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Employment and branch network effects on the efficiency of Polish cooperative banks

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ABSTRACT

Objective: The article aims to evaluate the influence of the employment structure and branch network on the capability of large cooperative banks in Poland (possessing assets exceeding PLN 1 billion) to sustain an optimal equilibrium between operational efficiency and liquidity. This article also seeks to identify the causes for the declining efficiency of cooperative banks in Poland in recent years and to evaluate the possibility of implementing solutions to enhance this efficiency.

Research Design & Methods: We used static panel models with data suitable for unit and time series analysis. The sample consisted of large cooperative banks operating in Poland (assets over 1 billion PLN). Statistical analysis involved diagnostic tests, collinearity analysis via VIF, and winsorisation at the first percentile to reduce outlier impact. We used Driscoll-Kraay standard errors to estimate the panel model.

Findings: We established that a high number of employees in a cooperative bank can negatively affect the return on assets (ROA) and lead to an increase in the cost-to-income (CtI) ratio. Similarly, an extensive branch network can lead to a decrease in the efficiency of assets used (ROA) and an increase in the CtI ratio. On the other hand, a higher bank's total assets-to-employee ratio is associated with a lower CtI ratio, suggesting improved cost efficiency. Moreover, banks with higher assets per branch achieve higher profitability (higher ROA) and better cost efficiency (lower CtI).

Implications & Recommendations: The results of our study imply that optimising the staffing structure and branch network is crucial to achieve a balance between profitability and cost efficiency in cooperative banks. The solution to the problem could be employment restructuring, the implementation of process automation technologies, precise staff planning, and investment in the development of employee competence. We also suggest optimising costs related to the branch network, implementing modern technologies, and performing operational restructuring. Cooperative banks should strive to increase the efficiency of asset allocation.

Contribution & Value Added: The article comprehensively analyses of impact of the employment structure and the branch network on the efficiency and liquidity of large cooperative banks, which complements previous research focusing mainly on financial aspects. We provided empirical evidence of the complex nature of the relationship between organisational factors and the financial performance of cooperative banks in Poland.

Article type: research article

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INTRODUCTION

Cooperative banks play an important role in financial stability and local economic development. Cooperative banks are less involved in systemic risk mechanisms, contributing to financial stability (Pacelli *et al*., 2019). Studies indicate that cooperative banks are more stable than commercial banks due to, among others, a stable customer base. However, it affects their relatively lower profitability and capi-

talisation (Hesse & Čihák, 2007). Cooperative banks contribute to local community income, employment growth, and the development of local businesses (Coccorese & Shaffer, 2018). Furthermore, cooperative banks provide tailored financial services to SMEs, which often face significant difficulties in accessing credit offered by commercial banks (Nisha & Rani, 2024). Cooperative banks are especially crucial in crisis situations, where their influence on local communities becomes significantly impactful (Ramcharan *et al*., 2016). We observed this phenomenon also during the recent macroeconomic upheavals associated with the COVID-19 pandemic and the war in Ukraine, among other events.

The development of cooperative banks also has an important impact on the financial inclusion of society. Through their activities in smaller towns and rural areas, they are taking care of access to a wide range of financial products and services from various actors in the financial, non-financial, and governmental sectors. Moreover, as a result of the increasing digitalisation in finance, cooperative banks are expanding their activities in urban areas and are increasingly courting young customers for financial services. However, the infrastructure of cooperative banks based on relatively high staffing levels and numerous bank branches, located especially in smaller towns and cities, can significantly affect the efficiency of cooperative banks' operations. Therefore, there has been a strong trend in recent years toward a significant increase in the knowledge of cooperative banks' employees, as indicated by the fact that they have placed greater emphasis on educating their staff (Piasecki, 2024).

Previous studies on cooperative bank efficiency and liquidity have mainly focused on financial factors, including balance sheet composition, lending policy, or return on equity. However, there is a lack of comprehensive studies on the impact of the staffing structure and the number and distribution of branches on the ability of cooperative banks to maintain an optimal balance between operational efficiency and liquidity. In particular, few studies compare these relationships in large cooperative banks (with assets greater than PLN 1 billion), which operate on a larger scale and may exhibit different resource management mechanisms compared to smaller institutions. This study aims to fill this gap by assessing the impact of organisational factors on the financial stability and competitiveness of large cooperative banks.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

In recent years, the significant increase in costs (*e.g.*, related to staff remuneration levels and maintaining the branch network) poses a major challenge to the operation of cooperative banks in terms of maintaining high levels of efficiency and liquidity. Research findings indicate that compared to commercial banks, cooperative banks, display a more stable workforce and an older workforce (Bossler & Schild, 2016). Furthermore, it has been proven that larger cooperative banks, compared to smaller banks, have lower systemic and business risks, better asset quality, are more orientated towards financing the local real economy and towards the satisfaction of their customers (borrowers and depositors) (Venanzi & Matteucci, 2021). However, the high level of staffing and the number of branches may affect their profitability, efficiency, and liquidity. Therefore, the article sets out a research hypothesis:

H1: Optimising the branch structure and employment in cooperative banks positively affects their profitability, cost efficiency, and liquidity, contributing to their resilience to crises.

We aimed to identify the reasons for the low and deteriorating efficiency of cooperative banks in Poland in recent years and to assess the possibility of applying solutions and instruments that allow cooperative banks to achieve improvement in efficiency. In the literature, scholars have conducted analyses of the development of Polish cooperative banks most often in the area of threats to their efficiency. The literature provides research mainly in the area of macroeconomic factors, the current associative model, the structure of revenues and costs, the role of shareholders in the functioning of cooperative banks, changes in postcrisis regulatory burdens, the extent of centralisation and commonality of processes, and digital development. The results indicate that in light of the current macroeconomic and regulatory environment, it is important for cooperative banks to take advantage of economies of scale, with the need to preserve the social and regional aspects of the business and opportunities in the technological area to build a new relational approach based on digital proximity (Kil *et al*., 2020).

Cooperative banks continue to play a systemic role in key European countries such as Austria, Finland, France, Germany, the Netherlands, and Italy (Lang *et al.*, 2016; Poli, 2019; Migliorelli & Lamarque 2022). The high-interest-rate situation in Poland allows banks to make great profits. However, the strong growth of net profits in cooperative banks is due to their traditionally greater reliance on interest income generation (Groeneveld, 2023). Therefore, it is worth paying particular attention to the cost side in view of possible future declines in interest income.

RESEARCH METHODOLOGY

To verify the research hypothesis set out in the introduction, we used data on 19 cooperative banks with total assets exceeding PLN 1 billion at the end of 2024 (Table 1). The research period covered the years 2020-2024 (quarterly data). The analysis used both aggregated data at the national level, derived from the Central Statistical Office database (GUS, 2025), and individual bank data, obtained from the BPS Association Protection System (System Ochrony Zrzeszenia BPS).

Table 1. List of banks with a balance sheet total above PLN 1 billion at the end of 2024

Bank name
Bank Spółdzielczy w Białej Podlaskiej
Bank Spółdzielczy w Białej Rawskiej
Bank Spółdzielczy w Bieczu
Bank Spółdzielczy w Jarosławiu
Bank Spółdzielczy w Kielcach
Bank Spółdzielczy w Limanowej
Bank Spółdzielczy w Oleśnicy
Bank Spółdzielczy w Ostrowi Mazowieckiej
Bank Spółdzielczy w Piasecznie
Bank Spółdzielczy w Płońsku
Bank Spółdzielczy w Skierniewicach
Gospodarczy Bank Spółdzielczy w Barlinku
Małopolski Bank Spółdzielczy
Mikołowski Bank Spółdzielczy w Mikołowie
Nadsański Bank Spółdzielczy
Polski Bank Spółdzielczy w Wyszkowie
Powiatowy Bank Spółdzielczy w Sokołowie Podlaskim
Powiślański Bank Spółdzielczy w Kwidzynie
Warszawski Bank Spółdzielczy

Source: own study based on the SOZ BPS data.

The data collected were panel data, which allowed for an analysis that varied between units and time. As Dańska-Borsiak (2011) notes, the use of panel data contributes to increasing the number of degrees of freedom, reducing the collinearity problem, and facilitating the identification of economic models and the choice between competing hypotheses, while eliminating or reducing the burden on estimators.

To verify the H1, we decided to use dynamic panel models. However, despite a number of attempts, using both the first-difference estimator (Arellano & Bond, 1991) and the system estimator (Blundell & Bond, 1998), it was not possible to build an adequate model. Model significance problems, demonstrated by Hansen's test, and an excessive number of instruments relative to the number of observed units, even when using the instrument reduction (collapse) option (Roodman, 2009; Dańska-Borsiak, 2011), prevented a correct interpretation of the results obtained. Consequently, we decided to use static panel models. As part of the statistical analysis, we conducted the following diagnostic tests:

- Breusch-Pagan – to assess the functional validity of static panel models;
- Hausman – to choose between a fixed effects (FE) model and a random effects (RE) model;
- Wooldridge (Drukker, 2003; Wooldridge, 2003) – for the diagnosis of first-order autocorrelation;

– Pesaran (Pesaran, 2003; 2004) – for analysis of the spatial dependence of the random component between panels;
– modified Wald test – used, where possible, to assess heteroskedasticity.

In addition to the aforementioned tests, we also performed a collinearity analysis using the Variance Inflation Factor (VIF). Moreover, we applied winsorisation at the first percentile level to minimise the outliers' impact. Based on the statistical test results obtained, we decided to estimate panel models using Driscoll-Kraay standard errors (Driscoll & Kraay, 1998; Hoechle, 2007; Rzońca *et al*., 2013; Sztaudynger, 2018).

Table 2 shows the characteristics of the variables used, while the Appendix provides the descriptive statistics of the panel variables. We performed calculations using Gretl software.

Table 2. Characteristics of the variables used in the panel study

Dependent Variables – ZM.ZAL	
ROA	Return on assets (net)
CtI	Cost-to-income ratio
LCR	Liquidity coverage ratio (ratio of liquid assets to net outflows)
Experimental Variables – ZM.EKSP	
LN_BRANCHES	Natural logarithm of the number of bank branches (excluding the bank headquarters)
LN_EMPL	Natural logarithm of bank employment
TA_EMPL	Ratio of bank assets (in million PLN) to the number of bank employees
TA_BRANCHES	Ratio of bank assets (in million PLN) to the number of bank branches
Bank-Level Control Variables – ZM.BANK	
LN_TA	Natural logarithm of total assets
LOAN_TA	Loan-to-asset ratio
NPL	Ratio of non-performing loans (NPL) to total loans
TCR	Total capital ratio
Macroeconomic Control Variables – ZM.EKON	
GDP	Gross Domestic Product growth (quarter-on-quarter)
CPI	Inflation (quarter-on-quarter)
BC_R	NBP (National Bank of Poland) reference rate (as at the end of the given period)

Source: own study based on the SOZ BPS data.

Depending on the result of the Hausman test, the final functional form of the model adopted in the subsequent analysis was as follows:

– Fixed effects model (FE):

$$ZM.ZAL_{it} = \alpha_i + \beta_1 ZM.EKSP_{it} + \beta 2 ZM.BANK_{it} + \beta 3 ZM.EKON_{it} + \varepsilon_{it} \quad (1)$$

in which:

i - period number;
t - object number;
$\mathrm{ZM.ZAL}$ - dependent variables (ROA, CtI, LCR);
$\mathrm{ZM.EKSP}$ - experimental variables (LN_BRANCHES or LN_EMPL);
$\mathrm{ZM.BANK}$ - bank-level control variables (LN_TA, LOAN_TA, NPL, TCR);
$\mathrm{ZM.EKON}$ - control variables at the macroeconomic level (GDP, CPI, BC_R)
ε_{it} - random component.

– Random effects model (RE):

$$ZM.ZAL_{it} = \alpha_i + \beta_1 ZM.EKSP_{it} + \beta 2 ZM.BANK_{it} + \beta 3 ZM.EKON_{it} + v_{it} \quad (1)$$

in which:

i - period number;
t - object number;
$\mathrm{ZM.ZAL}$ - dependent variables (ROA, CtI, LCR);

$ZM.EKSP$ - experimental variables (LN_BRANCHES or LN_EMPL);
$ZM.BANK$ - bank-level control variables (LN_TA, LOAN_TA, NPL, TCR)
$ZM.EKON$ - control variables at the macroeconomic level (GDP, CPI, BC_R)
v_{it} - random error component consisting of an individual effect (αi) and pure random error (εit).

RESULTS AND DISCUSSION

Table 3 presents the results of the panel models on the impact of the number of employees in cooperative banks.

Analysis of the results indicates that a large number of employees in a cooperative bank can generate significant consequences in terms of profitability and cost efficiency. The observed negative impact of the number of employees on ROA may suggest that high staffing levels may translate into a reduction in the efficiency of assets used by the cooperative bank, which, in view of the relatively high interest income in cooperative banks, may have important implications for the sustainability of these institutions. This may be due to the bank generating high operating costs that are not adequately offset by income. The causes of this phenomenon can include overstaffing, inefficient personnel management, insufficient automation of operational processes, and organisational structures that prevent full exploitation of the potential of staff. Simultaneously, there was a positive impact of the number of employees in CtI, which may indicate that costs are increasing faster than revenues generated. This may be the result of high salary and benefit costs, suboptimal distribution of responsibilities, and difficulties in optimising operational processes in an environment of increased employment.

These results imply that cooperative banks with a larger number of employees may experience profitability and cost efficiency problems, which may be due to a mismatch between the staffing structure and the actual bank needs. A solution to this problem could be employment restructuring, including the implementation of technologies that automate administrative and operational processes, precise workforce planning based on current workload and projected revenues, and investment in staff competence development to increase productivity.

In conclusion, the results of the study indicate that the high number of employees in cooperative banks can lead to a decrease in the profitability of assets and an increase in the cost/income ratio, which can imply the need to optimise employment and implement effective cost control mechanisms to improve the long-term performance of the bank.

The analysis of the results shows that the number of cooperative bank branches can be a complex phenomenon. Its effects are reflected in the results for the profitability indicators (ROA) and cost efficiency (CtI) (Table 4).

The observed negative impact of the number of branches on ROA may suggest that an expanded branch network may lead to a decrease in the efficiency of the assets used by the bank. We can assume that the expansion of the branch network structure may be associated with an increase in fixed costs, such as rental fees, salaries, and administrative costs, which are not compensated by an adequate increase in revenue. Consequently, cooperative banks may have to implement stricter cost management strategies, which could allow them to limit the negative impact of the high number of branches on profitability.

The positive impact of the number of branches on CtI confirms the previous conclusions of the ROA result. We may associate a large number of branches with a higher cost-to-income ratio. An increase in the CtI ratio may imply the need to optimise internal processes, including the implementation of modern technology and operational restructuring, to minimise the cost inefficiencies associated with running too many branches.

These results may imply that cost optimisation, the implementation of modern technologies and appropriate branch management may be key elements to achieve a balance between expansion and maintaining high operational efficiency.

Table 3. Panel model estimation results for the experimental variable: Number of bank employees

Model number	1	2	3
Estimation method	**RE**	**FE**	**RE**
Variable	**ROA**	**CtI**	**LCR**
LN_EMPL	-0.005* (0.003)	0.393*** (0.146)	1.313 (1.200)
LN_TA	0.006 (0.004)	-0.034 (0.057)	-1.258*** (0.305)
LOAN_TA	0.013*** (0.004)	-0.108 (0.109)	-9.565*** (1.006)
NPL	-0.010 (0.019)	-0.150* (0.088)	-3.663* (2.105)
TCR	0.060*** (0.022)	-0.137 (0.298)	3.884* (2.034)
GDP	0.013 (0.020)	0.061 (0.154)	1.028** (0.401)
CPI	-0.096 (0.063)	-0.595 (1.033)	-14.717*** (4.147)
BC_R	0.240*** (0.036)	-4.433*** (0.484)	-7.028*** (1.794)
Const.	-0.117 (0.074)	-0.500 (1.196)	27.709*** (5.752)
Breusch-Pagan Test	0.0000	0.0000	0.0000
Hausman Test	0.3281	0.0038	0.6474
Wooldridge Test	0.0002	0.0001	0.1042
Wald Test	–	0.0000	–
Pesaran Test	0.0000	0.0000	0.0000
VIF (max)	2.2470	2.2470	2.2470

Note: Estimation Method: FE – Fixed Effects Model, RE – Random Effects Model. Number of Observations: 380. Number of Banks: 19. Robust Standard Errors: Driscoll-Kraay standard errors reported in parentheses. P-values are given for statistical tests. *** significance at 1% level, ** significance at 5% level, *significance at 10%.
Source: own study in Gretl.

Table 4. Panel model estimation results for the experimental variable: number of bank branches

Model number	4	5	6
Estimation method	**FE**	**FE**	**RE**
Variable	**ROA**	**CtI**	**LCR**
LN_BRANCHES	-0.015*** (0.003)	0.170*** (0.027)	-0.362 (0.352)
LN_TA	0.009* (0.005)	-0.061 (0.06)	-0.824*** (0.303)
LOAN_TA	0.014 (0.009)	-0.048 (0.123)	-8.508*** (1.037)
NPL	0.002 (0.010)	-0.110 (0.117)	-3.283* (1.964)
TCR	0.051** (0.026)	-0.027 (0.297)	3.469* (1.991)
GDP	0.011 (0.019)	0.016 (0.150)	0.660* (0.377)
CPI	-0.096 (0.061)	-0.776 (1.019)	-15.235*** (4.293)
BC_R	0.219*** (0.035)	-4.335*** (0.424)	-8.256*** (1.901)
Const.	-0.165	1.492	25.854***

Model number	4	5	6
Estimation method	FE	FE	RE
Variable	ROA	CtI	LCR
	(0.113)	(1.208)	(6.058)
Breusch-Pagan Test	0.0000	0.0000	0.0000
Hausman Test	0.0088	0.0250	0.1376
Wooldridge Test	0.0002	0.0001	0.1316
Wald Test	0.0000	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000
VIF (max)	2.0840	2.0840	2.0840

Note: Estimation Method: FE – Fixed Effects Model, RE – Random Effects Model. Number of Observations: 380. Number of Banks: 19. Robust Standard Errors: Driscoll-Kraay standard errors reported in parentheses. P values are given for statistical tests. *** significance at 1% level, ** significance at 5% level, *significance at 10%.
Source: own study in Gretl.

The results of the study indicate that the ratio of total assets of a bank to the number of employees shows a significant and negative effect on the dependent variable CtI (Table 5). This may imply that banks with a high ratio of total bank balance sheet to employees may have lower costs in relation to revenue generated. Such an effect may suggest that a higher level of assets per employee may contribute to improving the bank's cost efficiency. Perhaps this effect is due to economies of scale, *i.e.*, an increase in total assets need not be proportionately correlated with an increase in headcount, allowing

Table 5. Results of the panel model estimation for the experimental variable: Ratio of total assets to bank employees

Model number	7	8	9
Estimation method	RE	FE	RE
Variable	ROA	CtI	LCR
TA_EMPL	0.000 (0.000)	-0.016** (0.007)	-0.094 (0.124)
LN_TA	0.004 (0.004)	0.186* (0.111)	-0.114 (1.271)
LOAN_TA	0.010** (0.004)	0.041 (0.136)	-9.141*** (1.109)
NPL	-0.011 (0.019)	-0.052 (0.120)	-3.341* (1.940)
TCR	0.062*** (0.022)	-0.122 (0.281)	3.963** (1.931)
GDP	0.014 (0.020)	-0.024 (0.161)	0.734* (0.418)
CPI	-0.093 (0.063)	-0.706 (0.998)	-14.989*** (4.333)
BC_R	0.242*** (0.036)	-4.622*** (0.422)	-7.67*** (1.765)
Const.	-0.086 (0.082)	-3.057 (2.301)	10.95 (25.213)
Breusch-Pagan Test	0.0000	0.0000	0.0000
Hausman Test	0.7860	0.0416	0.5990
Wooldridge Test	0.000	0.0001	0.1066
Wald Test	-	0.0000	-
Pesaran Test	0.000	0.0000	0.0000
VIF (max)	2.2780	2.2780	2.2780

Note: Observations: 380. Number of Banks: 19. Robust Standard Errors: Driscoll-Kraay standard errors reported in parentheses. P-values are given for statistical tests. *** significance at 1% level, ** significance at 5% level, *significance at 10%.
Source: own study in Gretl.

for more efficient cost management. This result implies that human resource management and appropriate asset allocation may be the key to improving the cost efficiency of a cooperative bank.

The results indicate that the ratio of a bank's total assets to the number of branches is an important indicator affecting profitability and cost efficiency (Table 6). The results obtained indicate that a higher value of assets per branch may be associated with a significant increase in ROA, which may suggest a better use of resources by branches and higher profitability. At the same time, we can observe a negative effect of the ratio in question on the CtI ratio. This may imply that banks with higher assets per branch have lower costs in relation to the income generated. In general, these results suggest that optimising asset allocation in the context of the branch structure may contribute to improving profitability and cost efficiency.

Table 6. Results of panel model estimation for the experimental variable: ratio of total assets to number of bank branches

Model number	**10**	**11**	**12**
Estimation method	**FE**	**FE**	**RE**
Variable	**ROA**	**CtI**	**LCR**
TA_BRANCHES	0.000*** (0.000)	-0.002*** (0.000)	0.007*** (0.002)
LN_TA	-0.008 (0.005)	0.122** (0.049)	-1.401*** (0.341)
LOAN_TA	0.009 (0.009)	0.019 (0.122)	-8.52*** (1.161)
NPL	0.005 (0.011)	-0.134 (0.118)	-3.097 (2.006)
TCR	0.052** (0.025)	-0.051 (0.286)	3.337* (2.011)
GDP	0.014 (0.020)	-0.021 (0.156)	0.735** (0.362)
CPI	-0.091 (0.063)	-0.823 (1.001)	-14.99*** (4.201)
BC_R	0.231*** (0.036)	-4.485*** (0.408)	-8.200*** (1.545)
Const.	0.153 (0.118)	-1.726 (1.057)	36.374*** (7.453)
Breusch-Pagan Test	0.0000	0.0000	0.0000
Hausman Test	0.0109	0.0346	0.1151
Wooldridge Test	0.0002	0.0001	0.1338
Wald Test	0.0000	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000
VIF (maks.)	2.101	2.101	2.101

Note: Estimation Method: FE – Fixed Effects Model, RE – Random Effects Model. Number of Observations: 380. Number of Banks: 19. Robust Standard Errors: Standard errors are reported in parentheses. P-values are given for statistical tests. *** significance at the 1% level, ** significance at the 5% level, *significance at 10%.
Source: own study in Gretl.

Researchers draw similar conclusions from other studies available in the literature. A study by Juszczyk *et al*. (2015) shows that the number of employees in cooperative banks negatively impacts return on equity (ROE) and return on assets (ROA), and furthermore contributes to a reduction in net profit and financial margins, indicating that an increase in staffing levels can increase banks' operating costs, thereby reducing their efficiency. Barra *et al*. (2025) also argue that an increase in the network of bank branches contributes significantly to an increase in maintenance costs, which is associated with a decrease in the efficiency of resource utilisation and, consequently, can also negatively affect the bank's cost efficiency. Bernini and Brighi (2017) contribute by adding that the expansion of branch networks

generates significant investment costs in human and physical capital, which also negatively affects bank efficiency, although banks themselves see their branches as an effective channel for generating revenue.

To assess the stability of the results obtained, we conducted an additional robustness check of the panel models. The analysis procedure consisted of replacing highly correlated explanatory variables, implementing new control variables and estimating the models using a different method, in this case, the least squares method. The analysis showed that the above modifications did not qualitatively affect the results of the study, and the interpretation of the results so far remained unchanged (see Appendix, Table A4-A9).

CONCLUSIONS

Summarising the results of the study, we can conclude that both the number of branches and the level of employment in cooperative banks can influence key indicators of profitability and cost efficiency.

The bank's branch network shows a significant, albeit different, impact on the individual dependent variables. The number of branches has a negative impact on ROA, suggesting a reduction in asset utilisation efficiency, probably due to an increase in fixed costs (*e.g.*, rent, administration, employment) with inadequate levels of income. However, this impact can simultaneously increase the CtI ratio, implying that costs will increase faster than revenues.

The analysis of the impact of the number of employees confirms that an increase in staff can have a negative impact on ROA and CtI. That is, an increase in headcount generates higher costs that are not adequately compensated for by an increase in revenue, resulting in a reduction in the bank's operational efficiency. This implies that an increase in employment should be reflected in a parallel increase in revenue.

Additional research on the bank's total assets-to-employee ratio indicates that higher assets per employee are associated with lower CtI. This result may suggest that the efficient use of human resources, as measured by asset value per employee, may contribute to improving a bank's cost efficiency.

Further analysis of the ratio of total assets to number of branches shows that banks with higher assets per branch achieve higher profitability (higher ROA) and better cost efficiency (lower CtI).

In summary, the results of the study may indicate that the optimisation of both the branch structure and the staff is key to achieving a balance between profitability and cost efficiency. Cooperative banks should aim to increase the efficiency of their asset allocation to reduce costs, while at the same time maintaining an appropriate funding structure that will allow them to remain resilient to potential liquidity crises.

The results obtained may influence supervisory and regulatory decisions concerning the cooperative banking sector in Poland, as well as the management boards of cooperative banks, for decision-making purposes, as to the day-to-day operations. The study focused on large cooperative banks (with assets above PLN 1 billion), which may limit the generalisability of the results to smaller institutions in this sector. Future research could focus on comparing the impact of staffing structure and branch network on the efficiency of small and large cooperative banks and examining the impact of digitalisation and technological developments on optimising staffing structure and branch network.

REFERENCES

Arellano, M., & Bond. S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies*, *58*(2), 277-297. https://doi.org/10.2307/2297968

Barra, C., Papaccio, A. & Ruggiero, N. (2025). Management Cost Efficiency and Technology Gap: Cooperative vs. Non-Cooperative Credit Banks. Journal of the Knowledge Economy. https://doi.org/10.1007/s13132-025-02612-0

Bernini, C., & Brighi, P. (2017). Bank branches expansion, efficiency and local economic growth. *Regional Studies*, *52*(10), 1332-1345. https://doi.org/10.1080/00343404.2017.1380304

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*. https://doi.org/10.1016/S0304-4076(98)00009-8

Bossler, M., & Schild, C-J. (2016).The employment structure of cooperative banks – a test of institutional hypotheses. *European Economics: Labor & Social Conditions eJournal*, *87*(1). https://doi.org/10.1111/apce.12084

Coccorese, P., & Shaffer, S. (2018). Cooperative Banks and Local Economic Growth. *CAMA Working Paper*, 11/2018. Available at SSRN: https://ssrn.com/abstract=3125909 or https://doi.org/10.2139/ssrn.3125909

Dańska-Borsiak, B. (2011). *Dynamiczne modele panelowe w badaniach ekonomicznych*. Łódź, Wydawnictwo Uniwersytetu Łódzkiego.

Driscoll, J.C., & Kraay, A. (1998). Consistent Covariance Matrix Estimation With Spatially Dependent Panel Data. *The Review of Economics and Statistics, MIT Press*, *80*(4). https://doi.org/10.1162/003465398557825

Drukker, D.M. (2003). Testing for serial correlation in linear panel-data models. *Stata Journal*, *3*(2). https://doi.org/10.1177/1536867X0300300206

Kil, K., Folwarski, M. & Walitza, A. (2020). *Optymalne ścieżki dojścia do zbudowania efektywności banków spółdzielczych*. Warszawa, WIB.

Groeneveld, H. (2023). European Co-operative Banks in 2022: A Concise Assessment (October 30, 2023). Available at SSRN. https://doi.org/10.2139/ssrn.4641319

GUS (2025). Retrieved from https://stat.gov.pl/wskazniki-makroekonomiczne/ on March 12, 2025.

Hesse, H., & Cihak, M. (2007). Cooperative Banks and Financial Stability. *IMF Working Paper*, *07*(02). Retrieved from SSRN: https://ssrn.com/abstract=956767 on March 12, 2025.

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal*, *7*. https://doi.org/10.1177/1536867X0700700301

Juszczyk, S., Balina, R., & Kowalski, O. (2015). Efficiency Determinants of Cooperative Banks in Poland in 2005-2012. *Krakow Review of Economics and Management Zeszyty Naukowe Uniwersytetu Ekonomicznego W Krakowie*, *10*(934), 35-50. https://doi.org/10.15678/ZNUEK.2014.0934.1003

Lang, F., Signore, S., & Gvetadze, S. (2016). The role of cooperative banks and smaller institutions for the financing of SMEs and small midcaps in Europe. *EIF Working Paper, 2016*(36).

Migliorelli, M., & Lamarque, E. (2022). *Contemporary Trends in European Cooperative Banking*. Palgrave Macmillan. (No. hal-03665298).

Nisha, & Rani, R. (2024). Co-operative Banks – A Helping Hands for Small and Medium Entrepreneurs in Saharanpur District. *Integrated Journal for Research in Arts and Humanities*, *4*(2). https://doi.org/10.55544/ijrah.4.2.3

Pacelli, V., Pampurini, F., & Sylos Labini, S. (2019). The peculiarity of the cooperative and mutual model: evidence from the European banking sector. *Journal of Financial Management, Markets and Institutions*, *07*(01). https://doi.org/10.1142/S2282717X19400012

Pesaran, M.H. (2003). A Simple Panel Unit Root Test in the Presence of Cross Section Dependence. *University of Cambridge, Cambridge Working Papers in Economics*, 0346. https://doi.org/10.2139/ssrn.457280

Pesaran, M.H. (2004). General Diagnostic Tests for Cross Section Dependence in Panels. *CESIFO Working Papers Series*, 1229, *IZA Discusion Paper* 1240. https://doi.org//10.2139/ssrn.572504

Piasecki, P. (2024). The influence of training, membership and employee age on turnover intention in co-operative financial institutions. *International Journal of Contemporary Management*, *6*(1), 109-124. https://doi.org/10.2478/ijcm-2024-0005

Poli, F. (2019). *Co-operative banking networks in Europe*. Cham: Palgrave Macmillan.

Ramcharan, R., Verani S., & Skander J. (2016). From Wall Street to Main Street: The Impact of the Financial Crisis on Consumer Credit Supply. *The Journal of Finance*, *71*(3), 1323-1356. https://doi.org/10.1111/jofi.12209

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, 9. https://doi.org/10.1177/1536867X0900900106

Rzońca, A., Ciżkowicz, P., & Albinowski, M. (2013). Links between the trust in the ECB and its interest rate policy. Warsaw, Economic Institute, *NBP Working Paper*, *158*. Retrieved from https://static.nbp.pl/publikacje/materialy-i-studia/158_en.pdf on March 12, 2025.

Sztaudynger, M. (2018). Czynniki makroekonomiczne a spłacalność kredytów konsumpcyjnych. *Gospodarka Narodowa*, *4*(296). https://doi.org/10.33119/GN/102228

Venanzi, D., & Matteucci, P. (2021). The largest cooperative banks in Continental Europe: a sustainable model of banking. *International Journal of Sustainable Development & World Ecology*, *29*(1), 84-97. https://doi.org/10.1080/13504509.2021.1919784

Wooldridge, J.M. (2003). *Econometric Analysis of Cross Section and Panel Data.* Cambridge, MA: MIT Press, https://doi.org/10.1007/s00712-003-0589-6

APPENDIX

Table A1. Characteristics of additional independent variables used in the panel study for robustness Check

Bank-Level Control Variables – ZM.BANK	
LOAN_DEPO	Loan-to-deposit ratio
A_QUAL	Ratio of impaired assets to total assets
LOAN_D	Loan growth (quarter-on-quarter)
DEPO_D	Deposit growth (quarter-on-quarter)
TIER_I	Tier I capital ratio
Macroeconomic Control Variables – ZM.EKON	
UN	Unemployment rate (registered unemployment rate at the end of the period)
Source: own elaboration.	

Note: Table A1 provides a detailed description of additional independent variables included in the robustness check of panel models.
Source: own elaboration.

Table A2. Statistics for variables used in the panel study

Variable	Mean	Median	Minimum	Maximum	Standard Deviation
ROA	0.0143	0.0128	0.0010	0.0456	0.0108
CtI	0.5027	0.4557	0.2166	0.8929	0.1622
LCR	3.7399	3.2027	1.5511	10.4160	1.8113
LN_EMPL	5.0055	5.0434	4.1744	5.4806	0.2853
LN_BRANCHES	2.8235	2.7726	1.6094	3.4657	0.3182
TA_EMPL	8.4752	7.8242	4.5006	21.8000	2.6299
TA_BRANCHES	76.4070	70.8590	32.4270	198.1800	26.4150
LN_TA	20.9190	20.8910	20.4650	21.5880	0.2351
LOAN_TA	0.4432	0.4425	0.2166	0.6716	0.1039
NPL	0.1077	0.0961	0.0278	0.3567	0.0561
LOAN_DEPO	0.4936	0.4844	0.2352	0.7521	0.1199
LOAN_D	0.0036	-0.0002	-0.0796	0.1616	0.0351
DEPO_D	0.0253	0.0229	-0.1140	0.1483	0.0463
TCR	0.1903	0.1835	0.1269	0.2961	0.0367
TIER_I	0.1787	0.1730	0.0991	0.2961	0.0399
A_QUAL	0.0194	0.0145	-0.0069	0.1123	0.0209
GDP	0.0072	0.0095	-0.0920	0.0680	0.0288
UN	0.0548	0.0535	0.0490	0.0640	0.0046
CPI	0.0057	0.0020	-0.0040	0.0320	0.0080
BC_R	0.0373	0.0575	0.0010	0.0675	0.0281

Note: This Table shows the descriptive statistics of the variables used in the baseline and robustness testing of the models. *i.e.*, mean, median, minimum, maximum, and standard deviation. Table 1 and Table A1 define all variables.
Source: own calculations in Gretl.

Table A3. Correlation matrix for the variables used in the panel study

	ROA	CtI	LCR	LN_TA	LOAN_TA	NPL	LOAN_DEPO
ROA	1						
CtI	-0.831	1					
LCR	0.114	-0.097	1				
LN_TA	0.404	-0.338	0.046	1			
LOAN_TA	-0.233	0.273	-0.384	-0.022	1		
NPL	-0.354	0.262	-0.196	-0.237	0.16	1	
LOAN_DEPO	-0.153	0.206	-0.396	0.003	0.994	0.133	1
LOAN_D	0.085	0.017	-0.045	0.123	0.045	-0.054	0.062
DEPO_D	-0.036	0.128	0.064	0.154	-0.139	-0.064	-0.132
TCR	0.568	-0.508	0.099	0.257	-0.439	-0.394	-0.371
TIER_I	0.56	-0.541	0.188	0.305	-0.459	-0.489	-0.399
A_QUAL	-0.447	0.422	-0.17	-0.197	0.407	0.88	0.362
TA_EMPL	0.399	-0.488	-0.005	0.345	-0.486	-0.206	-0.44
TA_BRANCHES	0.412	-0.453	-0.136	0.418	-0.255	-0.087	-0.204
LN_BRANCHES	-0.149	0.252	0.212	0.31	0.213	-0.092	0.178
LN_EMPL	-0.069	0.213	0.052	0.489	0.406	0.003	0.38
GDP	-0.023	0.068	0.032	0.049	-0.038	-0.004	-0.043
UN	-0.654	0.685	-0.106	-0.354	0.301	0.215	0.247
CPI	-0.163	-0.009	-0.139	-0.146	0.113	0.095	0.082
BC_R	0.747	-0.819	0.064	0.34	-0.33	-0.222	-0.275
	LOAN_D	**DEPO_D**	**TCR**	**TIER_I**	**A_QUAL**	**TA_EMPL**	**TA_BRANCHES**
LOAN_D	1						
DEPO_D	0.215	1					
TCR	0.122	0.131	1				
TIER_I	0.108	0.12	0.946	1			
A_QUAL	-0.06	-0.065	-0.541	-0.611	1		
TA_EMPL	0.041	0.178	0.569	0.565	-0.402	1	
TA_BRANCHES	0.095	0.176	0.441	0.419	-0.302	0.661	1
LN_BRANCHES	0.002	-0.03	-0.252	-0.186	0.157	-0.417	-0.706
LN_EMPL	0.063	-0.022	-0.316	-0.264	0.228	-0.624	-0.304
GDP	0.094	-0.148	0.023	0.029	-0.012	0.048	0.025
UN	-0.101	-0.043	-0.522	-0.485	0.369	-0.357	-0.379
CPI	-0.258	-0.477	-0.353	-0.315	0.122	-0.139	-0.144
BC_R	-0.024	-0.118	0.484	0.45	-0.387	0.348	0.372
	LN_BRANCHES	**LN_EMPL**	**GDP**	**UN**	**CPI**	**BC_R**	
LN_BRANCHES	1						
LN_EMPL	0.704	1					
GDP	0	-0.019	1				
UN	0.144	0.067	0.057	1			
CPI	0.016	-0.004	0.096	0.203	1		
BC_R	-0.161	-0.079	-0.096	-0.85	-0.021	1	

Note: The Table shows Pearson's correlation coefficients for the dependent and independent variables in the baseline and robustness tests of the models. Table 1 and Table A1 define all variables.

Source: own calculations in Gretl.

Table A4. Results of the OLS panel model: Robustness check for the experimental variable: number of bank employees and number of bank branches

Model number	A1	A2	A3	A4	A5	A6
Variable	ROA		CtI		LCR	
LN_EMPL	-0.003*** (0.001)		0.165*** (0.033)		1.887*** (0.466)	
LN_BRANCHES		-0.003* (0.001)		0.083*** (0.018)		1.699*** (0.141)
Wooldridge test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wald Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
VIF (max)	2.2470	2.0840	2.2470	2.0840	2.2470	2.0840

Note: The Table shows the results of the panel models using the least squares method and the control variables used in the baseline survey (see Tables 3 and 4). Control variables: LN_TA, LOAN_TA, NPL, TCR, GDP, CPI, BC_R, included in the panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 380; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p-values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

Table A5. Results of the panel model, robustness check for the experimental variable, and number of bank employees

Model number	A7	A8	A9	A10	A11	A12
Model type	OLS	RE	OLS	RE	OLS	RE
Variable	ROA		CtI		LCR	
LN_EMPL	-0.003*** (0.001)	-0.010*** (0.003)	0.148*** (0.029)	0.166*** (0.062)	2.190*** (0.375)	0.888 (1.331)
Breusch-Pagan Test	-	0.0000	-	0.0000	-	0.0000
Hausman Test	-	0.1033	-	0.1547	-	0.9065
Wooldridge Test	0.0000	0.0001	0.0000	0.0000	0.0000	0.2892
Wald Test	0.0000	-	0.0000	-	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
VIF (max)	2.1620	2.1620	2.2900	2.2900	2.2900	2.2900

Note: The Table shows the results of panel models using the least squares (OLS) method and the estimation method for models with random effects (RE). Control variables: LN_TA, LOAN_DEPO, A_QUAL, LOAN_D, DEPO_D, TIER_I, GDP, CPI, UN, included in panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 360; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p-values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

Table A6. Panel model results – robustness check for the experimental variable: number of bank branches

Model number	A13	A14	A15	A16	A17	A18
Model type	OLS	RE	OLS	RE	OLS	RE
Variable	ROA		CtI		LCR	
LN_BRANCHES	-0.003*** (0.001)	-0.010*** (0.003)	0.092*** (0.014)	0.149*** (0.029)	1.916*** (0.144)	-0.450 (0.359)
Breusch-Pagan Test	-	0.0000	-	0.0000	-	0.0000
Hausman Test	-	0.1033	-	0.1036	-	0.6189
Wooldridge Test	0.0000	0.0001	0.0000	0.0000	0.0000	0.3486
Wald Test	0.0000	-	0.0000	-	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
VIF (max)	2.1620	2.1620	2.1620	2.1620	2.1620	2.1620

Note: The Table shows the results of panel models using the least squares (OLS) method and the estimation method for models with random effects (RE). Control variables: LN_TA, LOAN_DEPO, A_QUAL, LOAN_D, DEPO_D, TIER_I, GDP, CPI, UN, included in panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 360; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p-values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

Table A7. Results of the OLS panel model, robustness check for the experimental variable, and the ratio of total assets to the number of bank employees and the ratio of total assets to the number of bank branches

Model number	A19	A20	A21	A22	A23	A24
Variable	ROA		CtI		LCR	
TA_EMPL	0.000* (0.000)	-	-0.016*** (0.003)	-	-0.201*** (0.048)	-
TA_BRANCHES	-	0.000* (0.000)	-	-0.001*** (0.000)	-	-0.020*** (0.001)
Wooldridge Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wald Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
VIF (max)	2.278	2.101	2.278	2.101	2.278	2.101

The Table shows the results of the panel models using the least squares method and the control variables used in the baseline survey (see Tables N3 and N4). Control variables: LN_TA, LOAN_TA, NPL, TCR, GDP, CPI, BC_R, included in the panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 380; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p-values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

Table A8. Panel model results, robustness check for the experimental variable, ratio of total assets to bank employees

Model number	A25	A26	A27	A28	A29	A30
Model type	OLS	RE	OLS	RE	OLS	RE
Variable	ROA		CtI		LCR	
TA_EMPL	0.000** (0.000)	0.000 (0.000)	-0.014*** (0.002)	-0.013*** (0.004)	-0.232*** (0.040)	-0.099 (0.131)
Breusch-Pagan Test	-	0.0000	-	0.0000	-	0.0000
Hausman Test	-	0.8801	-	0.4913	-	0.9408
Wooldridge Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.2899
Wald Test	0.0000	-	0.0000	-	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
VIF (max)	2.361	2.361	2.361	2.361	2.361	2.361

The Table shows the results of panel models using the least squares (OLS) method and the estimation method for models with random effects (RE). Control variables: LN_TA, LOAN_DEPO, A_QUAL, LOAN_D, DEPO_D, TIER_I, GDP, CPI, UN, included in panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 360; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p-values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

Table A9. Panel model results, robustness check for experimental variable, ratio of total assets to number of bank branches

Model number	A41	A42	A43	A44	A45	A46
Model type	OLS	RE	OLS	RE	OLS	RE
Variable	ROA		CtI		LCR	
TA_BRANCHES	0.000*** (0.000)	0.000*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.022*** (0.002)	0.006*** (0.002)
Breusch-Pagan Test	-	0.0000	-	0.0000	-	0.0000
Hausman Test	-	0.3288	-	0.4356	-	0.6360
Wooldridge Test	0.0000	0.0001	0.0000	0.0000	0.0000	0.3483
Wald Test	0.0000	-	0.0000	-	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
VIF (max)	2.181	2.181	2.181	2.181	2.181	2.181

The Table shows the results of panel models using the least squares (OLS) method and the estimation method for models with random effects (RE). Control variables: LN_TA, LOAN_DEPO, A_QUAL, LOAN_D, DEPO_D, TIER_I, GDP, CPI, UN, included in panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 360; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

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Use of Artificial Intelligence

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