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Cost Efficiency of European Cooperative Banks

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***Abstract*—**This paper analyzes recent trends in cost efficiency of European cooperative banks using efficient frontier analysis. Our methodology is based on stochastic frontier analysis which is run on a set of 649 European cooperative banks using data between 2006 and 2015. Our results show that average inefficiency of European cooperative banks is increasing since 2008, smaller cooperative banks are significantly more efficient than the bigger ones over the whole time period and that share of net fee and commission income to total income surprisingly seems to have no impact on bank cost efficiency.

***Keywords*—** Cooperative banks, cost efficiency, efficient frontier analysis, stochastic frontier analysis, net fee and commission income

I. Introduction

COOPERATIVE banks are mostly retail oriented institutions with a long tradition dating back to the 1850s. Wide strata of population were unable to benefit from the economic growth at that time. One of the reasons was lack of access to financial services, and therefore, cooperative financial institutions emerged on the principle of self-help. The primal goal of this institution was not to create profit but to maximize value for its stakeholders. Such institutions are democratically controlled by its members who typically share some common bond. This is the difference to shareholder controlled commercial banks which are controlled according to the number of shares and their goal is to maximize shareholder value, i.e. profit.

Cooperative banks are typically focused on traditional banking activities such as loan granting and deposit taking, and are thus more connected to real economy than commercial banks.

Cooperative banks form about 20% of the European banking market but they are not distributed equally among individual European countries: in some of them their market share is close to 40%, while elsewhere they are either absent or their market share is negligible [1].

The aim of this paper is to run cost efficiency analysis for European cooperatives banks using efficient frontier analysis (stochastic frontier analysis). Important implications about optimal size of an institution (too big to fail against economies of scale effects) or about optimal strategy in terms on focusing either on interest income or fees and commissions can stem from this analysis.

The structure of this paper is as follows. Literature overview covering analyses about banking efficiency follows in the second section. Data used are described in the third section. Applied methodological approach is in Section IV. Results of our econometric analysis are in Section V. Finally, the conclusion and further research opportunities are described in Section VI.

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II. Literature Review

Lots of empirical studies interested in the cost efficiency of banks are based on the comparison of different ownership structures. This is the case of the analysis of Fries and Taci who study the efficiency of European banks in transition from a communist economy [2]. They arrive to conclusion that privately owned banks are more cost efficient than state owned banks and that foreign ownership also increases cost efficiency.

Barros et al. study productivity change in 10 EU member states cooperative banks between 1996 and 2003 and find that productivity change is driven by technological change. Southern European markets further benefited from economic growth and catching up with industry best practices [3]. Technology sharing arrangements and competition arising from deregulation further foster cooperative bank productivity [3].

Deelchand and Padgett study economies of scale for Japanese cooperative banks over the 2003 – 2006 period and find significant diseconomies of scale [4]. Wheelock and Wilson on the other hand find that cost efficiency of American credit unions during 1989 - 2006 decreased on average across all credit unions but especially among smaller institutions [5]. Another paper by Wheelock and Wilson suggests industry consolidation and growth in the average size of credit union as likely [6].

Goddard and Wilson show that small American credit unions tend to grow faster than the bigger ones [7]. Moreover, credit unions whose members share single common bond (locational, associational, etc.) outperform multiple bonds credit unions [7].

To sum up, some stylized facts can be derived from above mentioned analysis but it is not sure whether (or to what extend) cooperative banks enjoy benefits of scale economies. Governance model of cooperatives have typically problem with dispersed ownership as institution grows bigger. Becht et al. point out that the problem of collusion between the managers and supervisory board elected to monitor them may happen surprisingly often in the case of dispersed ownership [8]. Big credit unions can also loose information advantage arising from their proximity to members which is essential for cooperatives [9], [10]. On the other hand, bigger banks can benefit from economies of scale.

We are interested also in relation of selected strategy of imposing fees to clients to bank efficiency. Phenomena of

"fee-less banks" is said to be connected with low-cost banks and we would like to prove statistically, whether their total costs are in fact lower compared to banks focused more on fee and commission income.

III. Data Description

BankScope is used as a main data source of European cooperative banks data. Czech credit unions financial data which are missing in BankScope were added based on audited financial statements of individual banks. To prevent double counting of individual banks, we use consolidated bank statements only in the case no unconsolidated statements are available for the bank (or banking group) in the database. Similar setup is used also in paper by Hesse and Čihák [11].

We included all European cooperative banks which had all necessary data available for the whole 2006 - 2015 period. Full data availability is needed in order to have balanced data set.

Altogether we obtained data about 649 cooperative banks from 12 European countries. Thanks to different degree of integration and distinct history, there are several cooperative banking models among European countries. Either there can be only one country-wide cooperative bank for the whole country (Finland, Netherlands) or there can be lots of institutions such as in Italy or in Germany. For the number of cooperative banks in our dataset for each country see Table I.

TABLE I
Banks in Data Set by Country

Country	Number of banks
Austria	19
Belgium	2
Czech Republic	5
Germany	371
Denmark	2
Spain	2
Finland	1
France	9
Italy	235
Luxembourg	1
Netherlands	1
Portugal	1
SUM	**649**

Furthermore, we used Eurostat statistical database to get data about annual GDP growth and yield of five-year government bonds (general interest rate level in economy) and database of European Central Bank to obtain Herfindahl-Hirschman index as a proxy for banking concentration (or level of competition) for individual countries and years. These variables are commonly used as environmental variables in studies interested in banking cost efficiency [2], [4].

IV. Methodological Approach

There are two commonly used methodological approaches used in measuring bank efficiency. The first one is using simple financial ratios analysis, employing e.g. Cost-to-Income ratio. We will apply more rigorous approach in estimating cost efficiency using efficiency frontier analysis. The assumption of this method is that individual institutions depart from optimal input-output allocation given by efficiency frontier and hence are ineffective. Inefficiency is given by distance of cost of measured institution to minimal cost for given set of variables.

Since efficiency is common for all banks in the sample and we have cooperative banks from multiple countries, it is needed to account for factors of macroeconomic environment that could influence institution efficiency such as general interest rate level, level of competition on the market or current phase of economic cycle.

There are two techniques used for construction of efficient frontier: non-parametric and parametric one. Non-parametric approach uses linear programming to calculate segments of the efficient frontier. Problematic for our research is that this method does not allow for random error in the data. Random errors may be implied by accounting inaccuracies, measurement errors etc. These errors afterward can affect efficiency of all institution compared with this one [12].

Parametric methods use statistical methods to estimate efficiency frontier. These methods allow for random error and they use explicit functional form for both efficiency frontier and inefficiency term. Several parametric approaches are used. Distribution-free approach is applied to banks by Berger [13]. Distribution-free approach assumes that inefficiency of every institution remains constant over time. This assumption however is strong for longer time periods.

We will therefore use stochastic frontier approach (SFA) which was introduced by Aigner et al. [14]. This approach was used for the banks for the first time by Ferrier and Lovell in 1990 [15]. We will use conditional mean method by Battesse and Coelli allowing estimation of the cost function and bank inefficiencies in single step [16]. General form of our cost function has following form:

$$TC_{ijt} = \alpha + \boldsymbol{X}_{ijt}\beta + \boldsymbol{E}_{jt}\gamma + \varepsilon_{ijt}, \varepsilon_{ijt} = v_{ijt} + u_{ijt}, \quad (1)$$

where TC_{ijt} denotes total cost of *i* bank in country *j* in time *t*. α stands for constant term. $\boldsymbol{X}_{ijt}$ is a vector of outputs and input prices, $\boldsymbol{E}_{jt}\gamma$ is a vector of country-specific variables and ε_{ijt} is composite error term. Composite error term consists of random error term v_{ijt} and inefficiency term u_{ijt}. The inefficiency term can be estimated using formula by Jondrow et al. [17]. Our study uses standard translog specification of Cobb-Douglas cost function with three input prices and two outputs:

$$\begin{aligned} \ln \mathrm{TC}_{ijt} = \alpha_0 + \textstyle\sum_{a=1}^{3} \alpha_a \ln P_{a,ijt} + \sum_{b=1}^{2} \beta_b \ln O_{b,ijt} + \gamma_1 T + \\ \textstyle\sum_{c=1}^{3} \delta_c \ln E_{c,jt} + \frac{1}{2}\sum_{a=1}^{3}\sum_{e=1}^{3} \alpha_{a,e} \ln P_{a,ijt} \ln P_{e,ijt} + \\ \textstyle\frac{1}{2}\sum_{b=1}^{2}\sum_{f=1}^{2} \beta_{b,f} \ln O_{b,ijt} \ln O_{f,ijt} + \\ \textstyle\frac{1}{2}\gamma_{11} T^2 + \sum_{a=1}^{3}\sum_{b=1}^{2} \theta_{a,b} \ln P_{a,ijt} \ln O_{b,ijt} + \sum_{a=1}^{3} \mu_a T \ln P_{a,ijt} + \\ \textstyle\sum_{b=1}^{2} \pi_b T \ln O_{b,ijt} + \varepsilon_{ijt}, \end{aligned} \quad (2)$$

where ln stands for natural logarithm, *TC* are total costs, *P* stands for input prices, *O* for outputs, *T* for time trend and *E* is vector of environmental variables and ε_{ijt} is once more

composite error term. We use constraints on symmetry, homogeneity in prices and adding up [2]:

$$\alpha_{ae} = \alpha_{ea}; \beta_{st} = \beta_{ts}$$
$$\sum_{a=1}^{3} \alpha_a = 1$$
$$\sum_{a=1}^{3} \alpha_{a,e} = \sum_{e=1}^{3} \alpha_{e,a} = \sum_{a=1}^{3} \theta_{a,b} = \sum_{a=1}^{3} \mu_a = 0 \quad (3)$$

As mentioned above, we use model with three input prices and two outputs. This selection is often made in another empirical literature interested in banking efficiency, e.g. [18] or [19]. We use outputs that are considered as typical cooperative banking client services: client loans and volume of client deposits. To produce these services, banks generate costs which are unit price of funds (interest expense divided by total assets), unit price of labor (personnel expenditures divided by total assets) and finally the unit price of capital defined as other operating expenditures divided by total fixed assets. This price is then used for translog normalization of other input prices as advised by Perera et al. [19]. We also used the following environmental variables: Herfindahl-Hirschman index as a proxy for banking concentration, interest rates level defined as year average yield of government bond and GDP growth of a given country.

Whole analysis is run using Stata 12 econometric software and SFPANEL instruction set added according to Battesse and Coelli [16].

V. Regression Results

We run regression (3) and obtained the results in Table II.

Most of the variables turned out to be significant with expected signs: prices have positive coefficients and outputs as well. It is assumed that output will have positive coefficient because its creation is connected with some costs. Price is assumed to be positive because the higher the input price, the higher the total costs.

Interestingly, market competition (Herfindahl-Hirschman index serves as proxy) seems to have no impact on total cost of a bank. Higher interest rate level transfers into higher total cost which is expected because higher interest level means also higher cost of funds. In case of higher GDP growth, the total cost is smaller. We can attribute this finding to the fact that less developed EU countries are catching up developed ones and their personnel expenditures are generally lower than in case of more developed countries. Wald test proved joint significance of variables used.

Together with estimating Equation (3), bank inefficiency terms were assigned to every observation. Now we can finally assess some of the factors connected with cooperative banks inefficiency.

First of all, we plot graph of inefficiency term over time.

We can see clearly increasing trend in inefficiency among our sample since 2008. Explanation may be worsening of overall business climate after breakup of financial crisis in 2008.

Another view that interests us is the division of inefficiency according to the average size of an institution. For this case, we divided cooperative banks in our sample roughly by quantiles.

TABLE II
Regression Results

Variable	Coef.	Std. Err.	P>IzI
lnp1_norm	0.529	0.026	0.000
lnp2_norm	0.604	0.026	0.000
lnloans	0.618	0.049	0.000
lndepos	0.29	0.053	0.000
t	-0.071	0.001	0.000
lnp1nlnp1n	0.007	0.002	0.002
lnp1nlnp2n	-0.073	0.004	0.000
lnp2nlnp2n	0.122	0.003	0.000
lno1lno1	0.194	0.008	0.000
lno1lno2	-0.421	0.017	0.000
lno2lno2	0.236	0.011	0.000
t2	0.01	0.000	0.000
lnp1nlno1	-0.015	0.005	0.003
lnp1nlno2	-0.011	0.005	0.028
lnp2nlno1	-0.001	0.003	0.018
lnp2nlno2	0.01	0.004	0.016
lno1t	-0.011	0.001	0.000
lno2t	0.01	0.001	0.000
lnp1nt	-0.004	0.001	0.000
lnp2nt	0.004	0.001	0.000
hhi	-0.068	0.084	0.418
interest	0.036	0.001	0.000
gdp_growth	-0.002	0.001	0.000
cons	1.327	0.191	0.000
Nr. Obs		6490	
prob.>chi2		0.000	
Wald chi2 (23)		933779	

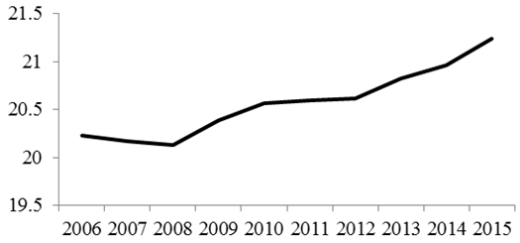

Fig. 1 Average inefficiency over time

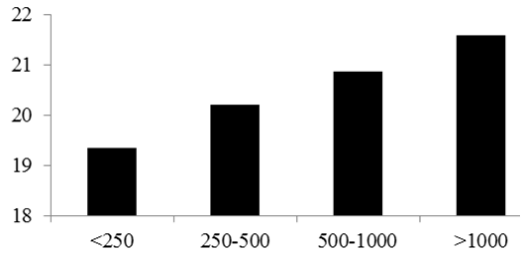

Fig. 2 Average inefficiency by asset size [EUR mn]

Fig. 2 shows clearly that inefficiency of cooperative banks grows with their size. This relation is stable and shows the same picture if we sub-sample the dataset into individual years.

Last but not least, we investigate the influence of bank fee

policy on inefficiency. We use ratio of net fee and commission income to total income for this cause. We make baskets for every 10 percentage point of share of net fee and commission income to total income and plot it on following graph:

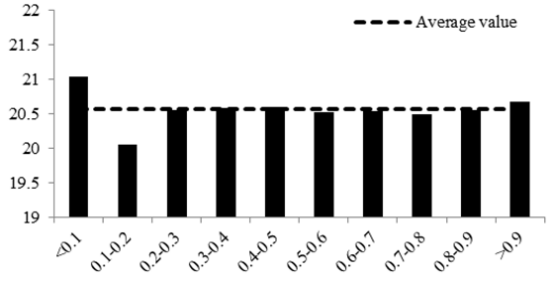

Fig. 3 Average inefficiency and net fee commission income to total income ratio

It can be seen that the inefficiency difference is insignificant and close to average inefficiency. The only difference is cooperative banks with the smallest share of fees on total income, nevertheless the deviation is insignificant.

VI. Conclusion

This paper empirically investigates cost efficiency of 649 cooperative banks from 12 European countries during the 2006 - 2015 period. Our goal was to statistically assess some of the factors that are often put into connection with banking efficiency. To do that, we employed one-step stochastic frontier analysis approach estimating standard translog specification of Cobb-Douglas cost function with three input prices and two outputs.

We find that inefficiency of European cooperative banks is rising since the breakup of financial crisis in 2008, possibly thanks to the general worsening of business conditions. Smaller cooperative banks are statistically significantly efficient during whole timespan of our analysis. On the other hand, share of net fee and commission income to total income seem to have no impact on effectiveness which is contradiction with common belief that "fee-less banks" are cost effective.

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References

[1] Oliver Wyman, "Outlook for Co-operative Banking in Europe 2012," Oliver Wyman's report, lead authors: McCarroll, V., Habberfield, S.
[2] S. Fries, A. Taci, "Cost efficiency of banks in transition: Evidence from 289 banks in 15 post-communist countries, " Journal of Banking & Finance 29 (2005), pp. 55–81.
[3] C. P. Barros, N. Peypoch, J. Williams, "A note on productivity change in European cooperative banks: the Luenberger indicator approach," International Review of Applied Economics Vol. 24, No. 2, March 2010, pp. 137–147.
[4] T. Deelchand, C. Padgett, "Size and Scale Economies in Japanese Cooperative Banking," ICMA Centre Discussion Papers in Finance, University of Reading, DP2009-02, 2009.
[5] D. C. Wheelock, P. W. Wilson, "The evolution of cost-productivity and efficiency among US credit unions," Journal of Banking & Finance 37 (2013), pp. 75–88.
[6] D. C. Wheelock, P. W. Wilson, "Are Credit Unions Too Small?" Federal Reserve Bank of St. Louis Working Paper Series, Working Paper 2008-033C, 2010.
[7] J. Goddarg, J. O. S. Willson, "US Credit Unions: An Empirical Investigation of Size, Age and Growth," Annals of Public and Cooperative Economics 76:3 2005 pp. 375–406.
[8] M. Becht, P. Bolton, A. Röell, "Corporate Governance and Control," European Corporate Governance Institute - Finance Working Paper No. 02/2002.
[9] T. W. Guinnane, "Cooperatives as Information Machines: the Lending Practices of German Agricultural Credit Cooperatives," Economic Growth Center Discussion Paper No. 699, Yale University., pp. 1883–1914.
[10] P. Angelini, R. Di Salvo, G. Ferri, "Availability and cost of credit for small businesses: customer relationships and credit cooperatives," Journal of Banking & Finance 22.6 (1998), pp. 925-954.
[11] H. Hesse, M. Čihák, "Cooperative Banks and Financial Stability," IMF WP, No. 07/02, Washington D.C.: IMF.
[12] A. N. Berger, D. B. Humphrey, "Efficiency of Financial Institutions: International Survey and Directions for Future Research," European Journal of Operational Research 98, pp. 175–212.
[13] A. N. Berger, "Distribution-free estimates of efficiency in the US banking industry and tests of the standard distributional assumptions,", Journal of Productivity Analysis 4, pp. 261–292.
[14] D. J. Aigner, C. A. K. Lovell, P. Schmidt, "Specification and estimation of frontier production, profit and cost functions," Journal of Econometrics 25, pp. 21–37.
[15] G. Ferrier, C. A. K. Lovell, "Measuring the cost efficiency in banking: Econometric and linear programming evidence," Journal of Econometrics 46, pp. 229–245.
[16] G. E. Battesse, T. J. Coelli, "model of technical inefficiency effects in a stochastic frontier production function for panel data," Empirical Economics 20, pp. 325–332.
[17] J. Jondrow, C. A. K. Lovell, I. S. Materov, P. Schmidt, "On Estimation of Technical Inefficiency in the Stochastic Frontier Production Function Model," Journal of Econometrics, 19, pp. 233–238.
[18] M. Z. A. Karim "Comparative Bank Efficiency across Select Asean Countries," ASEAN Economic Bulletin, 18, pp. 289–304.
[19] S. Perera, M. Skully, J. Wickermanayake, "Cost Efficiency in South Asian Banking: The Impact of Bank Size, State Ownership and Stock Exchange Listingsn," International Review of Finance, 7:1–2, 2007: pp. 35–60.