Tomasz Siudek[1]
Chair of Economics and Organization of Agricultural Enterprises
Warsaw University of Life Sciences
Warsaw, Poland

Impact of agricultural development on economic and financial situation of cooperative banks in Poland

Abstract. The paper examines the impact of development of agricultural sector on performance of the cooperative banks in Poland in years 1997-2004. The levels of the agricultural development and the economic/financial situation of the banks were assessed by using country-level and regional-level aggregate indicators based on the factor analysis. The research results show that the type of region (i.e. voivodeship and macro-region) has a statistically significant impact both on the aggregate indicator of agricultural development and the aggregate indicator of banks' performance. As for the relationship between the agricultural development level and the economic/financial situation of banks, statistically significant correlations were found only for four out of sixteen voivodeships.
Key words: cooperative banks, agriculture, regional development, economic and financial situation, aggregate indicator

Introduction

In recent times, much attention has been paid to the significant role that co-operative banks can play in the development of rural areas. Internationally, cooperative banks are seen as essential to meeting the agricultural and rural credit needs, allowing for the provisioning of finance at relatively low interest rate, and the financing of start-up activities or employment creating activities such as the development of the agricultural sector and rural areas [Chopra 1998, Alexopoulos 2006].

While most of the relevant literature has tends to concentrate upon the role of the cooperative banks, as local financial intermediaries, in economic development, this paper attempts to focus on role of agricultural sector development in influencing financial and economic performance of those banks in case of Poland.

Determinants of economic and financial situation of the cooperative banks in Poland can be divided into internal and external factors. In this paper, the regional development of agriculture is assumed to be significant external factor influencing the economic and financial results of the banks operating in selected regions of Poland over the period of 1997-2004.

Research aims, data and methodology

The purpose of this paper was to determine:
- regional development of agriculture by applying an aggregate index;

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[1] DrSc, 166 Nowoursynowska Str., 02-787 Warsaw, Poland, e-mail: tomasz_siudek@sggw.pl; phone (48-22) 59-34-226.

–   economic and financial situation of the cooperative banks by applying an aggregate indicator;
–   impact of regional development of agriculture on the economic and financial performance of cooperative banks in Poland.

Research is based on individual bank data from 1997 to 2004 collected from 949 cooperative banks all over the country. These data include key annual financial statements of the banks used to assess their economic and financial situation. Additionally, macroeconomic data drawn from the Central Statistical Office of Poland was used to assess the level of agricultural development.

Table 1 contains selected macroeconomic variables explaining differences in the agricultural economic performance of the regions whereas Table 5 is related to variables used to construct an aggregate indicator of economic and financial situation of the sampled banks.

In order to distinguish features exerting the greatest impact on development of agricultural sector and on the economic/financial results of cooperative banks, a factor analysis was presented [Jajuga 1993, Dobosz 2001]. For dropping the least important factors from the analysis, the Kaiser criterion and 'Scree plot' were used. Only factors which gained an eigenvalue in excess of 1 were retained [Aczel 2000].

The estimators of principal components, the estimators of aggregate indicators of agricultural development and of economic/financial performance of cooperative banks were calculated according to the following mathematical formulas:

$$U_k = a_{1k}x_1 + a_{2k}x_2 + a_{3k}x_3 + \dots a_{nk}x_n \qquad (1)$$

where:
U_k – estimate for k-principal component, k = 1,2,…,t,
a_{ik} – estimated weights of i-contributions for k-principal component,
x_i – value of i-contributions, i = 1,2,…,n.

$$W_s = b_1U_1 + b_2U_2 + b_3U_3 + \dots b_tU_t \qquad (2)$$

where:
W_s – aggregate indicator of agricultural development or aggregate indicator of economic-financial situation of cooperative banks,
b_k – estimated weights of k-principal component, k = 1,2,…,t,
U_k – value of k- principal component, k = 1,2,…,t.

Furthermore, one-factor ANOVA (analysis of variance) procedure was applied to uncover an impact of voivodeship and macro-region on the level of agricultural development and on the economic-financial results of cooperative banks. Least significant difference (LSD) test was used for determining differences between means for groups of each factor [Stanisz 2000, Borkowski et. al 2004]. The strength and direction of a linear relationship between variables describing the economic/financial performance of cooperative banks and the development of agriculture was measured by applying Pearson correlation coefficient. The t-Student test was used to establish if the correlation coefficients were significantly different from zero, and, hence that there was an evidence of an association between variables [Stanisz 2000]. Moreover, regression analysis was used for the investigation of the relationships between the variables of interest (i.e. describing the economic/financial situation of cooperative banks and the regional development of agriculture). The regression model was selected according to the goodness-of fit statistic

(R-squared). A simple linear regression model was chosen as it gave a higher adjusted R-square value. The model helped to identify relationships between dependent or explained variable ('economic/financial situation of cooperative banks') and independent or explanatory variable ('regional development of agriculture'). Significance of individual regression coefficients was tested with the t-Student test [Rao 1982, Dobosz 2001].

Results and discussion

Regional development of agriculture in Poland

The most important factors influencing the development of agriculture are given in Table 1. Records show that factors 1, 2 and 3 had the strongest impact on the agricultural development level; altogether the three explained 89% of the variability. For the first factor, average farm area (UAA, ha) and employment in agriculture exhibited the strongest impact on agricultural development. In the case of the second factor and the third factor the same was true for GVA in agriculture per person employed and agricultural production per 1 hectare UAA.

Table 1. Factors determining the regional differences in development of agriculture in Poland, 1997-2004

Variables	Aggregate factors, 89.54% of the variability			
	Factor 1	Factor 2	Factor 3	R^2
Share in the variability (%)	50.89	20.45	18.20	
1. Gross Value Added in agriculture per employee ['000 PLN]	0.1521	0.9825	0.1072	0.7905
2. Farm area [UAA, ha]	0.8687	0.1230	0.1459	1.0000
3. Employment in agriculture [%]	0.8681	0.1139	0.1548	0.7911
4. Agricultural production per 1 ha UAA ['000 PLN]	0.1998	0.1100	0.9736	1.0000

Notes: R^2 – the square of coefficient of multi-way correlation between variable X_i and main factors U_1-U_3; X_i – value of i-primary variable, i = 1,2,..4; U_k – value of k-main factor, k = 1, 2, 3.
Source: own research

Development of agriculture was considered according to such criteria as voivodeship and macro-region of the cooperative bank's activity. One-factor ANOVA showed that all selected factors had a statistically significant impact on agricultural development level (Table 2).

Table 2. Impact of selected factors on the level of aggregate indicator of agricultural development in Poland, 1997-2004

Specification	Impact of selected factors	
	Voivodeship	Macro-region
Aggregate indicator	109.51[x]	125.95[x]

Note: value F - Fisher-Snedecor test; x – statistically significant factor's impact on explained variable at p ≤ 0,05.
Source: own research

Table 3 presents agricultural development indicators calculated by author for 16 voivodeships of Poland. In the ranking, the top three voivodeships were: Warminsko-Mazurskie (1.69), Zachodniopomorskie (1.38) and Wielkopolskie (1.03) and the bottom

three were respectively Śląskie (-1.31), Małopolskie (-1.27), Świętokrzyskie (-1.16).

Table 3. The level of aggregate indicator of agricultural development of Polish voivodeships, 1997-2004

Voivodeship	Aggregate indicator of development of agriculture			
	n	$\overline{\mathrm{x}}$		$s\overline{\mathrm{x}}$
Dolnośląskie	56	0.53	e	0.09
Kujawsko-Pomorskie	37	0.98	fgh	0.12
Lubelskie	87	-0.09	d	0.08
Lubuskie	39	1.01	gh	0.11
Łódzkie	72	-0.52	c	0.08
Mazowieckie	160	-0.22	d	0.06
Małopolskie	64	-1.27	ab	0.09
Opolskie	26	0.82	efg	0.14
Podlaskie	56	0.84	fg	0.09
Podkarpackie	44	-1.02	b	0.11
Pomorskie	32	0.67	ef	0.12
Śląskie	85	-1.31	a	0.08
Świętokrzyskie	53	-1.16	ab	0.10
Wielkopolskie	66	1.03	gh	0.09
Warmińsko-mazurskie	55	1.69	i	0.09
Zachodniopomorskie	17	1.38	hi	0.17
Poland	949	4.29E-08		–

Notes: n – number of investigated banks, $\overline{\mathrm{x}}$ - average level of aggregate indicator. An occurrence at least one identical letter in two compared groups indicates no significant difference between them at $p \leq 0.05$; $s\overline{\mathrm{x}}$ – standard error of the average.
Source: own research

Table 4 displays the differences in agricultural development between macro-regions. The most progressive were: north-eastern (1.20), central-western (1.08) and north-western (0.79) macro-regions, the least respectively south-eastern (-1.16) and southern (-0.88).

Economic and financial performance of cooperative banks in Poland

Indicator variables were selected on the basis of theory and factor analysis. In this analysis seven main factors were chosen and these are set out in Table 5. They, altogether, explained 79.4% of the total variance in economic and financial situation of cooperative banks, and particularly:
- the first explained 20.4% of the total variance and was the most strongly correlated with such financial indicators as: interest margin, the administrative costs as a proportion of total assets, the personnel costs as a proportion of total assets, the net interest income as a proportion of total assets;
- the second, explaining 15.8% of the total variance in bank's performance was the most strongly correlated with assets profitability ratio ROA and work profitability ratio ROW (net financial results per worker);

- the third explained almost 11% of the total variability on its own and was most strongly associated with the net loans' share in total assets and net loans' share in liabilities;
- the fourth explaining 10% of the total variance was most correlated with: gross profit margin, net profit margin and costs level;
- the fifth explaining 8.3% of the total variance was most strongly correlated with the capital adequacy ratio (solvency ratio), the fixed assets and capital investments to total assets ratio as well as the working capital to total assets ratio;

Table 4. The level of aggregate indicator of development of agriculture in macro-regions of Poland, 1997-2004

Macro-region	Aggregate indicator on development of agriculture			
	n	$\bar{x}$		$s_{\bar{x}}$
Southern	129	-0.88	b	0.07
South-eastern	151	-1.16	a	0.06
South-western	8	0.16	de	0.28
Northern	32	0.75	ef	0.14
North-eastern	105	1.20	g	0.08
North-western	98	0.79	f	0.08
Central	96	-0.44	c	0.08
Central-eastern	76	0.00	d	0.09
Central-western	118	1.08	g	0.07
Capital	136	-0.19	d	0.07
Poland	949	4.29E-08		

Notes: as in Table 3.
Source: own research.

Table 5. Factors determining differences in the economic and financial performance of the cooperative banks in Poland, 1997-2004

Economic and financial indicators [%]	Aggregate factors - 79.43% of variability							
	U_1 Factor 1	U_2 Factor 2	U_3 Factor 3	U_4 Factor 4	U_5 Factor 5	U_6 Factor 6	U_7 Factor 7	R^2
Share in variability (%)	20.37	15.78	10.93	10.08	8.28	7.63	6..35	0.7207
X_1. Growth rate of total assets	-0.0135	-0.0148	-0.0443	-0.0481	-0.0884	0.9462	0.0231	0.3064
X_2. Growth rate of working assets	-0.0844	-0.0093	-0.0276	-0.0563	-0.0886	0.9616	0.0220	0.6166
X_3. Growth rate of net loans	-0.1188	-0.0530	0.0397	-0.0044	0.0608	0.6017	0.0235	0.6093
X_4. Profitability of total assets ROA	0.0934	0.8071	0.0006	0.1657	0.1461	-0.0002	0.1082	0.4616
X_5. Profitability of own funds ROE	0.0782	0.4713	-0.0752	0.0961	-0.1985	0.0815	0.1315	0.8492
X_6. Gross profit margin ratio	0.0377	0.1508	-0.0262	0.8810	0.0739	-0.0271	0.0311	0.2569
X_7. Net profit margin ratio	-0.0101	0.1458	-0.0204	0.8865	0.0816	-0.0348	0.0146	0.3002
X_8. Revenue/costs ratio	0.0476	0.0228	-0.0068	0.5234	-0.0171	-0.0134	0.0390	0.2078
X_9. Interest margin ratio	0.7770	0.2597	0.1034	0.0605	0.1430	-0.0931	0.1126	0.3597
X_{10}. Net financial result/worker (ROW) ['000 PLN]	-0.2850	0.7614	-0.0249	0.2001	0.2018	-0.0530	0.1042	0.9084
X_{11}. Costs ratio	0.0023	-0.0976	0.0233	-0.7716	0.0448	0.0178	-0.0566	0.9442
X_{12}. Solvency ratio	0.0332	-0.0524	-0.0879	0.0308	0.7676	-0.0668	0.1018	0.3849
X_{13}. Own funds/total assets ratio	0.0724	0.0597	0.2136	0.0106	0.7383	-0.0809	-0.0556	0.5850
X_{14}. Fixed assets and capital investments /total assets ratio	0.0808	-0.0648	0.0570	-0.1079	-0.0768	-0.0281	-0.6552	0.9343
X_{15}. Working capital/total assets ratio	0.1703	0.1503	0.0756	0.0803	0.6843	0.0559	0.5603	0.9186
X_{16}. Cash/total assets ratio	0.4739	-0.0876	-0.1170	0.0645	-0.0547	0.0061	-0.0614	0.1435
X_{17}. Total liquidity ratio	0.4001	-0.2154	-0.2980	0.0010	0.0121	0.0049	0.0687	0.0167
X_{18}. Current assets/current deposits	-0.2440	-0.0585	-0.3338	-0.0438	0.0975	0.0298	0.1454	0.9179
X_{19}. Working assets/total assets ratio	-0.5830	-0.1904	0.2920	-0.0549	0.2193	0.0738	0.2591	0.7082
X_{20}. Net loans/total assets ratio	0.0266	-0.0456	0.9634	-0.0238	0.0430	-0.0207	-0.0249	0.8491
X_{21}. Deposits/total assets ratio	-0.3484	-0.3933	-0.0869	0.0098	-0.2628	-0.0319	0.0770	0.2193
X_{22}. Net loans/deposits ratio	0.1135	0.0726	0.9375	-0.0065	0.1289	-0.0116	-0.0694	0.8287
X_{23}. Irregular loans/gross total loans	-0.0724	0.2531	-0.0101	0.0866	-0.1826	-0.0597	-0.1724	0.8059
X_{24}. Specific provisions/irregular loans ratio	0.0867	0.0130	0.0810	-0.0233	0.0119	0.0081	0.0415	0.4077
X_{25}. Interest income/total assets ratio	0.6954	0.1608	0.2379	0.0286	-0.1638	-0.1963	0.5345	0.3226
X_{26}. Interest expense/total assets ratio	0.3230	-0.0269	-0.0006	-0.0261	-0.5014	-0.1716	0.5671	0.5404
X_{27}. Net interest income/total assets	0.7144	0.2801	0.3491	0.0674	0.2814	-0.1145	0.2039	0.5146
X_{28}. Non-interest income/total assets ratio	-0.1444	-0.2122	0.2864	-0.1860	0.1388	0.1086	-0.0760	0.7274
X_{29}. Administrative expenses/total assets ratio	0.7449	-0.3169	0.3207	-0.0303	0.1286	-0.1357	-0.1863	0.7559
X_{30}. Personnel costs/total assets ratio	0.7120	-0.3818	0.3006	-0.0189	0.2003	-0.0997	-0.1117	0.8082
X_{31}. Depreciation costs/total assets ratio	0.2819	-0.0484	0.2421	-0.0663	-0.0416	-0.0897	-0.5031	0.8158
X_{32}. Charges to provisions/total assets ratio	-0.1700	0.3991	0.2137	-0.0001	-0.0400	-0.1450	-0.2573	0.2788
X_{33}. Released provisions/total assets ratio	-0.0593	0.5555	0.0634	-0.0134	-0.2028	-0.1092	-0.4136	0.6110
X_{34}. Encumbrances of financial result/total assets ratio	0.1757	0.5514	0.0593	0.1117	0.2291	-0.0250	0.3326	0.7207

R^2 – the square of coefficient of multi-way correlation between variable X_i and main factors U_1-U_7; X_i – value of i-primary variable, i = 1,2,…34; U_k – value of k-main factor, k = 1, 2, 3.
Source: own research

- the sixth explained 7.6% of the total variability and was mostly correlated with the rates of change in total assets, working assets and net loans
- the seventh explained 6.35% of the total variability and was most correlated with such primary variables as the fixed assets and capital investments to total assets ratio, the interest revenues to total assets ratio and the interest costs to total assets ratio.

Aggregate performance indicators obtained for the cooperative banks were subsequently compared between regions of their activities. It was found that both in voivodeships and macro-regions, selected factors had a statistically significant impact on the level of aggregate indicator of financial/economic performance of banks, as Table 6 shows.

Table 6. Impact of selected factors on the level of aggregate indicator of economic/financial performance of cooperative banks in Poland in 1997-2004

Specification	Impact of	
	Voivodeship	Macroregion
Aggregate indicator	$F = 1.99^x$	$F = 3.81^x$

Notes: as in Table 2.
Source: own research

Table 7. The level of aggregate indicator of economic/financial situation of cooperative banks in Poland by voivodeship, 1997-2004

Voivodeship	Aggregate indicator of economic and financial situation of cooperative banks			
	n	$\overline{x}$		$s_{\overline{x}}$
Dolnośląskie	33	-0.29	abc	0.25
Kujawsko-Pomorskie	31	0.37	cd	0.26
Lubelskie	50	0.26	bcd	0.20
Lubuskie	21	0.09	abcd	0.31
Łódzkie	45	-0.32	ab	0.21
Mazowieckie	109	-0.14	abc	0.14
Małopolskie	37	-0.28	abc	0.24
Opolskie	12	0.39	bcd	0.41
Podlaskie	30	-0.02	abcd	0.26
Podkarpackie	32	-0.69	a	0.25
Pomorskie	28	-0.16	abc	0.27
Śląskie	49	0.61	d	0.20
Świętokrzyskie	42	0.24	bcd	0.22
Wielkopolskie	53	0.04	bc	0.20
Warmińsko-mazurskie	38	0.21	bcd	0.23
Zachodniopomorskie	17	-0.28	abc	0.35
Poland	627	-1.51E-08		–

Notes: as in Table 3.
Source: own research

The aggregate performance indicators presented in Table 7 suggest that banks

located in Śląskie (0.61), Opolskie (0.39) and Kujawsko-pomorskie (0.37) voivodeships performed the best. The worst results were achieved by banks in Podkarpackie (-0.69), Łódzkie (-0.32) and Dolnośląskie voivodeships.

As illustrated in Table 8, there were also macro-regional differences in bank's financial results. The best performance, as measured by the indicator, was experienced by the banks in southern macro-region (0.55). Their counterparts in north-western (-0.35), south-eastern (-0.22) and central macro-regions experienced the worst financial situation.

Table 8. The level of aggregate indicator of economic/financial situation of cooperative banks in Poland by macro-region, 1997-2004

Macroregion	Aggregate indicator on economic and financial situation of the cooperative banks		
	n	$\overline{X}$	$s_{\overline{X}}$
Southern	71	0.55 c	0.17
South-eastern	102	-0.22 a	0.14
South-western	5	0.32 d	0.64
Northern	30	-0.18 ab	0.26
North-eastern	61	0.14 abc	0.18
North-western	62	-0.35 a	0.18
Central	65	-0.21 ab	0.18
Central-eastern	51	0.14 abc	0.20
Central-western	91	0.19 bc	0.15
Capital	89	-0.22 ab	0.15
Poland	627	-1,51E-08	

Notes: as in Table 3.
Source: own research

Impact of agricultural development on the economic/financial situation of the cooperative banks in Poland

Computed correlation coefficients suggest that at national level there was a positive but weak interrelation (r = 0.08) between banks' economic/financial results and agricultural development in years 1997-2004. However, the values of the correlation coefficients differed between voivodeships (Table 9).

Improvement of the agricultural development indicator resulted in better economic and financial situation of cooperative banks in the following voivodeships: Dolnośląskie, Mazowieckie and Śląskie. A negative impact was found out for Świętokrzyskie voivodeship. In the remaining voivodeships those variables were associated either positively or negatively but study showed statistically insignificant correlation between them

Table 9. Impact of regional agricultural development on the economic and financial situation of cooperative banks by voivodeship in Poland, 1997-2004

Voivodeship		Aggregate indicator of economic and financial situation of cooperative banks	
		r	b
Aggregate indicator of agricultural development	Dolnośląskie	0.64[x]	7.27[x]
	Kujawsko-Pomorskie	-0.47	-0.75
	Lubelskie	0.24	0.85
	Lubuskie	0.19	0.37
	Łódzkie	-0.20	-0.48
	Mazowieckie	0.39[x]	0.70[x]
	Małopolskie	0.00	-0.00
	Opolskie	-0.02	-0.20
	Podlaskie	-0.30	-0.62
	Podkarpackie	0.17	0.76
	Pomorskie	0.06	0.10
	Śląskie	0.50[x]	7.88[x]
	Świętokrzyskie	-0.62[x]	-7.82[x]
	Wielkopolskie	0.24	0.23
	Warmińsko-mazurskie	-0.15	-1.99
	Zachodniopomorskie	0.30	1.03
	Poland	0.08	0.05

Note: x - correlation coefficient r and regression coefficient b statistically significant at $p \leq 0.05$.
Source: own research

Furthermore, an analysis of relationship between development of agriculture and economic/financial performance of the banks across the selected macro-regions of Poland uncovered that as the values of the first variable increased, the values of the second variable also increased in central-eastern (r = 0.42) and central (r = 0.30) macro-regions. Relevant information compiled in Table 10 also shows that in the case of other macro-regions this relationship was statistically insignificant.

Table 10. Impact of regional agricultural development on the economic/financial situation of cooperative banks in Poland, 1997-2004

Macro-region		Aggregate indicator of economic and financial situation of cooperative banks	
		r	b
Aggregate indicator on agricultural development	Southern	-0.05	-0.09
	South-eastern	0.10	0.64
	South-western	0.38	3.26
	Northern	0.04	0.07
	North-eastern	-0.26	-0.52
	North-eastern	0.34	0.75
	Central	0.28	0.78
	Central-eastern	0.42^x	1.58^x
	Central-western	0.10	0.11
	Capital	0.30^x	0.48^x
	Poland	0.08	0.10

Notes: as in Table 9.
Source: own research

Concluding remarks

1. The study based on factor analysis suggests that the level of regional development of agriculture in Poland was strongest influenced by an average farm area and employment in agriculture, whereas the level of economic/financial performance of co-operative banks respectively by the interest/margin ratio, the net interest income to total assets ratio, and the interest costs to total assets ratio. All the above mentioned variables were positive stimuli for both development of agriculture and performance of cooperative banks.

2. The type of region (i.e. voivodeship and macro-region) had statistically significant impact both on the aggregate indicator of agricultural development and the aggregate indicator of economic/financial situation of cooperative banks.

3. The assessed level of agricultural development was highest in Wielkopolskie, Zachodniopomorskie and Warminsko-mazurskie voivodeships and correspondingly in the north-eastern as well as the central-western macro-regions. The lowest values were calculated for Małopolskie, Podkarpackie, Śląskie, Świętokrzyskie voivodsips and for the southern and south-eastern macro-regions.

4. The assessed level of economic and financial situation of cooperative banks was highest in Śląskie, Opolskie, Kujawsko-pomorskie voivodeships and in the southern macro-region. Worst-performing banks were situated in Podkarpackie, Łódzkie and Dolnośląskie voivodsips and in the north-eastern and south-eastern macroregions.

5. Analysis based on Pearson correlation coefficients suggests a positive correlation

between the agricultural development level and the economic/financial situation of banks in Dolnośląskie, Mazowieckie, Śląskie voivodeships and respectively negative correlation in Świętokrzyskie voivodeship. In the case of other voivodsips the coefficients were statistically insignificant. Positive correlation between variables of interest was also in the central-eastern and central macro-regions. For other macro-regions those coefficients were statistically insignificant.

6. With regard to the practical implications of the research the findings support a suggestion for the professionals and the policy makers to calculate the composite index of agricultural development as well as the financial and economic situation of business entities as a tool for decision-making.

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