

Profit and cost efficiency in the Italian banking industry (2006-2011)

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Abstract

This study evaluates the cost and the profit efficiency of Italian banking sector over the period 2006-2011. Translog stochastic frontiers are used for this purpose. Following the intermediation approach, efficiency scores are computed from estimating a model with three inputs and three outputs. Results show that the average levels of cost and profit efficiency are both around 90% and they are quite stable over time. However, there is high heterogeneity in results. Differences have been found when banks are classified by size (efficiency tends to decrease with size), legal type (cooperatives perform better than others) and area (the best performers are in the North East of the country).

Keywords: banking, translog stochastic frontiers, cost and profit efficiency

JEL Classification Codes: G21, C13, D01

1. Introduction

An intense restructuring process of banking industry has occurred in most countries over the last two decades. It was aimed at fostering efficiency and financial stability. In Italy the reform started with the 1990 Amato-Carli Act, the coming into force of EU Directive II and the 1993 Consolidated Act (Angelini and Cetorelli 2004; Giannola 2009; Messori *et al.* 2003)¹. All these norms have led to radical changes in the Italian banking sector. Over-time, there has been: a shift from state-owned to private banks; a marginalisation of banking foundations; a consolidation process involving the major Italian banks. The outcome of this process is also documented by the reduction in the number of banks (there were 1037 banks in 1993 and 706 in 2012) and the increase in bank branches (22133 in 1993 and 32875 in 2012).

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¹ The process of institutional reforms has been enriched by other norms, such as the 2002 budget law, the 262/2005 law and the 353/2006 Legislative Decree.

Given this circumstance, banks have re-examined their strategies to foster efficiency and face competition better. Thus, it is meaningful to investigate bank performance, given that the industry is now much more market-oriented than in the past. To this end, we use the Stochastic Frontier Approach (SFA) to measure the cost and profit efficiency of Italian banks and apply the specification proposed by Battese and Coelli (1995).² An aspect of interest in the analysis is related to the period covered, the years between 2006 and 2011. This was a period of instability in financial markets which has not yet been studied in terms of the effects on the efficiency of Italian banks. This work fills this gap by considering a sample of about 700 banks observed annually from 2006 to 2011.

Despite the huge literature on bank efficiency - there are exhaustive surveys by Berger and Humphrey (1997) and Fethi and Pasourias, (2010) - few papers have focused on Italy (Battaglia *et al.*, 2010; Dongili *et al.*, 2008; Fontani and Vitali, 2007; Giannola *et al.*, 1997; Giannola and Scarfiglieri, 1998; Girardone *et al.*, 2004). In this regards the evidence is mixed, but three conclusions may be drawn. Larger banks attain lower efficiency levels. Banks' cost-efficiency is higher in the North of Italy than in the South. Cooperatives perform better than other banks in controlling costs.³

This study contributes to the debate by updating the analysis. We find that the average level of profit and cost efficiency of Italian banks was around 90% over the period 2006-2011. However, efficiency was highly heterogeneous. Differences in results emerge when banks are classified by size (efficiency tends to decrease with size), legal type (cooperatives perform better than others) and area (the best performers are in the North East of Italy).

The paper is organised as follows. Section 2 presents the method. Section 3 describes the data and section 4 discusses the results. Section 5 concludes.

2. Stochastic Frontier framework and banks' cost and profit frontiers

The SFA is a stochastic method because it allows banks to be distant from the frontier also for randomness (Aigner *et al.*, 1977; Meeusen and van de Broek, 1977). It differs from the Data Envelopment Analysis (DEA) which supposes that distance from the frontier is entirely due to inefficiency. Again, SFA assigns a distribution to the stochastic component of the model and, thus, allows to make inference. Inference, however, is not specific to SFA (Simar and Wilson 2000). A further advantage of SFA derives from the specification of Battese and Coelli (1995), which improves, in terms of consistency, previous modelling where one firstly estimates inefficiency using a frontier and, secondly, uses the estimated efficiency-score as the dependent variable in subsequent regression (Greene 1993).⁴

The following function $F_c(\cdot)$ indicates the cost of producing an output y given a price w , whereas $F_p(\cdot)$ states the profit obtainable from producing y at input price w .

² The choice of considering both dimension of efficiency overcomes the limits arising from analysing only one of them. Indeed, profit efficiency only gauges performance properly if banks' objectives are restricted to profit maximisation. However, banks tend to minimise costs. According to some authors profit efficiency is superior to cost efficiency "for evaluating the overall performance of the firm" (Berger and Humphrey, 1997; Berger and Mester, 1997; Fitzpatrick and McQuinn, 2005). This view is intuitively based on the fact that profit derives from the maximisation of a function which depends on revenues and costs. It must be also said that profit efficiency requires not only technical efficiency and both input and output allocative efficiency (as does the cost efficiency), but also an appropriate scale. Thus, banks cannot be profit efficient if they are scale inefficient (Berger and Mester, 1997)

³ Giannola *et al.* (1997), Giannola and Scarfiglieri (1998), Girardone *et al.* (2004), Giordano and Lopes (2006), Giordano and Lopes (2012), Fontani and Vitali (2007), Dongili *et al.* (2008), Battaglia *et al.* (2010).

⁴ As shown by Lensink and Meesters (2012) and Wang and Schmidt (2002), the two-step approach suffers from the fact that the inefficiency is assumed to be identically and independently distributed in the main frontier equation, while it depends on other variables in the inefficiency equation.

$$Cost_{it} = F_c(y, w) e^{v_c} e^{u_c} \tag{1}$$

$$Profit_{it} = F_p(y, w) e^{v_p} e^{-u_p} \tag{2}$$

Eq. [2] is an alternative profit function since it depends on inputs and outputs, whereas actual profits depend on the prices of output. It uses the same variables as the cost function, implying that output-prices are free to vary (Huizinga *et al.*, 2001). Exhaustive discussions on alternative *versus* traditional profit efficiency are in Berger and Mester (1997) and Vander-Vennet (2002).

From eq. [1], the efficiency is expressed as the ratio between the minimum cost of a potentially efficient bank and the cost actually observed:

$$CE = \frac{F_c(y, w) e^{v_c}}{F_c(y, w) e^{v_c} e^{u_c}} = e^{-u_c} \tag{3}$$

Similarly, profit efficiency is the ratio between the observed banks' profit and the maximum level of profit achievable in case of full efficiency

$$PE = \frac{F_p(y, w) e^{v_p} e^{-u_p}}{F_p(y, w) e^{v_p}} = e^{-u_p} \tag{4}$$

We use the translog function to model the form of frontiers. It satisfies the assumptions of non-negativity, concavity and linear homogeneity (Kumbhakar and Lovell, 2000). After taking into account the constraint of homogeneity⁵ in relation to input-prices ($\sum_n \gamma_n = 1$), the cost frontier in the log-linear (w_r is the price of deposits) is:

$$\begin{aligned} \log\left(\frac{Cost}{w_r}\right) = & \beta_0 + \sum_j \beta_j \log y_j + \sum_n \gamma_n \log \frac{w_n}{w_r} + \frac{1}{2} \left[\sum_j \sum_s \beta_{js} \log y_j \log y_s + \sum_n \sum_q \gamma_{nq} \log \frac{w_n}{w_r} \log \frac{w_q}{w_r} \right] + \\ & + \sum_n \sum_j \alpha_{nj} \log \frac{w_n}{w_r} \log y_j + u + v \end{aligned} \tag{5}$$

where *Cost* is a bank's total costs; y_j represents the *j*-th output; w_n is the cost of the *n*-th input; β , γ and α are the parameters to be estimated; u is the inefficiency; v is the random error.

With regards profits, the right-hand side replicates the cost function, while the dependent variable is banks' profit, expressed as $\log\left(\frac{Profit}{w_r}\right)$. As in Berger and Mester (1997), Bonin *et al.* (2005), Fitzpatrick and McQuinn (2005), Huizinga *et al.* (2001) and Maudos *et al.* (2002) we transform profits by adding the absolute value of minimum profit plus one to actual profits. This ensures that $\log(Profit) = \log\left[\pi + \left|\pi^{\min}\right| + 1\right]$ is defined in $[0, +\infty)$.

Finally, we assume that v_{it} is normally distributed with mean zero and u_{it} is distributed as a truncated normal. Again, v_{it} and u_{it} are independently and identically distributed:

$$v_{it} \sim iidN(0, \sigma_v^2) \tag{6}$$

$$u_{it} \sim N^+(z\eta, \sigma_u^2) \tag{7}$$

⁵ Using a translog, linear homogeneity also requires standard symmetry ($\beta_{js} = \beta_{sj}$ and $\gamma_{nq} = \gamma_{qn}$) and linear restrictions of the cost (or profit) function ($\sum_n \gamma_{nq} = 0$ and $\sum_n \alpha_{nj} = 0$).

where $z'\eta$ is the linear predictor of inefficiency.⁶ The inefficiency component is specified as:

$$u_{it} = \sum_{k=1}^K \eta_k z_{itk} + e_{it} \quad (8)$$

where z_{itk} represents the k -th variable that affects inefficiency of the i -th bank; with $k = 1, \dots, K$. t is time and e_{it} the random component. In addition, the inequality $e \geq -z'\eta$ ensures the non-negativity of u .

3. Data and variables

Data are from the Italian Banking Association (ABI). The period under scrutiny covers the period 2006–2011 because the implementation of International Accounting Standards (IAS) occurred in 2005 and the balance sheets before-and-after the IAS implementation are not comparable.

The sample is presented in table 1. Banks are 686 in 2006, 692 in 2007, 689 in 2008, 686 in 2009, 648 in 2010 and 631 in 2011. They represent, on average, more than 96% of banks operating in Italy. The sample is dominated by cooperatives (on average 63% over-time), followed by corporations (32%) and Popolari banks (6%).⁷ Many banks are small and minor (92% of the sample in 2006 and 94% in 2011). Furthermore, the proportion of banks that have their headquarters in the North is 60% of the sample (20% in the South).⁸ Banks' size ranges from 2,764 mln euro in 2006 to 3,312 mln euro in 2011. Corporations are the largest, followed by Popolari and cooperatives. When considering location, the big banks are generally in the north-western of Italy with a size of about 6,3 mln euro in 2011. This value is double that reported by banks in central and north-eastern Italy and nine times higher than southern-banks' size.

We estimate a three-inputs-three-outputs model referring to the intermediation approach (Sealey and Lindley, 1977). Table 2 displays the variables used in defining the frontiers, while table 3 presents the determinants of efficiency. Table 4 reports some descriptive statistics of the variables included in the cost and profit frontiers.

⁶ As in many other recent papers – see, i.e., Battaglia *et al.* (2010) in the banking efficiency literature - the assumptions on v_{it} and u_{it} are those originally proposed by Battese and Coelli (1995), also because modeling other “possible correlated structures of the technical inefficiency effects and the random errors in the frontier” (Battese and Coelli, 1995, 327) goes beyond the scope of this work.

⁷ The Popolari banks are a specific category of cooperative that, during the restructuring process occurred in Italy over the last two decades, have maintained their nature of cooperatives for what concerns some features (the one vote per capita, irrespective of the number of shares held by the shareholder) but were transformed in profit-seeking companies.

⁸ As proposed by the Bank of Italy, bank size is defined by considering loans and deposits, the number of employees and of branches. The territorial classification consists of: North-West (Liguria, Lombardy, Piedmont, Aosta Valley), North-East (Emilia-Romagna, Friuli-Venezia-Giulia, Trentino, Veneto); Centre (Lazio, Marche, Tuscany, Umbria), South-and-Islands (Abruzzo, Basilicata, Calabria, Campania, Molise, Apulia, Sicily and Sardinia).

Table 1. Description of the sample. Number of banks* and size** by year

	2006		2007		2008		2009		2010		2011	
	Banks	Size	Banks	Size	Banks	Size	Banks	Size	Banks	Size	Banks	Size
<i>Area</i>												
North-West	151	6,011	149	6,955	144	8,210	152	7,464	138	5,762	129	6,370
North-East	241	1,636	242	1,884	242	1,877	239	2,045	231	2,883	230	3,020
Centre	151	3,250	150	3,106	154	3,238	150	3,381	144	3,182	139	3,418
South	143	725	151	701	149	712	145	768	135	742	133	736
<i>Legal form</i>												
Corporations	218	7,327	218	7,845	222	8,593	233	8,082	207	8,001	193	8,879
CCB	431	241	436	257	428	278	414	301	406	318	404	328
Popolari	37	5,276	39	6,368	39	5,506	39	6,001	35	6,689	34	7,154
<i>Size</i>												
Minor	514	277	520	244	521	281	517	296	496	342	489	344
Small	118	2,393	119	2,623	118	2,801	121	2,958	109	2,790	102	3,120
Medium	32	11,100	35	13,100	33	15,900	29	13,800	29	14,200	27	16,000
Large	13	25,000	11	28,900	10	30,600	12	31,200	10	32,700	9	40,000
Major	9	87,800	7	121,000	7	133,000	7	137,000	4	202,000	4	203,000
Total	686	2,764	692	2,983	689	3,253	686	3,268	648	3,177	631	3,312

Note:

* The number of banks changes year-by-year because (i) the dataset does not comprise the balance-sheet of some minor and small banks in 2010 and 2011; (ii) some banks have ceased to operate; (iii) few banks were involved in a very limited number of merges and acquisitions.

** Average value of total assets, expressed as the ratio between the total assets and the number of banks of each group. Constant values in mln of euro - NIC Index Istat, base year = 1995.

Source: our calculations based on data from ABI.

Table 2. Definition of the variables included in the cost and profit functions

Variables	Name	Description
y_1	Loans	Loans to customers. It includes current accounts, repurchase agreements, mortgages, credit cards, personal loans and salary-backed loans, transactions relating to financial leasing and factoring, business loans, structured debt securities and other securities
y_2	Commission Income	Revenues arising from non-traditional loans and deposits of banks. It includes incomes from trading of financial instruments and currencies, custody and administration of securities, business consulting, management of insurance products, collection and payment services, collection services.
y_3	Securities	Sum of loans to other banks, equities and bonds
x_1	Labour	Number of employees
x_2	Capital	Gross Banking Product, expressed as the sum of loans, direct and indirect funding.
x_3	Deposits	Debts to customers
w_1	Labour cost	Ratio between the personnel expenses and the number of employees
w_2	Cost of capital	Ratio between the other expenses (commission expenses, operating costs, depreciation of fixed assets, the administrative costs that do not relate to personnel expenses and the interest expenses that do not relate to those calculated on deposits) and the Gross Banking Product
w_3	Cost of deposits	Ratio between the interest expenses and the debts to customers
Costs (y, w)	Total costs	$w_1x_1 + w_2x_2 + w_3x_3 =$ Administrative expenses + Depreciation of fixed assets + Interest expenses + Operating costs + Commission expenses
Profits (y, w)	Total profits	$\log(Profit) = \log\left[\pi + \left \pi^{\min}\right + 1\right]$

Table 3. Definition of variables included in the inefficiency equation

Variables	Name	Description
z_1	Credit Quality	Ratio between bad loans and total loans for each areas according to the location of customers. Source: Bank of Italy
z_2	Solvency index	Ratio between the regulatory capital and the risk-weighted assets for each areas. It is a proxy of the risk faced by banks and it takes into account the directions in the Basel regulations. Risk-weights consider the operational risk (the risk of loss due to errors in the management of ordinary banking activities), market risk (the risk of loss due to the change in value for financial instruments) and credit risk (risk of loss due to insolvent counterparties)
z_3	Herfindahl-Hirschman index (HH)	It is calculated by squaring the market share of each bank and then summing the resulting numbers. Market shares are expressed as the ratio between the total assets of each bank and the total assets of all banks operating in any geographical macro-area. It is used as proxy of industry concentration
z_4	FTSE	FTSE refers to the Italian banks listed on the Milan Stock Exchange
$d_{2006}, d_{2007}, d_{2008}, d_{2009}, d_{2010}$	Time	Annual dummy variables. 2011 is the controlling group-year
d_{corp}, d_{pop}	Legal form	Dummies for legal form. CCB is the controlling group
$d_{smallest}, d_{med}, d_{large}, d_{major}$	Size	Dummies for size. small-banks is the controlling group
$d_{nw}, d_{centre}, d_{south}$	Geographical location	Dummies for geographical areas. North-East is the controlling group

Table 4. Average values of input and output (2006-2011)
(constant values in mln of euro - NIC Index Istat, base year = 1995)

Variables	Obs.	Mean	S.D.	Min	Max
Cost	3766	161456.60	856024	378.2148	20100000
Π	3766	10226.17	108520	-1040415	4395613
Profit	3766	1050642	108520	1	5436029
y_1 = loans to customers	3766	1712072	8435175	1.45	182000000
y_2 = commission income	3766	27212.08	133176	0.72	2880022
y_3 = securities	3766	716470.30	5922604	206.47	154000000
w_1 = labour cost	3758	53.14	20.50	7.12	712.77
w_2 = cost of capital	3766	0.0595	1.0283	0.000048	44.81
w_3 = cost of deposits	3741	0.0135	0.0344	0.000008	1.25

Source: see table 1

4. Econometric results

The estimates of cost and profit frontiers are in table 5.⁹ One meaningful result regards gamma, which is the ratio between the variance of the inefficiency and the variance of the composite error. The estimated gamma parameter is always 0.99 indicating that all the distance from the frontiers is due to inefficiency. This evidence is confirmed by the Likelihood Ratio test, which verifies the correct model specification of a SFA. It considers the H_0 that all the parameters in eq. [8] are equal to zero: if this hypothesis is accepted, then the OLS estimates will be consistent because the composite error comprises only randomness. Results indicate that the LR is 805.13 and 4570 in cost and profit frontiers respectively and, therefore, H_0 is rejected at 1% (table 5).

Something that is immediately evident from the inefficiency model is that all variables are significant (table 6). The positive coefficient of z_1 suggests that low credit quality results in high inefficiency.¹⁰ The negative coefficient of solvency index (z_2) indicates that banks' cost and profit efficiency increases when banking risk is low. The effect of market concentration (z_3) on efficiency differs according to the frontier. The coefficient is negative in cost frontier, implying that a higher concentration allows higher cost efficiency levels to be reached.¹¹ The opposite holds when considering profit, where the estimated inverse relationship between profits and concentration indicates that Italian banks fail, on average, to benefit from the revenue side, in spite of the increasing market-shares. This might be due to the competitive pressures from operating in a more-liberalized market. The estimated negative relationship between FTSE and inefficiency means that an increase in the index induces a reduction in inefficiency. As regards yearly dummies, we find that in 2006, 2007 and 2008 inefficiency was lower than in 2011. The opposite holds for 2009 and 2010.

The positive coefficients associated with territorial dummies highlight the role of location: banks in north-eastern Italy perform better than others, whatever the frontier. Moreover, the estimations reveal that southern banks perform less well than north-eastern institutions, but better than those in the Centre and North-West. It is also important to underline that cooperatives are the best performing type of banks. Mixed results are found when considering dummies associated with size, where the effect varies according to the frontier.

⁹ We implement a LR test to verify the correctness of the translog. Under H_0 there is the Cobb-Douglas model, which we always reject at 1%.

¹⁰ In line with the bad management hypothesis, the increased cost efficiency is a result of cost savings in screening and monitoring activities. This, however, has negative consequences on credit-quality (Berger and De Young, 1997).

¹¹ Similar results are in Fontani and Vitali (2007), but contrast with Turati (2008), according to which a higher concentration involves lower cost efficiency levels. However, they consider the Herfindahl-Hirschman at national level, while we refer to territorial markets.

Table 5. Cost and profit frontiers of Italian banks
Translog estimates in 2006-2011

	Cost	Profit
β_0	-5.44***	10.18***
β_1	0.73***	0.02
β_2	-0.20***	-0.29***
β_3	0.38***	0.16***
γ_1	1.60***	1.18***
γ_2	0.03	-0.05
β_{11}	0.04***	0.01***
β_{12}	-0.06***	-0.03***
β_{13}	-0.03***	0.05***
β_{22}	0.03***	0.02***
β_{23}	0.02***	-0.07***
β_{33}	0.01***	0.03***
γ_{11}	-0.05***	-0.002
γ_{12}	-0.004	-0.02
γ_{22}	0.05***	0.06***
α_{11}	-0.06***	-0.03***
α_{12}	0.07***	0.08***
α_{13}	-0.02*	-0.06***
α_{21}	0.07***	0.03***
α_{22}	-0.05***	-0.03***
α_{23}	-0.002***	0.01
σ^2	119.43*	260.38***
$\gamma = \frac{\sigma_u^2}{\sigma^2}$	0.9997***	0.9999***
Log-likelihood	363.15	1557.89
LR test	805.13*	4570.00*
	(34.2) ⁺	(34.2) ⁺

Significance levels: '***' = 0.01; '**' = 0.001; '*' = 0.05; '.' = 0.1; ' ' = 1.
+ LR critical value as tabulate by Kodde and Palm (1986)

Source: see table 1

Table 6. Cost and profit inefficiency for Italian banks
Estimates over the 2006-2011 period

	Cost	Profit
$z_1 = \text{bad loans}$	615.77*	1580.20***
$z_2 = \text{solvency index}$	-868.05*	-733.66***
$z_3 = \text{H-H index}$	-2875.70*	4728.90***
$z_4 = \text{FTSE}$	-0.03*	-0.09***
d2006	-105.64*	-236.19***
d2007	-73.35*	-658.29***
d2008	-859.18*	-4062.70***
d2009	163.84*	-213.31***
d2010	121.89*	-1196.20***
d_corp	684.34*	3004.90***
d_pop	892.63*	2555.40***
d_minor	-65.13*	16.50***
d_med	-402.49*	760.80***
d_large	-170.87*	1004.60***
d_major	152.38*	1114.10***
d_nw	607.00*	273.02***
d_centre	262.75*	107.54***
d_south	144.99*	157.71***

Significance levels: '****' = 0.01; '***' = 0.001; '**' = 0.05; '.' = 0.1; ' ' = 1

Source: see table 1

We find that the cost and profit efficiencies are both slightly higher than 90% in 2006-2011. By considering costs, it emerges that banks would have needed only 90% of the inputs used in offering banking services. They earned 90% of their potential profits: a 10% recovery of profitability would have been possible without increasing inputs. On average, this indicates that Italian banks perform similarly when they control costs or generate profits. We can see from table 8 that this holds even year-by-year: the average level of efficiency is 91% in both cases in 2006, declines up to 2008 and shows a slight recovery in the two subsequent years. In 2011, cost and profit efficiency-scores are around 90%, a lower value than that of 2010. While the average values of cost and profit efficiency are comparable, a certain heterogeneity exists between and within groups. The density function of cost efficiency differs from that of profit: profit efficiency is more dispersed than cost efficiency: standard deviations are 0.1162 and 0.0825 respectively. Again, the median cost efficiency is 92.4%, while it is 94.54% for profits. Finally, for 1% of banks, cost efficiency ranges from 4.89% to 50%, while the upper value of profit efficiency is 34.41% for 1% of banks (figure 1 and table 7).

Marked differences emerge when disaggregating the analysis by year and bank category (table 8). What regards the banks' type, we find that cooperatives perform better than others in both frontiers and every year. Over the 2006-2011 period, cooperatives register a cost inefficiency of 3.3% and a profit inefficiency of 4.1%. These are much lower values than those estimated for corporations, which are 14% inefficient, whatever the frontier, and Popolari banks, which have a gap of 17.1% from the cost frontier and almost 13% in the case of profits. Over time, we see a common decline at the beginning of the period, a recovery in 2009 and 2010 and a new loss of efficiency in 2011. These time-changes do not alter the

stylised-fact according to which cooperatives gain more in generating profits than in controlling costs (although the gap in efficiency scores is marginal and disappears in 2011). The same applies for Popolari banks, although their efficiency is always lower than that registered for cooperatives. The picture changes for corporations, which show different patterns: except for 2010, their cost efficiency is always higher than their profit efficiency. Interestingly, at the end of the period, the distance between profit and cost behaviour increased, as a consequence of the sharp reduction in 2011 profitability.

Three facts emerge when classifying banks by size. Firstly, minor banks perform well: inefficiency is less than 7% in profitability and 8.5% in costs. Thus they make better use of inputs and outputs than any other group. The same thing applies for small-banks for profits, while mixed evidence is found from cost-side (where small-banks might reduce inputs by 14,53%, a value close to that (14,16%) observed for large-banks and much higher than the cost inefficiency of medium-banks (10,22%). Secondly, data indicate that efficiency decreases when size increases. This scale-effect is evident in profitability in 2009 and 2011, whereas, in the other years, it applies for the first four bank-groups. A noteworthy fact is that profit efficiency in 2006-2011 is 93.19% for minor-banks, 87.29% for small-banks, 72.86% for medium-banks and 60.01% for large-banks. The last group is that of major-banks, which registers a profit efficiency of 63.98%, a higher value than that observed for large-banks, but sharply lower than that estimated for any other sub-sample. Similarly, a size-effect is revealed on the cost-side: with the exception of small-banks, efficiency is 91.56% for minor-banks, 89.78% for medium-sized banks, 85.85 for large-banks and only 77.60% for major-banks. This relationship between size and cost efficiency is at work in every year. Another aspect regards the fact that cost and profit efficiencies record very narrow values for minor-small-banks (with cost efficiency slightly higher than profit efficiency). The contrary holds for medium-large-major banks which perform better when controlling costs than when producing profits. The difference in efficiency scores is high at any time and assumes remarkable numbers for 2011 when banks tended to improve their behaviour in managing costs and experienced a drastic worsening in profitability (table 8).

Figure 1. Density of cost and profit efficiency

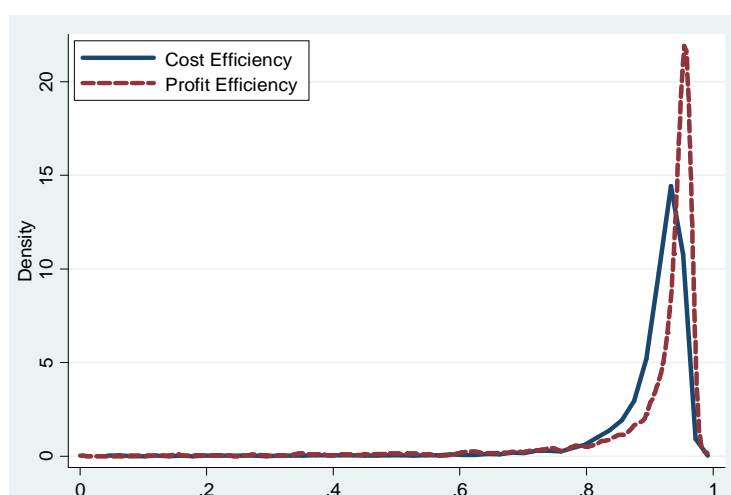


Table 7. Some descriptive statistics of cost and profit efficiency scores (2006-2011)

Cost Efficiency				
	Percentiles	Smaller values		
1%	0.5008	0.0490		
5%	0.7830	0.0548		
10%	0.8387	0.0612		
25%	0.8950	0.0672	Obs	3741
50%	0.9245		Mean	0.9021
			Std.	0.08
		Larger values		
75%	0.9413	0.9737		
90%	0.9523	0.9788	Variance	0.0068
95%	0.9566	0.9801	Skewness	-486.57
99%	0.9643	0.9855	Kurtosis	3.595.15

Profit Efficiency				
	Percentiles	Smaller values		
1%	0.3441	0.000001		
5%	0.68178	0.0872		
10%	0.8140	0.1142		
25%	0.9112	0.1190	Obs	3741
50%	0.9454		Mean	0.9048
			Std.	0.11
		Larger values		
75%	0.9571	0.9898		
90%	0.9629	0.9905	Variance	0.0135
95%	0.9656	0.9908	Skewness	-3.729.905
99%	0.9713	0.9909	Kurtosis	1.896.607

Source: see table 1

Table 8. Cost and profit efficiency of Italian banks by legal form, size and area (2006-2011)

	2006	2007	2008	2009	2010	2011	2006-2011
Cost Efficiency							
All sample	0.9156	0.8955	0.8766	0.9008	0.906	0.9207	0.9021
<i>Legal form</i>							
Corporations	0.8751	0.8557	0.8203	0.8634	0.8703	0.8866	0.8608
Popolari	0.8583	0.8182	0.7799	0.8106	0.8419	0.8782	0.8290
Cooperative Banks	0.9378	0.9203	0.9129	0.9256	0.9263	0.9402	0.9270
<i>Size</i>							
Minor	0.9286	0.9117	0.8996	0.9123	0.9151	0.9278	0.9156
Small	0.8675	0.8438	0.8005	0.8612	0.8748	0.8874	0.8547
Medium	0.9117	0.8806	0.8607	0.9032	0.9092	0.9290	0.8978
Large	0.8753	0.8581	0.7734	0.8779	0.8552	0.9236	0.8584
Major	0.8551	0.7745	0.6759	0.7787	0.7881	0.8586	0.7760
<i>Area</i>							
North West	0.8696	0.8503	0.8315	0.8681	0.8794	0.8857	0.8635
North East	0.9388	0.9138	0.8974	0.9230	0.9394	0.9448	0.9258
Centre	0.9183	0.9054	0.8800	0.8999	0.8855	0.9172	0.9007
South	0.9163	0.8983	0.8816	0.8959	0.8940	0.9174	0.9000
Profit Efficiency							
All sample	0.9191	0.8993	0.8814	0.9102	0.9298	0.8930	0.9048
<i>Legal form</i>							
Corporations	0.8436	0.7962	0.7731	0.8293	0.8685	0.7844	0.8138
Popolari	0.9105	0.8734	0.8345	0.8692	0.9187	0.8658	0.8762
Cooperative Banks	0.9529	0.9497	0.9383	0.9511	0.9570	0.9459	0.9490
<i>Size</i>							
Minor	0.9398	0.9320	0.9154	0.9368	0.9470	0.9232	0.9319
Small	0.8909	0.8565	0.8413	0.8747	0.9108	0.8687	0.8729
Medium	0.7895	0.6892	0.6275	0.7712	0.8302	0.6789	0.7286
Large	0.6783	0.5959	0.5444	0.6525	0.6840	0.4066	0.6001
Major	0.8225	0.7152	0.6719	0.5718	0.7718	0.2391	0.6398
<i>Area</i>							
North West	0.8746	0.8320	0.8093	0.8590	0.8992	0.8334	0.8499
North East	0.9464	0.9298	0.9157	0.9367	0.9505	0.9172	0.9325
Centre	0.8998	0.8865	0.8642	0.9022	0.9084	0.8790	0.8894
South	0.9346	0.9254	0.9104	0.9229	0.9452	0.9237	0.9264

Source: see table 1

5. Concluding remarks

By using the SFA on a single sample of Italian banks, this study provides evidence on the likely mis-estimation involved when considering exclusively cost or profit efficiency. On average, no biased image of efficiency appears to occur given that cost and profit efficiency scores are both around 90%. The picture changes when banks are classified into sub-groups. The groups of medium-large-major banks perform better when controlling costs than when generating profits. In such cases, studies which only focus on the cost frontier will overestimate the capability of the Italian banks to be efficient. With regards these groups of banks, it is worth emphasising that profit efficiency is quite a bit lower than cost efficiency. As the profit measure admits the existence of market power in setting the output-prices, the find that large-sized banks suffer the increase of competition. Two different results have been found for minor-small banks. They not only perform better than major-sized banks, but their cost and profit efficiency scores are similar: being small is an advantage in performing well. It also emerges that cooperatives attained the highest efficiency. They even perform better than the corporations, which are the banks involved in recent radical changes.

We may argue that large-sized banks face the competitive pressures in international markets more than the others do and this tends to reduce profit opportunities. Furthermore, the smallest banks and those organised as cooperatives perform well because, evidentially, they still enjoy a certain degree of monopolistic power in the restricted local markets where they operate.

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