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THE EFFICIENCY OF THE NETWORK ORGANIZATIONAL STRUCTURE OF COOPERATIVE BANKS

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The paper proposes an empirical investigation of scale economies, scope economies, and market power of the *network* organizational structure of Italian cooperative banks. For 452 cooperative banks (and a control group of 223 commercial banks) over 2006–2018, empirical findings show that cooperative banks experienced cost economies of scale and scope, but they experienced scale diseconomies and constant scope economies on the revenue side. Unlike commercial banks, cooperative banks did not seem to benefit on the earnings side from increases in scale and diversification. Moreover, cooperative banks experience greater market power than commercial banks. Traditional advantages, in terms of network economies and relationship lending, are proven empirically to persist for the *network* organizational structure.

Keywords: Cooperative banks; banking efficiency; organizational structure.

JEL Classifications: G21, L25

1. Introduction

Cooperative banking plays a key role in financial markets, providing credit, especially to small and medium enterprises (SMEs) and families. Their business model is highly distinctive in financial markets (Migliorelli & Lamarque 2022). Cooperative banks are still present in many European countries; however, a unique organizational model cannot be defined. Indeed, national and regional circumstances impacted their local development (see Fonteyne 2017, Karafolas 2016). This led to different organizational structures, although cooperative banks still play a systemic role in key European countries such as Austria, Finland, France, Germany, the Netherlands, and Italy (see, for instance, Lang *et al.* 2016; Poli 2019, Migliorelli & Lamarque 2022).

Besides the importance and peculiarity of the topic, no studies have been conducted on the efficiency of cooperative banks has been rarely studied, and the focus has been mainly on cost. Moreover, different cooperative banking organizational structures efficiency have never been studied in literature, as to my knowledge. This work aims at starting to fill these two gaps, by considering the former Italian cooperative banking organizational structure, following on cost, revenue and earnings efficiency.

Before 2018, the Italian cooperative banks' business model could be defined as a *network* organizational structure, with local banks which are largely independent in their daily activities and where centralization is very limited.[a] Hundreds of small stand-alone banks ("Banche di Credito Cooperativo", BCCs) were joined together in a national horizontal network with three levels, where they share protection in terms of liquidity and solvency. They were autonomous in managerial decisions and could join the local federation on a voluntary basis (15 local regional or interregional), which conducted consortium functions. Local federations played an important role in the local (regional) strategies for some fundamental functions, such as delegation, and protecting the quality and efficiency of cooperative banks. The national federation (Federcasse) upheld and protected the rights of the associated banks, and offered them legal, fiscal, and organizational assistance, also tackling overall strategy and policy guidelines. However, local banks operated with great independence in their business choices, in their operations and in providing services for customers. Italian cooperative banks had a strong presence in SMEs and the family loan market (with a share of, respectively, 25% and 8.5%). They represented 52.8% of banks operating in Italy, with around 4200 branches (18% of total branches) and 1.3 million members. In 2018 a reform was enacted to shift their organizational structure to the integrated one (the more common in Europe).[b] Before that, Italian cooperative banks relied on network economies (Coccorese *et al.* 2016) and relationship lending (Coccorese & Ferri 2020). Even in a system of a few hundred cooperative banks organized in a network, as it was in Italy, the existence of network economies enhanced efficiency (Coccorese *et al.* 2016): belonging to a network where some products or services are jointly produced in a setup of non-excludability created network economies and cooperation that favors efficiency, possibly without the need for an

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[a] This is identified by articles 400(2)(d) and 422(8) of the Capital Requirements Regulation, CRR. Other typical examples of this type of cooperative banking are the Polish and Hungarian cooperative banks (Cornée *et al.* 2018).

[b] The literature identifies three different versions of integrated models (Cornée *et al.* 2018). Besides the ICN, a model with a lower degree of integration (with an Institutional Protection Scheme, IPS) can be defined: the central body acts as an umbrella association (to provide liquidity and solvency in case of bankruptcy), while local banks are still largely independent and are individually supervised at national levels. This model is employed in Germany, Austria, and Spain. Second, the integrated cooperative networks (ICNs): most functions are centralized, as in the French model, and the supervision is at the European level, given the relevant size. The third and most integrated model is the so-called consolidated cooperative groups: local banks and the central body are consolidated as a single entity. That is the case of Finland, Portugal, and Luxemburg.

increase in size. Relationship lending qualifies cooperative banks and distinguishes them from commercial banks. The relatively small scale of cooperative banks is strictly connected to the scope of serving SMEs and families in local areas (Hasan *et al.* 2017). Specifically, Italian cooperative banks focus on financing SMEs through small loans: as of 2021, 65% of their corporate loans are worth less than € 2.5 million. As defined by the conventional paradigm, banks with strong relationships with the territory use soft information gathered through relationship lending to be more informed about customers' businesses to make better lending decisions (Berger & Udell 2006). This enables small banks to better discriminate investment decisions, and to have less risky and more profitable relationships with small (and opaque) firms thanks to soft information (see, among others, Berger & Udell 2002, Mudd 2013, Hasan *et al.* 2017).

Given this background, an empirical investigation of the efficiency of Italian cooperative banks' *network* organizational structure appears to be needed to evaluate whether it was *per se* efficient, to detect if those peculiar features (network economies and relationship lending) foster the efficiency of cooperative banking, even with a reduced size and a low degree of centralization. To investigate that, using a sample of 675 Italian banks, 452 of which are cooperative banks and 223 commercial (used as a control group), this paper estimates cost, revenue, and earnings function and considers three distinctive features: economies of scale, economies of scope, and market power. The period of analysis spans from 2006 to 2018, the final year of implementation of the *network* organizational structure. Indeed, this work aims at evaluating the efficiency status of pre-reform Italian cooperative banks, since the supervisory authority stressed this point to motivate the need for the reform.

Regarding scale economies, empirical findings reveal that both cooperative and commercial banks have a margin to exploit on the cost side: enlarging their size would lead to a decrease in their marginal costs. That could be linked to the considerable impact of compliance costs which are particularly significant especially for smaller banks (such as cooperative ones), given that the proportionality principle does not find extensive application (see Masera 2021). Regarding revenue, cooperative banks are found to experience neither scale economies nor scale diseconomies. Concerning earnings[c], cooperative banks experienced diseconomies of scale in the last years of analysis. That might be linked to the low-interest rate environment in which banks are operating (see, for instance, Altavilla *et al.* 2018, Borio & Gambacorta 2017, Borio *et al.* 2017), but it is also connected to cooperative banks' peculiarity associated to the conventional paradigm, which relies on the small size of banks.

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[c]Note that, even though cooperative banks do not have the maximization of earnings as the first goal, being profitable remains a condition for survival and to make the system work, also for being compliant with capital requirements. Indeed, earnings are mainly allocated as reserves and in mutualistic funds aimed at promoting and developing cooperation (as also imposed by the Italian regulator through article 37 of TUB). Therefore, it is relevant to study earnings scale and scope economies as well.

Concerning cost scope economies, results show that, on average, cooperative banks have constant scope economies and commercial banks have negative ones. Regarding revenue scope economies, commercial banks have positive economies of scale, whereas cooperative banks have constant ones. It means that cooperative banks acquire neither benefits nor disadvantages in diversifying their business. For earnings scope economies, two different trends emerge: commercial banks experience earnings scope economies for the whole period of analysis, whereas cooperative banks show a downward sloping trend, meaning that in the last years of the analysis they are experiencing earnings diseconomies of scope. Also, in this case, cooperative banks which rely on the conventional paradigm are known to better perform when focusing on lending rather than diversifying their business.

Finally, empirical findings reveal that cooperative banks have a greater market power than commercial banks throughout the analysis period.

All these results bring new evidence to be considered in evaluating the efficiency status of Italian cooperative banks. Firstly, the *network* organizational structure does not determine any disadvantage on earnings, at least in the context of low-interest rates. Secondly, cooperative banks do not have significant advantages in diversifying their business (instead, they have negative earnings scope economies). Thirdly, cooperative banks experienced a greater market power in terms of mark-up price consistent with banking literature suggesting that cooperative banks are better able to exploit soft information in relationship lending. Moreover, not having scope economies advantages in diversifying their business, given that cooperative banks have a strong position in the lending market, they do not have the incentive to move to the financial assets market. Empirical evidence on Italian cooperative banks does not necessarily support the need for a change in organizational structure to foster diversification and size increase, at least from the efficiency perspective. Results highlight the efficiency of the *network* organizational structure, at least whenever network economies and relationship lending are still pillars for cooperative banking activity.

The rest of the paper is organized as follows. Section 2 discusses the existing literature regarding the cooperative bank business model, scale and scope economies, and estimation of market power. Section 3 depicts the methodology and the sample. Section 4 reports the empirical results while Sec. 5 presents robustness checks. Section 6 concludes the paper.

2. Literature Review

The role of cooperative banking in providing credit for families and firms which tend to experience more difficulties in getting access to traditional commercial banks, such as SMEs (Hasan *et al.* 2017, Coccorese & Ferri 2020), has been often analyzed in the literature. This translates into the "conventional paradigm", which states that "community banks" (i.e. small, single-market, local institutions) are better able to form strong relationships with informationally opaque small businesses, while

"megabanks" (i.e. large, multimarket, non-local institutions) tend to serve more transparent firms. Recently, several studies (Berger *et al.* 2017, Hasan *et al.* 2017, Mkhaiber & Werner 2021) support the conventional paradigm by empirically investigating the role of small (cooperative) banks for SMEs.[d] Berger *et al.* (2017) reported that the presence of small banks allows small businesses in the same area to face fewer financial constraints. The role of cooperative banks in facilitating credit access to SMEs at a lower cost, and therefore, contributing to their growth is reported by Hasan *et al.* (2017). Mkhaiber & Werner (2021) findings suggest a negative relation between bank size and propensity to lend to SMEs. Therefore, the literature suggests that SMEs benefit from the presence of small banks (cooperative banks) and that bigger banks are less focused on lending to SMEs.

Besides the conventional paradigm, cooperative banks have been extensively analyzed for performance (see, for instance, Goddard *et al.* 2008a, Kontolaimou & Tsekouras 2010), ownership structure (Gorton & Schmid 1999), competition and financial stability (Fiordelisi & Mare 2014), and diversification (Goddard *et al.* 2008b, Lepetit *et al.* 2008, Mercieca *et al.* 2007, McKillop & Wilson 2011).

Studies relating to efficiency have been rarely conducted about cooperative banks. Lang & Welzel (1996) studied economies of scale on the cost side for German banks, while few research has been conducted on credit unions: Garden & Ralston (1999) studied the X-efficiency and allocative efficiency of Australian credit unions following mergers, McKillop *et al.* (2002) focused on UK credit unions cost efficiency, Wheelock & Wilson (2013) studied the evolution of US credit unions' cost and scale efficiency. Shifting the focus on Italian cooperative banks, they have been rarely studied regarding efficiency, mainly focusing on costs (Girardone *et al.* 2004, Battaglia *et al.* 2010, Fiordelisi & Mare 2013, Coccorese & Ferri 2020).

To the best of my knowledge, however, the efficiency (in terms of both scale economies and scope economies) of the *network* organizational structure has never been studied for cooperative banks, while studies regarding cooperative banks' market power have rarely been conducted, nor has any comparison with commercial banks ever been carried out, even though these topics have been under discussion, especially in Italy, at the political and legislative level in recent years.

Since scale economies reflect the possibility to spread (in unit cost) the impact of fixed costs, literature has focused especially on large banks in the US (see Gambacorta & van Rixtel (2013) for a complete review) and in Europe (Beccalli *et al.* 2015), whereas few investigations have been conducted specifically for cooperative banks, just on the cost side (Lang & Welzel 1996, Girardone *et al.* 2004). Therefore, this research takes into account the peculiar nature of cooperative banks compared to commercial banks, and empirically estimates economies of scale for the *network* organizational structure, advancing the literature by considering not just cost but also revenue and earnings scale economies.

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[d] Berger *et al.* (2014) pose some doubts about the conventional paradigm, perhaps because of changes in lending technologies and the deregulation of the banking industry.

Concerning scope economies, the literature mainly focuses on non-cooperative large banks. Mixed results are found when studying the potential benefits of diversification compared to its costs for the US (Gambacorta & van Rixtel 2013)[e] and for European banks (Altunbas & Molyneux 1996, Vennet 2002). Regarding European non-cooperative banks, Beccalli & Rossi (2020) included in their study both cost and profit scope economies, finding cost economies of scope and profit diseconomies of scope. Moreover, some studies suggest that product diversification may have detrimental effects: for instance, Fiordelisi & Marques-Ibanez (2013) found that diversification in product lines is associated with significant increases in risk (both at the level of the banking sector and overall financial system).

Market power is typically measured as the markup that banks can charge on their customers, and so by computing the Lerner index.[f] Very few studies focus on the competition of cooperative banks. As for competition, when cooperative banks are found to be dominant in local markets, Italian cooperative banks react to an increase in competition by investing more in building long-lasting relationships with customers, as documented by Presbitero & Zazzaro (2011). Competition of cooperative banks has also been studied in relationship with stability: Liu *et al.* (2013) report a non-linear relationship between competition and stability for European cooperative banks (similarly to Martinez-Miera & Repullo 2010), while Fiordelisi & Mare (2013) show that competition increases individual bank stability. Conversely, Clark *et al.* (2018) find that competition decreases individual cooperative bank stability, but a hump-shaped relationship does exist, probably driven by market power in the loans market. Looking at the relationship with other efficiency measures, Beccalli & Rossi (2020) report that profit scope economies are related to lower levels of market power.

Overall, the literature has rarely investigated scale economies and never scope economies for cooperative banks, while cooperative banks' market power was rarely examined. This paper aims to investigate these efficiency features for the cooperative *network* organizational structure given its benefits in terms of network economies and conventional paradigm.

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[e]For instance, Mester (1993), Pulley & Humphrey (1993), and Clark (1996) report cost scope economies. On the opposite, Ferrier *et al.* (1993) and Mitchell & Onvural (1996) find cost diseconomies of scope. Berger *et al.* (1996) find no evidence of economies or diseconomies of scope for the revenues of either small or large US banks, while Boot (2011) and Hoenig & Morris (2014) do not report significant and substantial economies of scope in banking

[f]The literature provides other market power measures based on the concentration, such as the *H*-statistic (based on the Panzar & Rosse 1987, methodology) and the HHI index. However, industrial organization literature argued, both theoretically and empirically, that the Lerner index and other structural competition measures are superior to concentration measures in investigating market power (see, for instance, Connor & Peterson 1992, Dell'Ariccia 2001) Specifically, the HHI as a measure of market power lacks consistency and robustness (Berger & Ofek 1995, Hannan 1997). The *H*-statistic requires a banking system in perfect equilibrium, while the Lerner index does not (Schaeck & Čihák 2010). In short, the Lerner index does not require a clear definition of the geographical market and is positively related to other competitiveness measures (Beck *et al.* 2013).

3. Methodology and Sample

Cost, revenue, and earnings functions are estimated by the following, Anginer *et al.* (2014):

$$
\begin{aligned}
\ln(Y_{it}) = {}& \alpha_0 + \sum_{n=1}^{2} \beta_n \ln(Q_{it,n}) + \frac{1}{2} \sum_{n=1}^{2} \sum_{m=1}^{2} \beta_{nm} \ln(Q_{it,n}) \ln(Q_{it,m}) + \sum_{n=1}^{3} \delta_n \ln(W_{it,n}) \\
& + \frac{1}{2} \sum_{n=1}^{3} \sum_{m=1}^{3} \delta_{nm} \ln(W_{it,n}) \ln(W_{it,m}) + \sum_{n=1}^{2} \sum_{m=1}^{3} \gamma_{nm} \ln(Q_{it,n}) \ln(W_{it,m}) \\
& + \Theta \ \text{Year} + \varepsilon_{it},
\end{aligned}
\tag{1}
$$

where $Q_{it,1}$ is the total loan output and $Q_{it,2}$ is the total financial assets output.[g] Depending on the function, the dependent variable Y is either C, R, or π where C is total operating costs, R is total operating revenues, and π is total operating earnings.[h] Three input prices are included: $W_{it,1}$ is the cost of funds defined as the ratio of interest expenses to total assets, $W_{it,2}$ is the cost of labor defined as the ratio of personnel expenses to total assets, and $W_{it,3}$ is the cost of physical capital defined as the ratio of operating expenses to total assets. Subscripts i and t represent banks and years, respectively. Year dummies are included in the OLS regression. Functions are separately estimated for cooperative and commercial banks because the two types of banks rely on different technologies. Moreover, to reduce the influence of outliers, all variables are winsorized at the 1st and 99th percentile. Symmetry requires $\beta_{nm} = \beta_{mn}$, $\delta_{nm} = \delta_{mn}$ and $\gamma_{nm} = \gamma_{mn}$. Homogeneity of degree one in input prices requires that $\sum_{n=1}^{3} \delta_n = 1$, $\sum_{m=1}^{3} \delta_{1m} = 0$, $\sum_{m=1}^{3} \delta_{2m} = 0$, $\sum_{m=1}^{3} \delta_{3m} = 0$, $\sum_{m=1}^{3} \gamma_{1m} = 0$, and $\sum_{m=1}^{3} \gamma_{2m} = 0$.

Commercial banks have been chosen as a counterfactual for different reasons. First of all, they are the main competitors, especially in Italian lending market, for cooperative banks. Secondly, they were not affected by the reform, obviously. Third, it was not possible to have a geographical matching with other local banks of similar size, they being not so spread all over Italian territory as cooperative banks.

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[g]Research design does not include off-balance-sheet assets as an output. This is due to the fact that off-balance-sheet items do not represent a relevant operating activity for cooperative banks, as recognized in other investigations on cooperative banking (Huljak *et al.* 2018). This approach is consistent with the methodology employed by Huljak *et al.* (2018) in their analysis of the cost efficiency of euro-area banks published in the Financial Stability Review (May 2018) of the ECB.

[h]Total operating costs are equal to the sum of interest expenses, personnel expenses, and other operating expenses (fee and commission expenses, other administrative expenses, and trading expenses). Operating revenues are obtained as the sum of interest income, commission and fee income, dividend income, and trading income, while operating earnings are the difference between revenues and costs (as already defined), minus the net values regarding hedging, disposal, or repurchase of financial assets, and losses or recoveries regarding impairments. Whenever π is negative, it is not possible to compute $\ln(\pi)$, so those cases are treated as missing. To fix this problem, Vennet (2002) proposed the following adjustment: $\ln(\pi) = \ln(\pi + |\pi_{\min}| + 1)$, where $\pi_{\min}$ is the minimum value of π. However, adding a fixed amount alters variables, given the presence of in-sample variability.

3.1. *Economies of scale*

Mathematically, economies of scale are defined as the sum of individual costs, revenues, and earnings elasticities:

$$ES_{it} = \frac{\partial \ln(Y)}{\partial \ln(Q_{it,1})} + \frac{\partial \ln(Y)}{\partial \ln(Q_{it,2})}. \tag{2}$$

When addressing cost economies of scale, a bank is found to experience economies of scale if the value is lower than 1, constant economies of scale if the value is 1, and diseconomies of scale if the value is greater than 1. By contrast, when computing revenue and earning scale economies, having a value of economies of scale greater than 1 means that the bank is experiencing economies of scale.

3.2. *Economies of scope*

To estimate scope economies, WSCOPE measure (Mester 1993) is employed. This measure differs from the SCOPE measure because, while WSCOPE substitutes in-sample minimum outputs ($Q_{it,n}^{\min}$, which is the minimum value of either $Q_{it,1}$ or $Q_{it,2}$), SCOPE assigns a value of zero to not produced outputs, leaving the logarithmic function undefined. Moreover, WSCOPE adjusts all output values by their minimum output to avoid introducing distortions in the measure ($\tilde{Q}_{it,n} = Q_{it,n} - Q_{it,n}^{\min}$). WSCOPE is defined in the following way:

$$\text{WSCOPE}_{it} = \begin{cases} \dfrac{Y(\tilde{Q}_{it,1}; Q_{it,2}^{\min}) + Y(Q_{it,1}^{\min}; \tilde{Q}_{it,2}) - Y(Q_{it,1}; Q_{it,2})}{Y(Q_{it,1}; Q_{it,2})}, & \text{if } Y = C, \\[2ex] \dfrac{Y(Q_{it,1}; Q_{it,2}) - [Y(\tilde{Q}_{it,1}; Q_{it,2}^{\min}) + Y(Q_{it,1}^{\min}; \tilde{Q}_{it,2})]}{Y(Q_{it,1}; Q_{it,2})}, & \text{if } Y = R, \pi. \end{cases} \tag{3}$$

If WSCOPE is statistically different from zero, there are economies or diseconomies of scope. If the indicator is positive, economies of scope exist, which means that producing the two outputs separately would lead to an increase in cost (or a reduction in revenue and/or earnings). Conversely, if WSCOPE is negative, the bank is experiencing diseconomies of scope: it would be more profitable (or less costly) to produce the two outputs separately.

3.3. *Market power*

Lerner measures banks' market power, which is computed as the difference between the loan interest rate (as a proxy of the price of loans) and marginal costs (as a proxy of the cost of generating a loan). Following the approach by Anginer *et al.* (2014),

coefficients are obtained from the following regression[i]:

$$\ln(C_{it}) = \alpha_0 + \beta_1 \ln(Q_{it}) + \beta_2 (\ln(Q_{it}))^2 + \sum_{n=1}^{3} \delta_n \ln(W_{it,n})$$

$$+ \frac{1}{2} \sum_{n=1}^{3} \sum_{m=1}^{3} \delta_{nm} \ln(W_{it,n}) \ln(W_{it,m}) + \sum_{m=1}^{3} \gamma_m \ln(Q_{it}) \ln(W_{it,m}) + \Theta \, \text{Year} + \varepsilon_{it}. \tag{4}$$

Then, using cost economies of scale results (ES^{cost}) to estimate each bank's marginal costs:

$$MC_{it} = \frac{\partial C_{it}}{\partial Q_{it}} = \frac{\partial \ln(C_{it})}{\partial \ln(Q_{it})} \frac{C_{it}}{Q_{it}} = ES^{\text{cost}}_{it} \frac{C_{it}}{Q_{it}}. \tag{5}$$

The Lerner index is obtained as follows:

$$\text{Lerner}_{it} = \frac{P_{it} - MC_{it}}{P_{it}}, \tag{6}$$

where P_{it} represents marginal revenue, which is obtained by dividing total revenues by total assets. Lerner Index theoretically ranges between 0 and 1. Since in a perfectly competitive market banks have no market power, they charge $P_{it} = MC_{it}$, Lerner Index has a value of 0. A positive value represents an oligopolistic or monopolistic market in which banks have market power ($P_{it} > MC_{it}$).

3.4. *Sample*

The sample comprises Italian cooperative and commercial banks operating in Italy from 2006 to 2018. Data are taken from banks' balance sheets, provided by the Italian Cooperative Banks Federation (Federcasse).[j] The research focuses on two different types of banks: cooperative banks and commercial banks as a control sample. The unbalanced panel dataset consists of 675 banks, of which 452 are cooperatives and 223 commercial banks (6762 observations). The sample period in terms of the number of institutions is depicted in Table 1. The list of variables and their definition is reported in Table B.1 in Appendix B.

In-sample variability is given by the fact that the research comprises banks with very different sizes and characteristics. Indeed, descriptive statistics in Table 2 show the differences between cooperative banks and commercial banks. Data are reported in millions of euros. Bank size is very different: on average, cooperative banks are nearly 1/9 of commercial banks in terms of assets (median). That is expected given the classical features of cooperative banks (small size, local and relationship-based banks).

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[i]When computing the Lerner Index, one output is used in the translog function, therefore, having Q_{it} (total assets) instead of $Q_{it,1}$ and $Q_{it,2}$ as in Eq. (1).

[j]Federcasse provided data both regarding cooperative and commercial banks.

Table 1. Number of banks by year.

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Cooperative	432	437	430	414	406	406	386	375	368	357	334	253	268	4866
Commercial	165	185	187	196	178	160	151	137	129	120	113	95	80	1896
Total	597	622	617	610	584	566	537	512	497	477	447	348	348	6762

Note: This table reports the number of cooperative and commercial banks per year over the entire period of analysis.

Table 2. Summary statistics.

Variable	N obs.	Mean	Median	Std. dev.	Min	Max
Panel A: Cooperative banks						
Total assets: Q (Mln. EUR)	4866	506.300	305.100	713.100	28.670	11,769.000
Gross loans: $Q1$ (Mln. EUR)	4866	360.900	213.500	505.300	19.110	10,002.000
Financial assets: $Q2$ (Mln. EUR)	4866	124.600	64.710	211.600	0.023	4,483.000
Operating Cost: C (Mln. EUR)	4866	16.520	10.720	21.330	1.150	313.700
Operating Revenues: R (Mln. EUR)	4866	20.570	13.420	26.550	1.189	390.000
Operating Earnings: π (Mln. EUR)	4866	1.802	1.320	5.601	−101.200	56.020
Cost of funds: $W1$	4866	0.013	0.012	0.007	0.001	0.033
Cost of labor: $W2$	4866	0.013	0.012	0.003	0.002	0.031
Cost of physical capital: $W3$	4866	0.010	0.010	0.005	0.003	0.214
Marginal revenue: P	4866	0.044	0.043	0.012	0.020	0.242
NPL ratio	4866	0.098	0.083	0.065	0.000	0.329
ROA	4866	0.005	0.005	0.008	−0.047	0.025
Cost to Income Ratio	4866	0.832	0.802	0.240	0.489	1.681
LR	4866	0.007	0.006	0.004	0.000	0.047
NIM	4866	0.024	0.023	0.007	0.002	0.043
Panel B: Commercial banks						
Total assets:Q (Mln. EUR)	1896	9416.000	2695.000	17,372.000	28.670	77,877.000
Gross loans: $Q1$ (Mln. EUR)	1896	7531.000	2033.000	14,084.000	19.110	65,454.000
Financial assets: $Q2$ (Mln. EUR)	1896	1306.000	138.100	3329.000	0.023	15,767.000
Operating Cost: C (Mln. EUR)	1896	612.100	112.400	1454.000	1.150	6827.000
Operating revenues: R (Mln. EUR)	1896	715.200	137.800	1657.000	1.189	7819.000
Operating earnings: π (Mln. EUR)	1896	37.230	9.297	90.750	−101.200	351.600
Cost of funds:$W1$	1896	0.013	0.012	0.008	0.001	0.033
Cost of labor: $W2$	1896	0.013	0.012	0.006	0.002	0.031
Cost of physical capital: $W3$	1896	0.028	0.014	0.043	0.003	0.214
Marginal revenue: P	1896	0.062	0.050	0.044	0.020	0.242
NPL ratio	1896	0.076	0.056	0.074	0.000	0.329
ROA	1896	0.002	0.004	0.014	−0.047	0.025
Cost to Income Ratio	1896	0.866	0.791	0.332	0.489	1.681
LR	1896	0.008	0.006	0.010	0.000	0.047
NIM	1896	0.019	0.019	0.009	0.002	0.043
Panel C: Total sample						
Total assets: Q (Mln. EUR)	6762	3004.000	432.800	10,048.000	28.670	77,877.000
Gross loans: $Q1$ (Mln. EUR)	6762	2371.000	314.700	8134.000	19.110	65,454.000
Financial assets: $Q2$ (Mln. EUR)	6762	455.800	74.180	1849.000	0.023	15,767.000
Operating cost: C (Mln. EUR)	6762	183.500	15.210	815.100	1.150	6827.000
Operating revenues: R (Mln. EUR)	6762	215.400	18.860	931.200	1.189	7819.000

Table 2. (*Continued*)

Variable	*N* obs.	Mean	Median	Std. dev.	Min	Max
Operating earnings: π (*M*ln. EUR)	6762	11.740	1.642	50.830	-101.200	351.600
Cost of funds: $W1$	6762	0.013	0.012	0.007	0.001	0.033
Cost of labor: $W2$	6762	0.013	0.012	0.004	0.002	0.031
Cost of physical capital: $W3$	6762	0.015	0.010	0.025	0.003	0.214
Marginal revenue: P	6762	0.049	0.044	0.027	0.020	0.242
NPL ratio	6762	0.092	0.076	0.068	0.000	0.329
ROA	6762	0.004	0.005	0.011	-0.047	0.025
Cost to Income Ratio	6762	0.842	0.800	0.269	0.489	1.681
LR	6762	0.007	0.006	0.006	0.000	0.047
NIM	6762	0.022	0.022	0.008	0.002	0.043

Notes: This table reports the summary statistics for the variables in the analysis. Panel A displays summary statistics of cooperative banks. Panel B displays summary statistics of commercial banks. Panel C displays summary statistics of the total sample. Q represents total assets, Q_1 represents gross loans, Q_2 represents financial assets, C represents operating costs, R represents operating revenues, π represents operating earnings, E represents equity, W_1 represents the price of funds that is computed as the ratio of interest expenses to total assets, W_2 represents the price of labor that is computed as the ratio of personnel expenses to total assets, W_3 represents the price of physical capital that is computed as the ratio of other operating expenses to total assets, P represents marginal revenue computed as the ratio of total revenues to total assets, NPL ratio represents the ratio between NPLs and gross loans, ROA represents the ROA and it is computed as Earnings Before Interests and Taxes (EBIT) over total assets, Cost to Income ratio reports the ratio between operating costs and net income from banking activities, LR represents the LR computed as cash and cash equivalents over total assets, and NIM is the NIM computed as interest margin (interest income minus interest expenses) over total assets.
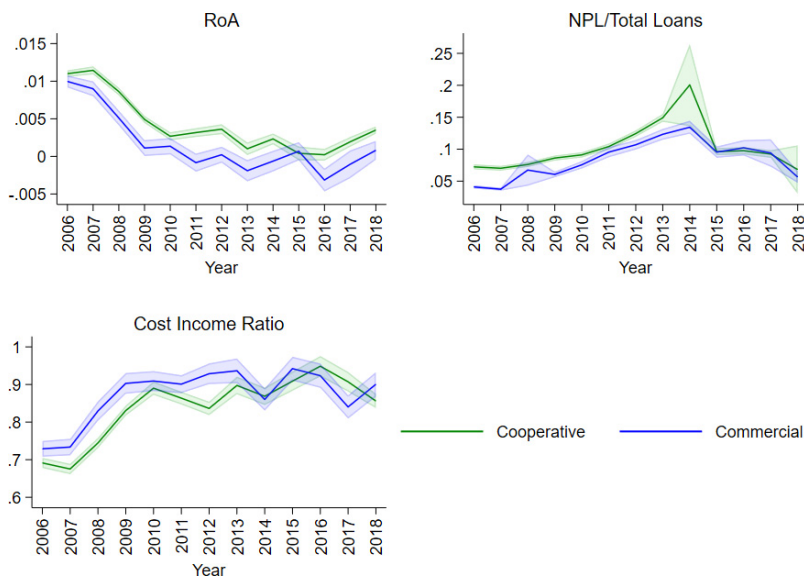
Note: Figure 1 reports the trend of some key indicators of banking activities for cooperative and commercial banks: ROA, NPL ratio, and Cost to Income ratio. 95% confidence intervals are reported.

Fig. 1. Banks' key indicators trend.

Before heading to analysis, trends of some key indicators are reported to describe the performances of banks over the entire period of analysis, to be able to better examine the performance of cooperative banks. In particular, return on assets (ROA, net income before taxes to total assets), non-performing loan (NPL) ratio (NPLs to total loans), and cost to income ratio (operating costs with respect to net income from banking activities) are shown. Figure 1 reports trends for cooperative and commercial banks over the period. The NPL ratio had a spike over the period 2011–2014 for cooperative banks. However, after that, they were able to quickly recover the same level of NPLs as commercial banks. In addition, cooperative and commercial banks report similar trends all over the period, and during some sub-periods cooperative banks seem to outperform commercial banks. Relying on these indicators, a possible underperformance of cooperative banks is not detected during the period of analysis.

4. Empirical Findings

4.1. *Economies of scale*

The estimation of scale economies for cooperative and commercial banks is conducted separately.[k] This choice is motivated by the fact that the business models of cooperative and commercial banks are significantly different (see also descriptive statistics in Table 2), and it is in line with prior studies (see, for instance, Altunbas *et al.* 2001, Beccalli 2007). The results of cost scale economies are reported in Table 3 (Panel A).[l] Both cooperative banks and commercial banks experience economies of scale on the cost side. This means that increasing the scale of banks decreases costs for both cooperative and commercial banks. By increasing size, cooperative banks would experience advantages in their cost structure, and this is more relevant in the

Table 3. Economies of scale.

Variable	N obs.	Mean	Median	Std. dev.	Min	Max
Panel A: Costs						
Cooperative	4866	0.997	0.997	0.0078	0.968	1.013
Commercial	1896	0.986	1.009	0.0755	0.726	1.099
Panel B: Revenues						
Cooperative	4866	1.010	1.010	0.012	0.981	1.037
Commercial	1896	1.035	1.058	0.077	0.713	1.149
Panel C: Earnings						
Cooperative	4866	0.960	0.958	0.0777	0.788	1.163
Commercial	1896	1.028	1.017	0.0647	0.911	1.234

Notes: This table reports summary statistics of economies of scale estimated with Eq. (1). Panel A presents cost economies of scale. Panel B presents revenue economies of scale. Panel C presents earnings economies of scale.

[k]For robustness checks, the regression was run also on the whole sample, obtaining very similar results regarding the distribution of scale economy.
[l]For results by cooperative banks' size, see Appendix B.

last years of analysis. That is likely linked to the well-known compliance diseconomies (see Masera 2021) determined by the absence of the proportionality principle in bank regulation: increases in regulatory compliance may have disproportionately increased cooperative banks' costs (Hughes *et al.* 2019), therefore, welcoming structures able to achieve size increases. Focusing on the evolution of cost economies of scale over the years 2006–2018 (Fig. 2, Panel A), two downward cliffs are observed for cooperative banks. The first one is in the period 2008–2010, just after the onset of the global financial crisis. The second one corresponds to the quantitative easing monetary policy. In short, both cooperative and commercial banks have margins to exploit on the cost side. Moreover, differences between the two types of banks are narrowing over time.

Table 3 (Panel B) shows results for revenue scale economies. On average, cooperative banks experience nearly constant economies of scale: Cooperative banks adopting a *network* organizational structure experience neither advantages nor disadvantages in expanding their size, at least in a low-interest rate environment. In contrast, commercial banks have a margin to expand their size since they are experiencing economies of scale. Focusing on the evolution over time, a common path is appearing throughout the analyzed period. Again, differences between the two banking models are narrowing over time, and in the last years, both types of banks are experiencing constant economies of scale on the revenue side.

Table 3 (Panel C) shows results for scale economies on earnings. Cooperative banks have negative economies of scope, whereas commercial banks experience economies of scale on the earnings side. For cooperative banks adopting a *network*
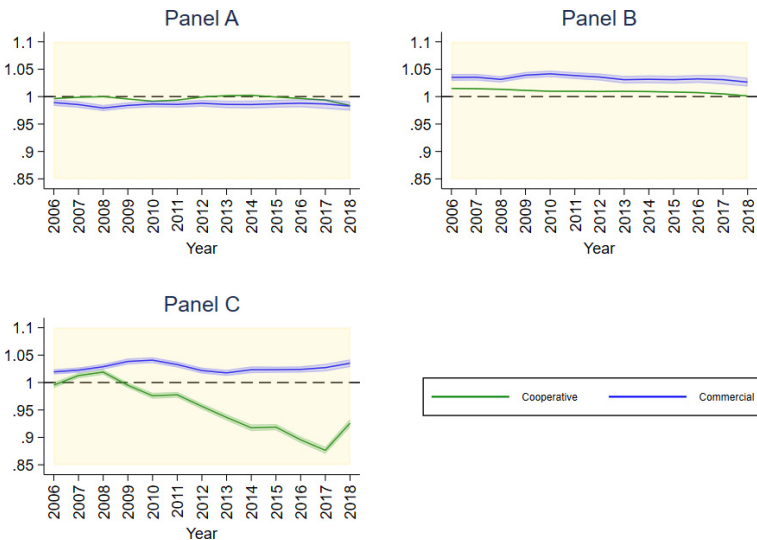
Note: Figure 1 reports scale economies separately for cooperative and commercial banks, in the different years. Panel A displays cost scale economies, Panel B displays revenue scale economies and Panel C displays earnings scale economies.

Fig. 2. Economies of scale.

organizational structure, which strongly relies on relationship lending, enlarging their size would not increase their earnings, especially in a low-interest rate environment. This evidence supports the persistence of the traditional theoretical advantages attributed to the *network* organizational structure: network economies among hundreds of small banks represent a viable way to realize benefits on the earnings side. In this regard, it is also worth mentioning that several merger operations that occurred over the period under analysis were aimed at saving smaller cooperative banks experiencing financial distress. These operations are not expected to generate earnings scale economies, at least in the short term.

Focusing on the evolution over time, commercial banks experience nearly stable economies of scale, while cooperative banks experience a downward trend after having reached a peak in 2008. The monetary reaction to the financial crisis has strongly affected cooperative banks on the earnings side: the low-interest rates environment makes it difficult for banks to increase profitability (Borio & Gambacorta 2017, Borio *et al.* 2017, Altavilla *et al.* 2018).

4.2. *Economies of scope*

Results on economies of scope are reported in Table 4 (Panel A). Cooperative banks experience nearly constant cost economies of scope, while commercial banks seem to have experienced diseconomies of scope. Thus, cooperative banks are indifferent from the cost point of view in either diversifying their business or not. Concerning revenue scope economies, Table 4 (Panel B) shows that cooperative banks experience nearly constant economies of scope. On average, similar to cost scope economies, cooperative banks are indifferent from the revenue point of view in diversifying or focusing just on lending, at least in a low-interest rate environment. Conversely, commercial banks can exploit revenue scope economies, generating more revenue when diversifying on both outputs. Focusing on the evolution over time (Fig. 3, Panel A and B), both cooperative and commercial banks experience rather stable values over time.

Table 4. Economies of scope.

Variable	N obs.	Mean	Median	Std. dev.	Min	Max
Panel A: Costs						
Cooperative	4866	−0.017	−0.023	0.108	−0.173	0.287
Commercial	1896	−0.168	−0.155	0.168	−0.496	0.092
Panel B: Revenues						
Cooperative	4866	0.037	0.046	0.108	−0.273	0.187
Commercial	1896	0.180	0.166	0.161	−0.072	0.494
Panel C: Earnings						
Cooperative	4866	−0.383	−0.151	0.548	−1.710	0.069
Commercial	1896	0.174	0.184	0.234	−0.577	0.615

Notes: This table reports summary statistics of economies of scope estimated with Eq. (3). Panel A presents cost economies of scope. Panel B presents revenue economies of scope. Panel C presents earnings economies of scope.
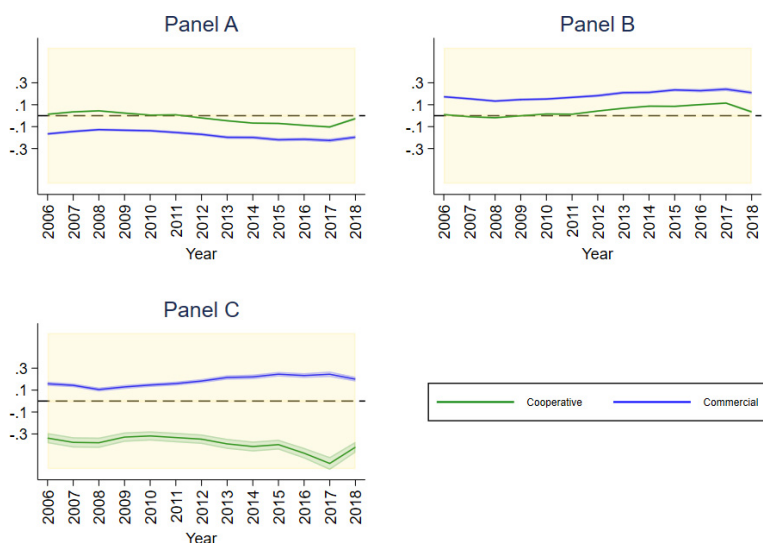
Note: Figure 1 reports scope economies separately for cooperative and commercial banks, in the different years. Panel A displays cost scope economies, Panel B displays revenue scope economies and Panel C displays earnings scope economies.

Fig. 3. Economies of scope.

Shifting the focus to earnings scope economies, Table 4 (Panel C) shows diseconomies of scope for cooperative banks and economies of scope for commercial banks. The traditional focus of cooperative banks on lending provided to members and customers (Coccorese & Ferri 2020) is empirically documented to be efficient in terms of scope economies. This evidence supports the conventional paradigm which asserts that cooperative banks' business model is based on exploiting soft information in relationship lending, while business diversification would not be beneficial in terms of earnings generation. Focusing on the trend (Fig. 3, panel C), cooperative banks experience decreasing earnings scope economies over the analyzed period, while commercial banks have increasing earnings scope economies over time.

In conclusion, cooperative banks are proven to be able to exploit the advantages of activities connected to credit supply, and this could suggest they can be profitable if they focus on this rather than diversifying on more outputs. Conversely, commercial banks have advantages in diversifying their business. The findings for cooperative banks are consistent with the stream of literature that asserts, especially during a crisis period, banks should concentrate on the traditional intermediation function (deposits and loans) rather than diversifying their activities and investments (see Kim *et al.* 2020). Moreover, as shown by Mercieca *et al.* (2007), small banks (such as cooperative banks) do not have better performances when shifting to non-interest income activities, suggesting that those banks might improve their performances by expanding their resources within their existing business lines where they have distinctive comparative advantages.

Table 5. Lerner index.

Variable	N obs.	Mean	Median	Std. dev.	Min	Max
Cooperative	4866	0.189	0.2	0.119	-0.967	0.46
Commercial	1896	0.125	0.186	0.267	-0.967	0.46

Note: This table reports summary statistics of market power estimated with Eq. (7).
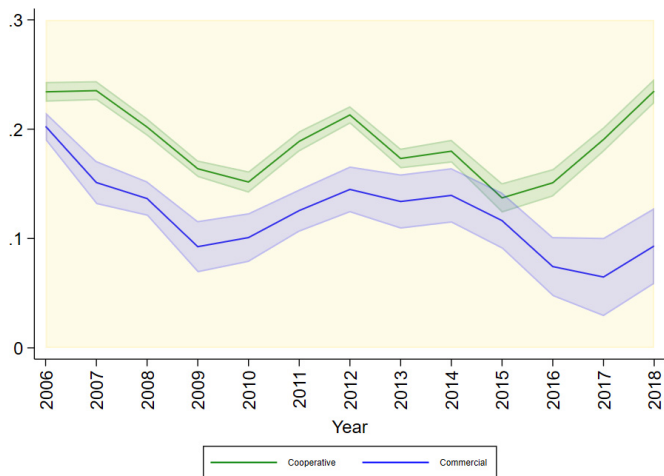
Note: Figure 3 reports the mean Lerner Index in the different years separately for cooperative and commercial banks.

Fig. 4. Lerner index.

4.3. *Market power*

The results for market power, proxied by the Lerner index, are reported in Table 5. Cooperative banks have a greater market power than commercial banks throughout the years under investigation. This finding is in line with prior banking literature: Cooperative banks can exploit soft information to reach customers who are not considered by commercial banks. Focusing on the evolution over time (Fig. 4), both cooperative and commercial banks experienced an increase in their market power in the last years of the sample. The results for cooperative banks are consistent with the findings of Beccalli & Rossi (2020), showing that a higher Lerner index is correlated with reduced scope economies on the earnings side.

5. Robustness Tests

5.1. *Common frontier*

To check the robustness of scale economies, scope economies, and Lerner index findings, the analysis is once again performed by running equations on the whole

sample rather than on separate samples for cooperative and commercial banks. This is performed by running equation (2), adding a control for bank type.[m] As reported in Table 6, the results on scale economies (Panel A) and market power (Panel C) are in line with the ones presented in the baseline model. The results are also confirmed for scope economies on the cost and revenue sides, whereas the findings for earnings scope economies are not confirmed (Table 6, Panel B).

Table 6. Common frontier.

Variable	N obs.	Mean	Median	Std. dev.	Min	Max
Panel A: Economies of scale						
Total Sample – Costs	6,62	0.997	0.999	0.026	0.905	1.051
Cooperative – Costs	4866	0.995	0.997	0.018	0.905	1.051
Commercial – Costs	1896	1.001	1.014	0.039	0.905	1.051
Total Sample – Revenues	6762	1.025	1.025	0.030	0.913	1.123
Cooperative – Revenues	4866	1.021	1.022	0.016	0.923	1.123
Commercial – Revenues	1896	1.036	1.042	0.049	0.913	1.123
Total Sample – Earnings	6762	0.975	0.963	0.055	0.900	1.232
Cooperative – Earnings	4866	0.959	0.958	0.030	0.900	1.232
Commercial – Earnings	1896	1.017	1.003	0.078	0.900	1.232
Panel B: Economies of scope						
Total Sample – Costs	6762	−0.154	−0.160	0.151	−0.501	0.360
Cooperative – Costs	4866	−0.149	−0.159	0.137	−0.478	0.360
Commercial – Costs	1896	−0.167	−0.164	0.182	−0.501	0.360
Total Sample – Revenues	6762	0.162	0.171	0.145	−0.327	0.486
Cooperative – Revenues	4866	0.168	0.181	0.128	−0.327	0.461
Commercial – Revenues	1896	0.146	0.134	0.180	−0.327	0.486
Total Sample – Earnings	6762	0.108	0.160	0.236	−0.964	0.469
Cooperative – Earnings	4866	0.131	0.173	0.194	−0.964	0.469
Commercial – Earnings	1896	0.050	0.094	0.311	−0.964	0.469
Panel C: Lerner Index						
Total Sample	6762	0.171	0.198	0.176	−0.967	0.460
Cooperative	4866	0.189	0.200	0.119	−0.967	0.460
Commercial	1896	0.125	0.186	0.267	−0.967	0.460

Notes: This table reports the estimate of scale economies, scope economies, and market power on the whole sample (common frontier). Panel A reports results obtained by estimating scale economies through Eq. (1) on the total sample and summary statistics are reported for cooperative and commercial banks separately. Panel B shows economies of scope estimates through Eq. (3) on the total sample and summary statistics are reported for cooperative and commercial banks separately. Panel C displays Lerner Index results obtained by using Eq. (7) on the total sample and summary statistics are reported for cooperative and commercial banks separately.

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[m] A dummy that takes the value of 0 for cooperative banks and 1 for commercial banks is employed.

5.2. *Entropy balancing method*

Conducting a comparison between cooperative and commercial banks may raise some concerns given the different business models, aims, and sizes of these two types of banking. Indeed, there is a possible bias due to the differences in the fundamentals of the two types of banking. In order to answer this concern and check the robustness of findings, an Entropy Balancing Method is performed to create similar samples (Hainmueller 2012). This methodology is closely related to the propensity score matching (PSM) method: the advantage over PSM is that it designates weights for the control and treatment groups achieving, not only an identical covariate balance but also similar higher-order moments of the covariate distribution between the treated and control sample. To implement the Entropy Balancing Method, a set of observable characteristics among the determinant of scale and scope economies is identified (Beccalli *et al.* 2015, Beccalli & Rossi 2020): the natural logarithm of total assets to account for bank size; the ratio between liquid assets and total assets (liquidity ratio, LR) to control for bank liquidity; the net interest margin (NIM, measured as net interest income to total assets), that is used as a proxy for the bank profitability on traditional lending activities; and the ratio between NPLs and total loans, as a proxy for the credit risk. Table 7, Panel A, shows the covariates adjustments, while Table 7, Panel B, reports the comparison between variables of interests for cooperative banks and the weighted sample of commercial banks, and confirms baseline evidence.

Table 7. Entropy balancing method.

Variable	*N* obs.	Mean	Median	Std. dev.	Min	Max
Panel A: Cooperative banks						
Total assets (ln)	4866	12.590	12.620	1.039	10.260	16.280
NPL Ratio	4866	0.098	0.084	0.065	0.000	0.329
LR	4866	0.007	0.006	0.004	0.000	0.047
NIM	4866	0.024	0.023	0.007	0.002	0.043
Panel B: Commercial banks						
Total assets (ln)	1896	12.540	12.280	1.032	10.260	18.190
NPL Ratio	1896	0.102	0.082	0.077	0.000	0.329
LR	1896	0.007	0.006	0.005	0.000	0.047
NIM	1896	0.024	0.023	0.007	0.002	0.043

Panel C: Results

	Economies of scale			Economies of scope			
	Cost	Revenues	Earnings	Cost	Revenues	Earnings	Lerner index
Cooperative banks	0.997	1.01	0.961	−0.016	0.036	−0.381	0.188
Commercial banks	0.972	1.064	1.064	−0.044	0.099	0.124	0.114
Difference	0.025	−0.054	−0.103	0.028	−0.063	−0.505	0.074

Notes: This table reports the entropy balancing method reweighted covariates (Panel A, cooperative banks; Panel B, commercial banks) and results (Panel C).

Table 8. Cooperative banks results by banks' size.

	Economies of scale			Economies of scope			
	Cost	Revenues	Earnings	Cost	Revenues	Earnings	Lerner index
1 (Smaller)	0.992	1.026	1.024	0.044	−0.022	−0.470	0.160
2	0.996	1.014	0.979	−0.044	0.068	−0.031	0.189
3	0.998	1.005	0.939	−0.062	0.086	−0.210	0.199
4 (Bigger)	1.000	0.994	0.897	−0.004	0.016	−0.822	0.205

Note: This table reports results for cooperative banks by banks' size (total assets quartiles) on economies of scale, economies of scope, and Lerner Index.

5.3. *Results by bank size*

To further check the robustness of findings, the sample is split according to bank size in order to detect if the results were driven by particularly small (or large) banks. Table 8 reports results on economies of scale, economies of scope, and Lerner Index by bank size (specifically, the sample is split according to total assets quartiles distribution).

Regarding economies of scale, a possible link emerges between bank size and economies of scale: smaller cooperative banks have more margin to exploit both on the cost and earnings side. However, this just applies to really small banks (first quartile of total asset distribution), and those margins get eroded as size increases, especially as regards revenue and earnings.

Shifting the focus on scope economies, a trend related to size cannot be detected, being all classes of cooperative banks in nearly constant cost scope economies and earnings scope diseconomies. Since all cooperative banks definitely focus on lending regardless of size, the effort to diversify the business would be significant for all of them, and not efficient in terms of scope economies (especially at the earnings level), at least in the short term.

Lastly, bigger cooperative banks result to have better performances in terms of the Lerner Index.

5.4. *Exclusion of Euro debt crisis period*

The period under analysis have been impacted by many crises. Among these, the height of Euro debt crisis (2012–2016) may have affected banks efficiency. For this reason, this period has been excluded as for robustness check of findings. So, the model has been estimated excluding those years, and results are shown in Table 9.

Table 9. Exclusion of Euro debt crisis period.

	Economies of scale			Economies of scope			
	Cost	Revenues	Earnings	Cost	Revenues	Earnings	Lerner index
Cooperative banks	0.995	1.014	1.018	−0.016	0.027	−0.007	0.192
Commercial banks	0.978	1.033	1.012	−0.085	0.101	0.711	0.105

As for cost and revenue, the results did not change. Cooperative banks' performance in terms of earnings efficiency are slightly better than in the baseline analysis, however, results show that this type of banking would have neither increase or decrease in efficiency if the size would increase, or if cooperative banks diversify more their business activities.

5.5. *Alternative measure of competition*

To check the robustness of the Lerner index, an alternative measure of competition is employed, the H-statistic based on the Panzar & Rosse (1987) methodology. To compute the H-statistic, Claessens & Laeven (2004) approach has been followed (see Appendix A for computational details). Negative H-statistic stands for monopoly or perfect collusion, positive H-statistics suggests an oligopolistic type of competition, while a value of 1 represents perfect competition. Positive values of the H-statistic are obtained for both cooperative and commercial banks (and also when testing the whole sample, adding a control for bank type), which depicts a market that is not monopolistic. This result is in line with the evidence on the Lerner index.

6. Conclusions

Italian cooperative banks used to rely on a *network* organizational structure. This was meant to be based on network economies and relationship lending. Indeed, the literature identifies different cooperative banks' organizational structures, however, no studies investigate the efficiency of their organizational structure. Moreover, literature has focused on studying the efficiency of banking by measuring scale and scope economies for commercial banks (see, among others, Gambacorta & van Rixtel 2013, Beccalli & Rossi 2020), however, scholars did not focus on efficiency of cooperative banks organizational structures. This background makes the Italian cooperative banking model a natural candidate to investigate the efficiency of the traditional *network* organizational structure, by specifically considering three features: economies of scale, economies of scope, and market power.

This research empirically estimates scale and scope economies by looking at the cost, revenue, and earnings side, and estimates banks' market power. On the cost side, it emerges that cooperative banks have a margin to exploit scale economies: by increasing their size, they would be able to better spread fixed costs. As reported by Masera (2021) and Hughes *et al.* (2019), regulatory and compliance requirements particularly impact small banks, determining diseconomies. Shifting the focus to revenue, results show constant scale and scope economies, meaning that neither scaling the size nor diversifying the business brings advantages to cooperative banks. Concerning earnings, cooperative banks experience scale and scope diseconomies. These results may be driven by the low-interest rate environment, but they are surely connected to cooperative banks' peculiarity associated with the conventional paradigm, which relies on the small size of banks and the focus on lending. It follows that

an increase in size and diversification produces disadvantages for banks adopting a *network* organizational structure. This finding on scope economies appears even more significant when analyzed together with the evidence on market power: cooperative banks can apply a higher markup price in comparison to commercial banks. Rather than fostering the diversification of cooperative banks, they might benefit more in keeping the focus on the lending activities where they experience high market power.

Findings shed new light on the efficiency of cooperative banking enacting a *network* organizational structure. Although an enlargement of size could be needed from a cost point of view, a higher degree of integration might determine the dissipation of the traditional theoretical advantages in terms of network economies and relationship lending. Indeed, both are proved empirically to persist in the *network* organizational structure, which is found to be efficient for banks with a strong focus on lending activities.

All of these may suggest that a move toward a new organizational structure with a low degree of integration, such as the Institutional Protection Scheme (that was considered viable also by the Italian supervisory authority) might have better enabled the persistence of those traditional advantages combined with the need for a change to better manage the cost side. Considering that, once relevant years of financial statements will be available, further empirical research might evaluate the efficiency status of the post-reform integrated organizational structure, to explore differences compared with the *network* organizational structure.

Acknowledgment

Appendix A

A.1. *H-statistic*

H-statistic, based on the Panzar & Rosse (1987) methodology, is computed following Claessens & Laeven (2004) formulation:

$$\ln(P_{it}) = \alpha + \beta_1 \ln(W_{it1}) + \beta_2 \ln(W_{it2}) + \beta_3 \ln(W_{it3}) + \gamma_1 \log(Y_{it1})\gamma_2 \ln(Y_{it2})$$

$$+ \gamma_3 \ln(Y_{it3}) + \varepsilon_{it}. \tag{A.1}$$

P_{it} is computed as total interest income divided by total assets, it is meant to measure the output price of loans. W_{it1}, W_{it2}, and W_{it3} represent, as before, respectively, input price of loans, the input price of labor, and the input price for other operating costs (representing the input price for capital). The research design controls for equity (Y_{it1} is computed as equity to total assets), net loans (divided by total

assets, Y_{it2}), and total assets (Y_{it3}). The *H*-statistic is obtained as $\beta_1 + \beta_2 + \beta_3$, and it ranges from $-\infty$ to 1. Negative values of the *H*-statistic indicate a market that experiences monopoly or perfect collusion, while positive values are associated with an oligopolistic market. A value of 1 represents perfect competition.

Appendix B

Table B.1. List and description of variables.

Variable		Description
Total assets	Q	Total assets of the bank, reported in millions of Euro.
Gross loans	$Q1$	Gross Loans of banks, reported in millions of Euro.
Financial assets	$Q2$	Financial assets of banks, reported in millions of Euro.
Operating cost	C	The operating cost of banks, reported in millions of euros. This is the sum of interest expenses, personnel expenses, and other operating expenses (fee and commission expenses, other administrative expenses, and trading expenses).
Operating revenues	R	Operating revenues of banks, reported in millions of euros. This is the sum of interest income, commission and fee income, dividend income, and trading income.
Operating earnings	Π	Operating earnings of banks, reported in millions of euros. This is the difference between revenues and costs, minus the net values regarding hedging, disposal or repurchase of financial assets, and losses or recoveries regarding impairments.
Cost of funds	$W1$	Interest expenses to total assets.
Cost of labor	$W2$	Personnel expenses to total assets.
Cost of physical capital	$W3$	Other operating expenses (operating costs net of personnel expenses and interest expenses) to total assets.
Marginal revenue	P	Total revenues to total assets.
Non-performing loans ratio	NPL Ratio	Non-performing loans to gross loans.
Return on Assets	ROA	Earnings before interest and taxes to total assets.
Cost to Income Ratio	C_I	Operating costs to net income from banking activities.
Liquidity Ratio	LR	Cash and cash equivalents to total assets.
Net Interest Margin	NIM	Interest margin (interest income minus interest expenses) to total assets.

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