

# Are mergers among cooperative banks worth a dime? Evidence on post-M&A efficiency in Italy

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# Outline

- Motivation
- The role and importance of cooperative banks
- Are cooperative banks' mergers worth it?
- *Data and methodology*
- Results
- Further robustness checks
- Conclusions

# Motivation

Following banking deregulation and liberalization, *trends to consolidate the banking sector have been pervasive since the 1980s in many countries.*

Conventional view → *banking consolidation delivers efficiency gains and is compatible with more, not less, effective competition*

But → *banking diversity allows more resilient and functional banking systems*

For example, *savings banks & cooperative banks may generate less systemic risk and favor financial inclusion of marginal customers and reduce credit rationing of borrowers, particularly SMEs, because of more retail-oriented business and relationship lending*



**Trade-off** ⇨ **consolidation = higher banking efficiency but lessened banking diversity (more systemic risk & financial exclusion)**

# Motivation

We focus on the 'positive' side of the potential trade-off, and test whether consolidation through M&As improves efficiency in a system of small-sized mutual cooperative banks.

In particular, we focus on Italian "Banche di Credito Cooperativo" (BCCs), small credit institutions organized in a banking network that mainly operate in local areas and whose activity is grounded on mutual principles.

In Italy's total, BCCs manage about 14% of branches and 7% of loans.

*Their typical customers are SMEs and households, with whom they generally adopt the relationship lending business model (based on long-lasting fiduciary relationships with customers) to cope with problems of asymmetric information.*

# Motivation

Recent *calls to change the Italian credit cooperative system* – as BCCs are regarded to be “too many and too little” – have *resulted in a reform by the Italian government* intended to aggregate BCCs into three Bank Holding Companies with central bodies having direction and intervention powers.

Based on pre-reform data, our research question is:

***as consolidation might be a different way to achieve efficiency, are mergers able to effectively promote BCCs overall efficiency?***

Again, this possibility foreshadows a *trade-off*:

*larger (perhaps more efficient) BCCs might undermine current network economies and make relationship lending unsustainable, thus lessening (or even offsetting) the efficiency gains from mergers.*

# Motivation

To assess whether M&As among Italian BCCs are efficiency-enhancing, we employ a *two-step empirical framework*:

- *first, we estimate bank-level cost efficiency scores for a sample of 1,079 Italian credit institutions* (therefore including commercial, popular, savings and cooperative banks) in the years 1993-2013 by means of a Stochastic Frontier approach;
- *second, we regress the estimated efficiency scores of 688 BCCs on a set of merger status dummy variables* (never merged, before the first merger, merged once, merged twice...) *as well as a vector of control variables.*

# Cooperative banks in Italy

Italy has both – for profit – *shareholder value oriented banks* (SHV) and – not for profit – *stakeholder value oriented banks* (STV).

Among STV banks, BCCs have a major role & good capitalization/performance serving SMEs/households by OTH model. BCCs' peculiar features are: a) *governance*; b) *organizational structure*; c) *network size*.

a) **Governance** – BCCs' "**prevailing mutualism**" hinges on seven features: 1-voting rights "1-head 1-vote"; 2-shares held  $\leq$ €50K shares; 3-membership members where BCC operates; 4-mutualism  $\geq$ 51% risk assets with members; 5-territorial ties  $\geq$  95% loans in BCC catchment area; 6-profit distribution  $\geq$ 70% to not disburse legal reserves; 7-safe business derivatives only for hedging.

b) **Organization** – BCCs are stand-alone but join in a multi-level **horizontal network**: 1-local (individual BCC); 2-regional (15 Federations help/monitor member BCCs); 3-nat'l (Federcasse, represents & assists operationally BCCs).

c) **Network size** – today BCCs represent the greatest majority of local banks.

# Mergers among BCCs

## **Pros of BCCs mergers:**

First, M&As among BCCs can allow **cutting costs**: 1-replacing inefficient management; 2-exploiting scope economies, product-mix synergies; 3-exploiting scale economies (larger BCCs may cut mean operating expenses).  
Second, M&As allow **diversifying costs & risks** by both: 4-broadening scope of consolidated bank's assets; 5-expanding geographic scope of its operations.

## **Cons of BCCs mergers:**

Small BCCs may offer a better answer than **M&As might damage** to: 1-**local needs** → a BCC has highly homogeneous members, its typical borrowers, who belong to the same local community/social group; 2-**marginal borrowers needs** → BCCs' features boost screening/monitoring & efficiency/effectiveness to serve small/marginal borrowers; 3-**financial exclusion** → small BCCs can effectively curb it via relationship banking, possibly diluted at larger BCCs.

Bigger size could lessen BCCs' ability to serve informationally opaque markets.  
We check possible efficiency gains via BCCs M&As: a) if **substantial OK**; b) if instead **negligible, M&As may just damage local communities and economies**.

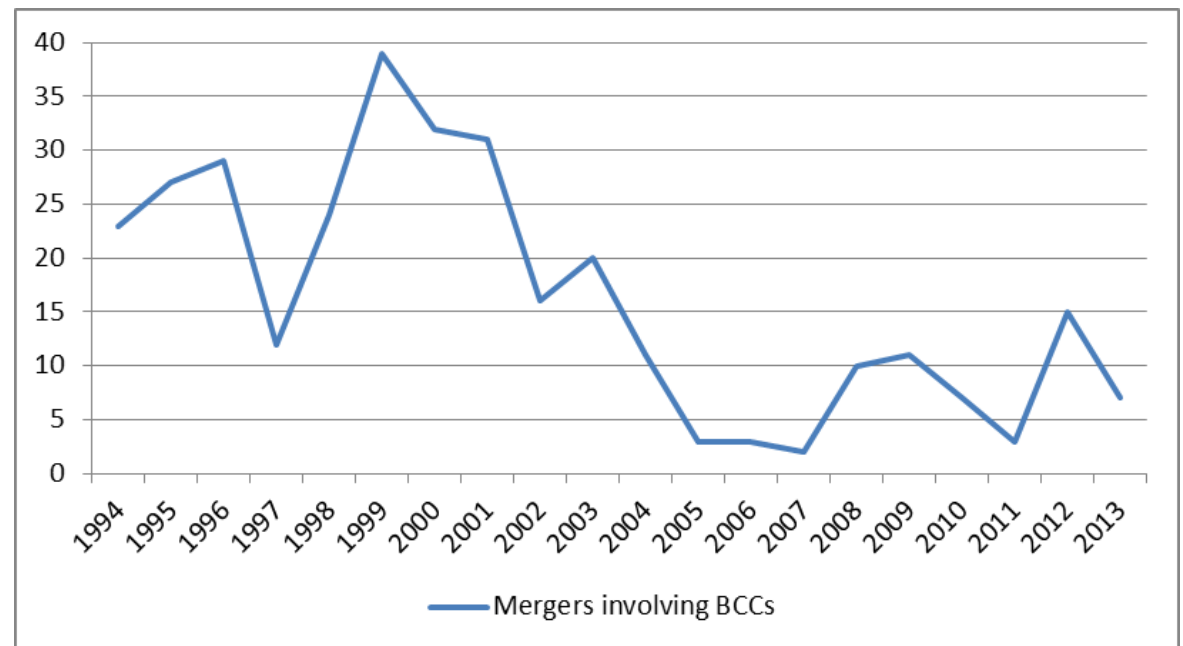
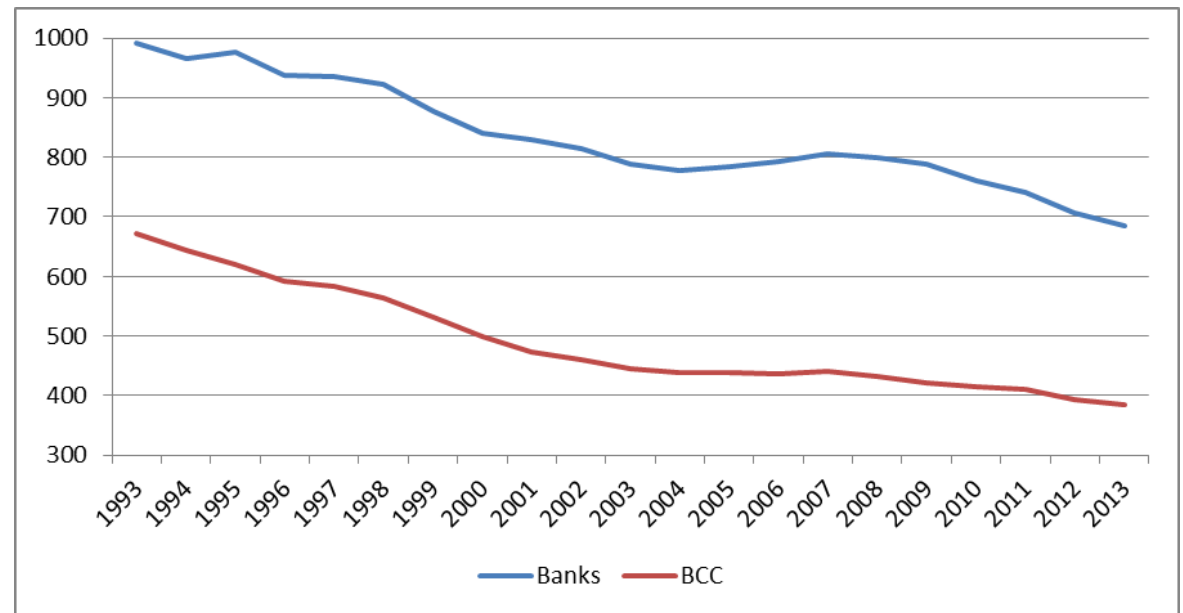


# Mergers among BCCs

Over 1993-2013, *the number of Italian BCCs dropped from 671 to 385 (-42.6%), following a trend similar to the overall banking sector (top figure).*

*At the same time, there were several M&As among BCCs (including assets/liabilities transfers).*

Over 1994-2013, Bank of Italy's Supervisory Bulletins report **325 M&As involving only BCCs** (corresponding to about 16 a year), with a maximum of 39 in 1999 (bottom figure).



# Empirical strategy

We gauge the effects of M&As on BCCs *empirically assessing BCCs post-merger changes in cost efficiency, comparing them to those of never merged BCCs.*

*We use bank-level cost efficiency scores: Actually, we regard costs as the only variable of concern (since BCCs do not pursue profit maximization).*

*We get time-varying cost efficiency scores via the stochastic frontier model of Battese & Coelli (1992). For robustness, we also estimate our SF model as suggested by Aigner et al. (1977) (henceforth ALS) and Meeusen & van den Broeck (1977). [see Appendix 1, if needed]*

In both methodologies, the *cost efficiency scores CE* are estimated as

$$CE_{it} = E[\exp(-u_{it}) | \varepsilon_{it}]$$

where  $\varepsilon_{it}$  is the overall error term.

Given that  $u_{it} \geq 0$ , it is

$$0 \leq CE_{it} \leq 1$$

with  $CE_{it} = 1$  characterizing the fully efficient bank.

# Empirical strategy

We explore the effects of M&As among BCCs by regressing the  $CE_{it}$ 's for each bank, on a set of five dummy variables that identify the sample BCCs by groups along their engagement in M&As, and a vector of control variables:

$$\begin{aligned} CE_{it} = & b_0PREMERGE_{it} + b_1POSTMERGE1_{it} + b_2POSTMERGE2_{it} + \\ & + b_3POSTMERGE3_{it} + b_4POSTMERGE4_{it} + \\ & + b_5 \ln TOTAST_{it} + b_6 (\ln TOTAST_{it})^2 + b_7 NPL_{it} + b_8 \ln BRBUS_{it} + \\ & + b_9 EQAST_{it} + b_{10} DEPAST_{it} + b_{11} LOANAST_{it} + b_{12} POPDENS_{it} + \delta_i + \gamma_t \end{aligned}$$

For BCCs involved in M&As: a-*PREMERGE* is 1 for the years up to the first M&A, and 0 afterwards; b-*POSTMERGEN* ( $n = 1, \dots, 4$ ) is 1 for the years after the  $n$ -th merger (and up to another M&A, if any), and 0 otherwise.

For BCCs never involved in M&As in the sample period – our reference group – the above dummy variables are always zero.

If *PREMERGE* is **positive** (**negative**) → before first M&A the two (or more) previously independent BCCs had **higher** (**lower**) efficiency than the reference (never merged) group. Note: *PREMERGE* banks are also those acquired by, or merged with, non-BCCs.

Also, **positive** (**negative**) *POSTMERGEN* variables → BCCs originating from  $n$ -th M&A **raises** (**lowers**) its efficiency → this M&A is **efficiency-enhancing/reducing**

# Empirical strategy

$$\begin{aligned} CE_{it} = & b_0PREMERGE_{it} + b_1POSTMERGE1_{it} + b_2POSTMERGE2_{it} + \\ & + b_3POSTMERGE3_{it} + b_4POSTMERGE4_{it} + \\ & + b_5 \ln TOTAST_{it} + b_6 (\ln TOTAST_{it})^2 + b_7 NPL_{it} + b_8 \ln BRBUS_{it} + \\ & + b_9 EQAST_{it} + b_{10} DEPAST_{it} + b_{11} LOANAST_{it} + b_{12} POPDENS_{it} + \delta_i + \gamma_t \end{aligned}$$

## Control variables

- *TOTAST* = total assets (*banks' size*; squared term captures possible nonlinearities);
- *NPL* = NPLs/total loans (proxy of *credit risk management*: a negative coefficient is expected);
- *BRBUS* = customer loans + customer deposits per branch (proxy of *business size of the representative bank office*: a positive coefficient is expected);
- *EQAST* = equity/assets (it controls for *bank capitalization* level: a positive sign is expected due to members' higher incentives to monitor costs and capital allocation in highly capitalized BCCs);
- *DEPAST* = deposits/assets (included as they are a *core activity* of BCCs);
- *LOANAST* = loans/assets (included as they are a *core activity* of BCCs);
- *POPDENS* = population density (number of inhabitants per square km);
- $\delta_i$  = regional dummy variables (when necessary, BCCs are attributed to the region where the majority of branches is located);
- $\gamma_t$  = yearly dummy variables.

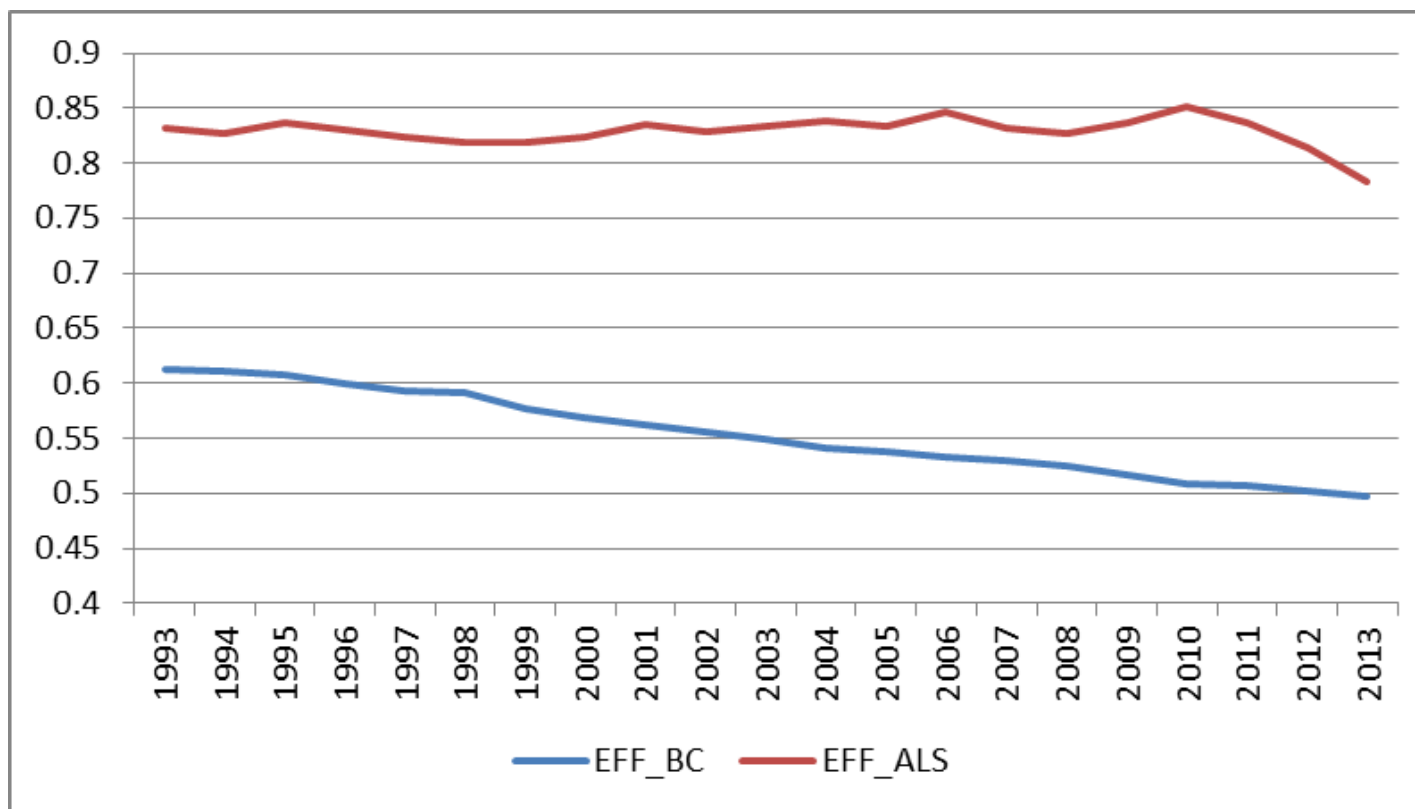
[See Appendix 2, if needed, for additional aspects on method & data]

# Empirical results

## *Estimation results for the stochastic frontier models*

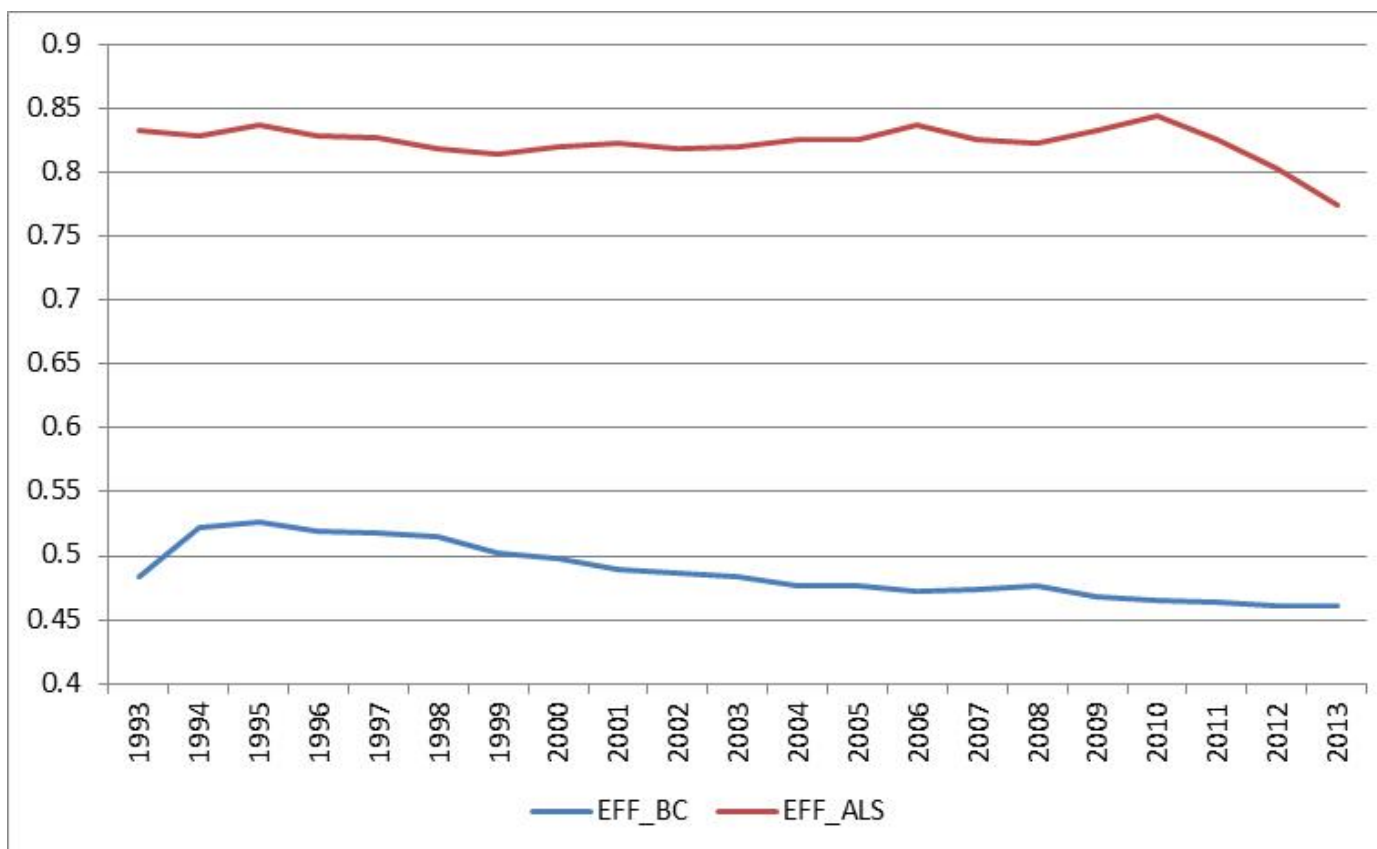
Variable	Coefficient	BC MODEL (Battese-Coelli)		ALS MODEL (Aigner-Lovell-Schmidt)	
		Coeff.	z-value	Coeff.	z-value
Constant	$a_0$	0.1112	0.27	0.8908	1.50
$\ln Q$	$a_Q$	0.7574	24.35 ***	0.9338	35.61 ***
$\ln(W_1/W_3)$	$a_1$	0.8122	8.22 ***	1.4152	9.06 ***
$\ln(W_2/W_3)$	$a_2$	-0.4569	-4.04 ***	-0.8752	-5.27 ***
$\ln TREND$	$a_T$	-0.2619	-3.49 ***	-0.2107	-1.81 *
$(\ln Q)^2/2$	$a_{QQ}$	0.0159	7.74 ***	0.0104	10.62 ***
$(\ln(W_1/W_3))^2/2$	$a_{11}$	0.0622	4.48 ***	0.1446	6.57 ***
$(\ln(W_2/W_3))^2/2$	$a_{22}$	0.0338	1.46	0.0602	1.83 *
$(\ln TREND)^2/2$	$a_{TT}$	-0.1413	-15.40 ***	-0.2177	-17.24 ***
$\ln(W_1/W_3) \cdot \ln(W_2/W_3)$	$a_{12}$	-0.0873	-5.52 ***	-0.1541	-6.38 ***
$\ln Q \cdot \ln(W_1/W_3)$	$a_{Q1}$	0.0142	6.12 ***	0.0120	3.49 ***
$\ln Q \cdot \ln(W_2/W_3)$	$a_{Q2}$	0.0149	3.86 ***	0.0033	0.73
$\ln Q \cdot \ln TREND$	$a_{QT}$	-0.0199	-9.99 ***	-0.0052	-2.07 **
$\ln TREND \cdot \ln(W_1/W_3)$	$a_{T1}$	-0.0620	-5.80 ***	-0.0507	-3.03 ***
$\ln TREND \cdot \ln(W_2/W_3)$	$a_{T2}$	-0.0172	-1.36	0.0287	1.51
Log-likelihood		6,171.25		895.83	
N. obs.		13,191		13,191	
N. banks		1,079		1,079	

# Empirical results



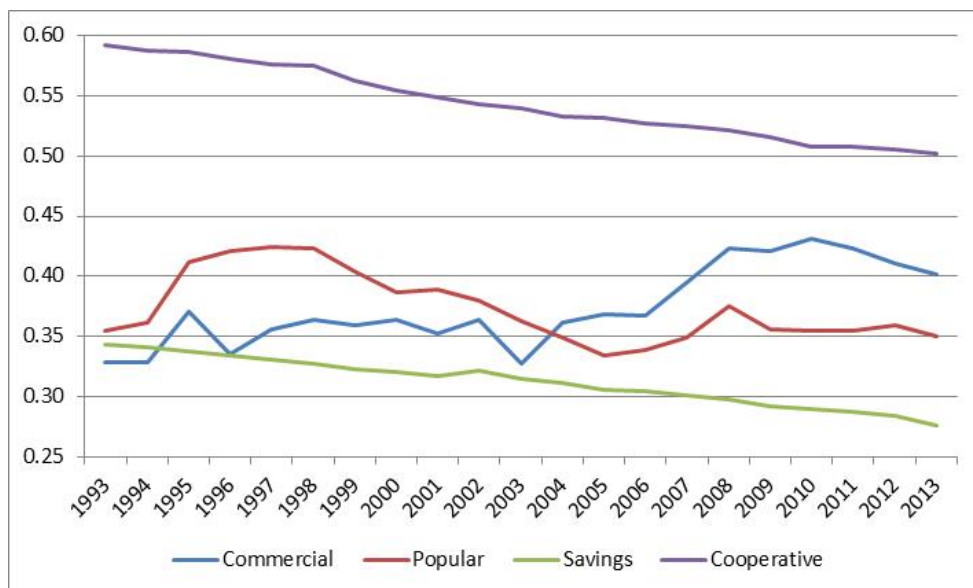
- *BC model* → decreasing trend for the efficiency scores
- *ALS model* → more irregular pattern over time for the efficiency scores, higher values and lower variability among banks
- Correlation between the two measures of cost efficiency =  $+0.4236$

# Empirical results

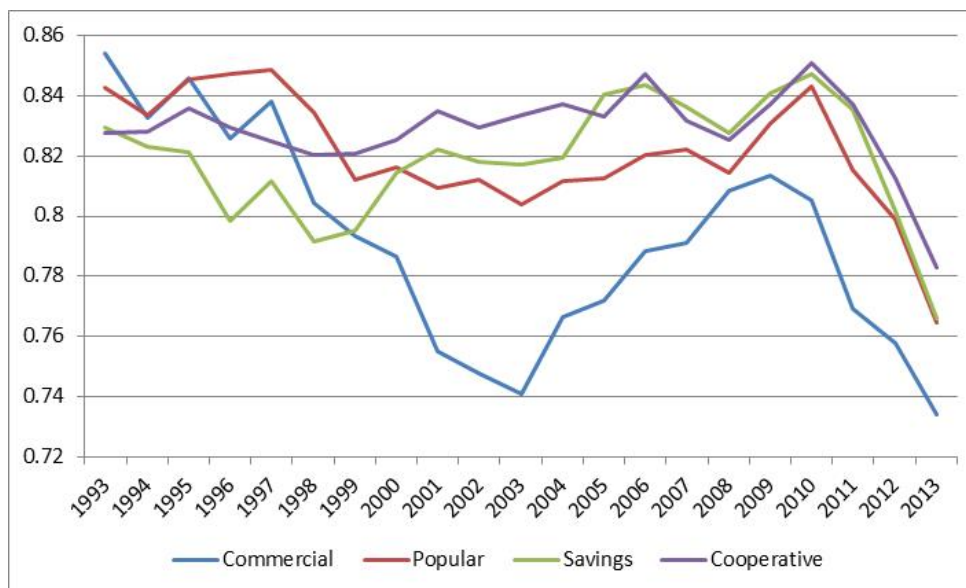


- *BC model* → decreasing trend for the efficiency scores
- *ALS model* → more irregular pattern over time for the efficiency scores, higher values and lower variability among banks
- Correlation between the two measures of cost efficiency = +0.4019

# Empirical results



BC efficiency scores



ALS efficiency scores

***BCCs are generally characterized by a higher level of cost efficiency***

*⇒ appropriateness of their size and/or their business model*

Let's now assess *whether M&As among BCCs have helped to reach an even higher level of efficiency (→ second-step estimation).*



# Empirical results

## Battese-Coelli efficiency scores

Variable	TOBIT ESTIMATION		LOGISTIC TRANSFORMATION	
	Coeff.	z-value	Coeff.	z-value
<i>PREMERGE</i>	-0.0174	-11.53 ***	-0.0787	-10.29 ***
<i>POSTMERGE1</i>	-0.0059	-4.20 ***	-0.0044	-0.65
<i>POSTMERGE2</i>	-0.0065	-2.71 ***	0.0055	0.46
<i>POSTMERGE3</i>	0.0125	2.77 ***	0.0668	2.99 ***
<i>POSTMERGE4</i>	0.0356	5.48 ***	0.1864	4.82 ***
<i>lnTOTAST</i>	-0.4047	-31.69 ***	-2.2375	-29.43 ***
<i>(lnTOTAST)<sup>2</sup></i>	0.0116	22.10 ***	0.0687	22.48 ***
<i>NPL</i>	-0.0212	-0.86	-0.1925	-1.34
<i>lnBRBUS</i>	0.1122	51.36 ***	0.5647	36.16 ***
<i>EQAST</i>	0.1573	6.79 ***	1.0073	8.61 ***
<i>DEPAST</i>	-0.1452	-18.83 ***	-0.7206	-15.64 ***
<i>LOANAST</i>	0.1442	19.18 ***	0.6184	15.03 ***
<i>POPDENS</i>	-0.0053	-1.00	-0.0277	-1.14
Log-likelihood	14,198.45			
Adj. $R^2$			0.8154	
N. obs.	8,451		8,451	
N. banks	688		688	

# Empirical results

Variable	TOBIT ESTIMATION		LOGISTIC TRANSFORMATION	
	Coeff.	z-value	Coeff.	z-value
<i>PREMERGE</i>	-0.0174	-11.53 ***	-0.0787	-10.29 ***
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N. obs.	8,451		8,451	
N. banks	688		688	

## Battese-Coelli efficiency scores

***PREMERGE*** = always negative and significant at the 1% level

• *BCCs that are going to be involved for the first time in a merger* are characterized by lower efficiency compared to the reference group (i.e., those that will never merge in the sample period)

• Tobit model →  $CE_{it}$ 's are 0.0174 points lower for the *PREMERGE* group (-3.2% of the sample mean)

• Logistic model → it is  $CE_{it}/(1-CE_{it}) = \exp(-0.0787) = 0.9243$  for the *PREMERGE* group, and  $CE_{it}/(1-CE_{it}) = 1$  for the *NEVERMERGED* group →  $CE_{it}$ 's are 0.0197 points lower for the *PREMERGE* group

• Hence, results are almost identical

# Empirical results

Variable	TOBIT ESTIMATION		LOGISTIC TRANSFORMATION	
	Coeff.	z-value	Coeff.	z-value
PREMERGE	-0.0174	-11.53 ***	-0.0787	-10.29 ***
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Log-likelihood	14,198.45			
Adj. R <sup>2</sup>			0.8154	
N. obs.	8,451		8,451	
N. banks	688		688	

## Battese-Coelli efficiency scores

**POSTMERGE1** and **POSTMERGE2** = negative; significant at the 1% level only in the tobit estimation

- Both a first merge and a second merge (the latter concerning at least one cooperative banks that had been already previously involved in one merger) do not allow to achieve a higher cost efficiency than the reference group
- Hence, once and twice merged BCCs are still significantly less efficient, or at best their level of efficiency is undistinguishable from the reference group

# Empirical results

Variable	TOBIT ESTIMATION		LOGISTIC TRANSFORMATION	
	Coeff.	z-value	Coeff.	z-value
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POSTMERGE1	-0.0059	-4.20 ***	-0.0044	-0.65
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Log-likelihood	14,198.45			
Adj. R <sup>2</sup>			0.8154	
N. obs.	8,451		8,451	
N. banks	688		688	

## Battese-Coelli efficiency scores

**POSTMERGE3** and **POSTMERGE4** = positive and significant at the 1% level

- A significant improvement in cost efficiency can be observed only after the third merger (about +0.013 in the tobit model, +2.3% of the sample mean)
- This gain is *even higher with the fourth merge* (+0.036 compared to the never-merged BCCs, meaning +6.6% with respect to the sample mean; according to the regression based on the odds of  $CE_{it}$ , the increase is a bit higher, +0.047)

# Empirical results

*Aigner et al. efficiency scores*

Variable	TOBIT ESTIMATION		LOGISTIC TRANSFORMATION	
	Coeff.	z-value	Coeff.	z-value
<i>PREMERGE</i>	-0.0020	-1.97 **	-0.0165	-2.34 **
<i>POSTMERGE1</i>	-0.0085	-7.45 ***	-0.0502	-6.47 ***
<i>POSTMERGE2</i>	-0.0162	-7.10 ***	-0.0967	-7.06 ***
<i>POSTMERGE3</i>	-0.0116	-3.59 ***	-0.0588	-2.70 ***
<i>POSTMERGE4</i>	0.0099	1.89 *	0.0818	2.17 **
<i>lnTOTAST</i>	-0.0801	-7.90 ***	-0.5559	-8.81 ***
<i>(lnTOTAST)<sup>2</sup></i>	0.0027	6.54 ***	0.0181	7.03 ***
<i>NPL</i>	-0.1338	-6.79 ***	-0.9363	-7.46 ***
<i>lnBRBUS</i>	0.0454	30.55 ***	0.3691	39.36 ***
<i>EQAST</i>	0.3095	19.99 ***	2.2767	21.54 ***
<i>DEPAST</i>	-0.0581	-12.02 ***	-0.5117	-15.06 ***
<i>LOANAST</i>	0.4126	77.61 ***	2.8687	83.80 ***
<i>POPDENS</i>	-0.0125	-2.60 ***	-0.0943	-3.16 ***
Log-likelihood	17,186.65			
Adj. $R^2$			0.7984	
N. obs.	8,451		8,451	
N. banks	688		688	

# Empirical results

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Log-likelihood	17,186.65			
Adj. <i>R</i> <sup>2</sup>	0.7984			
N. obs.	8,451		8,451	
N. banks	688		688	

## *Aigner et al. efficiency scores*

- A pre-merger BCC is less efficient than those that decide not to merge (the coefficient of **PREMERGE** is negative and significant)
- One, two or three consecutive mergers lead to a more inefficient firm than the group of BCCs that have never been involved in M&As (**POSTMERGE1**, **POSTMERGE2** and **POSTMERGE3** are negative and significant)
- Gains in efficiency are possible only after four successive mergers (**POSTMERGE4** is positive and significant at least at the 10% level)

# Empirical results

*[The results for all the other covariates are in Appendix 3, if needed]*

*We can conclude that, even if a single BCC is not efficient in minimizing costs, a M&A process does not appear to be the best efficiency-enhancing solution, at least for small-scale operations.*

*Significant improvements can be achieved with more consecutive mergers, but:*

- *they would imply an increase in the average bank's size;*
- *the latter would probably modify the intrinsic nature of BCCs, currently based on relationship banking and strong ties with local communities and hence unavoidably requiring a smaller size.*

## Empirical results

Actually, *bigger BCCs might begin to overlook marginal borrowers*, i.e. their *current main clientele*, normally served by smaller banks but very often neglected by large-sized banks.

Twofold consequence:

- *a severe detrimental impact on local development and inequality*, and
- *the BCCs' discharge of their ethics and mission*.

Perhaps a *better solution* would be the *careful improvement of banks' way of managing business*, especially considering that on average BCCs' cost efficiency scores are nonetheless higher than other types of banks.



## Further Robustness Checks

In a more recent version of the paper (not the one presented at IWFSAS 2017) we have checked that our results are robust to:

1. Dealing with endogeneity via an IV approach;
2. Controlling for potential selection bias via a propensity score matching methodology;
3. Checking for possible differences between 'voluntary' vs 'induced' mergers;
4. Allowing more time after the merger for efficiency gains to kick in.

# Conclusions

Though *banking consolidation* can give efficiency gains, it *may cause losses* via reduced banking diversity with more systemic risk and less support for marginal banking customers, *especially when it spoils the role of cooperative banks*, which have shown *most effective at favoring the financial inclusion of the marginal borrowers*, thanks to retail & relationship banking orientation

We asked whether M&As among mutual cooperative banks deliver efficiency gains, i.e. whether these M&As have the same meaning as M&As of SHV banks

We empirically tested the effects of M&As among Italian BCCs on the level of cost efficiency over 1993-2013, featuring intense consolidation

Estimating bank-level cost efficiency scores for all Italian banks via a translog stochastic frontier model, we found that *BCCs outperformed other banks types*

On the BCCs sub-sample we used a set of merger status dummy variables (never merged, before the first merger, merged once, merged twice...) & a set of control variables, via both a tobit regression & a logistic model (due to the fact that the dependent variable ranges between 0 and 1) to explain their efficiency scores.

# Conclusions

*Our results are robust to model specification, and make clear that:*

- *BCCs decide to merge when their efficiency is lower than (or at best equal to) other cooperative banks;*
- *there is need of at least three consecutive mergers* – hence, *a much bigger dimension – in order to become more efficient than those never involved in a M&A process.*

However, even if such significant mergers could be *convenient in terms of cost efficiency, they would probably imply a loss of identity for BCCs*, since the larger size appears in direct conflict with their traditional mission of supporting small firms and households in the local area of business, which could be therefore *undermined as regards social and economic development.*

**...THANK YOU!!**

## Appendix 1 – SF Model – 1

For a given bank, production costs (in logs) depend on *output*  $Q$ , *input prices*  $W$ , *inefficiency*  $u$ , and *random error*  $v$ :

$$\ln C_{it} = f(Q_{it}, W_{it}) + v_{it} + u_{it}$$

- The *error term*  $v_{it}$  has the usual characteristics, i.e. independent and identically distributed  $N(0, \sigma_v^2)$ .
- The *non-negative inefficiency term*  $u_{it}$  is assumed to be independent and identically distributed as a truncated normal distribution with mean  $\mu$  and variance  $\sigma_u^2$ , and modelled as a function of time in the following way:

$$u_{it} = u_i \{ \exp[-\gamma(t - T_i)] \}$$

Hence, *bank  $i$ 's inefficiency varies with time*  $\rightarrow$

e.g. if  $\gamma > 0$ , the level of inefficiency decays toward the base level, i.e. bank  $i$  improves its cost efficiency over time.

## Appendix 1 – SF Model – 2

In line with other banking studies, we use a *standard translog specification of the cost function* with *three inputs and one output*.

In order to impose *linear homogeneity in input prices*, we divide total costs and factor prices by  $W_{3it}$ , thus getting:

$$\begin{aligned} \ln(C_{it} / W_{3it}) = & a_0 + a_Q \ln Q_{it} + \sum_{h=1}^2 a_h \ln(W_{hit} / W_{3it}) + a_T \ln TREND + \\ & + \frac{1}{2} \left\{ a_{QQ} (\ln Q_{it})^2 + \sum_{h=1}^2 a_{hh} (\ln(W_{hit} / W_{3it}))^2 + a_{TT} (\ln TREND)^2 \right\} + \\ & + a_{12} \ln(W_{1it} / W_{3it}) \ln(W_{2it} / W_{3it}) + \sum_{h=1}^2 a_{Qh} \ln Q_{it} \ln(W_{hit} / W_{3it}) + a_{QT} \ln Q_{it} \ln TREND_{it} + \\ & + \sum_{h=1}^2 a_{Th} \ln TREND \ln(W_{hit} / W_{3it}) + v_{it} + u_{it} \end{aligned}$$

where:

$i = 1, \dots, N$  (banks index) /  $t = 1, \dots, T$  (time index) /  $C$  = total cost

$Q$  = output /  $W_h$  = factor prices ( $h = 1, 2$ ) /  $TREND$  = time trend

$v_{it}$  = error term /  $u_{it}$  = inefficiency term.

Note: in ALS, differently from BC, the cost inefficiency component  $u_{it}$  is free to vary over time without any a priori assumption, and is distributed as a positive half-normal random variable  $N^0(0, \sigma_u^2)$ .

## Appendix 2 – Empirical strategy & Data – 1

As  $0 \leq CE_{it} \leq 1$ , we make use of both:

- a *double-censored tobit estimation*, and
- an *OLS estimation with the dependent variable being replaced by its logistic transformation*

where the terms in brackets represent the *odds of the efficiency scores*.

Since the dependent variable  $CE_{it}$  is a predicted value coming from the first-stage regressions, in order to avoid a potential generated regressor problem we adjust the second-stage standard errors *estimating bootstrapped standard errors with one thousand replications*.

## Appendix 2 – Empirical strategy & Data – 2

*Efficiency scores are estimated for all Italian banks (commercial, popular, savings, and cooperative banks), in order to better assess cost performances (we consider the whole Italian banking industry, not just a limited subgroup).*

*First stage* (estimation of the translog cost function & the efficiency scores)

$W_1 = \text{price of deposits} = \text{interest expenses} / \text{deposits plus other funding}$

$W_2 = \text{price of labour} = \text{personnel expenses} / \text{number of employees}$

$W_3 = \text{price of capital} = \text{other operating costs} / \text{number of branches}$

$Q = \text{output} = \text{total loans}$

Outliers (i.e. observations < 1st centile or > 99th centile) have been *dropped*.

Final (unbalanced) sample  $\Rightarrow$  *13,191 observations on 1,079 banks observed over 21 years (1993-2013)*

Second stage (assessment of the impact of mergers on cost efficiency)

*The sample is restricted to include only cooperative banks* ⇒

*8,451 observations referring to 688 BCCs over 21 years (1993-2013)*

Among them, *from 1994 we have recorded 236 M&As involving 387 BCCs:*

- 175 cooperative banks resulted from *one* merger
- 44 banks came out from *two* sequential mergers
- 13 from *three* subsequent mergers
- 4 from *four* successive mergers

Note that sequential mergers concern *at least one of the involved banks*.

On the other hand, *254 BCCs were never subject to a merger or acquisition* (they form our reference group).



## Appendix 2 – Empirical strategy & Data – 4

- *Balance sheet data* come from *ABI* (the Italian Banking Association).
- The *number of branches* are drawn from the *Bank of Italy* database.
- All *information on the various M&As* concerning the cooperative banks have been gathered from the various *Supervisory Bulletins* available at the *Bank of Italy*.
- *Regional population and size* have been taken from *Istat* (the Italian National Statistical Institute).
- *All economic figures* have been deflated using the *2005 GDP deflator*.

# Appendix 3 – Empirical results on the covariates – 1

Variable	BATTESE-COELLI EFFICIENCY SCORES				AIGNER ET AL. EFFICIENCY SCORES			
	TOBIT ESTIMATION		LOGISTIC TRANSFORMATION		TOBIT ESTIMATION		LOGISTIC TRANSFORMATION	
	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value
...	...	...	...	...	...	...	...	...
$\ln TOTAST$	-0.4047	-31.69 ***	-2.2375	-29.43 ***	-0.0801	-7.90 ***	-0.5559	-8.81 ***
$(\ln TOTAST)^2$	0.0116	22.10 ***	0.0687	22.48 ***	0.0027	6.54 ***	0.0181	7.03 ***
$NPL$	-0.0212	-0.86	-0.1925	-1.34	-0.1338	-6.79 ***	-0.9363	-7.46 ***
$\ln BRBUS$	0.1122	51.36 ***	0.5647	36.16 ***	0.0454	30.55 ***	0.3691	39.36 ***
$EQAST$	0.1573	6.79 ***	1.0073	8.61 ***	0.3095	19.99 ***	2.2767	21.54 ***
$DEPAST$	-0.1452	-18.83 ***	-0.7206	-15.64 ***	-0.0581	-12.02 ***	-0.5117	-15.06 ***
$LOANAST$	0.1442	19.18 ***	0.6184	15.03 ***	0.4126	77.61 ***	2.8687	83.80 ***
$POP DENS$	-0.0053	-1.00	-0.0277	-1.14	-0.0125	-2.60 ***	-0.0943	-3.16 ***
N. obs.	8,451		8,451		8,451		8,451	
N. banks	688		688		688		688	

$\ln TOTAST$  & its squared = negative and positive, respectively, and significant

- Cost efficiency scores decrease as total assets grow, up to a minimum that varies according to the model (U-shaped relationship)
- The lowest estimated minimum is about 2,570 millions euro (tobit model with the ALS  $CE_{it}$ 's; for the other regressions, this figure is much higher)

## Appendix 3 – Empirical results on the covariates – 2

Variable	BATTESE-COELLI EFFICIENCY SCORES				AIGNER ET AL. EFFICIENCY SCORES			
	TOBIT ESTIMATION		LOGISTIC TRANSFORMATION		TOBIT ESTIMATION		LOGISTIC TRANSFORMATION	
	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value
...	...	...	...	...	...	...	...	...
$\ln TOTAST$	-0.4047	-31.69 ***	-2.2375	-29.43 ***	-0.0801	-7.90 ***	-0.5559	-8.81 ***
$(\ln TOTAST)^2$	0.0116	22.10 ***	0.0687	22.48 ***	0.0027	6.54 ***	0.0181	7.03 ***
$NPL$	-0.0212	-0.86	-0.1925	-1.34	-0.1338	-6.79 ***	-0.9363	-7.46 ***
$\ln BRBUS$	0.1122	51.36 ***	0.5647	36.16 ***	0.0454	30.55 ***	0.3691	39.36 ***
$EQAST$	0.1573	6.79 ***	1.0073	8.61 ***	0.3095	19.99 ***	2.2767	21.54 ***
$DEPAST$	-0.1452	-18.83 ***	-0.7206	-15.64 ***	-0.0581	-12.02 ***	-0.5117	-15.06 ***
$LOANAST$	0.1442	19.18 ***	0.6184	15.03 ***	0.4126	77.61 ***	2.8687	83.80 ***
$POP DENS$	-0.0053	-1.00	-0.0277	-1.14	-0.0125	-2.60 ***	-0.0943	-3.16 ***
N. obs.	8,451		8,451		8,451		8,451	
N. banks	688		688		688		688	

$\ln TOTAST$  & its squared = negative and positive, respectively, and significant

- In our sample, only 3 BCCs (7 observations) over 688 have a (slightly) bigger size than this threshold → an increase of Italian BCCs' size would hardly allow an improvement in the quality of organization and management, whereas it would generally lead to worse cost performances

- Again, mergers are not efficiency-enhancing, at least up to a certain point

## Appendix 3 – Empirical results on the covariates – 3

Variable	BATTESE-COELLI EFFICIENCY SCORES				AIGNER ET AL. EFFICIENCY SCORES			
	TOBIT ESTIMATION		LOGISTIC TRANSFORMATION		TOBIT ESTIMATION		LOGISTIC TRANSFORMATION	
	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value
...	...	...	...	...	...	...	...	...
lnTOTAST	-0.4047	-31.69 ***	-2.2375	-29.43 ***	-0.0801	-7.90 ***	-0.5559	-8.81 ***
(lnTOTAST) <sup>2</sup>	0.0116	22.10 ***	0.0687	22.48 ***	0.0027	6.54 ***	0.0181	7.03 ***
NPL	-0.0212	-0.86	-0.1925	-1.34	-0.1338	-6.79 ***	-0.9363	-7.46 ***
lnBRBUS	0.1122	51.36 ***	0.5647	36.16 ***	0.0454	30.55 ***	0.3691	39.36 ***
EQAST	0.1573	6.79 ***	1.0073	8.61 ***	0.3095	19.99 ***	2.2767	21.54 ***
DEPAST	-0.1452	-18.83 ***	-0.7206	-15.64 ***	-0.0581	-12.02 ***	-0.5117	-15.06 ***
LOANAST	0.1442	19.18 ***	0.6184	15.03 ***	0.4126	77.61 ***	2.8687	83.80 ***
POPDENS	-0.0053	-1.00	-0.0277	-1.14	-0.0125	-2.60 ***	-0.0943	-3.16 ***
N. obs.	8,451		8,451		8,451		8,451	
N. banks	688		688		688		688	

**NPL** = negative coefficient (not significant when using the BC scores) → bad loans are negatively correlated with cost efficiency and signal an inadequate management quality

**BRBUS** = positive and significant coefficient → BCCs are more efficient when they can count on more business at the branch level

## Appendix 3 – Empirical results on the covariates – 4

Variable	BATTESE-COELLI EFFICIENCY SCORES				AIGNER ET AL. EFFICIENCY SCORES			
	TOBIT		LOGISTIC		TOBIT		LOGISTIC	
	ESTIMATION	TRANSFORMATION	ESTIMATION	TRANSFORMATION	ESTIMATION	TRANSFORMATION	ESTIMATION	TRANSFORMATION
	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value
...	...	...	...	...	...	...	...	...
lnTOTAST	-0.4047	-31.69 ***	-2.2375	-29.43 ***	-0.0801	-7.90 ***	-0.5559	-8.81 ***
(lnTOTAST) <sup>2</sup>	0.0116	22.10 ***	0.0687	22.48 ***	0.0027	6.54 ***	0.0181	7.03 ***
NPL	-0.0212	-0.86	-0.1925	-1.34	-0.1338	-6.79 ***	-0.9363	-7.46 ***
lnBRBUS	0.1122	51.36 ***	0.5647	36.16 ***	0.0454	30.55 ***	0.3691	39.36 ***
<b>EQAST</b>	<b>0.1573</b>	<b>6.79 ***</b>	<b>1.0073</b>	<b>8.61 ***</b>	<b>0.3095</b>	<b>19.99 ***</b>	<b>2.2767</b>	<b>21.54 ***</b>
DEPAST	-0.1452	-18.83 ***	-0.7206	-15.64 ***	-0.0581	-12.02 ***	-0.5117	-15.06 ***
LOANAST	0.1442	19.18 ***	0.6184	15.03 ***	0.4126	77.61 ***	2.8687	83.80 ***
POPDENS	-0.0053	-1.00	-0.0277	-1.14	-0.0125	-2.60 ***	-0.0943	-3.16 ***
N. obs.	8,451		8,451		8,451		8,451	
N. banks	688		688		688		688	

*EQAST* = positive and significant coefficient → more capitalized BCCs are also more cost efficient (managers are compelled to implement more efficient programs and procedures because of the stronger monitoring by cooperative members)

# Appendix 3 – Empirical results on the covariates – 5

Variable	BATTESE-COELLI EFFICIENCY SCORES				AIGNER ET AL. EFFICIENCY SCORES			
	TOBIT ESTIMATION		LOGISTIC TRANSFORMATION		TOBIT ESTIMATION		LOGISTIC TRANSFORMATION	
	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value
...	...	...	...	...	...	...	...	...
lnTOTAST	-0.4047	-31.69 ***	-2.2375	-29.43 ***	-0.0801	-7.90 ***	-0.5559	-8.81 ***
(lnTOTAST) <sup>2</sup>	0.0116	22.10 ***	0.0687	22.48 ***	0.0027	6.54 ***	0.0181	7.03 ***
NPL	-0.0212	-0.86	-0.1925	-1.34	-0.1338	-6.79 ***	-0.9363	-7.46 ***
lnBRBUS	0.1122	51.36 ***	0.5647	36.16 ***	0.0454	30.55 ***	0.3691	39.36 ***
EQAST	0.1573	6.79 ***	1.0073	8.61 ***	0.3095	19.99 ***	2.2767	21.54 ***
DEPAST	-0.1452	-18.83 ***	-0.7206	-15.64 ***	-0.0581	-12.02 ***	-0.5117	-15.06 ***
LOANAST	0.1442	19.18 ***	0.6184	15.03 ***	0.4126	77.61 ***	2.8687	83.80 ***
POPDENS	-0.0053	-1.00	-0.0277	-1.14	-0.0125	-2.60 ***	-0.0943	-3.16 ***
N. obs.	8,451		8,451		8,451		8,451	
N. banks	688		688		688		688	

*DEPAST* = negative and significant coefficient → as BCCs' deposits increase, they impose efficiency losses to banks

*LOANAST* = positive and significant coefficient → BCCs with a higher proportion of loans experience a higher cost efficiency

## Appendix 3 – Empirical results on the covariates – 6

Variable	BATTESE-COELLI EFFICIENCY SCORES				AIGNER ET AL. EFFICIENCY SCORES			
	TOBIT ESTIMATION		LOGISTIC TRANSFORMATION		TOBIT ESTIMATION		LOGISTIC TRANSFORMATION	
	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value
...	...	...	...	...	...	...	...	...
<i>lnTOTAST</i>	-0.4047	-31.69 ***	-2.2375	-29.43 ***	-0.0801	-7.90 ***	-0.5559	-8.81 ***
<i>(lnTOTAST)<sup>2</sup></i>	0.0116	22.10 ***	0.0687	22.48 ***	0.0027	6.54 ***	0.0181	7.03 ***
<i>NPL</i>	-0.0212	-0.86	-0.1925	-1.34	-0.1338	-6.79 ***	-0.9363	-7.46 ***
<i>lnBRBUS</i>	0.1122	51.36 ***	0.5647	36.16 ***	0.0454	30.55 ***	0.3691	39.36 ***
<i>EQAST</i>	0.1573	6.79 ***	1.0073	8.61 ***	0.3095	19.99 ***	2.2767	21.54 ***
<i>DEPAST</i>	-0.1452	-18.83 ***	-0.7206	-15.64 ***	-0.0581	-12.02 ***	-0.5117	-15.06 ***
<i>LOANAST</i>	0.1442	19.18 ***	0.6184	15.03 ***	0.4126	77.61 ***	2.8687	83.80 ***
<i>POPDENS</i>	-0.0053	-1.00	-0.0277	-1.14	-0.0125	-2.60 ***	-0.0943	-3.16 ***
N. obs.	8,451		8,451		8,451		8,451	
N. banks	688		688		688		688	

Overall, we deduce that *cooperative banks are more efficient when they focus mainly on the traditional activity of loan granting* (which is normally based on relationship lending), while *a higher fraction of deposits among liabilities produces inefficiencies on the cost side*.

# Appendix 3 – Empirical results on the covariates – 7

Variable	BATTESE-COELLI EFFICIENCY SCORES				AIGNER ET AL. EFFICIENCY SCORES			
	TOBIT ESTIMATION		LOGISTIC TRANSFORMATION		TOBIT ESTIMATION		LOGISTIC TRANSFORMATION	
	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value
...	...	...	...	...	...	...	...	...
lnTOTAST	-0.4047	-31.69 ***	-2.2375	-29.43 ***	-0.0801	-7.90 ***	-0.5559	-8.81 ***
(lnTOTAST) <sup>2</sup>	0.0116	22.10 ***	0.0687	22.48 ***	0.0027	6.54 ***	0.0181	7.03 ***
NPL	-0.0212	-0.86	-0.1925	-1.34	-0.1338	-6.79 ***	-0.9363	-7.46 ***
lnBRBUS	0.1122	51.36 ***	0.5647	36.16 ***	0.0454	30.55 ***	0.3691	39.36 ***
EQAST	0.1573	6.79 ***	1.0073	8.61 ***	0.3095	19.99 ***	2.2767	21.54 ***
DEPAST	-0.1452	-18.83 ***	-0.7206	-15.64 ***	-0.0581	-12.02 ***	-0.5117	-15.06 ***
LOANAST	0.1442	19.18 ***	0.6184	15.03 ***	0.4126	77.61 ***	2.8687	83.80 ***
<b>POPDENS</b>	<b>-0.0053</b>	<b>-1.00</b>	<b>-0.0277</b>	<b>-1.14</b>	<b>-0.0125</b>	<b>-2.60 ***</b>	<b>-0.0943</b>	<b>-3.16 ***</b>
N. obs.	8,451		8,451		8,451		8,451	
N. banks	688		688		688		688	

**POPDENS** = *negative coefficient* (not significant when using the BC scores) → in terms of efficiency, *the complexity of crowded markets seems to more than offset the advantage of reaching more customers*