Do Farm Credits Stimulate Development of Agriculture in Poland?

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In Poland, farmers rely primarily on cooperative banks for agricultural credit. Therefore, the paper attempt is to examine the impact of agricultural credits disbursed by the cooperative banks on regional development of agricultural sector in Poland over 1997-2006. Sources of data include financial statements of the banks (1373 observations) providing credit-related information and sectoral background data for agriculture from Central Statistical Office of Poland. The levels of agricultural development were assessed using a nation-level and regional-level composite indicators constructed by the author by the use of factor analysis. Additionally, one-factor ANOVA, Pearson correlations and linear regression were applied. There was found, that the most prosperous agricultural regions include wielkopolskie, zachodniopomorskie and warminsko-mazurskie, the least prosperous malopolskie, podkarpackie, slaskie and swietokrzyskie voivodships. Results of econometric analysis suggest also that region of bank's activity has statistically significant impact both on agricultural credit and agricultural development levels. In Poland as a whole, farm credits provided by cooperative banks stimulate development of agriculture but only in two of sixteen regions (voivodships) their impact was positive and statistically significant. The average farm size and agricultural employment were found to be strongest in influencing agricultural development.

Keywords: **cooperative banks, agriculture, regional development**

I. INTRODUCTION

Agricultural credit is to perform many significant purposes and is assumed to play an important role in the development of agriculture [1, 2]. Its main tasks include intensification of farm production, enhancing the agricultural productivity and helping agricultural sector to achieve faster technological, biological and social progress.

In Poland, credits to farm sector are provided mainly by cooperative banks having one of the best expanded the nation-wide retail branching network. They operate in the local markets serving predominantly agriculture and agribusiness sector. Taking into account that those banks are the key creditors of farm sector, Author's attempt was to assess an impact of agricultural credits granted by those banks on agriculture development.

II. RESEARCH AIMS, SCOPE AND METHODS

The main objectives of this study include the following:

1. To identify the level of loans provided to agriculture by cooperative banks in Poland
2. To assess regional development of agriculture using composite indicator.
3. To estimate agricultural credits' impact on development of agricultural sector.

A nationwide study covered 1373 observations of cooperative banks over the period from 1997 to 2006. Credit-related data were derived from financial statements of the banks. Development-related data come from Central Statistical Office of Poland. Macroeconomic variables used in the research were described in Table 2. In order to describe a larger number of observed variables from initial data set by a smaller number of unobserved variables determining Polish agriculture development factor analysis was applied. For selecting factors, two alternative methods were used: Kaiser's eigenvalue-greater-than-one rule [3] and Cattell's scree test [4]. The estimators of principal components and composite indicators of agricultural development were calculated using Equations 1 and Equation 2 respectively:

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

Where U_k is estimated k-principal component (k=1,2,..,t), a_{ik} are estimated weights of i-contributions for k-principal component, x_i is value of i-contributions (i=1,2,…,n).

$$W_s = b_1 U_1 + b_2 U_2 + b_3 U_3 + \ldots + b_t U_t \qquad (2)$$

Where W_s represents a composite indicator of agricultural development, b_k are estimated weights of k-principal component (k=1,2, ...,t), and U_k is value of k-principal component (k=1,2,…,t).

Furthermore, one-factor ANOVA was applied in

order to determine an impact of voivodship[1] both on level of agricultural loans (measured as their ratio to banks' total assets) and on agricultural development. A comparison of the mean results for groups of each factor was carried out using LSD test. Interrelation between relative agricultural credits and agriculture development level was assessed by Pearson correlation and regression coefficients with the t-Student test.

III. RESULTS AND DISCUSSION

A. Relative level of agricultural loans provided by cooperative banks in Poland

Study revealed that the cooperative banks in warminsko-mazurskie, wielkopolskie and kujawsko-pomorskie voivodships have the highest agricultural loan to asset ratios (Table 1).

Table 1 Agricultural loans to asset ratios in cooperative banks in Poland, 1997-2006

An occurrence at least one identical letter indicates no significant difference (at $p \leq 0.05$) between means for any two regions compared

N = number of measurements. SE = the standard error of the mean.

Regions (Voivodsips)	N	Agricultural loans relative to total bank's assets		
		Mean (%)		SE
Dolnoslaskie	69	18.64	b	1.91
Kujawsko-pomorskie	65	33.64	efg	1.97
Lubelskie	126	33.39	efg	1.41
Lubuskie	44	17.55	b	2.39
Lodzkie	104	30.62	ef	1.55
Mazowieckie	238	31.16	de	1.03
Malopolskie	83	10.49	a	1.74
Opolskie	33	17.82	bc	2.76
Podlaskie	84	42.08	h	1.73
Podkarpackie	66	9.52	a	1.95
Pomorskie	52	24.64	cd	2.20
Slaskie	107	8.63	a	1.53
Swietokrzyskie	84	25.22	d	1.73
Wielkopolskie	106	34.52	fg	1.54
Warminsko-mazurskie	80	35.38	g	1.77
Zachodniopomorskie	32	28.09	de	2.80
Poland	1373	26.50		–

[1]Voivodship is national administrative unit in Poland. All 16 such units correspond to the EU NUTS II level.

In those regions of Poland, average acreage per farm likewise commercial production of total farm output is relatively high. Since farms here have tended to modernize and expand in order to increase their competitiveness in the market, they have been in need of large external financing, more often being met by bank loans. Opposite situation was observed in slaskie, podkarpackie and malopolskie woivodsips with highly fragmented, extensive and small-scale farms taking small amounts of loan.

B. Development of Polish agriculture – a composite indicator assessment

The way in which agriculture contributes to development varies between states depending on how they rely on this sector as the base for economic growth, employment creation and human welfare. In 2006 agriculture and forestry accounted merely for about 4 per cent of Gross Vale Added (GVA) produced in Polish economy, whereas food processing industry contributed to as much as 23 per cent of GVA. National employment in agriculture is one of the highest in the EU and represents 16 per cent of total civilian employment.

According to the World Bank, "agriculture has features that make it a unique instrument for development", it "can work in concert with other sectors to produce faster growth, reduce poverty, and sustain the environment" [5].

In a broad sense, development of agriculture denotes both qualitative and quantitative changes within farm sector over given period of time. The main research question is: How to measure this development? Review of recent literature suggests that agricultural development has been assessed mainly by synthetic indicators obtained from sets of diagnostic variables [6, 7, 8]. Different multidimensional analysis techniques are used, i.e. 'zero unitarisation method' [9], Hellwig's measure [10], cluster analysis [11], and factor analysis chosen by this paper's author.

The results of factor analysis are presented in Table 2. Identified three factors had the strongest contribution to agricultural development in Poland. They together explained almost 90 per cent of the total variance in the data set was found. The factor 1 had strong contributions from farm area (0.87) and employment in agriculture (0.87). This factor explained 50.9 per cent of the total variance. Factor 2 had strong contribution from GVA per employee in agriculture (0.98). Factor 3 had strong contribution from farm production per 1 ha UAA (0.97).

Table 2 Factors determining differences in regional development of Polish agriculture, 1997-2006

Factor analysis identified three uncorrelated factors that, in aggregate, explained 89.54% of the total variance of the entire data set.

U_k = value of *k*-main factor (k = 1, 2, 3). R^2 = the square of coefficient of multi-way correlation between variable x_i and main factors U_1, U_2, U_3. x_i = value of *i*-primary variable (i = 1,2,..4). Loadings ≥ 0.7 shown in bold.

Agricultural sector variables	Factor 1 (U_1)	Factor 2 (U_2)	Factor 3 (U_3)	R^2
x_1 - Gross Value Added in agriculture per employee ('000 PLN)	0.1521	**0.9825**	0.1072	0.79
x_2 - Farm area (UAA, ha)	**0.8687**	0.1230	0.1459	1.00
x_3 - Employment in agriculture (%)	**0.8681**	0.1139	0.1548	0.79
x_4 - Farm production per 1 ha UAA ('000 PLN)	0.1998	0.1100	**0.9736**	1.00
Cumulative % of variance	50.89	20.45	18.20	

A review of literature [12, 13, 14] confirms, that agricultural development may vary significantly among different regions of country.

Also my findings obtained using one-factor ANOVA (Table 3) revealed statistically significant impact of voivodship's type on level of agricultural development measured by composite indicator (see Equation 2).

The estimated impact suggests that voivodship as an area of the cooperative bank's activity might influence agriculture development level.

But firstly, composite indicator of agriculture development was used as an instrument of regional ranking. Table 4 presents regions from the most developed to the least developed according to composite indicator. The results indicate that regions with most developed agricultural sector include: warminsko-mazurskie and zachodniopomorskie voivodships (situated in North Poland; under the socialist regime dominated by state enterprises in agriculture) as well as wielkopolskie voivodship. At the same time such voivodships as slaskie (historically industrialized), malopolskie and swietokrzyskie were found to be regions with most backward agriculture. The levels of agriculture development indicators for the Polish regions to the highest extent depend on the average farm area and employment in agriculture.

Table 3 Voividsip's impact on the level of composite indicator of agriculture development, 1997-2006

F = Fisher-Snedecor test. * statistically significant impact on explained variable at p ≤ 0.05.

Specification	Impact of type of region (voivodship)
Composite indicator	F=109.5*

The reverse was found for land productivity measured by farm production per area of farmland.

Table 4 Region ranking according to the level of composite indicator of agriculture development, 1997-2006

An occurrence at least one identical letter indicates no significant difference (at p ≤ 0.05) between means for any two regions compared

N = number of measurements. SE = the standard error of the mean.

Regions (Voivodsips)	N	Composite indicator of agriculture development		
		Mean (%)		SE
Warminsko-mazurskie	10	1.69	i	0.09
Zachodniopomorskie	10	1.38	hi	0.17
Wielkopolskie	10	1.03	gh	0.09
Lubuskie	10	1.01	gh	0.11
Kujawsko-Pomorskie	10	0.98	fgh	0.12
Podlaskie	10	0.84	fg	0.09
Opolskie	10	0.82	efg	0.14
Pomorskie	10	0.67	ef	0.12
Dolnoslaskie	10	0.53	e	0.09
Lubelskie	10	-0.09	d	0.08
Mazowieckie	10	-0.22	d	0.06
Lodzkie	10	-0.52	c	0.08
Podkarpackie	10	-1.02	b	0.11
Slaskie	10	-1.31	a	0.08
Malopolskie	10	-1.27	ab	0.09
Swietokrzyskie	10	-1.16	ab	0.10
Poland	160	4.29E-08		–

C. The relationship between agricultural credits granted by cooperative banks and development of agriculture in Poland

An analysis using Pearson's correlation coefficients indicates a statistically significant positive relationship between the level of agricultural loans (relative to the

cooperative banks' total assets) and the level of agriculture development for the whole Poland over the period 1997-2006. However, regional differences exist within the country (Table 5).

Table 5 Impact of agricultural loans disbursed by the cooperative banks on development of agriculture in the selected voivodships of Poland, 1997-2006

R = correlation coefficient. b = regression coefficient.
* statistically significant at $p \leq 0.05$.

Regions (Voivodsips		Agricultural credits to bank assets ratio	
		R	b
Dolnoslaskie		-0.20	-0.020
Kujawsko-Pomorskie		-0.14	-0.009
Lubelskie		-0.13	-0.008
Lubuskie		0.21	0.031
Lodzkie	Composite	0.31*	0.014*
Mazowieckie	indicators	0.41*	0.032*
Malopolskie	of	0.01	0.000
Opolskie	agricultural	-0.30	-0.006
Podlaskie	development	-0.09	-0.006
Podkarpackie		0.02	0.002
Pomorskie		0.27	0.031
Slaskie		-0.07	-0.002
Swietokrzyskie		0.00	0.000
Wielkopolskie		0.11	0.019
Warminsko-mazurskie		-0.08	-0.004
Zachodniopomorskie		0.01	0.001
Poland		0.29*	0.031

Agricultural loans and levels of agriculture development were positively and statistically significant correlated only in lodzkie and mazowieckie voivodships. In other voivodships no significant relationship was observed. Consequently, one can assume that the farm financing offered by the cooperative banks (including agricultural preferential loans) does not serve agricultural development as a kind of a regional development policy. However, banks aiming at financing agricultural operations have an indirect effect on agriculture development.

IV. CONCLUSIONS

1. In Poland, farmers rely primarily on cooperative banks for agricultural credit. Both agricultural credits to bank assets ratios and levels of composite indicator of agricultural development over 1997-2006 were statistically significant influenced by region of bank's activity.
2. The shares of farm loans to total bank assets were highest in the cooperative banks operating in rural post-state-farm regions i.e. warminsko-mazurskie, wielkopolskie and kujawsko-pomorskie voivodships.
3. The average farm size and agricultural employment were found to be strongest in influencing agricultural development in Poland. The most prosperous agricultural regions include wielkopolskie, zachodniopomorskie and warminsko-mazurskie, while the least successful respectively malopolskie, podkarpackie, slaskie and swietokrzyskie voivodships.
4. While generally in Poland farm credits provided by cooperative banks over the period under review stimulated development of agriculture, only in two of sixteen voivodships they had positive statistically significant impact on this development.

REFERENCES

1. Belshaw H, Enfield R R (1932) The Provision of Credit with Special Reference to Agriculture. Econ. J. 42 (165):83-86
2. Jha D, Jha S K (2002) Agricultural credit and rural development. Asia-Pac J. Rural Devel. 12(2):106-112
3. Kaiser H F (1960) The application of electronic computers to factor analysis. Educ. Psychol. Meas. 20: 141-151 DOI 10.1177/001316446002000116
4. Cattell R B (1966) The scree test for the number of factors. Multivar. Behav. Res. 1:245-276
5. The World Bank (2007) World Development Report 2008. Agriculture for Development. The International Bank for Reconstruction and Development, Washington, p. 2
6. Zelias A (2000) Taksonomiczna analiza przestrzennego zroznicowania poziomu zycia w Polsce w ujeciu dynamicznym. Cracow University of Economics Publishers, Cracow
7. Zegar J (2003) Zroznicowanie regionalne rolnictwa. Central Statistical Office of Poland, Warsaw.
8. Binderman A (2005) Klasyfikacja polskich wojewodztw według poziomu rozwoju rolnictwa. Rocz. Nauk Rol. Seria G 92(1)
9. Kukula K (2002) Metoda unitaryzacji zerowanej. Polish Scientific Publishers PWN, Warsaw
10. Hellwig Z (1968) Zastosowanie metody taksonomicznej do typologicznego podzialu krajow ze wzgledu na poziom ich rozwoju i strukture wykwalifikowanych kadr. Przeglad Statystyczny 4:307-328
11. Dobosz M (2001) Wspomagana komputerowo statystyczna analiza wynikow badan. Academic

Publishing House Exit, Warsaw
12. Kopainsky B, Flury Ch, Giuliani G (2008) Agriculture's contribution to rural viability: An approach to estimate regional economic impacts of agricultural policy in Swiss case study regions, Paper prepared for presentation at the 107th European Association of Agricultural Economists Seminar "Modelling of Agricultural and Rural Development Policies", Seville, Spain 2008
13. Vandermeulen V, van Huylenbroeck G. (2006) Decentralized rural development policies: does it make sense? The example of diversification in Flanders, Poster paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, 2006
14. Poczta W, Mrowczyńska A (2002) Regionalne zroznicowanie polskiego rolnictwa. In: Poczta W, Wysocki F, editors Zroznicowanie regionalne gospodarki zywnosciowej w Polsce w procesie integracji z Unia Europejska. Agricultural University of Poznan Press, Poznan, pp 125-161

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