aigner et al. (1977). The SFA specifies a particular form for the cost (profit) function, usually a translog form, and allows for random error. It assumes that these errors consist of inefficiencies, which follow an asymmetric distribution (usually a truncated or half normal distribution), and random errors that follow a symmetric distribution (usually the standard normal distribution)¹. The reason for this particular structure of the composite error term is that, by definition, inefficiencies cannot be negative. Both the inefficiencies and random errors

are assumed to be orthogonal to input prices, outputs and country-level or bank-specific variables specified in the estimating equation.

We estimate efficiency levels by specifying the commonly-used translog functional form for the cost and profit functions. The cost function is presented as follows:

$$\begin{aligned} \ln CT = & \alpha_0 + \sum_i \beta_i \ln y_i + \sum_j \beta_j \ln w_j + 1/2 \sum_i \sum_k \lambda_{ik} \ln y_i \ln y_k + 1/2 \sum_j \sum_h \xi_{jh} \ln w_j \ln w_h \\ & + \sum_i \sum_j \omega_{ij} \ln y_i \ln w_j + u_i + v_i \end{aligned}$$

Where CT is the bank's total costs; $y_i, i=1,2$ are outputs; and $w_j, j=1,2,3$, are inputs prices. The homogeneity restrictions are imposed by normalizing total costs and input prices by one of the input prices $\sum_j \beta_j = 1$, $\sum_h \xi_h = 0$, $\sum_k \omega_k = 0$ and the symmetry restriction is $\lambda_{ik} = \lambda_{ki}$

Nevertheless, our approach aims to estimate not only the cost and profit efficiency scores of French banks but also to identify the determinants that affect these scores. Therefore, we adopt the *Battese et Coelli (1995)* approach, where u_i , the technical inefficiency effect, is assumed to be a function of a set of bank specific variables and could be specified in equation $u_i = z_i \delta + w_i$, where the random variable, w_i , is defined by the truncation of the normal distribution $N(0, \sigma^2)$, such that the point of truncation is $-z_i \delta$ i.e. $w_i \geq -z_i \delta$. These assumptions are consistent with u_i being a non-negative truncation of the $N(z_i \delta, \sigma^2)$.

3.2. Data and model specification

Our sample is an unbalanced panel which includes financials data of 102 French commercial banks, divided on 62 domestic and 40 foreign banks during the period 2000-2007. Income and Balance Sheet data taken was obtained from IBCA's BANKSCOPE data set. Domestic banks are defined as those banks whose state and/or private domestic ownership is 100% of total ownership;

¹ The rationale for this is that inefficiency cannot lower the cost and thus must have an asymmetric distribution, whereas random error can add or subtract cost and thus it can follow a symmetric distribution.

majority foreign banks are defined as those banks whose foreign ownership is 100% of total ownership².

In this paper, the intermediation approach is used, to define the outputs and inputs of a banking firm, which views the bank as employing labor, physical capital, and borrowed funds to produce earning assets, as originally proposed by *Sealey and Lindley (1977)*. This is the approach most commonly used in the conventional bank cost and profit functions literature. Two outputs are included in the model: Y_1 = loans and Y_2 = earning assets including negotiable certificates of deposit, all other negotiable debt instruments and equity investments. The inputs include labor, physical capital, and deposits. The first input price is the price of labor, w_1 , defined as the ratio of personnel expenses scaled by total assets. Although scaling over total employees, instead of total assets, gives a better proxy of price of labor, the latter is chosen since for many observations the former is not available. The price of capital, w_2 , is constructed as depreciation and other non interest expenses to fixed assets. The price of funds (financial factor), w_3 , is defined as the ratio of a bank's interest expenses scaled by the sum of deposits and other interest bearing funding. Total costs, CT, are defined as the sum of staff expenses, depreciation and other non interest expenses and interest expenses. We scale total costs, price of labor and price of capital by price of funds in order to guarantee linear homogeneity of the cost function.

To study the determinants of bank efficiency, the second set of analysis is to explore the characteristics of inefficient banks. A variety of financial ratios are applied for this evaluation to provide indications for a bank's technical efficiency. These are : (1) return on assets (ROA) measured by profits before taxes to total assets ; (2) the ratio of equity to assets (EQTA); (3) the ratio of bank's loans divided by customers and short term funding (LCSTF) ; (4) bank size measured by the log of total assets ; (5) ratio of loan-loss provision to total loans (LLPCR); (6) ratio of off-balance-sheet activities to total assets and off-balance-sheet activities (OBS); and (7) a foreign ownership variable is a dummy variable equals 1 for foreign banks and equals 0 for domestic banks.

² It should be noted that French banking sector is composed in 2007, by 290 commercial banks, divided on 130 domestic banks and 160 foreign banks. Source: CECEI annual report.

Profit efficiency is estimated similarly. This is an indicator of the quality of bank management, because profit efficiency is the more inclusive concept – taking account of both cost and revenue performance – given that managers have some control over both revenues and costs. Any qualitative differences in the findings between profit and cost efficiency are due to differences in revenue performance (Berger and Mester (1997) and Berger et al (2009)). We use the alternative profit function, who essentially, replicates the cost function except that it adds revenues to the dependent variable. It accounts for the additional revenue earned by high-quality banks, allowing it to offset their additional costs of providing the higher service levels. Therefore total profit (i.e. operating profit), π , replace total cost and the dependent variable is given by $\text{Ln}(\pi+k+1)$ and k indicates the absolute value of the minimum value of profit (π) over all banks in the sample, and is added to every firm's dependent variable in the profit function. This transformation allows us to take the natural log of profits, given that profits can obtain negative values. Also, the composite error term is now defined as $\varepsilon_{it} = v_{it} - u_{it}$.

The cost function model is:

$$\begin{aligned}
\text{Ln}\left(\frac{CT}{w_3}\right)_{it} &= \beta_0 + \beta_1 \text{Ln}\left(\frac{w_1}{w_3}\right)_{it} + \beta_2 \text{Ln}\left(\frac{w_2}{w_3}\right)_{it} + \beta_3 \text{Ln}Y_{1it} + \beta_4 \text{Ln}Y_{2it} + \frac{1}{2} \beta_5 \left(\text{Ln}\left(\frac{w_1}{w_3}\right)\right)_{it}^2 + \frac{1}{2} \beta_6 \left(\text{Ln}\left(\frac{w_2}{w_3}\right)\right)_{it}^2 \\
&+ \beta_7 \left(\text{Ln}\left(\frac{w_1}{w_3}\right)\text{Ln}\left(\frac{w_2}{w_3}\right)\right)_{it} + \frac{1}{2} \beta_8 (\text{Ln}Y_1)_{it}^2 + \frac{1}{2} \beta_9 (\text{Ln}Y_2)_{it}^2 + \beta_{10} (\text{Ln}Y_1 \text{Ln}Y_2)_{it} + \beta_{11} \left(\text{Ln}\left(\frac{w_1}{w_3}\right)\text{Ln}Y_1\right)_{it} \\
&+ \beta_{12} \left(\text{Ln}\left(\frac{w_1}{w_3}\right)\text{Ln}Y_2\right)_{it} + \beta_{13} \left(\text{Ln}\left(\frac{w_2}{w_3}\right)\text{Ln}Y_1\right)_{it} + \beta_{14} \left(\text{Ln}\left(\frac{w_2}{w_3}\right)\text{Ln}Y_2\right)_{it} + v_{it} + u_{it} \quad (1)
\end{aligned}$$

Where i, t index the bank and year, respectively, and cost efficiency determinants are defined as:

$$u_{it} = \delta_1 ROA_{it} + \delta_2 EQTA_{it} + \delta_3 LCSTF_{it} + \delta_4 \text{Ln}TA_{it} + \delta_5 LLPCR_{it} + \delta_6 OBS_{it} + \delta_7 \text{foreign}_{it} + w_{it} \quad (2)$$

These two models (1) and (2) are simultaneously estimated using the maximum likelihood parameter estimation (Battese & Coelli (1995)). The computer program, FRONTIER Version 4.1 developed by Coelli (1995) has been used to obtain the maximum likelihood estimates of parameters in estimating the technical efficiency. The program can accommodate cross sectional and panel data; cost and production function; half-normal and truncated normal distributions;

time-varying and invariant efficiency; and functional forms which have a dependent variable in logged or original units.

4. Empirical Results

4.1. Descriptive statistics

Bank characteristics and financial performance measures are reported in Table 3. The average values of total loans and earning assets varies greatly among the two groups, from 2484 and 2739 million € for domestic banks to 797 and 1008 million € for foreign banks. Similar findings are shown with the average values of total assets, total costs and operating profit. Regarding equity, domestic banks have a lower equity-to-asset ratio (9.24%) than foreign banks (10.65%). Interestingly, foreign banks have provision-to-loan ratio (0.9%) relatively more important than domestic banks ratio (0.5%), which would possibly suggest that foreign banks operate with high non-performing loan level on the one hand, and prudence and ability to set aside such reserves on the other hand. This is consolidated by the average value of off balance sheet activities ratio, where foreign banks have a high ratio (27%) than domestic banks (24%).

Table 3: Variables used in profit and cost efficiency estimations

	Domestic banks				Foreign banks			
	Mean	SD	Min	Max	Mean	SD	Min	Max
<i>Output quantities (in million €)</i>								
Total loans (Y_1)	2484.454	4045.386	3.9	30789.2	796.8303	1305.665	7.5	11497.1
Earning assets (Y_2)	2739.09	5744.826	1.7	52335.5	1008.013	1724.805	5.3	11644.1
<i>Input prices</i>								
Price of labor (w_1)	0.0176	0.0192	0.00016	0.16411	0.0224	0.0226	0.0009	0.1435
Price of capital (w_2)	0.2741	0.2833	0.0062	3	0.2524	0.2229	0.0154	1
Price of funds (w_3)	0.1779	1.0266	0.0044	17.9259	0.0510	0.0955	0.0011	1.1219
<i>Profit (cost)(in million €)</i>								
Total costs (CT)	311.9868	506.8551	1.8	3460.3	91.4115	138.5326	2.9	1136.6
Total profits (π)	44.3198	78.7223	-102.6	608	16.5094	29.9758	-94.5	167.2
<i>Bank efficiency determinants</i>								
ROA	0.0163	0.0326	-0.1572	0.3437	0.0138	0.0279	-0.1554	0.3840
EQTA	0.0924	0.1211	0.0027	0.8838	0.1065	0.0851	0.0026	0.5568
LCSTF	1.2889	2.8156	0.0015	37.7778	1.1081	4.2745	0.0237	50.3821
TA (in million €)	5566.214	8224.249	105.1	60789.2	2015.538	2778.507	48.7	16325.6
LLPCR	0.0056	0.0282	-0.2353	0.3536	0.0091	0.0437	-0.1333	0.4702
OBS	0.2401	0.1808	0	0.8565	0.2711	0.1819	0	0.8692
observations	485				320			

This table shows the descriptive statistics of basic variables used in the cost and profit efficiency estimations. In our translog based estimations of cost (profit) efficiency levels, output variables considered are total loans and earning assets, and the input prices variables are: price of labor, defined as the ratio of personnel expenses scaled by total assets, price of capital, constructed as depreciation and other non interest expenses to fixed assets and price of funds, defined as the ratio of a bank's interest expenses scaled by the sum of deposits and other interest bearing funding. Total costs include both financial and operating costs and are defined as the sum of staff expenses, interest expenses and depreciation and other non interest expenses. Total profits are proxied using the operating profit, defined as total income minus total cost. Bank-specific factors are (1) return on assets (ROA) measured by profits before taxes to total assets ; (2) the ratio of equity to assets (EQTA); (3) the ratio of bank's loans divided by customers and short term funding (LCSTF) ; (4) bank size measured by the log of total assets ; (5) ratio of loan-loss provision to total loans (LLPCR); (6) ratio of off-balance-sheet activities to total assets and off-balance-sheet activities (OBS); and (7) a foreign ownership variable is a dummy variable equals 1 for foreign banks and equals 0 for domestic banks.

4.2. Cost and profit efficiency

Table 4 presents the results of (weighted) average efficiency in cost and in alternative profit of domestic banks and foreign banks, as well as the total for each of the years of the period analyzed 2000-2007.

Table 4: Bank efficiency by ownership type and year (in percentage)

	Cost efficiency scores		Profit efficiency scores	
	<i>Domestic banks</i>	<i>Foreign banks</i>	<i>Domestic banks</i>	<i>Foreign banks</i>
2007	68.50	84.25	85.66	87.96
2006	65.81	87.29	85.63	88.59
2005	66.88	83.94	85.34	85.05
2004	66.63	88.33	84.60	84.43
2003	63.66	88.33	82.27	84.76
2002	63.16	87.09	82.87	86.74
2001	61.27	84.56	84.73	85.87
2000	62.85	84.13	83.69	86.45
Average scores	64.76	85.95	84.35	86.23

According to the results and in the case of cost efficiency, the comparison of domestic banks and foreign banks shows higher efficiency levels in the foreign banks for all the years of the sample. The average cost efficiency level for 62 domestic banks under examination is 64.76 percent. This suggests that, on average, about 34.24 percent of bank resources are wasted. Whereas the average cost efficiency level for 40 foreign banks is 85.95 percent. This implies that on average 14.05 percent of the resources are wasted. Based on the results, cost efficiency level has increased over the period for domestic banks, except for 2006, and the highest average efficiency level was reached in 2007 (68.50 percent). For foreign banks, they have improved their cost efficiency since 2000, with decreases of 4% and 3.5% for 2005 and 2007 respectively. This finding goes against previous empirical literature, concluding on advantage of cost efficiency for domestic banks in developed countries such as France (Berger et al. (2000)). However, during the last decade, the number of foreign banks in France continued to increase until 2000, while the overall number of domestic commercial banks was reduced steadily. Thus, the number of foreign banks has increased, in part due to a deterioration of the cost efficiency of domestic banks, which allowed foreign banks increase their market share. Weill (2006b) indicated that reduced performance of French banks allow foreign banks to settle easily in France.

In the case of alternative profit efficiency, the average efficiency estimates for domestic banks are lower than foreign banks (84.35 percent against 86.23 percent). We also note that since 2004, the efficiency scores have continued to increase for domestic banks, to reach the highest level in 2007 with a profit efficiency score of about 85.66 %. We show that foreign banks are more efficient than domestic banks. However, the comparison between the cost efficiency and the profit

efficiency scores, suggests that foreign banks are better managed in terms of profit efficiency mainly due to higher cost efficiency. On the other side, profit efficiency of domestic banks, was due to higher revenue efficiency. This suggests that French domestic banks operate with excessive margins.

4.3. Potential determinants of efficiency

The maximum likelihood parameter estimates of model 2 for both the cost and profit efficiency are presented in table 5.

Table 5: The effect of Bank-specific variables on bank inefficiency

Variables	Cost inefficiency	Profit inefficiency
<i>ROA</i>	2.189 (2.08)**	-17.387 (-24.08)***
<i>EQTA</i>	1.177 (2.46)**	3.709 (4.41)***
<i>LCSTF</i>	-0.041 (-9.53)***	-0.150 (-16.82)***
<i>LnTA</i>	0.064 (-1.51)	-0.739 (-7.82)***
<i>LLPCR</i>	-2.238 (-2.15)**	12.138 (8.49)***
<i>OBS</i>	-3.726 (-5.46)***	-2.452 (-5.12)***
<i>foreign</i>	-2.712 (-6.42)***	-1.419 (-9.82)***
$\sigma^2 + \sigma_v^2$ ⁽³⁾	0.678 (4.76)***	1.391 (10.19)***
$\gamma = \frac{\sigma^2}{\sigma^2 + \sigma_v^2}$	0.914 (39.54)***	0.988 (583.65)***
Log de Vraisemblance	-261.7155	67.9664
LR Test	124.414	1179.030
Nombre d'observations	805	805

This table shows the cost and profit estimated models using the maximum likelihood parameter estimation (Battese & Coelli (1995)). The sample includes foreign and domestic banks. Absolute values of t-statistics of the coefficients of the independent variables are shown in the parentheses. ***, **, * are significant at 1%, 5%, and 10% significance levels, respectively.

³ $\sigma^2 = \sigma_u^2 = \sigma_w^2$

Note that a negative sign indicates a negative impact of the variable on the bank inefficiency and therefore a positive effect on cost and profit efficiency.

The estimate for the variance parameter $\gamma = \frac{\sigma^2}{\sigma^2 + \sigma_v^2}$ ⁴ ($\gamma = 0.914$ and $\gamma = 0.988$ respectively for cost and profit efficiency) is close to one, which indicates that the inefficiency determinants are likely to be highly significant in the analysis of the value of cost and profit function. The value of likelihood-ratio test of null hypotheses LR⁵, that the inefficiency effects are absent or that they have simpler distributions is equal to 124.414 (1179.030) for cost (profit) efficiency and accepted at 1% level of significance. This indicates that the joint effect of these explanatory variables on the inefficiencies is significant.

The ROA coefficient is positive and significant at 5% in the cost inefficiency model, which indicates that it has a negative effect on the cost efficiency. This variable measures the quality of management, shows that French banks operate with higher costs, so they are less profitable and therefore less cost efficient. We deduce a poor quality of management which affects the cost efficiency of French banks. This is consistent with the notion that bad managers are poor at both operations and risk management. Nevertheless, the ROA coefficient is negative and significant at 1% in the profit inefficiency model, which indicates that it has a positive effect on the profit efficiency. The evidence suggests that revenue efficiency is more important than cost efficiency, for domestic banks. This analysis is confirmed by the profit efficiency scores calculated in Table 4, which shows that the gap between cost efficiency and profit efficiency scores for domestic banks is much higher. This suggests that French domestic banks operate with excessive margins.

The equity position of a bank turns out to have a negative and significant effect on cost and profit efficiency (i.e. positive effect on inefficiency). Indeed, financial capital affects costs through its use as a source of financing loans (Berger & Mester, (1997)), and raising capital through issuing

⁴ If the parameter, γ , is zero, then the variance of the inefficiency effects is zero and so the model reduces to a traditional mean response function in which the determinants of bank inefficiency are included in the cost (profit) function. In this case, the parameters $\delta_1, \delta_2, \dots, \delta_7$ are not identified.

⁵ The likelihood-ratio test statistic, $LR = -2\{\log[likelihood(H_0)] - \log[likelihood(H_1)]\}$, has approximately chi-square distribution with parameter equal to the number of parameters assumed to be zero in the null hypothesis. Ho, provided Ho is true.

shares involves higher costs than taking deposits, so a negative relationship between EQTA and efficiency is expected. As a result, French banks invest more in risky assets. This is confirmed by the sign of the coefficient of OBS variable, which has a positive and significant effect on the cost and profit efficiency. The diversification risk does appear to be consistently related to bank efficiency, when a bank is heavily using derivative contracts, such as swaps, forwards, and futures

Banks with higher loan-to-deposits (LCSTF) tend to have higher cost and profit efficiency. This might reflect that bank's loan product is more highly valued than securities, or it could reflect higher market power that exists in loan markets compared to the other product markets in which banks operate. This ratio is considered as a proxy for liquidity risk, and we find that the ratio loans-to-deposits, has a positive effect on efficiency. Thus, we conclude that more efficient banks are more actively engaged in off-balance sheet activities.

Bank size does not significantly affect cost efficiency, but the coefficient for bank size is significantly positive for the profit efficiency. Thus, large banks on average tended to be more profit efficient than small banks. An explanation for this finding is that large banks may find it easier to engage in relationship lending than small banks. Furthermore, large banks may undertake risky loans (with higher returns during certain periods such as the one examined), in contrast to small banks, which usually avoid undertaking this type of loans.

The provision for loan loss ratio (LLPCR) is significantly positively correlated with cost efficiency and negatively correlated with profit efficiency, suggesting that banks with more problem loans were associated with lower profit efficiency. This variable used to account for credit risk, suggests that banks which provide more loans are expected to incur higher credit risk. This may be due that banks that spent less resources on credit underwriting and loan monitoring appeared to be more cost efficient but at the expense of having more non-performing loans, appeared to be less profit efficient.

Foreign ownership, measured by the dummy variable FOREIGN, has a negative and significant coefficient at the 1% level, which indicates that it has a positive effect on the cost and profit efficiency. This result shows that foreign banks are on average more efficient than domestic banks in France. This finding goes against previous empirical literature, concluding on advantage

of cost and profit efficiency for domestic banks in developed countries such as France (Berger et al. (2000)). Therefore, the deterioration of the cost efficiency of domestic banks, allows foreign banks to increase their market share and to settle easily in France.

5. Conclusion

The French banking sector provides an interesting context for studying bank efficiency, as it underwent significant changes during the last two decades. Ownership structures have changed radically, as many foreign banks arrived on the French market and new institutions were created to specialize in specific business lines and types of financing. After that, one of the main changes in the French banking industry was a substantial decrease in the population of banks. At the same time, the number of foreign owned banks in France rose between 1984 and 2001, where foreign institutions have a strong presence.

In the present paper we have investigated the efficiency of French banks during the period 2000–2007 and analyzed the determinants of banking efficiency in France. We show that foreign banks exhibit higher cost efficiency than their domestic peers. This suggests that foreign banks are better managed in terms of cost efficiency. On the other side, analysis of the determinants of banking efficiency in France suggests a poor quality of management which affects the cost efficiency of French banks that invest more in risky assets. However, the comparison between the cost efficiency and the profit efficiency scores, suggests that foreign banks are better managed in terms of profit efficiency mainly due to higher cost efficiency. On the other side, profit efficiency of domestic banks, was due to higher revenue efficiency. This suggests that French domestic banks operate with excessive margins. Analysis of the determinants of banking efficiency in France suggests that revenue efficiency is more important than cost efficiency for domestic banks.

This study could be extended in several ways. One might use Data Envelopment Analysis (DEA) to compare the two methodologies. It is also interesting to investigate the profit efficiency of French banking sector.

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