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European cooperative banks: Exploring organizational differences and efficiency outcomes

Elena Beccalli, Andrea Viola *

School of Banking, Finance, and Insurance, Università Cattolica del Sacro Cuore, Largo Gemelli, 1, 20123, Milan, Italy

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ABSTRACT

We study how organizational structure shapes economies of scale, economies of scope, market power, and credit quality in European cooperative banking. Using 18,033 bank-year observations for 2258 Euro-area cooperative banks in 10 countries (2013–2023), we estimate multiproduct cost and profit functions to derive economies of scale and scope and a Lerner index measure of market power, and relate these outcomes to network versus integrated structures (IPS, ICN, CCG). More integrated models are associated with stronger cost-side economies of scale and scope and higher market power, whereas network and IPS banks exhibit larger profit-side economies of scale. The determinants of these outcomes differ across organizational forms, consistent with heterogeneous business strategies. Estimates show that moves from network to ICN and to IPS are associated with higher cost-side scale economies and market power, with IPS transitions also linked to improved profit-side scale economies. Credit-risk results are mixed, but IPS transitions are associated with lower non-performing loan (NPL) ratios. Overall, cooperative banking is both distinct from commercial banking and internally heterogeneous, cautioning against one-size-fits-all evaluations.

1. Introduction

The European banking industry is among the largest and most diverse in the world, reflecting the historical, regulatory, and market-specific features of its member countries. Within this landscape, cooperative banks play a prominent role—particularly in providing finance to households and small and medium-sized enterprises (SMEs), channeling funds to firms that often face constraints in accessing traditional commercial bank credit (Hasan et al., 2017). They provide more than 23% of loans in Europe (Groeneveld, 2023).[1]

The literature recognizes that mutual banks require specific organizational designs (Berger and Udell, 2002). Despite a common historical background and shared principles—including self-help, identity, democracy, and cooperation among cooperatives (McKillop et al., 2020)—cooperative banking models have evolved differently across European countries, with notable variation even within national contexts. As a result, distinct cooperative arrangements have emerged, differing in their degree of integration and structural features, as well as in their heterogeneous business models (Ayadi et al., 2023). This study contributes to this debate by examining cross-country differences in cooperative banks' organizational structures and assesses their implications for efficiency

* Corresponding author.
E-mail addresses: elena.beccalli@unicatt.it (E. Beccalli), andrea.viola@unicatt.it (A. Viola).

[1] Cooperative banks are major players in the mortgage market across several European countries, holding double-digit market shares in Austria (40%), Finland (34.3%), France (64%), Germany (23.4%), Luxembourg (13%), and the Netherlands (19.3%). They are also key partners for SMEs, with substantial market shares in Finland (37.9%), France (over 50%), Germany (32.2%), the Netherlands (39%), and Portugal (11.8%). In Italy, cooperative banks play a major role as well, with market shares of 25% for small enterprises, 19% for micro-enterprises, and 11.5% in the mortgage sector (EACB, 2025).

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and market power. To our knowledge, no study has systematically categorized and compared these organizational structures. While substantial national-level research addresses the efficiency of cooperative banks, comparative cross-country evidence for EU cooperative banks that links alternative organizational structures to multiple dimensions of efficiency and market power remains limited.

European cooperative banks mainly follow two organizational models (Cornée et al., 2018). The CRR framework formally defines these structures and links them to different prudential and supervisory regimes, including group-level monitoring of solvency and liquidity (Migliorelli and Lamarque, 2022a). The first is the *network* model, which is more decentralized: small stand-alone banks remain autonomous but join a network to provide mutual liquidity and solvency support (e.g., Spain and Italy - historically) (Beccalli et al., 2023). The second is the *integrated* model, which includes different degrees of centralization—such as IPS (e.g., Germany), ICN (e.g., France), and CCG (e.g., Portugal).[2] In line with McKillop et al. (2020), who emphasize the importance of governance arrangements, network structures, and business-model diversity in cooperative financial institutions, our classification of cooperative banks captures one salient dimension of this organizational and institutional heterogeneity. Diversity also exists within countries: France's groups evolved organically with varying integration levels, while Italy's shift toward integration was largely driven by regulatory reforms (Beccalli et al., 2023). This cross- and within-country variation motivates a closer assessment of how alternative structures affect efficiency and market positioning, particularly where multiple models coexist (e.g., Austria, France, Italy, and Spain).

Since 2010, the ECB's low interest rates, rising impairments, and weaker margins have put strong pressure on cooperative banks, while digitalization and Fintech have intensified competition. These forces have been accompanied by reforms in several European countries toward more consolidated cooperative banking groups or networks (Migliorelli and Lamarque, 2022a). In response, cooperative banks have increasingly adopted group or network structures mainly to cut costs (and, to a lesser extent, capture synergies). At the same time, EU regulation has raised compliance and supervision costs, especially for small local banks already hit by shrinking interest margins (Goglio and Stefancic, 2022). Overall, highly integrated groups are better suited to complex EU-wide rules, whereas smaller banks may perform better in looser networks under proportionate regulation that recognizes network guarantees and simplifies requirements for low-risk local institutions. Thus, greater integration could undermine the cooperative banks' specificity and therefore decrease their ability to serve borrowers and members.

Against this background, we estimate cost- and profit-side economies of scale, economies of scope, and market power for European cooperative banks. Our empirical strategy proceeds in four steps. First, we examine how different degrees of organizational integration are associated with these measures, to identify which structures are associated with stronger cost- and profit-side economies of scale and scope, as well as their implications for market power. Second, we investigate whether the drivers of scale and scope economies and market power vary across organizational forms, consistent with different strategic orientations. Third, we assess whether transitions from a network to a more integrated structure are associated with stronger performance measures. Finally, we analyze whether more integrated and diversified models are associated with weaker credit quality, potentially due to a loosening of ties with members and customers.

For the empirical analysis, we compile data on cooperative banks in the Euro-area that are also members of the EACB (European Association of Cooperative Banks), which covers 10 European countries. The dataset includes 2258 unique cooperative banks and 18,033 bank-year observations spanning from 2013 to 2023. Following the methodology of Shaffer and Spierdijk (2020), we estimate each bank's cost and profit function and compute efficiency measures, as in Beccalli et al. (2023).

We find that cooperative banks across Europe exhibit strong and persistent cost-side scale economies, consistent with previous evidence (Girardone et al., 2004; Beccalli et al., 2023; Viola, 2024). More integrated organizational structures are associated with a reduction in average costs as cooperative banks expand, potentially reflecting the absorption of fixed costs and scale-related advantages—spreading costs across multiple outputs and exploiting shared infrastructure and resources. Evidence on the profit side is more mixed. Notably, banks operating under a network structure or a low-integration model (such as the IPS) tend to display stronger profit-side economies of scale. This suggests that greater integration may be associated with declining profitability, possibly reflecting higher operating complexity, market saturation, and a greater distance from members and customers that may weaken cooperative banks' distinctive model (Fonteyne, 2007) and their ability to exploit soft information (Berger and Udell, 2006). We also find that European cooperative banks exhibit profit-side diseconomies of scope, in line with prior results (Beccalli and Rossi, 2020). In addition, integrated models appear to be associated with higher market power, potentially consistent with stronger cooperative banks' competitiveness vis-à-vis other banking types (Beccalli et al., 2023). Overall, while cost complementarities seem broadly attainable, the findings point to a persistent challenge in translating scope-related efficiencies into higher profitability. When examining the drivers of economies of scale, economies of scope, and market power, our findings align with Ayadi et al. (2023), who emphasize that cooperative banks pursue their objectives through heterogeneous strategies and business models. Consistently, we show that the performance of different organizational structures is shaped by different sets of determinants across all the indicators considered. In particular, network structures and IPS banks display broadly similar performance drivers, which is plausible given their comparable size and operating model: both typically consist of relatively small, locally oriented banks with strong ties to their territories. Our sample also allows us to assess how changes in organizational structure affect cooperative banks' performance. We extend (Beccalli et al., 2023) by exploiting several organizational transitions that occurred in 2019 in Spain and Italy. We confirm their findings for banks moving from a network structure to an ICN: this transition is associated with stronger cost-side economies of scale and scope, as well as higher market power. We further contribute by examining the shift from a network structure to an IPS.

[2] Section 2 provides an overview of the different cooperative banking models in Europe, outlining their key features and recent developments.

The results are broadly comparable to those for ICN transitions, with the additional evidence of improved performance in terms of profit-side economies of scale. Lastly, we examine the relationship between organizational structure and credit quality. Cooperative banks are typically viewed as engaging in relatively less risky activities and, accordingly, exhibiting lower non-performing loans (NPL) ratios than other bank types, consistent with the idea that stronger stakeholder engagement mitigates asymmetric information and limits risk-taking incentives (Fiordelisi et al., 2023). At the same time, greater integration may weaken cooperative banks' ability to collect soft information and to sustain relationship lending, thereby impairing credit screening and monitoring. Our results do not indicate that any organizational model is consistently superior in credit risk management. However, banks transitioning to an IPS structure experience a statistically significant reduction in the NPL ratio, suggesting that this model is associated with lower credit risk.

Overall, our analysis indicates that, despite being grounded in common principles, European cooperative banks have followed distinct developmental paths shaped by the specific needs of their local economies. This diversity has translated into heterogeneous efficiency outcomes, supported by different underlying drivers. The evidence, therefore, points to the absence of a single "optimal" cooperative banking model: rather, institutional, economic, and regulatory environments have steered cooperative systems toward different organizational trajectories. This, in turn, highlights the limits of a "one-size-fits-all" approach in two respects: first, as noted by Ayadi et al. (2023), it reaffirms the distinctiveness of the cooperative banking model vis-à-vis commercial banks; second, our results show that the cooperative sector itself is far from homogeneous, making it misleading to speak of a single cooperative organizational model. Accordingly, cooperative banks should not be treated as a uniform category, either when benchmarked against commercial banks or when compared across cooperative systems.

The remainder of the paper is organized as follows. Section 2 provides an overview of cooperative banks and the organizational models observed across and within countries. Section 3 reviews the relevant literature, develops research hypotheses, and describes empirical methodology, data, and variables. Section 4 presents and discusses the main results and robustness checks. Section 5 concludes.

2. Overview of European cooperative banks

The EACB provides a classification of organizational models, which draws on the categories established in the Capital Requirements Regulation (CRR) (EACB, 2021). In general, two main types of organizational structures prevail: network organizational structures and integrated organizational structures.

We define cooperative banks as employing a network organizational structure when individual cooperative banks operate as a set of small, autonomous institutions belonging to a network. This arrangement aims to provide mutual protection in terms of liquidity and solvency. Importantly, local banks maintain a high degree of independence in their operations; therefore, functions are almost entirely decentralized. This model was in place in Austria until 2014, and in Italy and Spain until 2018.

The integrated organizational structure is the most widespread in Europe. Specifically, the CRR identifies three forms of integrated structures, each with increasing levels of integration. First, the Institutional Protection Scheme (IPS, Article 113.7 CRR). In this case, banks enter into a contractual or legal agreement that protects the liquidity and solvency of local and regional cooperative banks, thereby preventing potential failures. This model is employed in Austria (since 2014 by the Raiffeisenbanken), in Germany (by the Bundesverband der Deutschen Volksbanken und Raiffeisenbanken), in Spain (approved in 2018, operating since 2019 by banks belonging to the Caja Rurales group), and in Italy following the cooperative banking reform enacted in 2019 (by the South Tyrolean cooperative banks, Casse Raiffeisen Alto Adige/Südtirol).

Second, the Integrated Cooperative Networks (ICNs, Article 113(6) CRR). In these structures, local and regional cooperative banks and the central institution are connected through a parent-subsidiary relationship, characterized by stronger central oversight. Although local/regional banks retain ownership and political control of the central body, they delegate a range of supervisory powers to it. The group is monitored on a consolidated accounting basis, and the central institution is subject to the same risk evaluation and control procedures as the local cooperatives. Given their size (often with assets exceeding €30 billion), the European Central Bank (ECB) is in charge of the supervision of cooperative banks employing ICNs. This model is applied in France by the Crédit Agricole and BPCE groups, and in Italy – albeit with some specificities compared to their French counterparts – by the cooperative banking groups Iccrea and Cassa Centrale Banca.

Third, the Consolidated Cooperative Groups (CCGs, Article 10 CRR). This model represents the highest degree of integration. While maintaining the structural characteristics described above, these groups implement mechanisms that enable economic integration, treating the central and local/regional institutions as a single banking entity. As a result, Article 10 allows supervisory authorities to exempt individual banks from certain prudential requirements and instead focus solely on the consolidated level. For instance, the central body has the authority to issue binding instructions to the management of local and regional cooperative banks. We observe this model in Austria (Volksbanken), Belgium (CERA KBC-Ancora), Finland (OP Group), France (Crédit Mutuel), Luxembourg (Raiffeisen Luxembourg), the Netherlands (Rabobank), Portugal (Credito Agricola), and, since 2014, in Spain by the banks of the BCC Grupo Cajamar.

Table 1 summarizes organizational models employed in different countries.

Table 1
Overview of cooperative banks organizational structure in Europe.

Country	Model type	Notes
Austria (AT)	From network to integrated	Network; now IPS (Raiffeisenbanken, since 2014) and CCG (Volksbanken)
Belgium (BE)	Integrated	CCG (CERA KBC-Ancora)
Germany (DE)	Integrated	IPS (Bundesverband der Deutschen Volksbanken und Raiffeisenbanken)
Spain (ES)	From network to integrated	Network; now IPS (Caja Rurales, since 2019) and CCG (BCC Grupo Cajamar, since 2014)
Finland (FI)	Integrated	CCG – OP group
France (FR)	Integrated	ICN (Crédit Agricole, BPCE); CCG (Crédit Mutuel)
Italy (IT)	From network to integrated	Network until 2018; IPS (Casse Raiffeisen Alto Adige); ICN (Iccrea, Cassa Centrale Banca)
Luxembourg (LU)	Integrated	CCG – Raiffeisen Luxembourg
Netherlands (NL)	Integrated	CCG – Rabobank
Portugal (PT)	Integrated	CCG – Crédito Agrícola

This table illustrates the organizational structure model employed around Europe.

3. Research design

3.1. Literature review and hypotheses development

European cooperative banks share several core characteristics, such as strong ties to their local communities and clients, who are often also their members. Their primary objective is not profit maximization, but rather the support of members' growth and welfare (Ayadi et al., 2023). These banks are governed by their members, following the principle of "one member–one vote". Scholars have developed a relevant body of literature on these financial institutions (for a comprehensive overview, see McKillop et al., 2020). Previous studies have inspected various perspectives, including financial stability (Fiordelisi and Mare, 2014; Fiordelisi et al., 2023) also during financial crises (Chiaramonte et al., 2015) and its relationship with competition (Clark et al., 2018); performance (Becchetti et al., 2016; Kontolaimou and Tsekouras, 2010), profitability (Kuc and Teplỳ, 2023), ownership structure (Ferri et al., 2014), diversification (Goddard et al., 2008), their counter-cyclical role in lending during crises (Meriläinen, 2016), and drivers of credit allocation policy (Banfi et al., 2025). The role of cooperative banks in reducing income inequality (Minetti et al., 2021; Peruzzi et al., 2023; Algeri et al., 2025), enhancing local growth (Coccorese and Shaffer, 2021), and the impact on the local system (Ghio et al., 2019) is well recognized in the literature. Researchers have examined their economic role from multiple angles over recent decades. Various studies indicate that these local and small banks are better suited to serve opaque small businesses (see, among others, Berger et al., 2017; Nitani and Legendre, 2021). Generally, this defines the "conventional paradigm" (Berger et al., 2005). Also, recent consolidation among cooperative banks – reducing their number and reshaping their organizational structure – has drawn scholars' attention (Poli et al., 2024; Cucinelli et al., 2025).

The efficiency of European cooperative banks – and the role of organizational structure in shaping their performance – has received increasing attention (Migliorelli and Lamarque, 2022b), yet remains only partially explored, particularly in cross-country settings. This question is often studied by comparing cooperative and commercial banks, but such comparisons are inherently difficult because their objectives differ (Fonteyne, 2007). Some studies have examined the efficiency of cooperative banks, especially at the single country level, including Lang and Welzel (1996) for German banks, Girardone et al. (2004) and Battaglia et al. (2010) for Italian banks, and Fiordelisi and Mare (2013), who explore efficiency and default risk. More recently, Aiello and Bonanno (2016) study the cost and profit efficiency of Italian cooperative banks during period of crisis, highlighting better performance of cooperative banks with respect to popular and commercial banks. Bernini and Brighi (2018) analyze the relation between cost efficiency and branch network expansion of Italian cooperative banks (2006–2013). Expansion negatively impacts banks' efficiency. Efficient local banks and a larger credit availability boost the local economy, while a bank structural change by a branch expansion generates a negative effect in terms of local economic development. Coccorese and Ferri (2020) assess the impact of local bank mergers on cost efficiency, while Algeri et al. (2022) analyze the technical efficiency of Italian cooperative banks that account for spatial dependence. Barra and Ruggiero (2022) inspect how banks' cost efficiency impacts firm innovation in an Italian sample, finding that the most efficient cooperative banks are found to foster innovation. Viola (2024) studies the performance in terms of scale and scope economies of the Italian network organizational structure before the reform. Beccalli et al. (2023) study the impact on efficiency of a change of organizational structure for Italian cooperative banks, indicating a benefit of a more integrated system on cost efficiency and market power, while no impact is detected on profit efficiency. Yamori and Harimaya (2024) apply a stochastic meta-frontier approach based on cost and profit functions on Japanese financial cooperatives (*Shinkin* Banks), finding a negative relationship between efficiency-adjusted Lerner indices and cost efficiency, while the relation between market power and profit efficiency is consistently positive.[3]

Only a few studies analyze European cooperative banks in cross-country settings. Ferri et al. (2015) compare the organizational structure of banks (cooperative and non-cooperative) and their lending supply responses to changes in monetary policy. They find that cooperative banks continued to cushion the impact of tighter monetary policy on their lending during the crisis period (2008–2011) whereas savings banks did not. Ayadi et al. (2023) conduct one of the few cross-country studies on cooperative banks, although focusing on bank business models (BBMs) rather than organizational structure, using cluster analysis and stochastic frontier methods. They identify five BBMs and suggest that cooperative banks pursue their goals by implementing different strategies, even though sharing common characteristics and objectives, such as mutualism, localism, and a stakeholder view. At the start of the century, a debate emerged on whether the European cooperative banking model needed to evolve (Fonteyne, 2007). Reforms have taken different paths across countries, resulting in different cooperative banking models (Migliorelli and Lamarque, 2022b). The creation of a more integrated network might foster performance in terms of cost scale and scope economies (Fonteyne, 2007); however, this could also cause a severe drift in the basics of cooperative banking, i.e., the proximity to members, which has given them several competitive advantages in the past. The importance of organizational structure in shaping banks' ability in the credit market is discussed by Berger and Udell (2002), highlighting that relationship lending requires a different organizational structure form. This also impacts their ability to serve counterparts (Beccalli et al., 2023). A trade-off may therefore emerge between cost efficiency and the ability to preserve close customer relationships, which may translate into higher profitability and greater market power thanks to cooperative banks' specificity. Accordingly, we formulate our first set of hypotheses:

- H_{1a}: Higher degrees of integration in organizational structures enable cooperative banks to achieve better performance in terms of cost-side economies of scale and scope and market power.
- H_{1b}: Lower degrees of integration in organizational structures enable cooperative banks to achieve better performance in terms of profit-side economies of scale and scope.

Secondly, as Ayadi et al. (2023) note, cooperative banks pursue their objectives through different strategies (BBMs). This heterogeneity may imply that the determinants of economies of scale and scope, as well as market power, differ across organizational structures. Accordingly, we formulate our second hypothesis to assess whether the estimated associations between the outcomes and their determinants vary across organizational structures, either in sign or in magnitude.

- H_2: The estimated associations between economies of scale, economies of scope, and market power and their determinants differ across cooperative banks operating under different organizational structures.

Several cooperative banks transitioned to alternative organizational models over the sample period. In particular, 2019 represents a pivotal year: following the 2016 reform, Italian cooperative banks moved away from the network structure and adopted either an IPS or an ICN model. In the same year, Spanish Caja Rural banks also shifted from the network model to an IPS. Building on and extending (Beccalli et al., 2023), we formulate the following hypothesis:

- H_3: A shift from a network to an integrated organizational structure improves cooperative banks' performance in terms of economies of scale, economies of scope, and market power.

More integrated models may benefit from a larger scale and greater diversification. However, diversification does not necessarily reduce risk, particularly when it reflects an expansion into non-interest activities (Lepetit et al., 2008). This concern may be especially relevant for cooperative banks, as greater integration can weaken ties with members and customers, potentially reducing the ability to collect soft information and, in turn, impairing credit screening and monitoring. Cooperative banks are typically known to engage in less risky activities, resulting in lower NPL ratios than other banks, suggesting that greater stakeholder engagement reduces problems of asymmetric information and bank risk appetite (Fiordelisi et al., 2023). Hence, we formulate our last hypothesis:

- H_4: Less integrated organizational structures are associated with better performance in credit risk management, measured by NPL ratio.

3.2. Empirical methodology

To estimate banks' cost and profit functions, we employ a multiproduct, non-homothetic generalized Leontief specification with three inputs and three outputs.[4] Generalized Leontief technologies are widely used in banking and other applied fields, including in multi-product settings, and offer several practical advantages relative to the commonly adopted translog functional form. In particular, the translog entails well-documented limitations (Shaffer and Spierdijk, 2020): it typically requires a relatively

[3] Literature has traditionally focused more on large commercial banks when studying economies of scale (see, among others, Beccalli et al., 2015; Davies and Tracey, 2014; Gambacorta and van Rixtel, 2013; Hughes and Mester, 2013; Mester, 2010) and economies of scope (Altunbas and Molyneux, 1996; Beccalli and Rossi, 2020; Gambacorta and van Rixtel, 2013).

[4] Cooperative banks in our sample are also significantly engaged in off-balance-sheet activities; accordingly, we include this component as an additional output in the estimation of the cost and profit functions. As a robustness check, we also re-estimate the same functions using a two-output specification.

homogeneous sample in terms of bank size to yield reliable estimates (Wheelock and Wilson, 2012), an assumption that is unlikely to hold in our setting given the substantial size heterogeneity among European cooperative banks, especially in a multi-output context (Shaffer and Spierdijk, 2020). Moreover, the translog can impose restrictive curvature that may bias the estimation of scope economies, and its usual logarithmic implementation precludes the inclusion of observations with negative profits—an important concern when estimating profit functions. These considerations motivate our adoption of the multiproduct, non-homothetic generalized Leontief function, which is better suited to our context and allows us to address these issues directly (Shaffer and Spierdijk, 2020). Appendix C provides details on the estimation of cost and profit functions and the construction of the dependent variables. The resulting measures of economies of scale and scope capture potential efficiencies implied by the underlying production technology, rather than realized operational efficiency outcomes.

We first aim to assess whether different organizational structures exhibit different performance in terms of economies of scale, economies of scope, and market power. Accordingly, we test hypotheses H_{1a} and H_{1b} by estimating the following regression:

$$Y_{i,t} = \alpha_0 + \gamma_{i,t}\mathrm{IPS}_{i,t} + \delta_{i,t}\mathrm{ICN}_{i,t} + \eta_{i,t}\mathrm{CCG}_{i,t} + \beta_{i,t}^T\mathbf{X_{i,t}} + \theta_i + \tau_t + \varepsilon_{i,t} \tag{1}$$

where the dependent variable $Y_{i,t}$, for bank i at time t, refers to either economies of scale (at cost level, $ES\_C_{i,t}$, or profit level, $ES\_P_{i,t}$), economies of scope (at cost level, $SCOPE\_C_{i,t}$, or profit level, $SCOPE\_P_{i,t}$), or the Lerner Index ($LERNER_{i,t}$). We include banks (θ_i) and time (τ_t) fixed effects.[5] All variables vary at the bank-year level. The model comprises three dummy variables to capture banks' organizational structures (IPS, ICN, and CCG), using the network organizational structure as the reference category. The vector of controls consists of the variables that the previous literature acknowledges as potential drivers of scale and scope economies. More precisely, for economies of scale and the Lerner Index, we follow the approach of Beccalli et al. (2015), who studied cost-side economies of scale in European commercial banks. Accordingly, we include the following variables: $SEC\_TA_{i,t}$, the securities-to-total-assets ratio, as a proxy for the bank's business model; $NIM_{i,t}$, the net interest margin (NIM, calculated as net interest income over total loans), as a proxy for profitability from lending activities — the core business of cooperative banks; $LR_{i,t}$, the liquidity ratio, as a proxy for liquidity risk; $LLP_{i,t}$, loan loss provisions, as a proxy for credit risk; and $Tier1_{i,t}$, the Tier 1 ratio, to measure a bank's capital strength. We also include squared terms for liquidity ($LRsq_{i,t}$) and Tier 1 ratio ($Tier1sq_{i,t}$) to capture potential non-linear relationships. When dealing with economies of scope, we follow the methodology of Beccalli and Rossi (2020), who recently studied scope economies of European banks. We therefore include the natural logarithm of total assets ($SIZE_{i,t}$) and its square to control for bank size, along with the liquidity ratio and the Lerner Index to account for competitive conditions in the banking sector.

Then, we also investigate whether determinants vary in their importance across organizational structures in shaping cooperative banks' economies of scale and scope and their market power. To this end, we estimate the following regression to test hypothesis H_2:

$$Y_{i,t} = \alpha_0 + \beta_{i,t}^T\mathbf{X_{i,t}} + \theta_i + \tau_t + \varepsilon_{i,t} \tag{2}$$

We estimate Eq. (2) separately for each of the four organizational models to highlight structural heterogeneity in drivers. We adopt a static panel model with bank and time fixed effects, consistent with prior works on the determinants of banking scale and scope economies (Beccalli et al., 2015; Beccalli and Rossi, 2020), because our objective is to relate economies of scale, economies of scope, and the Lerner index to differences in organizational structures and bank characteristics, rather than to model persistence and adjustment dynamics. Bank fixed effects absorb time-invariant unobserved heterogeneity, while time fixed effects control for common shocks. Standard errors are clustered at the bank level to account for within-bank serial correlation. Table 4 reports the pairwise correlation matrix of the regressors used in the empirical specifications.

During the observation period, some cooperative banks transitioned to different organizational models. In particular, 2019 marked a pivotal year: Italian banks adopted either IPS or ICN models, moving away from the network structure following the 2016 reform. Similarly, Spanish Caja Rural banks transitioned from the network model to IPS. This variation allows us to assess changes in performance measures associated with model adoption, using other cooperative banks that maintained the same structure as a counterfactual. To this end, we estimate the following two-way fixed-effects model:

$$Y_{i,t} = \alpha_0 + \phi_{i,t}\mathrm{Network\_to\_IPS}_{i,t} + \chi_{i,t}\mathrm{Network\_to\_ICN}_{i,t} + \beta_{i,t}^T\mathbf{X_{i,t}} + \theta_i + \tau_t + \varepsilon_{i,t} \tag{3}$$

where $\mathrm{Network\_to\_IPS}_{i,t}$ is a dummy variable equal to 1 from 2019 onward for banks that transitioned from network to IPS (including Spanish banks in the Caja Rural group and Italian banks in the Casse Raiffeisen Alto Adige/Südtirol group), while $\mathrm{Network\_to\_ICN}_{i,t}$ equals 1 from 2019 for Italian banks that adopted the ICN model (namely, those in the ICCREA and Cassa Centrale Banca groups). In our setting, the organizational changes induced by the Italian and Spanish reforms occur in our data from 2019 onwards (i.e., a common treatment start date across treated banks). Therefore, the two-way fixed effects specification corresponds to the standard difference-in-differences design.

The evolution of cooperative banks toward larger, more centralized, and more complex organizational structures may have weakened their ability to collect and process soft information, potentially reducing their effectiveness in screening and pricing opaque borrowers. At the same time, a stronger push toward product diversification to exploit scope economies may have altered

[5] Although supervisory reporting in the Euro-area is based on harmonized templates, some country-specific reporting practices and national options may still generate cross-country differences in the measurement of key items. We thus include country-fixed effects, rather than bank-fixed effects, as a robustness test (see Section 4.3).

Table 2
Sample composition by country and year.

	AT	BE	DE	ES	FI	FR	IT	LU	NL	PT	Total
2013	421	3	993	25	2	72	331	9	1	3	1,860
2014	327	1	975	23	2	76	328	9	1	5	1,747
2015	386	1	950	43	17	78	332	9	1	5	1,822
2016	338	1	914	52	131	76	314	10	1	4	1,841
2017	307	1	865	54	141	74	254	10	1	4	1711
2018	285	2	833	51	143	74	251	10	1	4	1,654
2019	270	2	801	46	135	73	240	2	1	5	1,575
2020	246	2	779	47	123	73	220	2	1	5	1,498
2021	332	2	738	47	111	73	211	2	1	5	1,522
2022	307	2	686	47	106	73	202	2	1	6	1,432
2023	293	2	655	48	94	73	196	1	1	8	1,371
Total	3512	19	9189	483	1005	815	2879	66	11	54	18,033

This table presents the sample composition by country and year, spanning from 2013 to 2023.

banks' loan portfolios and increased their exposure to credit risk. To study the dynamics of credit risk – and, in turn, the implied evolution of non-performing loans – we follow Pancotto et al. (2024) and compare the performance of banks characterized by different organizational arrangements. Specifically, we estimate a dynamic panel data model using both Difference (Arellano and Bond, 1991) and System (Arellano and Bover, 1995) GMM (one-step) to test hypothesis H_4:

$$NPL_{i,t} = \alpha NPL_{i,t-1} + \gamma \mathrm{IPS}_{i,t} + \delta \mathrm{ICN}_{i,t} + \lambda \mathrm{CCG}_{i,t} + \beta^T \mathbf{X_{i,t-1}} + \theta_i + \varepsilon_{i,t} \tag{4}$$

where NPL denotes the logarithmic transformation of the NPL ratio. $\mathbf{X}_{i,t-1}$ is a vector of lagged bank-level controls, including the Tier 1 ratio, ROE, the natural logarithm of total assets, the loan growth rate, and the net interest margin. In a second specification, again following Pancotto et al. (2024), we additionally incorporate a vector of lagged macroeconomic controls – GDP growth, the unemployment rate, the government-debt-to-GDP ratio, and the lending interest rate – to account for aggregate conditions affecting credit risk. Finally, θ_i captures unobserved bank-specific effects. System GMM allows us to assess how alternative organizational models are associated with NPL dynamics by exploiting both within-bank and between-bank variation. By contrast, Difference GMM relies solely on the first-differenced equation; as a result, this estimator is particularly informative about the consequences of organizational changes.

3.3. Sample and variables

The analysis focuses on banks that are members of the EACB from the Euro Area. Our sample comprises observations from 10 European countries: Austria, Belgium, Germany, Spain, Finland, France, Italy, Luxembourg, the Netherlands, and Portugal.[6]

We gather banks' financials from Orbis Bank Focus, filtering by bank specialization and only retaining cooperative banks. We drop bank-year observations with missing data. The final dataset is an unbalanced panel that covers 18,033 observations of 2258 European cooperative banks over the period from 2013 to 2023. This 10-year period allows us to examine cooperative banks' performance during a challenging decade shaped not only by evolving economic and financial conditions but also by significant organizational transformations, as several institutions moved toward more integrated organizational structures. Table 2 presents our sample composition by year and country.

We estimate several performance measures to conduct our analysis, focusing on cost- and profit-side economies of scale and scope, in line with Beccalli et al. (2023). To this end, we estimate banks' cost and profit functions following the approach proposed by Shaffer and Spierdijk (2020), as discussed in Section 3.2. We also compute the Lerner Index to capture cooperative banks' market power.

Table 3 reports summary statistics of the sample.[7] The vast majority of the analyzed banks are operating through an integrated organizational structure. Indeed, just 13% of the bank-year observations in our sample are of cooperative banks running a network organizational structure. The vast majority of our bank-year observations belong to cooperative banks employing the IPS model (69%), especially due to the abundance of German and Austrian cooperative banks, while ICN and CCG have similar weights (around 9%).

The median bank is relatively small in size, with a median total asset of €393 million. However, the size is skewed, with a mean total assets above €3 billion, showing the heterogeneity in size of cooperative banks. Loans account for the main portion of total assets (roughly 74% on average), as is typical for cooperative banks. Securities and off-balance sheet activities have similar weights, accounting for slightly below €500 million on average. On average, securities account for slightly less than 20% of total

[6] To construct the Lerner Index, we estimate the cost function on a sample including cooperative, commercial, and savings banks, as these institutions compete in the same output markets. Table B.1, Appendix B, shows their summary statistics. This allows us to measure market power relative to the overall market, while all subsequent analyses are restricted to cooperative credit banks. We acknowledge that this strategy cannot fully account for the finer heterogeneity in business models documented by Ayadi et al. (2023).

[7] We provide variables description in Appendix A, Table A.1.

Table 3
Summary statistics.

	N	Mean	Median	Std Dev
Network	18,033	0.132	0.000	0.338
IPS	18,033	0.689	1.000	0.463
ICN	18,033	0.094	0.000	0.291
CCG	18,033	0.086	0.000	0.280
ES_C	18,033	1.165	1.115	0.214
ES_P	18,033	1.098	0.789	0.993
SCOPE_C	18,033	0.594	0.509	0.347
SCOPE_P	18,033	−2.235	−2.178	0.567
LERNER	18,033	0.426	0.397	0.219
ES_C_20	18,033	1.377	1.090	0.737
ES_P_20	18,033	0.717	0.466	0.713
SCOPE_C_20	18,033	0.355	0.274	0.258
SCOPE_P_20	18,033	−1.007	−0.978	0.265
LERNER_20	18,033	0.331	0.279	0.198
Total assets	18,033	3214.479	393.486	18,404.424
SEC/TA	18,033	0.197	0.171	0.139
NIM	18,032	0.030	0.027	0.014
LR	18,033	0.194	0.155	0.140
LLP	12,132	0.028	0.013	0.198
Tier1	14,077	0.192	0.160	0.106
ROE	18,033	0.050	0.048	0.046
Loans (g)	15,598	0.073	0.054	0.128
Debt	18,033	83.924	74.538	25.927
Unemp	18,033	6.106	4.942	3.344
Lending	18,033	2.049	1.730	0.751
Operating costs	18,033	80.698	9.471	480.968
Operating profits	18,033	17.742	2.412	90.713
Q1	18,033	2285.605	279.448	12,101.394
Q2	18,033	494.731	71.156	2959.968
Q3	18,033	488.030	27.994	3516.596
Equity/Total assets	18,033	0.102	0.096	0.034
W1	18,033	0.005	0.003	0.004
W2	18,033	0.010	0.010	0.004
W3	18,033	0.010	0.009	0.004

This table presents the summary statistics of our sample, over the period 2013 to 2023. We provide the definition of variables in Appendix A, Table A.1. Data are in €million

Table 4
Correlation matrix.

	SEC/TA	NIM	LR	LRsq	LLP	Tier1	Tier1sq	SIZE	SIZEsq	LERNER
SEC/TA	1.000									
NIM	0.506*	1.000								
LR	−0.048*	0.207*	1.000							
LRsq	0.068*	0.302*	0.945*	1.000						
LLP	0.040*	0.139*	0.157*	0.211*	1.000					
Tier1	−0.161*	−0.069*	0.367*	0.326*	−0.012	1.000				
Tier1sq	−0.139*	−0.003	0.299*	0.303*	−0.014	0.889*	1.000			
SIZE	0.041*	−0.295*	−0.104*	−0.100*	−0.012	−0.198*	−0.164*	1.000		
SIZEsq	0.017*	−0.294*	−0.061*	−0.062*	−0.011	−0.164*	−0.135*	0.984*	1.000	
LERNER	0.017*	−0.091*	−0.098*	−0.082*	0.007	−0.017*	−0.010	0.321*	0.322*	1.000

This table reports the correlation matrix of controls employed in Eqs. (1) and (2). We provide variable definitions in Appendix A, Table A.1. * $p < 0.05$.

assets, the net interest margin is 3%, liquid assets account for 19.6% of total assets, while the loan loss provisions are at a 2.8% level. Cooperative banks have a good level of Tier 1 capital, accounting for 19.2% on average. European cooperative banks seem to experience strong cost scale and scope economies. Regarding profit, results are less clear: more than 50% of banks are experiencing profit diseconomies of scale, and overall, banks are experiencing profit diseconomies of scope.

4. Empirical findings

4.1. Preliminary evidence

We report results for economies of scale by organizational structure and year in Table 5, while Fig. 1 shows the trend over time. Focusing on the cost dimension, all cooperative banks in the sample exhibit economies of scale, but for cooperative banks

Table 5
Economies of scale across different organizational structures.

ES_C				
Year	**Network**	**IPS**	**ICN**	**CCG**
2013	**1.140**	**1.121**	**1.192**	**1.161**
2014	**1.098**	**1.144**	**1.183**	**1.193**
2015	**1.107**	**1.154**	**1.191**	**1.227**
2016	**1.145**	**1.166**	**1.236**	**1.152**
2017	**1.167**	**1.178**	**1.238**	**1.150**
2018	**1.149**	**1.187**	**1.249**	**1.143**
2019		**1.191**	**1.144**	**1.130**
2020		**1.202**	**1.190**	**1.108**
2021		**1.194**	**1.212**	1.103
2022		**1.181**	**1.205**	1.097
2023		**1.172**	**1.183**	1.102
Total	**1.134**	**1.171**	**1.193**	**1.136**
ES_P				
Year	Network	IPS	ICN	CCG
2013	**1.656**	**1.157**	**0.392**	**1.722**
2014	**1.435**	**1.230**	**0.408**	**1.618**
2015	**1.428**	**1.256**	**0.373**	**1.327**
2016	**1.303**	**1.048**	**0.338**	**0.679**
2017	**1.362**	1.017	**0.316**	**0.584**
2018	**1.668**	1.084	**0.323**	**0.712**
2019		**0.896**	**1.464**	**0.589**
2020		1.015	**1.384**	0.914
2021		**0.950**	**1.183**	**0.582**
2022		**1.242**	**0.850**	**0.590**
2023		**0.902**	**0.934**	**0.511**
Total	**1.502**	**1.076**	0.982	**0.772**

This table reports the average values of Economies of Scale at cost (ES_C) and profit (ES_P) by organizational structure and year for the banks in our sample. $ES < 1$ indicates decreasing returns to scale; $ES > 1$ indicates increasing returns to scale; $ES = 1$ indicates constant returns to scale. Bold typeface for values significantly different from one at the 5% level. We provide variable definitions in Appendix A, Table A.1.

in CCG in the last year of the sample, which exhibit constant economies of scale. Banks affiliated with an ICN appear to achieve stronger performance than peers operating under alternative organizational structures. This suggests that ICN-affiliated banks are associated with greater cost advantages as size increases. Furthermore, banks operating under the network organizational structure were already experiencing significant economies of scale prior to transitioning to a new model. This pattern may reflect the timing of their shift, as they moved toward more integrated governance structures – typically associated with larger bank size – which could enable them to further exploit cost-based scale economies.

In contrast, results related to profit-side economies of scale are more heterogeneous. Specifically, integrated models tend to perform less favorably in this respect compared to the network model. Once again, bank size may be a relevant explanatory factor: smaller banks might benefit more from scaling up. Larger institutions – such as those operating under ICN or CCG structures – tend to show constant profit-side economies of scale, or even diseconomies of scale. In the case of ICN banks, we observe a notable shift after 2019, likely driven by Italian cooperative banks that adopted the ICN model following the transition from the network structure. It is possible that these banks were adapting their governance to better exploit the scale economies they had already exhibited.

Table 6 reports average values of scope economies at the cost level ($SCOPE\_C$) and at the profit level ($SCOPE\_P$), by organizational structure and year, while Fig. 2 depicts economies of scope trend during the analyzed period. All organizational models display positive values of scope economies at the cost level throughout the sample period, suggesting that joint production of outputs allows cost savings – a signal of economies of scope. More consolidated organizational structures – CCG - seem to exhibit stronger cost-side scope economies. Interestingly, scope economies appear relatively stable over time across models, though ICN banks show a slight increase after 2019, possibly reflecting organizational adaptation following model shifts. In contrast, all values in the $SCOPE\_P$ panel are negative, consistently across years and structures. This indicates that the joint production of services is associated with a loss in profitability, consistent with diseconomies of scope from a profit perspective. This suggests that while cost complementarities might exist, they are not always associated with higher profitability — possibly reflecting increased complexity, inefficiencies, or coordination costs in managing diversified services.

Table 7 shows the average Lerner Index, while we report the time trend in Fig. 3. During the analyzed period, all integrated organizational structures outperform network organizational structures, which show the lowest average Lerner Index, implying more limited pricing power and greater exposure to competitive pressures. This is consistent with their looser integration and decentralized governance, which may constrain their ability to act strategically in pricing and cost management.

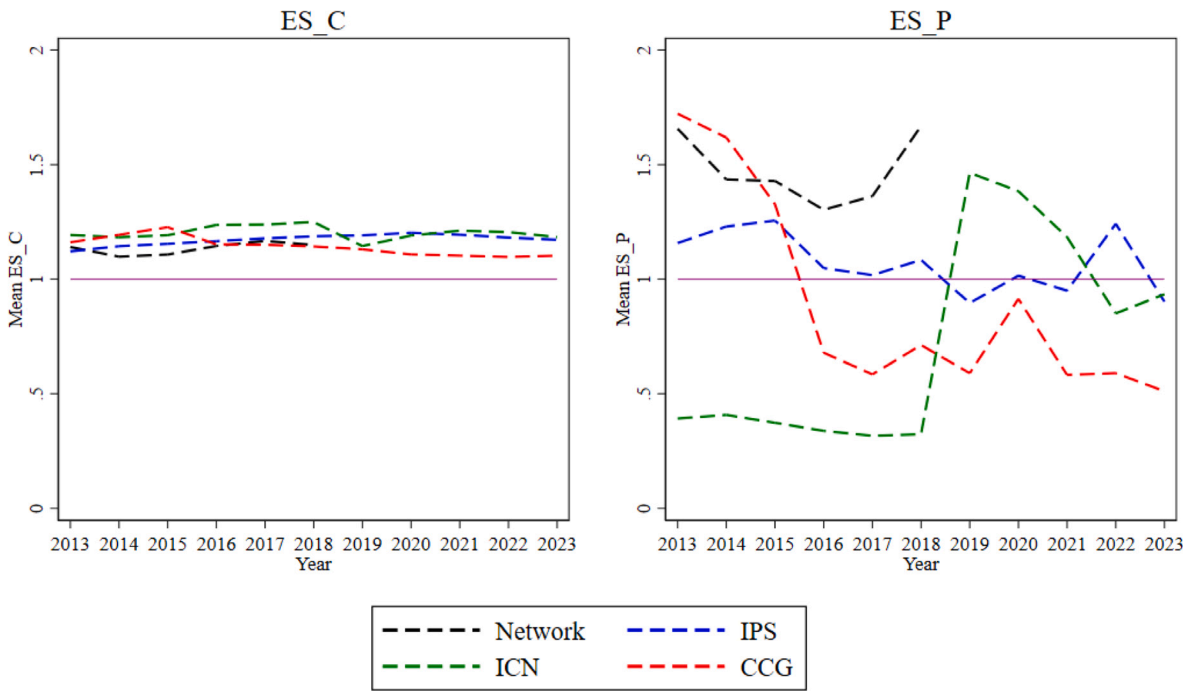

Fig. 1. Economies of scale.
This figure illustrates Economies of Scale on the cost (ES_C) and profit (ES_P) side by organizational structure over the sample period.

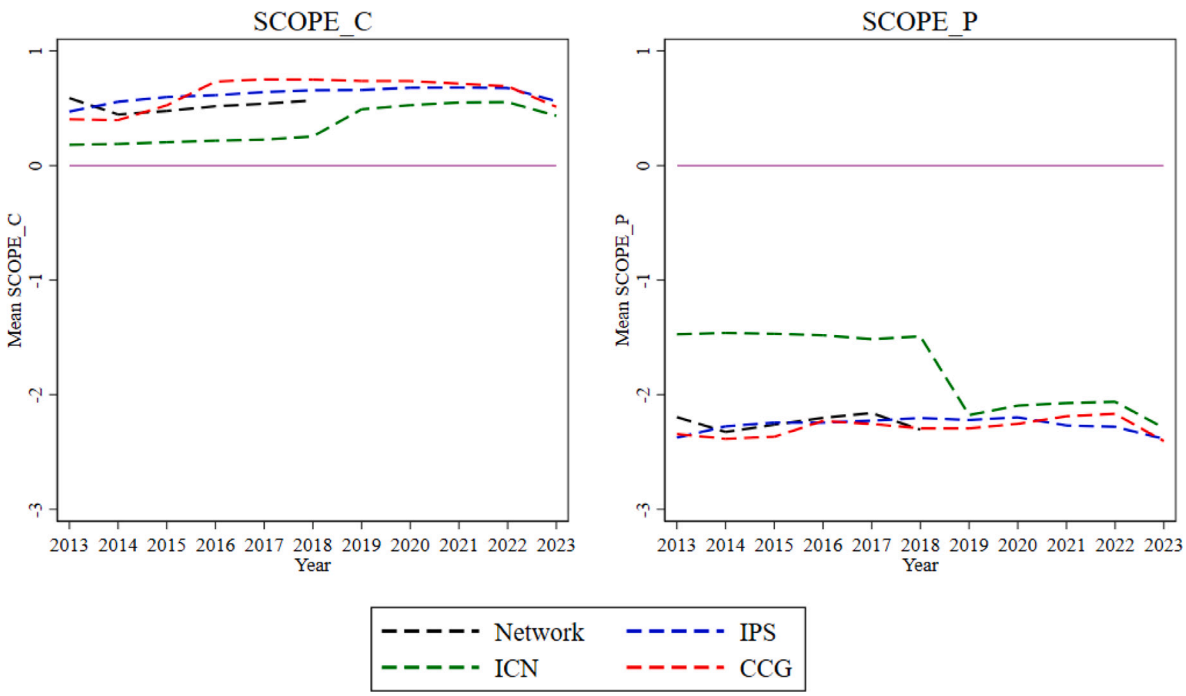

Fig. 2. Economies of scope.
This figure illustrates Economies of Scope on the cost ($SCOPE\_C$) and profit ($SCOPE\_P$) side by organizational structure over the sample period.

Table 6
Economies of scope across different organizational structures.

ES_C				
Year	Network	IPS	ICN	CCG
2013	**0.587**	**0.471**	**0.180**	**0.403**
2014	**0.445**	**0.556**	**0.188**	**0.396**
2015	**0.476**	**0.597**	**0.204**	**0.525**
2016	**0.517**	**0.613**	**0.217**	**0.732**
2017	**0.539**	**0.641**	**0.226**	**0.752**
2018	**0.567**	**0.657**	**0.254**	**0.750**
2019		**0.658**	**0.490**	**0.737**
2020		**0.678**	**0.526**	**0.737**
2021		**0.680**	**0.549**	**0.714**
2022		**0.676**	**0.552**	**0.691**
2023		**0.561**	**0.434**	**0.511**
Total	**0.531**	**0.617**	**0.441**	**0.674**
ES_P				
Year	Network	IPS	ICN	CCG
2013	**−2.196**	**−2.376**	**−1.473**	**−2.344**
2014	**−2.326**	**−2.277**	**−1.461**	**−2.386**
2015	**−2.262**	**−2.244**	**−1.469**	**−2.368**
2016	**−2.202**	**−2.244**	**−1.482**	**−2.229**
2017	**−2.161**	**−2.227**	**−1.515**	**−2.256**
2018	**−2.305**	**−2.204**	**−1.491**	**−2.294**
2019		**−2.220**	**−2.178**	**−2.294**
2020		**−2.198**	**−2.095**	**−2.255**
2021		**−2.269**	**−2.074**	**−2.188**
2022		**−2.280**	**−2.062**	**−2.167**
2023		**−2.387**	**−2.290**	**−2.405**
Total	**−2.324**	**−2.263**	**−1.986**	**−2.275**

This table reports the average values of Economies of Scope at cost (SCOPE_C) and profit (SCOPE_P) by organizational structure and year for the banks in our sample. $SCOPE < 0$ indicates diseconomies of scope; $SCOPE > 0$ indicates economies of scope; $SCOPE = 0$ indicates constant economies of scope. Bold typeface for values significantly different from zero at the 5% level. We provide variable definitions in Appendix A, Table A.1.

Table 7
Lerner index across different organizational structures.

LERNER				
Year	Network	IPS	ICN	CCG
2013	0.305	0.320	0.430	0.344
2014	0.332	0.347	0.434	0.379
2015	0.331	0.378	0.447	0.381
2016	0.338	0.414	0.439	0.432
2017	0.383	0.444	0.453	0.442
2018	0.424	0.470	0.458	0.422
2019		0.476	0.420	0.434
2020		0.498	0.447	0.407
2021		0.519	0.485	0.388
2022		0.545	0.502	0.418
2023		0.464	0.381	0.427
Total	0.342	0.441	0.446	0.415

This table reports the average values of Lerner Index (LERNER) by organizational structure and year for the banks in our sample. We provide variable definitions in Appendix A, Table A.1.

4.2. Results

We first examine whether cooperative banks operating under different organizational structures display systematically different performance by estimating Eq. (1) and testing hypotheses H_{1a} and H_{1b}. The results reported in Table 8 show that varying degrees of organizational consolidation are associated with heterogeneous effects across the dependent variables. With respect to cost-side economies of scale, integrated models perform significantly better than the network structure, with the most integrated arrangement (CCG) delivering the strongest results. A similar pattern emerges for cost economies of scope, for which cooperative banks adopting an ICN exhibit the best performance. Overall, these findings indicate that greater integration is associated with improved cost-side scale and scope economies, consistent with Fonteyne (2007). In addition, integrated models are associated with higher values of the Lerner Index. However, market power does not appear to increase monotonically with the degree of integration, as all integrated

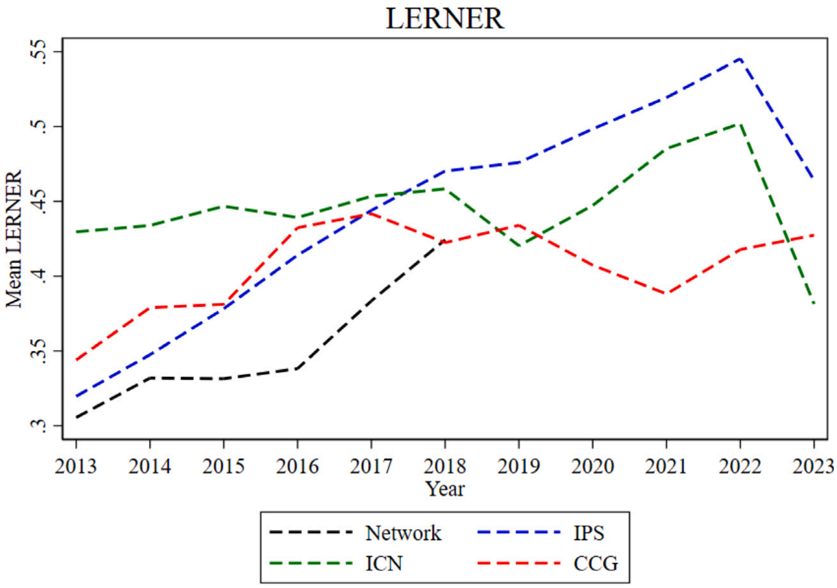

Fig. 3. Lerner index.
This figure illustrates Lerner Index ($LERNER$) by organizational structure over the sample period.

configurations yield broadly comparable estimates. Taken together, this evidence suggests that centralization is linked to cost-side scale and scope advantages, plausibly through increased standardization, shared services, and stronger bargaining power (Beccalli et al., 2023). Turning to profit-based measures, the evidence is less clear-cut. Highly integrated cooperative banks (CCG) exhibit the weakest performance in terms of profit-side economies of scale, whereas less integrated structures (IPS) appear more effective at translating growth into profitability. This result is consistent with the conventional paradigm (Berger et al., 2005) and with the view that cooperative banks' local proximity supports relationship lending and the provision of tailored services to local firms (Hasan et al., 2017; Banfi et al., 2025); stronger integration may be associated with weaker proximity advantages and soft-information channels. Finally, for profit-side economies of scope, results are heterogeneous: banks operating under the network structure and those organized as CCG display the highest values, in line with prior evidence (Beccalli et al., 2023). Overall, we confirm hypothesis H_{1a} and provide only partial support for hypothesis H_{1b}, which is corroborated solely for profit-side economies of scale.

We test hypothesis H_2 by estimating Eq. (2) separately for each organizational structure. Table 9 reports the results for economies of scale and shows that the determinants of scale economies differ markedly across organizational models. This evidence is consistent with Ayadi et al. (2023), who argue that cooperative banks pursue their objectives through heterogeneous business strategies, which in turn translate into differences in scale economies, scope economies, and market power. On the cost side, greater diversification – proxied by a higher share of securities – correlates with stronger scale economies for banks operating under the network structure and, among integrated arrangements, for IPS banks. The net interest margin is positive and statistically significant for network and ICN banks, indicating that stronger lending profitability is associated with larger cost-side scale potential advantages, particularly in more integrated settings. Loan loss provisions (LLP) also display a positive and significant coefficient for network banks, suggesting that more prudent credit risk management may be linked to cost-related scale advantages in this configuration. To capture potential non-linearities in capitalization, we include Tier 1 and its squared term. The squared term is negative and significant for IPS and CCG in the cost specifications, implying a concave relationship whereby higher capital levels eventually reduce the marginal gains from scale; the opposite pattern emerges for ICN banks. For profit-side economies of scale (Columns 5–8), results are more heterogeneous. Diversification is positively associated with profit-side scale economies for IPS banks, while it is negatively related to performance for ICN and CCG institutions. The net interest margin is negative and significant for IPS and ICN banks, consistent with the idea that more profitable intermediaries may already operate closer to their optimal scale and thus experience diminishing returns to further expansion. The liquidity ratio has a positive and significant effect for ICN and CCG banks, but the relationship is concave: increases in liquid assets improve profit-side scale economies only up to a point. For CCG banks, the implied turning point is around 35% (computed as $-\beta_3/(2\beta_4)$), beyond which additional liquidity no longer enhances scale potential advantages. Finally, stronger capital quality appears to support profit-side scale economies only for IPS banks.

Table 10 illustrates the results for economies of scope. The variable SIZE is negative and statistically significant for network and IPS banks (Columns 1 and 2), suggesting that, in these structures, cost-side scope economies tend to decline as bank size increases. However, the positive and significant coefficients on SIZE squared point to a non-linear (convex) relationship, consistent with a U-shaped pattern: increases in size initially reduce scope economies, but beyond a certain threshold, further growth is associated with improvements in scope economies. This may indicate that smaller banks are less able to exploit scope economies (and thus to engage efficiently in multiple activities), whereas larger institutions perform better. The non-linear pattern is more pronounced in

Table 8
The impact of organizational structures.

Variables	(1) ES_C	(2) ES_P	(3) SCOPE_C	(4) SCOPE_P	(5) LERNER
IPS	0.058***	0.204**	−0.081***	−0.238***	0.080***
	(0.017)	(0.098)	(0.008)	(0.018)	(0.017)
ICN	0.041***	−0.069	0.039***	−0.132***	0.066***
	(0.011)	(0.092)	(0.014)	(0.031)	(0.013)
CCG	0.321***	−0.440***	0.001	−0.063	0.094***
	(0.010)	(0.054)	(0.065)	(0.165)	(0.012)
SEC/TA	0.294***	−0.344			0.252***
	(0.050)	(0.257)			(0.050)
NIM	0.324	−8.460***			3.210***
	(0.433)	(2.096)			(0.550)
LR	−0.032	1.720***	0.023	0.164**	−0.436***
	(0.091)	(0.467)	(0.036)	(0.080)	(0.096)
LRsq	−0.107	−3.352***			0.476**
	(0.155)	(0.767)			(0.185)
LLP	0.005	0.086***			−0.009**
	(0.006)	(0.029)			(0.004)
Tier1	0.123	−0.660			0.268**
	(0.101)	(0.727)			(0.121)
Tier1sq	0.004	−0.278			−0.124
	(0.120)	(0.813)			(0.118)
SIZE			−0.482***	−0.971***	
			(0.053)	(0.116)	
SIZEsq			0.035***	0.079***	
			(0.004)	(0.008)	
LERNER			0.880***	0.797***	
			(0.031)	(0.040)	
Observations	11,423	11,423	17,954	17,954	11,423
R-squared	0.834	0.626	0.869	0.787	0.772
Bank FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports results of Eq. (1) when having as dependent variables ES_C, ES_P, $SCOPE\_C$, $SCOPE\_P$, and $LERNER$. We provide variable definitions in Appendix A, Table A.1. We cluster standard errors at bank level. The sample covers the period from 2013 to 2023. *** p < 0.01; ** p < 0.05; * p < 0.1.

Table 9
Economies of scale: Determinants across different organizational structures.

Variables	(1) ES_C	(2) ES_C	(3) ES_C	(4) ES_C	(5) ES_P	(6) ES_P	(7) ES_P	(8) ES_P
SEC/TA	0.451***	0.290***	0.006	0.037	−0.592	0.645*	−2.364**	−0.966**
	(0.104)	(0.075)	(0.165)	(0.081)	(0.627)	(0.350)	(1.021)	(0.402)
NIM	1.745***	−0.320	3.696***	−0.621	0.108	−13.561***	−27.683***	−4.629
	(0.673)	(0.688)	(0.818)	(0.731)	(5.723)	(3.300)	(4.294)	(3.381)
LR	0.132	0.076	0.191	−0.132	1.613	0.102	3.435***	1.297**
	(0.232)	(0.153)	(0.251)	(0.149)	(1.450)	(0.613)	(1.289)	(0.529)
LRsq	−0.501**	−0.309	−0.377	0.085	−2.621	0.184	−3.226*	−1.828***
	(0.248)	(0.438)	(0.343)	(0.221)	(1.630)	(1.303)	(1.916)	(0.683)
LLP	0.666***	−0.276	−0.003***	0.091	−3.829***	0.779	0.117***	1.281
	(0.190)	(0.173)	(0.001)	(0.715)	(1.139)	(0.837)	(0.005)	(1.339)
Tier1	−0.321	−0.161	−0.502	0.391***	3.196	1.874*	−0.796	−0.295
	(0.251)	(0.187)	(0.334)	(0.140)	(2.085)	(1.045)	(1.627)	(0.563)
Tier1sq	0.141	−0.497***	0.951**	−0.177*	−2.257*	1.420	−0.196	0.022
	(0.270)	(0.141)	(0.399)	(0.102)	(1.295)	(1.021)	(2.099)	(0.465)
Observations	1818	6983	1445	1137	1818	6983	1445	1137
R-squared	0.783	0.868	0.798	0.911	0.626	0.665	0.786	0.503
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Integration	Network	IPS	ICN	CCG	Network	IPS	ICN	CCG

This table reports the results of Eq. (2) when having as dependent variables ES_C (Columns 1 to 4) and ES_P (Columns 5 to 8). We run the analysis separately by organizational structure. The definitions of the variables are provided in Appendix A, Table A.1. We cluster standard errors at bank level. The sample covers the period from 2013 to 2023. *** p < 0.01; ** p < 0.05; * p < 0.1.

less integrated models. These results are in line with Beccalli and Rossi (2020). In contrast, SIZE and its squared term are mostly insignificant for ICN and CCG banks, indicating that size plays a more limited role in explaining cost-related scope economies in

Table 10
Economies of scope: Determinants across different organizational structures.

Variables	(1) SCOPE_C	(2) SCOPE_C	(3) SCOPE_C	(4) SCOPE_C	(5) SCOPE_P	(6) SCOPE_P	(7) SCOPE_P	(8) SCOPE_P
SIZE	−0.943***	−0.675***	−0.089	−0.050	−1.850***	−1.579***	0.048	−0.300
	(0.191)	(0.080)	(0.115)	(0.145)	(0.431)	(0.153)	(0.435)	(0.419)
SIZEsq	0.085***	0.051***	0.003	−0.002	0.157***	0.124***	0.003	0.029
	(0.016)	(0.007)	(0.008)	(0.009)	(0.034)	(0.011)	(0.021)	(0.024)
LR	−0.154**	0.242***	0.090	−0.095	−0.023	0.357***	0.341	−0.324
	(0.065)	(0.058)	(0.109)	(0.098)	(0.195)	(0.122)	(0.269)	(0.216)
LERNER	0.486***	0.974***	0.789***	0.471***	0.263**	0.870***	0.669***	0.355***
	(0.056)	(0.039)	(0.091)	(0.063)	(0.110)	(0.046)	(0.151)	(0.121)
Observations	1958	12,366	1675	1537	1958	12,366	1675	1537
R-squared	0.899	0.879	0.907	0.841	0.742	0.808	0.861	0.804
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Integration	Network	IPS	ICN	CCG	Network	IPS	ICN	CCG

This table reports the results of Eq. (2) when having as dependent variables $SCOPE\_C$ (Columns 1 to 4) and $SCOPE\_P$ (Columns 5 to 8). We run the analysis separately by organizational structure. We provide variable definitions in Appendix A, Table A.1. We cluster standard errors at bank level. The sample covers the period from 2013 to 2023. *** p < 0.01; ** p < 0.05; * p < 0.1.

more integrated structures. On the profit side, the evidence is similarly mixed. SIZE is again negative and significant for network and IPS banks (Columns 5 and 6), while the squared term remains positive, indicating that profit-side scope economies may deteriorate at intermediate sizes but recover for larger banks. Liquidity also matters, though in a structure-specific way. The liquidity ratio (LR) is positive and significant for IPS banks in both the cost and profit specifications (Columns 2 and 6), suggesting that stronger liquidity positions are associated with stronger scope economies in this model. For network banks, LR is negative and significant on the cost side (Column 1), consistent with a trade-off between holding liquidity buffers and realizing cost-side scope economies. Finally, greater market power is consistently associated with better performance across all specifications, with particularly strong effects for IPS and ICN banks, underscoring the role of market positioning in enabling multiproduct advantages in more integrated settings.

Turning to the determinants of the Lerner Index (Table 11), we find that a higher share of securities is positively associated with market power in most specifications, suggesting that greater diversification may translate into increased pricing flexibility. Higher profitability in lending activities—captured by larger interest margins—also strengthens pricing power in the more integrated structures. This effect is particularly pronounced for IPS and ICN banks, consistent with stronger scale and information advantages in these models. The positive coefficient on LLP for network and ICN banks indicates that more prudent credit-risk management is more readily reflected in lending spreads within these organizational arrangements. Overall, in integrated systems, market power aligns closely with profitability, consistent with stronger performance across these measures. In network structures, however, market power is more closely linked to risk provisioning, indicating differing operational priorities and constraints.

Overall, the results indicate that the determinants of economies of scale, economies of scope, and market power differ substantially across cooperative banks' organizational forms. Accordingly, we confirm hypothesis H_2.

Table 12 reports results for hypothesis H_3. The transition from network to IPS is associated with a statistically significant increase in economies of scale on both the cost and profit sides, as well as in market power (Lerner Index). This suggests that IPS adoption is associated with stronger performance in terms of profit-side scale economies and pricing power, while not translating into higher profit-side scope economies. The shift from network to ICN is associated with higher cost-side economies of scale and with stronger economies of scope and market power, consistent with Beccalli et al. (2023). This pattern is consistent with deeper integration being associated with stronger cost-side scale and scope economies. Overall, the results suggest that transitions toward more integrated organizational models are associated with stronger performance across the main measures – particularly cost-side economies of scale and scope and market power – thereby providing support for hypothesis H_3 (see Table 12).

Finally, we evaluate whether organizational structure is associated with a better credit quality, and thus with credit risk. Greater integration may be associated with increased distance between cooperative banks and their members and customers (Fonteyne, 2007), potentially consistent with weaker relationship-based lending technology. We therefore test hypothesis H_4 by estimating Eq. (4). Table 13 reports the results. The System GMM estimates do not yield robust evidence across the two specifications and thus do not point to any organizational model as consistently superior in managing credit risk, so we cannot confirm hypothesis H_4. By contrast, the Difference GMM results indicate that banks transitioning to an IPS structure experience a statistically significant reduction in the NPL ratio, suggesting that this model may be associated with higher advantages in managing credit risk.

4.3. Robustness tests

We perform a battery of robustness tests to validate our findings (see Appendix B). First, we repeat our analysis on the impact of organizational structures employing country fixed effects rather than bank fixed effects. This allows us better to compare the

Table 11
Lerner index: Determinants across different organizational structures.

Variables	(1) LERNER	(2) LERNER	(3) LERNER	(4) LERNER
SEC/TA	0.243**	0.187**	0.161	0.640***
	(0.110)	(0.088)	(0.137)	(0.166)
NIM	0.850	4.570***	8.544***	3.896**
	(0.867)	(0.778)	(0.634)	(1.754)
LR	0.165	−0.155	−0.317	−0.464***
	(0.219)	(0.169)	(0.270)	(0.140)
LRsq	−0.077	−0.210	−0.153	0.824***
	(0.237)	(0.312)	(0.562)	(0.220)
LLP	0.436***	−0.042	−0.015***	−0.008
	(0.156)	(0.153)	(0.001)	(0.705)
Tier1	0.331	−0.237	−0.193	0.256**
	(0.338)	(0.235)	(0.222)	(0.122)
Tier1sq	−0.267	−0.371**	0.312	−0.064
	(0.195)	(0.172)	(0.326)	(0.088)
Observations	1818	6983	1445	1137
R-squared	0.775	0.802	0.859	0.673
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Integration	Network	IPS	ICN	CCG

This table reports results of Eq. (2) when having as dependent variable $LERNER$. We run the analysis separately by organizational structure. We provide variable definitions in Appendix A, Table A.1. We cluster standard errors at the bank level. The sample covers the period from 2013 to 2023. *** p < 0.01; ** p < 0.05; * p < 0.1.

Table 12
Change of organizational structure.

Variables	(1) ES_C	(2) ES_P	(3) SCOPE_C	(4) SCOPE_P	(5) LERNER
Network to IPS	0.054***	0.203**	−0.052***	−0.158***	0.081***
	(0.018)	(0.103)	(0.017)	(0.036)	(0.017)
Network to ICN	0.041***	−0.070	0.046***	−0.113***	0.066***
	(0.011)	(0.092)	(0.014)	(0.031)	(0.013)
SEC/TA	0.295***	−0.349			0.252***
	(0.050)	(0.257)			(0.050)
NIM	0.347	−8.444***			3.225***
	(0.434)	(2.094)			(0.550)
LR	−0.034	1.719***	0.037	0.203**	−0.435***
	(0.091)	(0.467)	(0.037)	(0.082)	(0.097)
LRsq	−0.109	−3.350***			0.474**
	(0.155)	(0.768)			(0.185)
LLP	0.005	0.086***			−0.009***
	(0.006)	(0.029)			(0.004)
Tier1	0.123	−0.657			0.268**
	(0.101)	(0.727)			(0.121)
Tier1sq	0.005	−0.279			−0.123
	(0.121)	(0.813)			(0.118)
SIZE			−0.505***	−1.037***	
			(0.053)	(0.119)	
SIZEsq			0.037***	0.084***	
			(0.004)	(0.008)	
LERNER			0.877***	0.789***	
			(0.031)	(0.041)	
Observations	11,423	11,423	17,954	17,954	11,423
R-squared	0.834	0.626	0.868	0.784	0.772
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports results of Eq. (3) when having as dependent variables ES_C, ES_P, $SCOPE\_C$, $SCOPE\_P$, and $LERNER$. We provide variable definitions in Appendix A, Table A.1. We cluster standard errors at bank level. The sample covers the period from 2013 to 2023. *** p < 0.01; ** p < 0.05; * p < 0.1.

performance of banks in the same country employing different organizational structures. Table B.2 presents the results and confirms our baseline findings.

We replicate the analysis using estimates of economies of scale, economies of scope, and the Lerner Index derived from cost and profit functions specified with two outputs – thus excluding off-balance-sheet activities – as in Beccalli et al. (2023). Table B.3

Table 13
Organizational structure and credit risk.

Variables	(1) SystemGMM	(2) SystemGMM	(3) DiffGMM	(4) DiffGMM
lnNPL (t−1)	0.663***	0.609	0.593*	0.582*
	(0.252)	(0.439)	(0.313)	(0.316)
IPS	−0.115	−0.109	−2.049**	−1.570**
	(0.560)	(0.619)	(1.044)	(0.699)
ICN	−0.284	−0.334	0.494	0.120
	(0.249)	(0.216)	(0.603)	(0.429)
CCG	−3.371	−4.154		
	(2.874)	(2.621)		
Tier1 (t−1)	−0.352	−0.147	−0.178	−0.464
	(0.862)	(1.109)	(0.919)	(0.708)
ROE (t−1)	−0.423	−0.401	0.113	0.013
	(0.462)	(1.027)	(0.276)	(0.283)
SIZE (t−1)	0.073	0.060	−0.201	−0.307
	(0.137)	(0.117)	(0.268)	(0.195)
Loans (g) (t−1)	0.158	0.206	−0.011	0.081
	(0.275)	(0.265)	(0.197)	(0.139)
NIM (t−1)	11.063*	7.276	5.480	1.112
	(6.411)	(9.114)	(7.256)	(6.437)
GDP (g) (t−1)		−0.001		0.001
		(0.004)		(0.004)
Debt (t−1)		−0.003		0.001
		(0.005)		(0.003)
Unemp (t−1)		−0.052		−0.064
		(0.049)		(0.062)
Lending (t−1)		0.273***		0.144**
		(0.106)		(0.059)
Observations	1612	1612	1228	1228
Groups	343	343	308	308
Instruments	13	20	12	17
AR(1) p-value	0.005	0.058	0.057	0.044
AR(2) p-value	0.114	0.519	0.282	0.238
Hansen J p-value	0.237	0.288	0.323	0.286

This table reports results of Eq. (4). The definitions of the variables are provided in Appendix A, Table A.1. We cluster standard errors at bank level. The sample covers the period from 2013 to 2023. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

reports the results from Eq. (1) and confirms our baseline findings. Tables B.4–B.6 present the results when analyzing drivers (Eq. (2)), showing that the main results are broadly confirmed.

Lastly, we check the robustness of our findings regarding the change of organizational structure by also implementing a propensity score matching (PSM) procedure. The PSM–DiD exercise is meant to address selection into switching on observables. We estimate propensity scores using a logit model on pre-treatment covariates. We then apply kernel propensity-score matching and construct matching weights. Since the objective is to address selection into treatment, we focus on the average treatment effect on the treated (ATT): treated banks receive weight 1, while control banks receive kernel weights proportional to their similarity in propensity scores, as in Beccalli et al. (2023). Therefore, we estimate the probability of switching organizational model (from network to IPS or ICN) using a logit model that includes the full set of covariates employed in the baseline regressions, using Kernel as a matching algorithm (Figs. B.1 and B.2 illustrate the Kernel density maps before and after matching). Treated banks – those that change structure – are then matched to similar cooperative banks that do not change model but exhibit comparable observable characteristics. We apply the resulting PSM weights to the sample and re-estimate Eq. (3) to test whether the observed effects persist when accounting for potential selection bias. Table B.7 reports data balance before and after matching procedures. The results, presented in Tables B.8 and B.9, confirm the main conclusions.

5. Conclusions

This paper investigates how organizational structure shapes the performance of European cooperative banks. Using a cross-country panel of Euro-area cooperative banks over 2013–2023, we estimate cost- and profit-side economies of scale and scope, together with market power, and relate these measures to alternative cooperative organizational structures. We also exploit the major organizational transitions observed in 2019 in Spain and Italy to evaluate the effects of moving from a network configuration toward more integrated models, following the approach in Shaffer and Spierdijk (2020) and building on Beccalli et al. (2023).

The evidence indicates that integration yields clear cost-side advantages: more integrated structures are associated with stronger cost-side economies of scale and scope and higher market power, likely reflecting centralization and shared infrastructure, which can strengthen efficiency and market positioning for higher potential efficiency and competitive positioning (Fonteyne, 2007; Beccalli et al., 2023). By contrast, results on the profit side are more nuanced: less integrated configurations (network and IPS) tend to exhibit stronger profit-side economies of scale, consistent with the view that deeper integration may weaken proximity-based advantages and soft-information channels that are central to cooperative banking (Berger and Udell, 2006; Fonteyne, 2007). Moreover, profit-side diseconomies of scope emerge as a pervasive feature across cooperative banks, in line with prior evidence (Beccalli and Rossi, 2020). We also find that the determinants of scale economies, scope economies, and market power differ across organizational forms, supporting the idea that alternative structures reflect heterogeneous strategies and constraints (Ayadi et al., 2023). The transition analysis confirms that shifting from a network toward integrated models is generally associated with stronger outcomes, especially in cost-side scale economies and market power (Beccalli et al., 2023). In terms of credit quality, we do not find a uniformly superior structure, although transitions to an IPS are associated with a reduction in NPL ratios.

Overall, the findings suggest that there is no single optimal cooperative banking model. Different organizational structures are associated with trade-offs between cost-side scale and scope economies, profitability dynamics, and the preservation of cooperative specificities rooted in proximity and member-oriented governance (Fonteyne, 2007; Berger and Udell, 2002). This has two broader implications. First, it reinforces that cooperative banks should not be evaluated through the same lens as commercial banks (Ayadi et al., 2023). Second, it highlights that the cooperative sector itself is far from homogeneous, making a single-model characterization misleading. From a policy perspective, these results caution against "one-size-fits-all" regulatory or supervisory approaches and support frameworks that recognize both the distinctiveness and the internal diversity of cooperative banking systems.

This study is subject to limitations that also indicate directions for future research. Our sample covers Euro-area cooperative banks that are EACB members. Further work could investigate longer-run dynamic effects of transitions, explore channels (e.g., governance, risk control architecture, and the role of central institutions), and assess how local market characteristics and regulatory environments interact with organizational design. Extending the analysis to additional jurisdictions and to alternative measures of cooperative objectives beyond scale and scope economies, market power, and credit risk would also help deepen our understanding of how cooperative banking models evolve and perform.

CRediT authorship contribution statement

Elena Beccalli: Writing – original draft, Supervision, Methodology, Conceptualization. **Andrea Viola:** Writing – original draft, Writing – review & editing, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Definition of variables

See Table A.1.

Appendix B. Additional tables and robustness tests

See Tables B.1–B.9 and Figs. B.1 and B.2.

Appendix C. Estimation of cost and profit functions and dependent variables

We estimate the cost and profit functions using the following specification, following (Shaffer and Spierdijk, 2020):

$$\begin{aligned} Y_{i,t} = &\sum_{n=1}^{3} \beta_n W_{n,it} + \frac{1}{2} \sum_{n=1}^{3} \sum_{m=1}^{3} \beta_{n,m} W_{n,it} Q_{m,it}^2 + \sum_{n=1}^{3} \sum_{m=1}^{3} \beta_{n,m} W_{n,it} Q_{m,it} \\ &+ \sum_{n=1}^{3} \sum_{k>n} \sum_{m=1}^{3} \beta_{n,m} W_{j,it}^{\frac{1}{2}} W_{k,it}^{\frac{1}{2}} Q_{m,it} + \sum_{n=1}^{3} \sum_{m=1}^{3} \sum_{k>m}^{3} \beta_{n,m} W_{j,it} Q_{m,it} Q_{k,it} \\ &+ \delta_i E_{i,t} + \alpha_i + \alpha_t + \varepsilon_{i,t} \end{aligned}$$

where the dependent variable $Y_{i,t}$ is either operating costs ($C_{i,t}$) or operating profits ($\pi_{i,t}$), varying across banks (i) and years (t). The three outputs of our cost and profit functions are $Q_{1,it}$, gross loans, $Q_{2,it}$, financial assets, and $Q_{3,it}$, off-balance sheet assets. $W_{1,it}$ is the cost of funds, defined as the ratio of interest expenses to total assets; $W_{2,it}$ is the cost of labor, defined as the ratio of personnel expenses to total assets; $W_{3,it}$ is the cost of physical capital, defined as the ratio of operating expenses to total assets. Those are the

Table A.1
Variable definition.

Variable	Definition	Source
CCG	A dummy variable taking value of 1 if the bank is in a CCG in year *t*	EACB
Debt	General government gross debt-to-GDP (%)	World bank
Equity/Total assets	The ratio of equity over total assets	Orbis bank focus
ES_C	Economies of Scale on the cost side, computed as explained in Appendix B	Own calculations
ES_C_2O	Economies of Scale on the cost side, computed as explained in Appendix B using a cost function with two outputs	Own calculations
ES_P	Economies of Scale on the profit side, computed as explained in Appendix B	Own calculations
ES_P_2O	Economies of Scale on the profit side, computed as explained in Appendix B using a profit function with two outputs	Own calculations
GDP (g)	Real gross domestic product (GDP) growth at country level	World bank
ICN	A dummy variable taking value of 1 if the bank is in a ICN in year *t*	EACB
IPS	A dummy variable taking value of 1 if the bank is in a IPS in year *t*	EACB
Loans (g)	Annual growth of gross loans at bank level (%)	Orbis bank focus
LERNER	Lerner Index, computed as explained in Appendix B	Own calculations
LERNER_2O	Lerner Index, computed as explained in Appendix B using a cost function with two outputs	Own calculations
Lending	Lending interest rate - Cost of borrowing for new long-term loans	Eurostat
LLP	Loan Loss Provisions, computed as the ratio of loan loss reserves over loans to customers	Orbis bank focus
LR	Liquidity ratio, computed as liquid assets over total assets	Orbis bank focus
NIM	Net interest margin (NIM), computed as net interest income (interest income less interest expenses) over loans to customers	Orbis bank focus
Network	A dummy variable taking value of 1 if the bank is employing a Network Organizational Structure in year *t*	EACB
NPL	Non-performing loans to total loans of the bank (%)	Orbis bank focus
Operating costs	Operating costs of the bank, computed as the sum of total operating expenses, interest expenses, fee and commission expenses	Orbis bank focus
Operating profits	Operating profits of the bank	Orbis bank focus
Q1	Total loans of the bank (loans to customers plus loans to banks)	Orbis bank focus
Q2	Total securities owned by the bank	Orbis bank focus
Q3	Off-balance sheet assets	Orbis bank focus
SCOPE_C	Economies of Scope on the cost side, computed as explained in Appendix B	Own calculations
SCOPE_C_2O	Economies of Scope on the cost side, computed as explained in Appendix B using a cost function with two outputs	Own calculations
SCOPE_P	Economies of Scope on the profit side, computed as explained in Appendix B	Own calculations
SCOPE_P_20	Economies of Scope on the profit side, computed as explained in Appendix B using a profit function with two outputs	Own calculations
SEC/TA	Securities over total assets ratio	Orbis bank focus
Tier1	Tier1 ratio capital	Orbis bank focus
Total assets	Bank's total assets, expressed in €million	Orbis bank focus
Unemp	Unemployment rate (% of labor force)	World bank
W1	The cost of funds, computed as interest expense over total assets	Orbis bank focus
W2	The cost of labor, computed as staff expenses over total assets	Orbis bank focus
W3	The cost of physical capital, computed as other operating costs over total assets	Orbis bank focus

This table illustrates the definition of variables employed in the analyses.

three inputs of the functions. We also include $E_{i,t}$, a netput defined as the ratio of equity to total assets. Additionally, we saturate the model by including a set of fixed effects; α_i represents bank fixed effects, while α_t represents year fixed effects. $\varepsilon_{i,t}$ is the error term. To account for heterogeneity in size of banks when estimating cost and profit function, we follow Shaffer and Spierdijk (2020) and divide our sample in four asset classes: (i) less than € 100 million, (ii) € 100–500 million, (iii) € 500 million–1 billion, and (iv) more than € 1 billion.[8]

Following Beccalli et al. (2023), cost (profit) scale economies are computed as the inverse of the sum of cost (profit) elasticities with respect to output. To estimate cost (profit) scale economies, we calculate the inverse of the sum of the output elasticities of costs (profits). A value higher than one indicate that the given bank is performing economies of scale, a value lower than one is associated to diseconomies of scale (a value equal to one is associated to constant economies of scale, i.e. neither advantage nor disadvantage in enlarging bank size). Scope economies are assessed by examining whether costs (profits) decrease (increase) when multiple outputs are produced jointly rather than separately, following the approach of Mester (1993). A positive value of economies of scope indicates that the given bank is experiencing scope economies, a negative value is associated to scope diseconomies. The

[8] All function estimations converge normally and exhibit high goodness of fit. Full coefficient tables and estimation are available from the authors upon request.

Table B.1
Summary statistics of non-cooperative banks.

	N	Mean	Median	Std Dev
Q	11,980	13,369.335	1646.626	43,761.747
SEC/TA	10,853	0.179	0.155	0.148
NIM	11,301	0.033	0.025	0.029
LR	11,918	0.270	0.188	0.234
LLP	9126	0.095	0.014	2.664
Tier1	9178	0.195	0.161	0.117
ROE	11,796	0.050	0.043	0.091
Loans (g)	10,237	0.059	0.037	0.174
C	11,199	360.036	47.498	1160.221
pi	11,908	60.596	5.876	203.332
Q1	11,662	8893.495	1168.218	27,513.787
Q2	10,853	2411.343	272.384	7945.977
Q3	10,965	2628.565	137.224	9449.685
CAPITAL	11,863	0.117	0.091	0.104
W1	11,514	0.007	0.005	0.006
W2	11,380	0.012	0.010	0.010
W3	11,009	0.014	0.011	0.012

This table presents the summary statistics of commercial, popular, and saving banks employed to estimate Lerner Index, over the period 2013 to 2023. We provide the definition of variables in Appendix A, Table A.1. Data are in €million

Table B.2
The Impact of organizational structures - country FE.

Variables	(1) ES_C	(2) ES_P	(3) SCOPE_C	(4) SCOPE_P	(5) LERNER
IPS	0.019	0.241*	−0.103***	−0.361***	0.070***
	(0.026)	(0.130)	(0.014)	(0.035)	(0.021)
ICN	0.082***	0.144	0.054***	0.034	0.098***
	(0.021)	(0.088)	(0.017)	(0.046)	(0.018)
CCG	0.313***	−0.242	−0.028	−0.334***	0.170***
	(0.065)	(0.165)	(0.036)	(0.098)	(0.053)
SEC/TA	0.274***	−0.129			0.326***
	(0.053)	(0.173)			(0.046)
NIM	−1.905***	−1.216			−1.235***
	(0.492)	(1.681)			(0.452)
LR	−0.040	1.425***	0.132***	0.324***	−0.407***
	(0.117)	(0.393)	(0.043)	(0.097)	(0.112)
LRsq	0.118	−2.772***			0.549***
	(0.174)	(0.629)			(0.163)
LLP	0.044***	0.066***			0.014**
	(0.010)	(0.023)			(0.007)
Tier1	−0.812***	−0.299			−0.370***
	(0.150)	(0.549)			(0.124)
Tier1sq	0.837***	−0.067			0.311***
	(0.165)	(0.549)			(0.119)
SIZE			−0.272***	−0.967***	
			(0.033)	(0.080)	
SIZEsq			0.013***	0.067***	
			(0.003)	(0.007)	
LERNER			1.192***	0.986***	
			(0.021)	(0.031)	
Observations	11,478	11,478	18,033	18,033	11,478
R-squared	0.112	0.127	0.603	0.405	0.117
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports results of Eq. (1) when having as dependent variables ES_C, ES_P, $SCOPE\_C$, $SCOPE\_P$, and $LERNER$ and using Country FE rather than Bank FE. We provide variable definitions in Appendix A, Table A.1. We cluster standard errors at bank level. The sample covers the period from 2013 to 2023. *** p < 0.01; ** p < 0.05; * p < 0.1.

Lerner index is obtained by measuring the difference between marginal revenue and marginal cost, following the methodology of Shaffer and Spierdijk (2020).[9]

[9] Note that, when computing the Lerner Index, we also include observations for commercial and savings banks in the sample. This is because the Lerner Index measures market power by accounting for the performance of competitors. Therefore, to accurately estimate the index for cooperative banks, it is necessary to consider all banks operating in the market. In contrast, this inclusion is not required when calculating scale and scope economies.

Table B.3
The impact of organizational structures - different cost and profit functions.

Variables	(1) ES_C_2O	(2) ES_P_2O	(3) SCOPE_C_2O	(4) SCOPE_P_2O	(5) LERNER_2O
IPS	0.026	0.135**	−0.024***	0.008	0.051***
	(0.036)	(0.061)	(0.008)	(0.009)	(0.015)
ICN	0.066*	−0.091	0.020	0.141***	0.031***
	(0.034)	(0.069)	(0.012)	(0.018)	(0.012)
CCG	0.200***	−0.022	0.017	−0.102	0.147***
	(0.036)	(0.038)	(0.037)	(0.074)	(0.009)
SEC/TA	1.249***	−1.362***			0.345***
	(0.172)	(0.186)			(0.044)
NIM	−1.009	−3.421**			2.175***
	(1.318)	(1.408)			(0.436)
LR	0.296	0.867**	0.067**	−0.149***	−0.298***
	(0.265)	(0.350)	(0.031)	(0.045)	(0.073)
LRsq	−0.548	−1.470***			0.353***
	(0.427)	(0.560)			(0.133)
LLP	0.003	−0.014			−0.014***
	(0.010)	(0.025)			(0.003)
Tier1	0.508*	−0.036			0.319***
	(0.299)	(0.498)			(0.088)
Tier1sq	−0.418	−0.466			−0.153
	(0.317)	(0.516)			(0.098)
SIZE			0.271***	−0.160***	
			(0.047)	(0.061)	
SIZEsq			−0.012***	0.019***	
			(0.003)	(0.004)	
LERNER			0.414***	0.045*	
			(0.030)	(0.027)	
Observations	11,423	11,423	17,954	17,954	11,423
R-squared	0.797	0.622	0.817	0.645	0.802
Bank FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports results of Eq. (1) when having as dependent variables ES_C_2O, ES_P_2O, $SCOPE\_C\_2O$, $SCOPE\_P\_2O$, and $LERNER\_2O$. We provide variable definitions in Appendix A, Table A.1. We cluster standard errors at bank level. The sample covers the period from 2013 to 2023. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table B.4
Economies of scale: Determinants across different organizational structures.

Variables	(1) ES_C	(2) ES_C	(3) ES_C	(4) ES_C	(5) ES_P	(6) ES_P	(7) ES_P	(8) ES_P
SEC/TA	1.565***	0.891***	0.694*	1.737***	−1.373***	−1.142***	−2.528***	−0.614
	(0.367)	(0.304)	(0.368)	(0.599)	(0.479)	(0.249)	(0.733)	(0.420)
NIM	−0.617	2.975	2.965*	−2.112	4.114	−4.651**	−17.118***	−4.635
	(2.169)	(2.651)	(1.679)	(2.291)	(3.611)	(2.105)	(2.980)	(3.111)
LR	0.559	0.428	−0.243	−0.279	−0.730	0.354	1.946**	0.651
	(0.621)	(0.588)	(0.573)	(0.291)	(1.007)	(0.454)	(0.983)	(0.579)
LRsq	−1.260*	−1.686	0.385	0.625*	0.141	−0.721	−2.013	−0.550
	(0.641)	(1.483)	(1.220)	(0.353)	(1.105)	(1.007)	(1.532)	(0.721)
LLP	1.393**	−0.983	−0.010***	−1.787	−3.326***	0.286	0.010***	−0.843
	(0.607)	(0.748)	(0.002)	(1.106)	(0.836)	(0.522)	(0.003)	(1.304)
Tier1	−1.643**	0.819	−0.558	0.385*	2.056	1.651**	−0.420	−0.071
	(0.711)	(0.977)	(0.486)	(0.217)	(1.369)	(0.695)	(1.197)	(0.409)
Tier1sq	0.995**	−2.879***	1.330**	−0.165	−1.487	0.184	0.288	−0.189
	(0.492)	(0.694)	(0.573)	(0.140)	(0.903)	(0.666)	(1.639)	(0.325)
Observations	1818	6983	1445	1137	1818	6983	1445	1137
R-squared	0.734	0.812	0.854	0.884	0.646	0.684	0.771	0.528
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Integration	Network	IPS	ICN	CCG	Network	IPS	ICN	CCG

This table reports the results of Eq. (2) when having as dependent variables ES_C_2O (Columns 1 to 4) and ES_P_2O (Columns 5 to 8). We run the analysis separately by organizational structure. The definitions of the variables are provided in Appendix A, Table A.1. We cluster standard errors at bank level. The sample covers the period from 2013 to 2023. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table B.5
Economies of scope: Determinants across different organizational structures.

Variables	(1) SCOPE_C	(2) SCOPE_C	(3) SCOPE_C	(4) SCOPE_C	(5) SCOPE_P	(6) SCOPE_P	(7) SCOPE_P	(8) SCOPE_P
SIZE	−0.122	0.159**	0.224	0.488***	−0.821***	−0.389***	−0.247	−0.039
	(0.191)	(0.075)	(0.137)	(0.119)	(0.254)	(0.094)	(0.212)	(0.150)
SIZEsq	0.028*	−0.003	−0.014*	−0.035***	0.076***	0.040***	0.014	0.003
	(0.015)	(0.005)	(0.008)	(0.007)	(0.019)	(0.006)	(0.012)	(0.010)
LR	−0.033	0.143**	0.098	0.010	−0.291***	0.067	−0.137	−0.217*
	(0.059)	(0.057)	(0.118)	(0.076)	(0.104)	(0.087)	(0.132)	(0.119)
LERNER	0.192***	0.457***	0.648***	0.182***	0.052	0.037	0.037	−0.105
	(0.065)	(0.039)	(0.080)	(0.056)	(0.068)	(0.034)	(0.084)	(0.073)
Observations	1958	12,366	1675	1537	1958	12,366	1675	1537
R-squared	0.871	0.825	0.908	0.802	0.730	0.627	0.787	0.696
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Integration	Network	IPS	ICN	CCG	Network	IPS	ICN	CCG

This table reports the results of Eq. (2) when having as dependent variables $SCOPE\_C\_2O$ (Columns 1 to 4) and $SCOPE\_P\_2O$ (Columns 5 to 8). We run the analysis separately by organizational structure. We provide variable definitions in Appendix A, Table A.1. We cluster standard errors at bank level. The sample covers the period from 2013 to 2023. *** p < 0.01; ** p < 0.05; * p < 0.1.

Table B.6
Lerner index: Determinants across different organizational structures.

Variables	(1) LERNER	(2) LERNER	(3) LERNER	(4) LERNER
SEC/TA	0.374***	0.122*	0.274**	0.914***
	(0.079)	(0.070)	(0.126)	(0.185)
NIM	1.969***	3.542***	7.057***	1.663
	(0.541)	(0.601)	(0.668)	(1.809)
LR	0.041	−0.093	−0.547***	−0.294**
	(0.166)	(0.126)	(0.163)	(0.128)
LRsq	−0.099	−0.341	0.316	0.448**
	(0.180)	(0.271)	(0.280)	(0.179)
LLP	0.366**	−0.045	−0.021***	−0.373
	(0.143)	(0.120)	(0.001)	(0.596)
Tier1	−0.007	0.004	−0.455**	0.268**
	(0.199)	(0.202)	(0.211)	(0.115)
Tier1sq	−0.009	−0.578***	0.760***	−0.120
	(0.127)	(0.144)	(0.280)	(0.084)
Observations	1818	6983	1445	1137
R-squared	0.812	0.855	0.828	0.670
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Integration	Network	IPS	ICN	CCG

This table reports results of Eq. (2) when having as dependent variable $LERNER\_2O$. We run the analysis separately by organizational structure. We provide variable definitions in Appendix A, Table A.1. We cluster standard errors at the bank level. The sample covers the period from 2013 to 2023. *** p < 0.01; ** p < 0.05; * p < 0.1.

Table B.7
Data balance before and after propensity score matching.

Economies of scale and lerner index							
Variable		Mean - IPS			Mean - ICN		
		Treated	Control	p-values	Treated	Control	p-values
SEC/TA	Unmatched	0.264	0.245	0.014	0.308	0.245	0.000
	Matched	0.264	0.257	0.504	0.308	0.239	0.000
NIM	Unmatched	0.031	0.033	0.004	0.034	0.033	0.000
	Matched	0.031	0.030	0.538	0.034	0.034	0.242
LR	Unmatched	0.339	0.116	0.000	0.373	0.116	0.000
	Matched	0.339	0.337	0.850	0.373	0.368	0.139
LRsq	Unmatched	0.124	0.020	0.000	0.148	0.020	0.000
	Matched	0.124	0.126	0.755	0.148	0.146	0.344

(continued on next page)

Table B.7 (*continued*).

Economies of scale and lerner index

Variable		Mean - IPS			Mean - ICN		
		Treated	Control	p-values	Treated	Control	p-values
LLP	Unmatched	0.031	0.012	0.000	0.074	0.012	0.000
	Matched	0.031	0.033	0.299	0.074	0.075	0.119
Tier1	Unmatched	0.198	0.168	0.000	0.187	0.168	0.000
	Matched	0.198	0.186	0.075	0.187	0.182	0.157
Tier1sq	Unmatched	0.043	0.034	0.001	0.040	0.034	0.000
	Matched	0.043	0.037	0.026	0.040	0.039	0.119

Economies of scope

Variable		Mean - IPS			Mean - ICN		
		Treated	Control	p-values	Treated	Control	p-values
SIZE	Unmatched	5.820	5.914	0.284	6.148	5.914	0.000
	Matched	5.820	5.877	0.625	6.148	6.202	0.114
SIZEsq	Unmatched	35.972	37.419	0.230	39.115	37.419	0.002
	Matched	35.972	36.923	0.539	39.115	40.112	0.087
LR	Unmatched	0.356	0.157	0.000	0.395	0.157	0.000
	Matched	0.356	0.337	0.045	0.395	0.403	0.110
LERNER	Unmatched	0.362	0.397	0.004	0.341	0.397	0.000
	Matched	0.362	0.360	0.913	0.341	0.335	0.212

This table reports covariate balance before (unmatched) and after (matched) the propensity score matching procedure—on the left for the IPS specification and on the right for the ICN specification. It shows average values of the covariates before and after matching, along with t-tests for differences in means and the corresponding p-values.

Table B.8

Change of organizational structure - PSM (IPS).

Variables	(1) ES_C	(2) ES_P	(3) SCOPE_C	(4) SCOPE_P	(5) LERNER
Network to IPS	0.038	−0.076	0.001	−0.079**	0.125***
	(0.030)	(0.115)	(0.022)	(0.038)	(0.036)
SEC/TA	0.194	−1.554*			0.213
	(0.132)	(0.820)			(0.211)
NIM	2.404*	−7.314**			6.333***
	(1.268)	(3.297)			(1.741)
LR	0.513*	−0.154	0.146	0.203	−0.469
	(0.306)	(1.275)	(0.105)	(0.133)	(0.320)
LRsq	−0.781*	−0.025			0.642
	(0.453)	(1.982)			(0.603)
LLP	−0.680	0.316			−0.205
	(0.472)	(0.676)			(0.278)
Tier1	0.068	−3.267			−0.278
	(0.524)	(2.319)			(0.400)
Tier1sq	−0.077	3.297			−0.204
	(0.543)	(2.500)			(0.412)
SIZE			−0.387***	−0.872***	
			(0.120)	(0.260)	
SIZEsq			0.013	0.063***	
			(0.008)	(0.018)	
LERNER			0.604***	0.282***	
			(0.067)	(0.097)	
Observations	8778	8778	15,009	15,009	8778
R-squared	0.895	0.755	0.878	0.778	0.813
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports results of Eq. (3) when having as dependent variables ES_C, ES_P, $SCOPE\_C$, $SCOPE\_P$, and $LERNER$ after having applied PSM weights to the sample, having as variable of interest the shift of organizational structure from network to IPS ($Network\_to\_IPS$). We provide variable definitions in Appendix A, Table A.1. We cluster standard errors at bank level. The sample covers the period from 2013 to 2023. *** p < 0.01; ** p < 0.05; * p < 0.1.

Table B.9
Change of organizational structure - PSM (ICN).

Variables	(1) ES_C	(2) ES_P	(3) SCOPE_C	(4) SCOPE_P	(5) LERNER
Network to ICN	−0.004	−0.397***	0.084**	−0.060	0.143***
	(0.034)	(0.102)	(0.034)	(0.052)	(0.042)
SEC/TA	−0.042	−0.475**			0.202*
	(0.083)	(0.241)			(0.113)
NIM	0.584	−4.741***			3.580**
	(0.616)	(1.744)			(1.769)
LR	0.358**	0.105	0.063	0.177	−0.437*
	(0.157)	(0.691)	(0.143)	(0.171)	(0.230)
LRsq	−0.117	−1.429*			0.925**
	(0.191)	(0.768)			(0.361)
LLP	−0.027	−0.898			0.180
	(0.205)	(1.538)			(0.326)
Tier1	−0.035	−3.390***			0.001
	(0.168)	(0.543)			(0.224)
Tier1sq	−0.185*	3.948***			−0.195
	(0.100)	(0.705)			(0.182)
SIZE			−0.209	−0.764***	
			(0.144)	(0.293)	
SIZEsq			0.006	0.059***	
			(0.009)	(0.019)	
LERNER			0.802***	0.401***	
			(0.060)	(0.107)	
Observations	10,890	10,890	16,990	16,990	10,890
R-squared	0.877	0.650	0.840	0.750	0.794
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports results of Eq. (3) when having as dependent variables ES_C, ES_P, $SCOPE\_C$, $SCOPE\_P$, and $LERNER$ after having applied PSM weights to the sample, having as variable of interest the shift of organizational structure from network to ICN ($Network\_to\_ICN$). The definitions of the variables are provided in Appendix A, Table A.1. We cluster standard errors at bank level. The sample covers the period from 2013 to 2023. *** p < 0.01; ** p < 0.05; * p < 0.1.

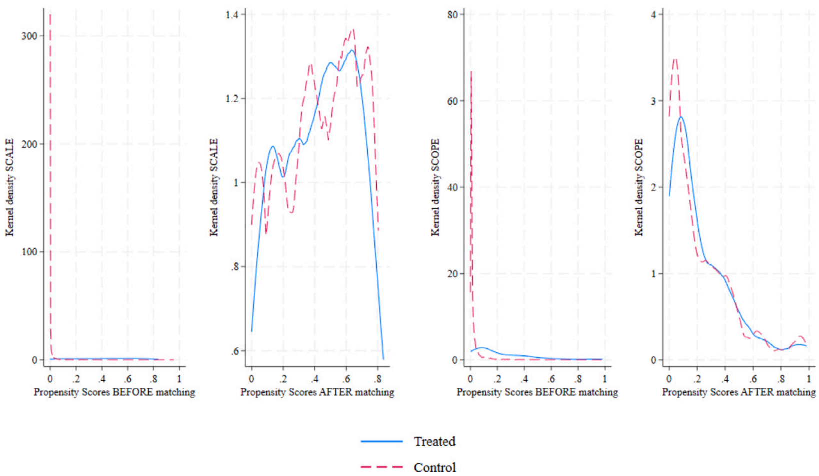

Fig. B.1. Kernel density map (IPS).
This figure presents the Kernel density distributions of propensity scores before and after the propensity score matching procedure, where banks that transitioned to an IPS structure constitute the treated group.

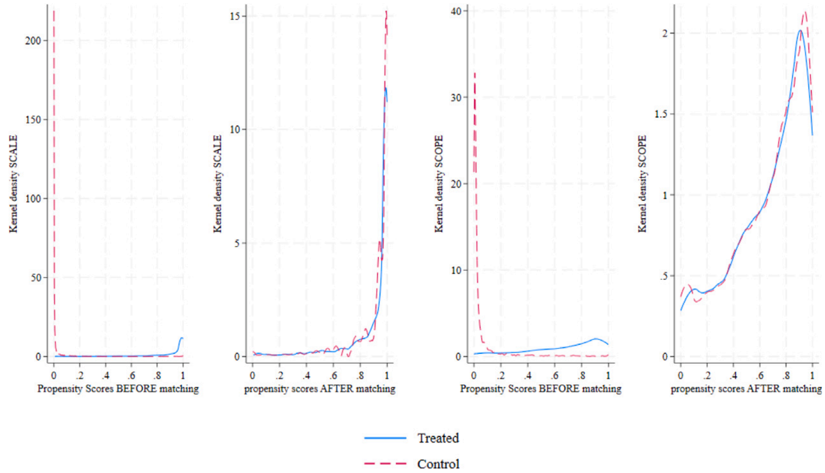

Fig. B.2. Kernel density map (ICN).
This figure presents the Kernel density distributions of propensity scores before and after the propensity score matching procedure, where banks that transitioned to an ICN structure constitute the treated group.

Data availability

The authors do not have permission to share data.

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