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CHANGES OF LABOUR PRODUCTIVITY ON FARMS IN CENTRAL AND EASTERN EUROPE COUNTRIES AFTER EUROPEAN UNION ACCESSION

ZMIANY W WYDAJNOŚCI PRACY GOSPODARSTW ROLNYCH W PAŃSTWACH CENTRALNEJ I WSCHODNIEJ EUROPY PO PRZYSTĄPIENIU DO UNII EUROPEJSKIEJ

Key words: agriculture, fieldcrop farms, longitudinal analysis, machinery, competitiveness
Słowa kluczowe: rolnictwo, pola uprawne, długotrwała analiza, maszyneria, konkurencyjność

Abstract. The accession of Central-Eastern European countries in 2004 and 2007 has placed the agriculture of these countries in the context of new economic policy and market competition. Former research has led to the conclusion that the majority of agricultural producers in the countries of the region are at a significant disadvantage in regards to productivity compared to the farmers of the countries integrated into the EU earlier. The research has examined what – if any – changes have been made during the elapsed period and whether there is any convergence in regard to country groups and different farm size units to the level of farming productivity in field crop farms of more developed countries. The research was based on EU FADN data which provided data until 2009. Figures of five full fiscal years are enough to reveal some tendencies. The research has evaluated the characteristics of changes (with longitudinal analysis) by utilizing the indices of partial efficiency. By using the status attainment theory, an attempt was made to find an explanatory context between the components with income generating capacity for farms and labour productivity. The main conclusion of the research is that the convergence of countries and the varying economic size of farms were differentiated and productivity substantially affected the added value of production potential.

Introduction

The accession of Central-Eastern European countries to the European Union has resulted in significant and positive economic and social changes in spite of anti-EU movements permanently existing in some countries, stimulated by the effect of different global economic processes. The agriculture of the countries has not only entered a new competitive environment, but also integrated into the institutional system of common agricultural policy (CAP).

As regards the evaluation of processes following EU accession, it should be considered that the post-socialist transition has fundamentally reconstituted ownership relations and estate structure of the land in most Central-Eastern European countries [Takács-György et al. 2008, Bandlerová, Marišová 2000]. Besides changes in ownership, there has been a shift in farm structure and the estate structure has been diversified [Takács-György, Sadowski 2005]. The new estate structure has brought considerable transformation in land use, too [Bozsik, Magda 2010]. Privatization has affected farm structure differently in the countries of the Central-Eastern European region and the survival of large-scale farms can be observed [Lazikova, Bandlerova 2007], as well as the emergence of numerous small-scale farms [Takács, Bojar 2003]. This farm structure has opened a new space for cooperation, which also has a stimulative impact on productivity [Ševarlić et al. 2010, Felföldi 2009]. Land market restrictions existing in most countries in the region [Magda 2001] actually conserve or permanently maintain the diversified estate structure which is a limiting factor in regard to productivity. Another new challenge in land use was renewable energy production by way of utilizing agricultural resources [Dombi et al. 2012].

The examination of technical progress and the efficiency of technical development can be made, among others, by the calculation of partial efficiency, where the change of live labour productivity (y/L) is determined in relation to equipment supply and capital productivity, as the multiplication of capital productivity (y/K) and technical facilities (K/L):

$$\frac{y}{L} = \frac{y}{K} \cdot \frac{K}{L} \tag{1}$$

The inter-corporational or international comparison of the partial efficiency index indicates how much the differences in productivity can be due to differences in capital productivity and capital supply (capital stock per head and the asset stock embodying it) [Szűcs et al. 2008].

Starting from the detailed context above, the examinations on the former FADN database have confirmed that the productivity of labour field crop production in Central-Eastern European countries at the time of accession was significantly lower in most of the countries accessing the European Union in 2004 than in the countries which had integrated into the EU earlier. This has caused a competitive disadvantage for these CEE countries [Takács 2008]. Based on the experiences of the decade following the accession and the data of the publicly available FADN database, the aim of the repeated research is to explore whether labour productivity could be increased, or the backlog reduced, in field crop farms in the newly accessed countries.

The presumption is that agricultural producers could reduce the competitive disadvantage in productivity with different success in the countries of the region.

Material and methods

The examination used secondary data: data of EUROSTAT, the Hungarian Central Statistical Office (HCSO) and the FADN database of the European Union. The examined period was from 1989 to 2009. The available data were arranged (into 6 groups) according to economic farm size (ESU) for 12 countries up to 1994, 15 countries up to 2003, 25 countries from 2005 to 2008 and 27 countries from 2009. Out of the 152 standard variables in the database, the following variables were used for the research: the number of represented farms, average labour use, average area utilized, total output, total assets, fixed assets including machinery. 16 826 data per variable were available for the examinations, from which 2148 records described field-crop farms.

In order to analyse partial efficiency, the changes of technical equipment supply (K/L) and capital productivity (y/K) for EU-12/15/25 countries were calculated.

During the research we analysed the impact of changes of factors. The method used was the longitudinal (panel) examination which described changes in their process, their inherent dynamics and development, which was contrary to the traditional, static examinations [Nábrádi et al. 2007]. The condition of analysis was, on the one hand, the availability of a homogenous time series, and, on the other hand, a unified identifier of analysed units, with the help of which the data of units could be reliably identified in the consecutive dates. The point of the method was that the volume categories were made on the basis of full-range data stock of the examined index. These volume categories were put in the head and side column of tables under examination. The units were placed in the cells of the table – following identification – according to the volume of their examination value in the examined 't' period (side column) and 't+1' period (head cells). Thus, the table diagonal contains those units, where the examination factor was similar in the examined 't' and 't+1' date. The units located above the table diagonal are units in which the volume of the examined factor increased from date 't' to date 't+1'. Units below the table diagonal are units in which the volume of the examined factor decreased [Gundel, Laczkáné 1995].

The elements were divided into four groups (G1-G4), according to their deviation from the average of EU-25 countries. G1: technical equipment supply (K/L) and capital productivity (y/K) were over the EU-25 average; G2: technical equipment supply (K/L) was under and capital productivity (y/K) was over the EU-25 average; G3: technical equipment supply (K/L) and capital productivity (y/K) were under the EU-25 average; G42: technical equipment supply (K/L) was over and capital productivity (y/K) was under the EU-25 average.

The research aimed to explore whether the technical equipment supply, the live labour productivity as well as the farm size unit have any explanatory power in the production of net value added on to the farms. For this reason, a linear regression model was set up on the basis of the status attainment theory (Fig. 1a, and functions (2), (3), (4) and (5)). (As regards the model, see Baranyai et al. 2012).

The equations of the linear regression models:

$$spVA = \beta_1 \cdot ESU + \beta_2 \cdot Lab\,Pr\,od + \beta_3 \cdot spMACH + \varepsilon_1 \tag{2}$$

$$Lab\,Pr\,od = \gamma_1 \cdot ESU + \gamma_2 \cdot spMACH + \varepsilon_2 \tag{3}$$

$$spMACH = \delta_1 \cdot ESU + \varepsilon_3 \tag{4}$$

$$spVA = \beta_1 \cdot ESU + \beta_2 \cdot \gamma_1 \cdot ESU + \beta_2 \cdot \gamma_2 \cdot \delta_1 \cdot ESU + \beta_3 \cdot \delta_1 \cdot ESU + \sum_i \varepsilon_i \tag{5}$$

Model variables:

ESU = average economic farm size in economic size unit (FADN code: SE005-economic size) [ESU],

spMACH = specific value of machinery on farms (SE455-machinery/SE025-total utilised agricult. area) [c.u../ha],

LabProd = labour productivity on farms (SE131-total output/SE010-total labour input) [c.u./AWU],

spVA = specific farm net value added (SE415-farm net value added/SE025-total utilised agricultural area) [c.u./ha].
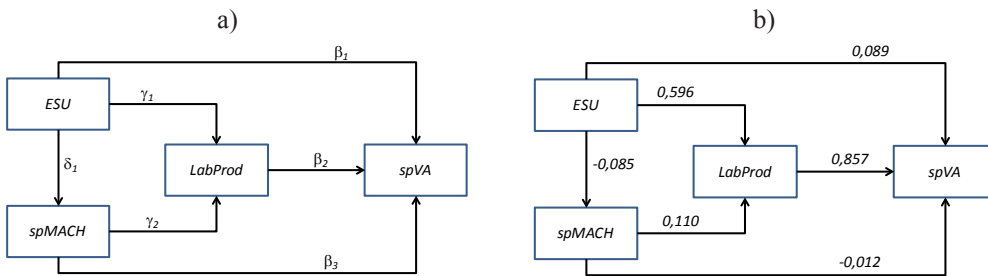

Figure 1. Impacts of farm size, machinery and labour productivity to the added farm net value analysed using the status attainment theory: a) theoretical model; b) Betas of linear regression models in all members
Rysunek 1. Wpływ rozmiaru gospodarstwa rolnego, maszyn i wydajności pracy na wartość dodaną netto gospodarstwa, analiza za pomocą teorii osiągnięć: a) model teoretyczny; b) model beta regresji liniowej obejmujący wszystkich członków
Source: own study
Źródło: opracowanie własne

Results

According to the results of the longitudinal change analysis (Tab. 1), the relative position of most of the Central-Eastern-European countries to the EU-25 average had changed by 2009, following accession in 2004. It was typical that the capital productivity declined, the technical equipment supply increased but the relative situation had mostly remained the same compared to the average of the EU-25 country group. Slovakia and Hungary could maintain their relatively favourable labour productivity (which was still considerably lower than the older member countries of EU), while the productivity of Poland was still behind average.

The examinations made on the basis of the status attainment theory proved the presumptions that labour productivity, technical equipment supply (mechanization) of farms and the economic size unit of farms have explanatory power in relation to the specific net value added productivity of farms.

Table 1. Longitudinal (panel) examination of partial capital efficiency of total capital in the new member countries joined in 2004 (2004/2009)
Tabela 1. Długofalowa (panelowa) analiza częściowej wydajności kapitału wśród nowych państw członkowskich, które przystąpiły do UE w 2004 roku (2004/2009)

Country/ *Kraj*	Change direction of partials/ *Kierunek zmian[a)]*	Economic size/*Rozmiar gospodarczy [ESU][b)]*					
		0 – <4	4 – <8	8 – <16	16 – <40	40 – <100	≥100
CZE	(-/+)	-	G3 → *G3*	G3 → *G3*	**G3 → *G4***	**G3 → *G4***	G4 → *G4*
EST	(-/+)	-	G1 → *G1*	**G1 → *G4***	G4 → *G4*	G4 → *G4*	-
HUN	(-/+)	G1 → *G1*	G1 → *G1*	G1 → *G1*	G1 → *G1*	**G4 → *G1***	G1 → *G1*
LTU	(-/+)	**G1 → *G4***	**G1 → *G3***	**G2 → *G3***	**G1 → *G4***	**G2 → *G4***	G3 → *G3*
LVA	(-/+)	G2 → *G2*	**G2 → *G1***	G2 → *G2*	G1 → *G1*	**G1 → *G4***	**G3 → *G4***
POL	(-/+)	**G4 → *G1***	G4 → *G4*	**G4 → *G3***	G3 → *G3*	G3 → *G3*	**G3 → *G2***
SVK	(-/+)	-	-	G2 → *G2*	G2 → *G2*	G1 → *G1*	G1 → *G1*

Explanations/*Objaśnienia*: a) sign of change of capital productivity/sign of change of technical equipment supply/*symbol zmiany wydajności kapitału/symbol zmiany dostawy sprzętu technicznego;* b) GX → *GY* means moving from Group X in 2004 to *Group Y* in 2009/*GX → GY oznacza przejście z grupy X w 2004 r. do grupy Y w 2009 r.*
Source: own calculation on the basis of FADN (denomination of countries as FADN)
Źródło: opracowanie własne na podstawie FADN (kraje według FADN)

Table 2. Beta coefficients of linear regression models on fieldcrop farms in EU countries
Tabela 2. Współczynnik β modelów regresji liniowej farm uprawnych w krajach UE

Model/ *Model*	Dependent variable/ *Zmienna zależna*	β *Sig.*	Independent variables/ *Zmienna niezależna*			R^2	Constant/ *Stała*	Sig. of constant/ *Symbol stałej*
			LabProd	spMACH	ESU			
EU27	spVA	β	**0.857**	-0.012	0.089	0.831	1854.014	0.000
		Sig.	*0.000*	*0.211*	*0.000*			
	LabProd	β	-	0.110	**0.596**	0.357	22355.957	0.000
		Sig.		*0.000*	*0.000*			
	spMACH	β	-	-	-0.085	0.007	993.783	0.000
		Sig.			*0.000*			
EU+10	spVA	β	**0.974**	0.115	-0.140	0.799	-1286.883	0.001
		Sig.	*0.000*	*0.000*	*0.000*			
	LabProd	β	-	-0.157	**0.478**	0.275	21893.487	0.000
		Sig.		*0.001*	*0.000*			
	spMACH	β	-	-	-0.148	0.022	1110.390	0.000
		Sig.			*0.006*			
EU15	spVA	β	**0.743**	-0.035	0.222	0.827	3861.767	0.000
		Sig.	*0.000*	*0,003*	*0,000*			
	LabProd	β	-	0.178	**0.709**	0.530	14126.992	0.000
		Sig.		*0.001*	*0.000*			
	spMACH	β	-	-	-0.016	0.000	89279.528	0.000
		Sig.			*0.552*			

Explanations/*Objaśnienia*: bold β are significant and sign strong impact/*pogrubioną czcionką oznaczono występowanie silnego wpływu*
Source: own calculation on the basis of FADN
Źródło: opracowanie własne na podstawie FADN

The relations are mostly strong and have great explanatory power (Fig. 1b). After performing regression analysis for EU-27, EU-15 and EU-10 countries (which accessed in 2004) it can be concluded that the models explain 80% or even more from the dispersion of added net value (Tab. 2). The effect of factors is significant in most of these cases. Labour productivity (*LabProd*) has a strong impact, especially in the case of those countries which accessed in 2004, where the beta value is 0.974. The effect of economic size unit on labour productivity is stronger than medium: beta is 0.596 in the case of all the member countries, while it is 0.709 in the case of EU-15. In the case of countries which integrated in 2004, the relation is weaker but still rather strong: the beta is 0.478. Economic size unit has actually no explanatory power on the specific machinery supply of farms. It is remarkable, however, that this impact is negative, which means that the increasing machinery supply deteriorates productivity and the impact is similarly negative on added value production.

Comparing the countries accessing earlier and those accessing in 2004, it can be underlined that the economic size unit has direct impact on value added in the countries which integrated earlier, while in the case of newly accessed ones, there is an opposite (negative) relation between variables.

Conclusions

Following the accession of Central-Eastern-European countries to the European Union in 2004 and 2007, their agricultural enterprises should have worked in the new competitive environment. The present research – partly repeating a survey made 5 years ago – examined the changes of labour productivity of agricultural business ventures in these countries. It could be concluded on the basis of available test-farm (FADN) data that the labour productivity of field crop farms of Central Eastern European countries had decreased slightly. Their position, however, has not changed too much compared to the EU average. It means that the competitive position of countries has not substantially changed. It has slightly deteriorated due to the decay of capital productivity.

Latvia could improve its relative situation, while the average capital productivity has deteriorated, but the equipment supply increased in Lithuania, which resulted in an increasing competitive disadvantage. On the basis of the above, the preliminary presumption can be regarded to be confirmed.

The status attainment examination has proved that the labour productivity is in strong positive relation (has great explanatory power) with the net value added of farms, which has a decisive impact on farm outputs. There is, however, a weak and relative relation between machine supply and value added production which also indicates that asset efficiency has not reached the required level and it can serve as a reserve for increasing competitiveness.

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Streszczenie

Przystąpienie państw środkowo-wschodniej Europy w 2004 i 2007 r. do UE sprawiło, że gospodarka rolna tych państw stanęła w obliczu nowej polityki ekonomicznej i nowej konkurencyjności rynku. Przeprowadzone badania wskazały, że większość producentów rolnych z tego regionu jest w niekorzystnym położeniu, jeśli chodzi o wydajność produkcji względem tych krajów, które wcześniej przystąpiły do UE. Określono zmiany, które wprowadzono podczas minionego okresu i oceniono czy istnieje podobieństwo między grupami państw a różnymi rozmiarami gospodarstw rolnych i poziomem produkcji gospodarstw rolnych bardziej rozwiniętych państw. Badania przeprowadzono na podstawie bazy danych Europejskiego FADN, w której zostały zawarte informacje do 2009 roku. Dane z pięciu pełnych lat fiskalnych są wystarczające do określenia pewnych tendencji. Oceniono charakterystykę zmian za pomocą długookresowej analizy, stosując wskaźniki częściowej wydajności. Stosując teorię status attainment starano się znaleźć czynniki, które składają się na możliwość generowania zysków przez gospodarstwa rolne i wydajność pracy. Wielkość ekonomiczna gospodarstw rolnych była zróżnicowana, a wydajność znacząco wpłynęła na dodaną wartość potencjału produkcyjnego.

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