1. EFFICIENCY IN COOPERATIVE BANKS AND SAVINGS BANKS: A STOCHASTIC FRONTIER APPROACH

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Abstract

In this article, we used a stochastic frontier model to estimate the cost efficiency of cooperative banks and savings banks from nine countries over the period 2005 to 2011. In addition, we analyzed the influence of certain variables that quantify the risk and performance of cooperative banks and savings banks on the level of inefficiency. We found that both the cooperative banks from Switzerland and the savings banks from Norway and Sweden have a high level of cost efficiency. With regard to the variables that influence the inefficiency level, the results showed that a higher risk implies the growth of this level, while an increase in performance leads to a decrease in inefficiency. The results showed that a higher rate of the Gross Domestic Product (GDP) growth implies an increase in the inefficiency level. Smaller cooperative and savings banks are more efficient in managing costs compared to larger banks. We interpreted this result as being a consequence of the advantages from which this institutions benefit within the groups to which they belong.

Keywords: cooperative banks, savings banks, cost efficiency, risk-taking, bank performance

JEL Classification: C30, G21, G32

I. Introduction

In recent years, the global crisis has significantly affected the activity of financial systems and of banking institutions, emphasizing their fragility. In such a context, dominated by intense competition between banks and by significant structural

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changes in the way they operate, the banks' cost efficiency became essential. Generally, cost efficiency is defined as the ratio of the minimum cost at which it is possible to attain a given volume of production to the cost actually incurred (Maudos *et al., 2002*). Therefore, increasing the efficiency in a turbulent competitive environment ensures stability and can provide a strategic advantage over competitors. Moreover, an efficient banking system has a positive influence on economic growth (Ferreira, 2012; Koetter and Wedow, 2010; Hasan *et al., 2009*). Also, given the fact that most of the commercial banks were confronted with higher risks as a consequence of the global financial crisis, the importance of the banks that adopted a traditional model of activity - cooperative banks and savings banks - grew. Thus, Bülbül *et al.* (2013) showed that the savings and cooperative banks performed better than the large private banks in the crisis and, therefore, it was important to safeguard the strengths of these types of banks. Also, Birchall (2013) revealed that customer-owned banks were much more stable and more efficient than the private banks and provided an alternative to the commercial banks.

Generally, within the banking systems the institutions embrace different business models, organizational forms and ownership structures. Along with the commercial banks that embrace the universal banking model, a significant number of credit institutions with different organizational forms and ownership structures - cooperative banks and savings banks - play an important role in the banking sector. In addition, Ayadi *et al.* (2010, p. 6) divided banks into two broad categories: Stakeholder Value banks and Shareholder Value banks. The distinction is made according to the banks' bottom line objectives and the extent to which profit maximization is the central focus of their business models. The authors consider that cooperative banks and savings banks represent "dual-bottom line" institutions.

The cooperative banks are not-for-profit organizations, established to sustain the activity of their members. Today, the main clients of the credit cooperatives are individuals and small- and medium-sized enterprises, and their business model approaches the universal bank model. Despite this, there are certain characteristics that cooperative banks retain and that differentiate them from the commercial banks. Cooperative banks operate under the regional principle, conferring an important role to them in financing the local communities (European Association of Cooperative Banks, Annual Report 2012). Regardless of the countries in which they operate, most of the cooperative banks have mutual support mechanisms, so that the local cooperatives are supported at the moment that difficulties are encountered. Being organizations that do not follow profit maximization, their main aim is to improve the economic welfare of their members, while the members' objective is to use financial services and not to obtain dividends.

Beside the cooperative banks, savings banks have an important role in the banking sector, particularly in Europe. Although savings banks were initially created to promote social inclusion, they have evolved into specific, universal banks that are in competition with the commercial banks for households and small- and medium-sized enterprises. The main feature that differentiates the savings banks from the commercial banks is their organizational structure. In Germany, savings banks are public entities and have no owners in the commercial sense, the public authorities being responsible for the activity of these institutions (Clarke, 2010). In Norway,

Denmark and Sweden, savings banks are organized as independent foundations. In other words, they do not have stockholders or traditional owners. Their capital consists of profits from the previous years (*Nordic Banking Structures – Report*, 2006; Organization for Economic Co-operation and Development - The Norwegian Financial Services Industry). On the other hand, the pressure to meet the capital requirements imposed by financial regulations led to the reorganization of the saving bank sector in some countries. Thus, in Italy, savings banks have been transformed into joint stock companies (Carletti *et al.*, 2005). In Spain, the authorities have decided to change the legal status of savings banks in order to facilitate access to capital markets (*Report on Banking Supervision in Spain*, 2010). Even so, savings banks remain close to the clients, as they are locally based and are oriented towards long-term lending strategies.

Regardless of the organizational form and the ownership structures, the technological developments and the constraints induced by the financial crisis have intensified the competition in the banking sector. Under these circumstances, both efficiency and cost management have become essential in the banks' attempts to improve their operational performance and financial reliability. In fact, in the recent years, both cooperative banks and savings banks have laid the foundations for intense cooperation within the groups to which they belong, in order to benefit from economies of scale.

In this article, we propose to estimate the cost efficiency of cooperative banks and savings banks in nine countries over the period 2005 to 2011 and to identify how environmental variables and control variables influence the inefficiency effect, using the model proposed by Greene (2005). The contribution provided by our study with respect to the existing literature is manifold. Firstly, the model is based on 9,352 observations corresponding to 1,059 cooperative banks and 551 savings banks within banking systems in which these banks have an important market share. Moreover, our sample is comparable with other similar studies (Kontolaimou, 2014; Kontolaimou and Tsekouras, 2010). We consider that this large database gives reliability to the estimations and results. Secondly, we included variables that describe the risk and performance of cooperative and savings banks among the factors that influence inefficiency. Also, we included environmental variables in the model. Thirdly, we consider that the results are important for understanding the way in which the activity of cooperative and savings banks developed over the period of analysis.

The remainder of the article is organized as follows: Section II reviews the literature on efficiency studies, paying special attention to cooperative and savings banks. Section III presents the methodology framework adopted in this study. Section IV describes the data and variables. Section V discusses the empirical results. Finally, Section VI presents the conclusions.

II. Cooperative and Savings Banks Efficiency: Literature Review

In the literature on banking efficiency we may find numerous studies with different results and aims. Most of them use the stochastic frontier approach (SFA) and data

envelopment analysis (DEA) to estimate cost efficiency. Hereinafter, we review some results of these researches, focusing particularly on those that consider the cooperative bank sector and the savings bank sector.

An important concern within the literature was represented by the attempt to establish whether cooperative banks and savings banks were more efficient than the commercial banks. Kontolaimou and Tsekouras (2010) investigated the productive performance of cooperative banks as compared to commercial banks and savings banks. The authors adopted a methodology based on a meta frontier notion that allowed for the identification of technology gaps among different bank types and their decomposition into input- and output-invariant components. The results suggest that the frontier corresponding to cooperative banks lies mainly away from the European meta frontier, while the commercial banks practically define this frontier. The authors consider that the cooperatives' technology gap is attributable to output production rather than to input use. The results are in line with Rasmusen's findings (1988), which showed that cooperative banks are less efficient than commercial banks because they are characterized by the one person-one vote principle. However, there are studies with different results. Girardone *et al*. (2009) analyzed cost efficiency in EU-15 countries over the period 1998 to 2003, emphasizing the higher performance of the cooperative banks. Altunbas *et al*. (2003) investigated the efficiency of a large number of European and US banks in the period 1999 to 2000. The results indicate higher cost efficiency of the cooperative banks as compared to the commercial banks, but lower profit efficiency.

The determinants of cost efficiency have also been examined in several papers. Battaglia *et al*. (2010) estimated cost and profit efficiency for cooperative banks in Italy using a SFA model. The authors included environmental variables to account for disparities among the Italian regions in their model. The results of the study show that the environmental variables substantially influenced the efficiency of estimates. Thus, the banks in Northern Italy are more cost efficient, benefiting from a favorable environment, while the banks in Southern Italy are more profit efficient due to lower competitive pressure. Assaf *et al*. (2011) studied the productivity and efficiency of cooperative banks in Japan - Shinkin banks – over the period 2000 to 2006, using the bootstrapped Malmquist index and the Bayesian distance frontier approach. The results do not show a considerable improvement in efficiency and productivity in the analyzed period. Also, the efficiency level is homogenous because the variations between banks are low. The authors concluded that the market share on deposit, the number of branches, the return on assets and the concentration ratio of deposits for the five largest banks are important contributors to efficiency and productivity growth. Analyzing the credit unions in the USA, Glass and McKillop (2006) found that factors beyond management control could explain much of the variability of the cost efficiency level.

Other studies focused on cross country comparisons of cooperative banks and savings banks regarding cost efficiency. Barros *et al*. (2010) used the Luenberger productivity index to estimate efficiency and productivity changes in the European cooperative banks over the period 1996 to 2003. The results indicate that there has been productivity growth in the cooperative industry with rates that differ across countries, driven by improvements in the technological change. The results are similar

to those obtained by Molyneux and Williams (2005). Given that innovation represents the main determinant of the productivity increase in the cooperative sector, Barros *et al*. (2010) recommended that larger or centralized cooperative banks develop and franchise technology to smaller cooperatives. Williams *et al*. (2011) used the Luenberger productivity index to estimate productivity growth and its decomposition for savings banks in 10 EU countries in the period 1996 to 2003. The estimations show an annual productivity growth of 2.78%, driven by technological change. The results are similar to those obtained by Williams (2001), who found a growth in productivity of 2.86% for savings banks in six EU countries. Also, Williams *et al*. (2011) emphasized cross-country differences between the savings banks. Thus, the highest productivity growth is found in Finland, Spain and France, while in Germany the index has a negative value. Carbo *et al*. (2003) estimated the technological progress of European savings banks over the period 1989 to 1997, using a Fourier flexible form cost function methodology. The results indicate that, on average, technological progress reduced savings banks' total costs by around 3.4% per annum and that this cost reduction was higher for the larger savings banks. The savings banks in Sweden, Portugal, Luxembourg, Belgium, Austria and France benefited most from the technological progress, while the total cost reduction for banks in Denmark and Germany was below the average.

III. Methodology

This section summarizes the theoretical model used to estimate cost efficiency. To measure the efficiency of cooperative banks and savings banks, we used a SFA model. The main reason behind the choice of the SFA is related to the fact that the DEA does not allow for the presence of a random error term. Thus, any deviation from the efficiency frontier is associated with inefficiency. For instance, DEA considers the influence of factors such as measurement error, luck or extreme observations to indicate inefficiency. SFA, independently proposed by Aigner *et al*. (1977) and Meeusen and van den Broeck (1977), allows for the specification of a composed error that can be decomposed into two parts: a one-sided error that measures the nonnegative inefficiency effects and a classical random error. However, the major drawback of the model used in our estimations is that it does not compute the non-monotonic effects, which allows a better understanding of the relationship between efficiency and its determinants.

In the literature on efficiency there are many models that model inefficiency within the panel data. A detailed description of these models' specifications can be found in Belotti *et al*. (2012). Most of the models treat inefficiency as a time-invariant "effect" (Schmidt and Sickles, 1984; Pitt and Lee, 1981). Greene (2005) argued that a preferable approach would be to allow inefficiency to vary freely over time in a panel, to the extent that there is a common time-invariant effect in the model that should be treated as unobserved heterogeneity, not as inefficiency. The SFA model employed in our study adopts the methodology proposed by Greene (2005). The stochastic frontier model specification as proposed by Pitt and Lee (1981) for the cost function can be represented as follows:

$$Y_{it} = f(x_{it}, z_i) + v_{it} + u_i, \qquad i = 1, \dots, N \quad t = 1, \dots, T \tag{1}$$
$$= \alpha + \beta' x_{it} + \tau' z_i + v_{it} + u_i \tag{2}$$
$$v_{it} \sim N(0, \sigma_v^2) \tag{3}$$
$$u_i \sim N^+(0, \sigma_u^2) \tag{4}$$

where Y_{it} is the total cost of the bank *i* in year *t*; x_{it} is a vector of input prices and z_i is a vector of bank specific characteristics. Greene (2005) considers it would be convenient to include $\tau' z_i$ in $\beta' x_{it}$; thus, Equation 2 becomes:

$$Y_{it} = \alpha + \beta' x_{it} + v_{it} + u_i \tag{5}$$

Schmidt and Sickles (1984) argued that the estimation of a stochastic frontier model with time invariant inefficiency could be done by adapting conventional fixed-effects estimation techniques. Therefore, inefficiency will be correlated with the frontier regressors and distributional assumptions about u_i will be avoided. For estimations based on panel data, the time invariant nature of the inefficiency term has been questioned. Thus, Cornwell *et al*. (1990) proposed the following stochastic frontier model, where the parameters are estimated by extending the conventional fixed- and random-effects panel data estimators.

$$Y_{it} = \alpha + \beta' x_{it} + v_{it} + u_{it}, \qquad i = 1, \dots, N \quad t = 4, \dots, T_i \tag{6}$$
$$u_{it} = \omega_i + \omega_{i1} t + \omega_{i2} t^2 \tag{7}$$

Lee and Schmidt (1993) proposed an alternative specification, in which:

$$u_{it} = g(t) \cdot u_i \tag{8}$$

where $g(t)$ represents a set of dummy variables. Kumbhakar (1990) proposed the ML estimation of a time-varying SF model, in which $g(t)$ is specified as:

$$g(t) = [1 + \exp(\gamma t + \delta t^2)]^{-1} \tag{9}$$

A similar model was proposed by Battese and Coelli (1992), as follows:

$$g(t) = \exp[-\gamma(t - T_i)] \tag{10}$$

All these models assume that α is the same for all the units included in the analysis. Belotti *et al*. (2012) considers that this characteristic can generate a misspecification bias in the presence of time-invariant unobservable factors, unrelated to the production process but still affecting the output. As a result, the effect of these factors may be captured by the inefficiency term, producing biased results. In order to avoid this disadvantage, Greene (2005) proposed a model that allows the disentanglement of time-varying inefficiency from unit specific time invariant unobserved heterogeneity:

$$Y_{it} = \alpha_i + \beta' x_{it} + v_{it} + u_{it} \tag{11}$$
$$v_{it} \sim N(0, \sigma_v^2) \tag{12}$$
$$u_{it} \sim N^+(0, \sigma^2) \tag{13}$$

IV. Data

Our sample covers an unbalanced panel dataset of 9,352 observations corresponding to 1,059 cooperative banks and 551 savings banks over the period 2005 to 2011. We have chosen to include in the sample cooperative banks and savings banks from developed countries and from banking systems in which they play an important role.

Thus, we have included cooperative banks from Austria, Germany, Switzerland, Spain, France and Italy and savings banks from Austria, Germany, Norway, Sweden, Denmark, Spain, France and Italy. The data were extracted from the Bankscope database. Table 1 reports some descriptive statistics for the banks included in the sample.

As one may see, cooperative banks and savings banks have a significant market share in all the countries included in the sample. Consequently, the organization of the activities based on effective principles is essential to ensure the stability of the banking systems of which they are part. Moreover, bearing in mind the fact that cooperative banks and savings banks do not pursue profit maximization, efficiency becomes more important.

Table 1

Descriptive Statistics of the Dataset and the Market Share of Cooperative Banks and Savings Banks

	Equity to total assets ratio	Cost to income ratio	ROA	ROE	Net interest margin	Liquid Assets to Deposits and short term funding ratio	Market share-2011
Austria							
Cooperative banks	7.58	65.65	0.35	4.06	2.12	28.39	36.9%[a]
Savings banks	6.71	66.87	0.22	3.09	2.23	18.21	16.5%[b]
Germany							
Cooperative banks	6.46	69.31	0.31	4.97	2.56	17.03	19.4%[a]
Savings banks	5.87	67.55	0.17	3.01	2.36	15.28	13.25%[c]
Switzerland							
Cooperative banks	3.02	64.09	0.17	6.35	1.55	11.89	19.8% [a]
Spain							
Cooperative banks	10.24	61.58	0.52	5.75	2.39	21.17	6.78% [a]
Savings banks	7.75	57.36	0.55	5.64	1.90	11.86	30% [d]
France							
Cooperative banks	11.26	58.89	0.75	6.71	1.83	18.39	38.2% [a]
Savings banks	9.80	70.85	0.42	5.39	1.83	43.54	N.A.
Italy							
Cooperative banks	10.82	65.69	0.58	5.21	2.87	17.39	33.9% [a]
Savings banks	8.66	65.58	0.59	6.49	3.07	21.94	N.A.
Norway							
Savings banks	9.61	59.91	0.69	7.39	2.34	9.18	45.2%[e]
Sweden							
Savings banks	14.27	63.31	0.96	6.85	2.82	13.27	10.0%[f]
Denmark							
Savings banks	15.18	76.74	0.24	0.28	3.84	15.07	N.A.

Note: Sample Means Are for Bank-Year Observations by Bank Type and Country
Source of data: [a] European Association of Co-operative Banks (2012) Key Statistics Financial Indicators 2011; [b] Oesterreichische Nationalbank (OeNB), Statistics and Reporting - Banks' Business Structure; [c] Deutsche Bundesbank (2012) Banking statistics December 2011,

Statistical Supplement to the Monthly Report; [d] Banco de España (2010) Report on banking supervision in Spain; [e] Norges Bank (2011) Financial Stability 1/2011, Reports from the Central Bank of Norway No. 2/2011; [f] Swedish Bankers' Association (2011) Banks in Sweden.

For selecting the bank's output vector, we followed the intermediation approach (Sealey and Lindley, 1977). The output vector includes total loans (TL), and total other earnings assets (OEA). Loan loss provisions are subtracted from total loans in order to ensure comparable quality (Havrylchyk, 2006). The input prices are the price of labor (PL), the price of funds (PF) and the price of capital (PC). The price of labor is calculated as personnel expenses divided by the number of employees. The price of funds is measured by dividing total interest expenses by total deposits and other purchased funds. The capital price is defined by the ratio of other noninterest expenses to total fixed assets. The total cost of each bank is the sum of interest expenses and noninterest expenses. In order to ensure the homogeneity of the cost function, the total cost, the price of labor and the price of funds were normalized by the price of capital. All the monetary values were deflated using the GDP deflator provided by the International Monetary Fund (IMF), with 2005 as the base year. Table 2 presents the descriptive statistics of the output and input variables used in the model. In order to measure the country's effect, we created a dummy variable for cooperative banks and savings banks. We dropped the first variable to avoid multicollinearity. We included in the model two dummy variables for the years 2008 and 2009, which takes the value of one in these years and 0 otherwise, in order to identify the impact of the financial crisis on the level of cost efficiency. We have chosen these years following Laeven and Valencia (2013) description of systemic banking crisis.

Table 2

Descriptive Statistics of the Variables Used in the Cost Efficiency Estimations

	Mean	Median	SD	Min.	Max.
Total cost (in billion US $)	0.2007	0.0366	1.6610	0.0006	69.9000
Output quantities (in billion US $)					
Total loans	2.8341	0.5692	16.2000	0.0042	492.0000
Other earning assets	2.5535	0.2663	39.4000	0.0005	1560.0000
Input prices					
Price of funds	0.0227	0.0224	0.0080	0.0033	0.0817
Price of labor	75.3291	73.2159	22.9864	7.7453	792.3094
Price of capital	1.0354	0.6667	3.6953	0.0803	145.2109

An important aim of our study was to examine how exogenous factors influence inefficiency. Therefore, in order to achieve this objective, we included environmental variables and control variables in the SFA model. The inclusion in the model of some environmental variables is based on the premise that efficiency is influenced by the economic conditions of the countries in which the banks operate. The control variables capture different strategies adopted by each institution. Real GDP growth and the Z score are the environmental variables. Real GDP growth was extracted from the IMF International Financial Statistics Database. Real GDP growth is a proxy for the

economic development. An increase in the real GDP should lead to a higher credit demand, a better quality of loan portfolios and, consequently, a lower ratio of nonperforming loans. Therefore, real GDP growth should reduce inefficiency. The Z score is a measure of a bank's risk taking. Lepetit *et al.* (2008a) posits that the Z score reveals the insolvency risk, indicating the probability of bankruptcy for a bank. The index is estimated by combining the elements that describe profitability, leverage and return volatility:

$$Z = \frac{\text{average } ROA + \text{average } EQ/TA}{\text{VOL } (ROA)} \quad (14)$$

Higher Z scores indicate a lower probability of bankruptcy and, therefore, lower costs. In our study, the Z score was calculated for each country and for each banking sector, (the cooperative banking sector and the savings banking sector), based on individual observations of banks.

The bank capital to assets ratio, the loan loss provisions divided by total loans, the Return on Equity (ROE), the net interest margin, the net loans to total assets ratio and the logarithm of total assets are the control variables. Bank capital to assets ratio is associated with lower costs, because banks are perceived of as being less risky. Loan loss provisions divided by total loans is a measure for risk, reflecting the quality of a bank's assets. We included this rate in our model to emphasize the influence of the credit risk on cost efficiency. Furthermore, the loan loss provisions/total loans ratio can also reflect the effects of the financial crisis on the bank's balance sheet. Basically, growth of the loan loss provisions/total loans ratio will lead to a growth in costs and inefficiency. ROE and the net interest margin are proxies for a bank's performance. ROE and the net interest margin are commonly used in the literature to describe a bank's earning ability (De Haas and Van Lelyveld, 2006; Xu, 2011; Heffernan and Fu, 2010). A growth in these two rates should result in better cost efficiency. Net loans to total assets ratio is a measure of loan specialization. Freixas (2005) posits that a high rate provides informational advantages, which reduce intermediation costs and improve profitability. However, Heffeman and Fu (2010) state that very high ratios could also reduce liquidity and increase the number of marginal borrowers that default. Log(assets) is a measurement of the size of banks and may be an important determinant of a bank's efficiency. On one hand, larger banks may be more efficient compared to smaller banks, as a result of the economies of scale. On the other hand, there are also small banks that are efficient.

V. Results

The determination of cost efficiency by estimating a maximum likelihood function was conducted using Stata 10.1 software. As mentioned, we adopted Greene's (2005) truncated normal model. The same model, with the exception of exogenous variables, was estimated using ordinary least squares. Table 3 presents the complete results. The signs of the majority of parameters in both models are almost identical. This indicates consistent and sound results.

However, our model has a possible endogeneity problem. In order to test the presence of endogeneity we have employed the Durbin–Wu–Hausman test. We treat equity to total assets ratio, loan loss provisions/total loans, net interest margin, ROE

and net loans to total assets ratio as endogenous and we use total equity, loan loss reserves, loans to deposit ratio, cost to income ratio and liquidity ratio as instrumental variables. The result of the Durbin–Wu–Hausman test does not show the presence of endogeneity (F-test statistic is 1.17, with a p-value of 0.32).

Table 3

Stochastic Frontier Estimates

Dependent variable ln(TC/PC)	Coefficient Greene (2005)	Coefficient OLS
Independent variables		
ln(TL)	0.2338*	0.0921***
ln(OEA)	0.6641*	0.8958*
ln(PF/PC)	0.8593*	0.6386*
ln(PL/PC)	0.6963*	0.7973*
$ln(TL)^2$	0.1460*	0.2356*
$ln(OEA)^2$	0.1141*	0.1965*
$ln(PF/PC)^2$	0.0638*	0.0534*
$ln(PL/PC)^2$	-0.0956*	-0.0839*
ln(TL) x ln(OEA)	-0.2594*	-0.4328*
ln(TL) x ln(PF/PC)	-0.0670*	-0.0208***
ln(TL) x ln(PL/PC)	0.0644*	0.0735*
ln(OEA) x ln(PF/PC)	0.0571*	0.0348*
ln(OEA) x ln(PL/PC)	-0.0639*	-0.0946*
Year	-0.0697*	-0.0717*
$Year^2$	0.0021*	0.0033*
ln(TL) x year	-0.0049*	-0.0019***
ln(OEA) x year	0.0072*	0.0049*
ln(PF/PC) x year	-0.0064*	-0.0028
ln (PL/PC) x year	0.0143*	0.0097*
Germany‘s cooperative banks	0.0762*	0.0683*
Switzerland‘s cooperative banks	-0.1491*	-0.1744*
Spain’s cooperative banks	0.0114**	-0.0033
France’s cooperative banks	0.0220*	0.0104***
Italy‘s cooperative banks	0.0096*	0.0133*
Austria’s savings banks	0.0143**	0.0081
Germany’s savings banks	0.0986**	0.0832*
Norway’s savings banks	-0.0804*	-0.0756*
Sweden’s savings banks	-0.0416*	-0.0510*
Denmark’s savings banks	0.0006	0.0428*
Spain’s savings banks	0.0311*	0.0211**
France’s savings banks	0.0288*	-0.0083
Italy’s savings banks	0.0730*	0.0798*
Constant	-0.3914**	-0.8596*
Effects on μ_{it}		
GDP growth	0.1131*	

Dependent variable ln(TC/PC)	Coefficient Greene (2005)	Coefficient OLS
Equity to total assets ratio	0.0552*	
Z Score	-0.0339*	
Loan loss provisions / total loans	0.1842*	
Net interest margin	0.9558*	
ROE	-0.0104**	
Net loans to total assets ratio	-0.0850*	
Log(assets)	0.5559*	
Year 2008	-0.3600*	
Year 2009	0.3534***	
σ_v	1.7916	

Notes: *, ** and *** denote test statistic significance at the 1, 5 and 10% levels, respectively.

Most of the coefficients of output and input prices are positive and significant. Also, the coefficients of the quadratic terms for output are positive. We noticed that the quadratic term PL/PC is negative. However, higher prices and higher output seems to generate higher total costs.

The analysis of cross-country cost efficiency reveals significant findings. Cooperative banks in Switzerland are by 14.9% more cost efficient than are cooperative banks in Austria, while cooperative banks in Germany, France, Spain and Italy are less cost efficient than are the cooperative banks in Austria. With respect to savings banks, Norway and Sweden's savings banks are more cost efficient than are Austria's cooperative banks. Thus, despite their organizational forms and ownership structures, these institutions are efficient in terms of cost management. The cost efficiency of Germany`s savings banks is by 9.8% lower than that of Austria's cooperative banks. We found similar results for Spain and Italy's savings banks. Thus, cost efficiency for these banks is by 3.1% and 7.3% respectively, lower than it is for Austria's cooperative banks. Comparing the results between cooperative and savings banks we do not notice significant differences. This result can be explained through the similarities between these institutions, as they are locally based and are oriented towards long-term lending strategies.

With respect to the influence of exogenous factors on the inefficiency effect, it is surprising that real GDP growth is positively associated with cost efficiency. Afanasieff *et al*. (2002) suggested that a higher output growth reflects more intense competition, a lower interest margin and higher costs to resist on the market. Moreover, in periods of economic growth, Rajan (1994) posited that banks concerned with their short-run reputation would reduce credit standards to gain market share. In our opinion, in periods of economic growth, cooperative banks and savings banks have lost market share in favor of commercial banks with more aggressive strategies and which had easier access to cheaper financial resources. However, the result may also suggest a mismatch between wage costs and productivity levels. The results from the literature on efficiency are mixed. For example, Fries and Taci (2005) and Hauner (2005) found that overall economic development is not significantly related to costs. On the other hand, Hermes and Nhung (2010) and Kasman and Yildirim (2006) obtained results

that indicated that banks which operate in countries with a higher GDP growth were more cost efficient. The insolvency risk of the cooperative banking sector and of the savings banking sector is negatively associated with cost efficiency. Thus, a higher Z score, which reflects a lower probability of bankruptcy, implies a decrease in the level of bank inefficiency. The result is in line with expectations, taking into consideration the fact that a higher risk increases the banks' operation uncertainty, an inadequate management of risk also implying the poor administration of costs.

The capital ratio has a positive effect on the inefficiency level. Thus, a growth of this rate leads to lower cost efficiency. Banks with a higher credit risk, such as a higher loan loss provisions/loans ratio, will have lower cost efficiency. Havrylchyk (2006) considered that problem loans create additional costs associated with the monitoring and enforcement of loan repayments. Banks with a higher ROE are more cost efficient than are banks with a lower ROE. Somewhat counterintuitive is the positive relation between inefficiency and the net interest margin. On the other hand, this result can be explained by the fact that a higher net interest margin is a sign of a higher credit risk. Maudos and de Guevara (2004) and Lepetit *et al*. (2008b) showed that banks charge higher interest margins if their credit risk increases.

The loans to assets ratio, a measure of loan specialization, has a negative effect on inefficiency, a growth by 1% in the loans to total assets ratio leads to a decrease in inefficiency by 0.8%. In these circumstances, a higher ratio of the loans in total assets and an increased lending-focused activity of the banks lead to a higher efficiency for the banks.

With regard to the effect of the bank's size on inefficiency, we noticed that smaller banks were more cost efficient than were the larger banks. This result is reasonable if we bear in mind the fact that smaller savings banks cooperate with larger banks in technological services and other financial services, benefiting from economies of scale. Also, in the cooperative sector, the central institution provides services to local credit cooperatives.

The coefficient associated with 2008 is negative and significant, implying a decrease in costs for the banks included in the analysis. The coefficient associated with 2009 is positive, indicating an increase in banks' inefficiency, signaling the negative effects of the financial crisis.

VI. Conclusions

This paper studied the cost efficiency of cooperative banks and savings banks from nine developed countries over the period 2005 to 2011, using a SFA model. In order to measure the country's effect and to identify the impact of the financial crisis on the cost efficiency level, we created dummy variables. Also, the study examined how the exogenous variables influenced the level of efficiency. Thus, we included environmental variables and control variables within these variables. Furthermore, control variables captured the performance level and the risk assumed by each bank. We also included risk factors because, over the period of analysis, banks faced higher risks, particularly after 2008.

The results revealed important findings. Firstly, we notice that the country's effect plays an important role in explaining the differences between the cost efficiency levels. Thus, cooperative banks in Switzerland have a very high level of cost efficiency. Worthy of noticing is the fact that the savings banks in Norway and Sweden are more cost efficient, despite their organizational form and ownership structures. Secondly, the financial crisis reduced banks' cost efficiency in 2009. Thirdly, the results show that a higher GDP growth is positively related to inefficiency. We interpret this result as a consequence of the fact that commercial banks, as compared to cooperative banks and savings banks, had easier access to cheap resources in periods of economic growth. Therefore, commercial banks adopted strategies that were more aggressive in order to obtain a higher market share. This behavior resulted in a market share reduction of the cooperative banks and savings banks and in an increase in inefficiency. Fourthly, banks with a higher credit risk have lower cost efficiency. The banks with a higher ROE are more cost efficient than are the banks with a lower ROE. Cooperative banks and savings banks that focus on the traditional activity of loan granting are more efficient in comparison with the banks that have a lower share of loans to total assets. Finally, the results show that smaller cooperative and savings banks are more cost efficient than are larger cooperative and savings banks. We consider that this result is a consequence of the advantages from which these institutions benefit within the groups to which they belong.

Our results have important implications for management and policy makers. Cooperative and savings bank management should focus more on cost efficiency and should adopt cautious policies. Policy makers should have in view particular policies in order to regulate these types of institutions. Moreover, the authorities should strongly encourage the activity of cooperative and savings banks, as they promote long-term lending strategies.

However, it would be interesting to study the effects of the financial crisis on commercial banks' cost efficiency, as well as how risk and performance factors influence this level compared to that of cooperative banks and savings banks. Future research may consider these factors.

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