Labour productivity on farms in the CEE EU member countries (2004–2011)
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Abstract

The agriculture of the new member of the European Union joined 2004 was significantly behind the majority of the 15 former EU member countries both from technical and productivity perspectives. In the common market the competitiveness of products and producers is a key factor. One important factor of competitiveness is labour productivity, which can be divided into partial factors that could be the technical equipment and the productivity of those tools. The study examines the changes of these two partial productivity factors at the former EU member and at the group of countries integrated in 2004.

Keywords: agriculture, technical supply, efficiency, competitiveness, disadvantage

Introduction

There are several factors of competitiveness of the agricultural producers and products [Gorton, Davidova, 2001; Vásáry 2012; Vásáry et al. 2013] but one of the key ones is how efficiently it can use the available resources and how the level of available resources (both in terms of quantity and quality) is related to that of the competitors.

As the result of the innovation activities going on in the recent decades in the agricultural machinery production all over the world [Husti 1998], the high-performance machinery has prevailed in the supply of marketed products. However, the trend-like processes (reduction of environmental load, emergence of soil-protecting technologies, improvement of production quality and later the expansion of sustainable development theories [Magó 2006], as well as the new technical possibilities (for example the wide-range availability of geographical positioning which enabled the implementation of precision crop farming [Takácsné György 2012]) have all increased the supply of new technical and technological solutions.

The relations between technical progress and economic growth can be examined by quantifying the key factors of productivity (productivity of labour and assets that is the productivity of capital manifested in technical equipment and assets). Wide range method for this is the calculation of partial efficiency. The approach determines the change of labour as a function of asset supply (technical equipment) and the productivity of capital, as product of their multiplication. The inter-company or international comparison of partial efficiency index clearly shows the differences in the productivity factors. [Késmárki-Gally 2008]

Material and methods

The data for the examination of factors determining the productivity of labour come from the database of FADN of the European Union. The research covered the period of 2004-2011 (since consistent data was available for this period). The farms were classified into 6 groups on the basis of European Size Unit (according to the methodology of the European Union) and the types of production (fieldcrops, horticulture, wine, other permanent crops, milk production, other grazing livestock, granivores and mixed farms). Number of represented farms, average annual labour use (in AWU), gross production value, total assets, fixed assets, as well as machinery were used for the database.

The partial efficiency analysis was made for EU-10 (8) countries (countries which joined the EU in 2004 without Malta and Cyprus), EU-15 countries (member countries of the EU before the accession in 2004) and EU-25 countries. The function used for the analysis of partial efficiency is as follows:

$\frac{y}{L} = \frac{y}{K} \cdot \frac{K}{L}$, where: $\frac{y}{L}$ = is the labour productivity [currency unit/annual work unit], [EUR/AWU]; $\frac{y}{K}$ = capital productivity [currency unit/currency unit], [EUR/EUR]; $\frac{K}{L}$ = technical equipment [currency unit/annual work unit], [EUR/AWU].

The following data were used from the FADN database for the calculation of partial efficiency: gross production value (the title of the variable in the database: SE131-Total output-c.u.); total annual labour use (SE010-Total labour input-AWU); value of machinery (SE455-machinery-c.u.). Note: instead of fixed assets (SE441-Total fixed assets-c.u.) variable the machinery use was applied because in some countries the land and the value of quotas have a substantial share, therefore these would distort the results of asset capital efficiency analysis (Table 1).

In the depiction, iso-productivity curves help to identify the inner components of productivity change (Figure 1). If two points are located on the same iso-productivity curve, it means that the labour productivity is unchanged, while the technical equipment and capital productivity change in the opposite direction. With the aim to reduce the „rambling" of factor values, the average values of years between 2004-2006 and 2009-2011 are compared in order to present the change tendency of partial efficiency factors.

Results

During the decade following the EU accession of Central-Eastern European countries – on the basis of test farm database – the annual labour input declined altogether by 405.000 people in the Central-Eastern European countries, while in the old member states of the EU it decreased by further 516 thousand people. (Table 2) During the examined period, the output increased all over the EU, and the countries which integrated in 2004 had an outstanding performance (39% growth). The value of machinery stock within fixed assets substantially increased both in regard to the European Union and the country group accessing in 2004, although within this the value of machinery stock in Hungary declined significantly, while the same value usually increased in EU10(8) countries. The output growth and the parallel decline in labour use predicts the increase of labour productivity. Typically there is a moderate or strong statistical relation between the partial factors of productivity during the examined period. In case of EU-10(8) country group the value of correlation coefficient was -0.521 between labour input and output; -0.700 between labour use and machine asset value; while in case of EU-25 country group it was -0.612 between labour input and output, 0.857 between machine asset value and output; while it was -0.815 between labour use and machine asset value. By analysing the change in productivity (Figure 1) it can be concluded that EU-25 countries, owing to the EU-15 countries, have achieved substantial labour productivity growth, realized at an essentially permanent capital productivity. The change can be due to the expansion of technical equipment (machinery stock). In all the countries which accessed in 2004, the labour productivity slightly increased, as a result of the declining capital productivity and growing technical equipment. There are significant differences within the country group which is also indicated by the fact that the capital productivity of Hungary approached the average of EU-15 countries but it is only about one-third of their labour productivity due to the lower technical equipment.

Table 1 Breakdown of non-current assets and share of machinery according to production line in the EU countries, in 2011 (%)

Group of countries	Fixed asset supply compared to the average of EU25	Share of fixed assets in total assets	Land, plan-tation and quo-tes	Buil-dings	Mach-inery	Breed ing stock	Share of machinery in total non-current assets							
							Field crops	Hor-ticul-ture	Wine	Other perma-nent crops	Milk	Other gra-zing lives-tock	Grani-vores	Mi-xed
EU-15	120.6	79.1	70.5	14.2	11.2	4.1	11.5	21.4	13.3	14.3	11.9	12.7	10.0	13.2
EU-10(8)	25.1	80.4	45.5	30.7	19.6	4.2	37.3	21.4	20.2	19.4	25.6	24.4	32.1	31.8
EU-25	100.0	79.5	68.2	15.6	12.2	4.0	13.7	18.5	13.8	11.5	13.7	13.1	16.0	15.5

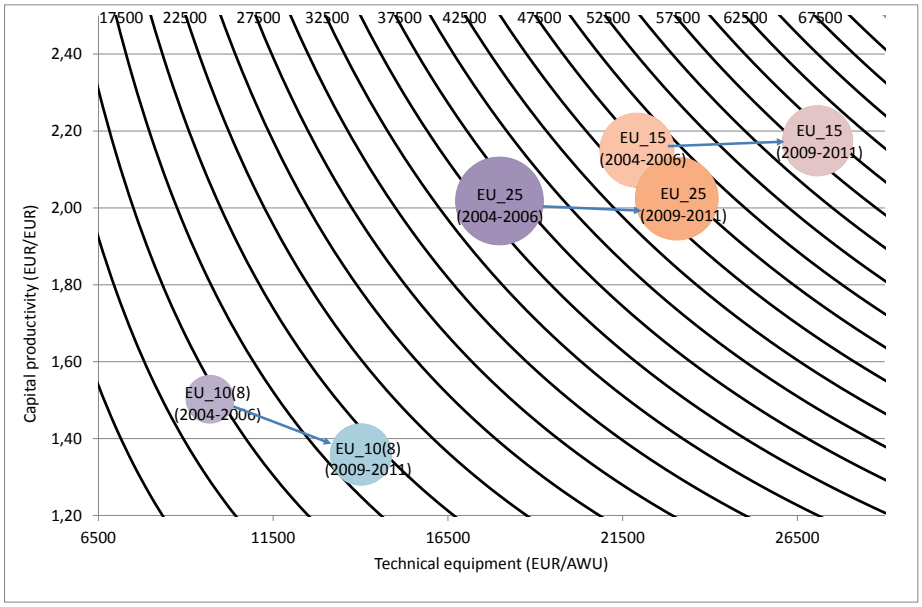
Source: own construction on the basis of FADN

Table 2 Annual labour input, annual output and machine asset value in 2011, average annual change between 2004 and 2011

Group of countries	Annual labour input in 2011	Average annual change (slope of linear trend)	Change (2011/2004)	
	1000 ÉME	1000 ÉME/year	1000 ÉME	%
EU-15	4120.7	-92.95	-516.4	-11.1
EU-10(8)	1767.3	-70.18	-404.6	-18.6
EU-25	5907.5	-163.85	-925.6	-13.5
Name	Annual output in 2011	Average annual change (slope of linear trend)	Change (2011/2004)	
	1000 EUR	1000 EUR/year	1000 EUR	%
EU-15	263806	5733.97	49778.6	23.3
EU-10(8)	39358	1197.80	11017.2	38.9
EU-25	303631	6924.61	60751.4	25.0
Name	Machine asset value in 2011	Average annual change (slope of linear trend)	Change (2011/2004)	
	1000 EUR	1000 EUR/year	1000 EUR	%
EU-15	115826	2191.85	16949.6	17.1
EU-10(8)	26199	867.20	6009.7	54.2
EU-25	142219	3040.29	22831.9	19.1

Source: on the basis of FADN, own calculation

The productivity of labour increases if the economic size unit is growing. (Table 3) By relating the figures to the change of technical equipment, it can be concluded that the smaller farms have relatively higher equipment supply (compared to output), thus their capital productivity (asset efficiency) is lower than the larger holdings. If the picture is differentiated and the change is examined, too, it can be declared that the capital productivity generally improved in the size categories. The growth was outstanding in the smaller economic size categories, approaching the average of farms in the larger size categories. It is a specific situation that the labour productivity of size category (5) and (6) is basically the same, while in the average of category (6) the production is performed at a lower technical equipment and higher capital productivity, which indicates better competitiveness – at least in this regard.



Source: on the basis of FADN, own work

Figure 1 Change of labour productivity in EU country groups and Hungary in relation to partial efficiency components (technical equipment and capital efficiency) (2004-2011) (Note: the area of marking is proportionate with the number of farms belonging to each group)

Table 3 Labour productivity in field crop farms

Year	EU-25 average (EUR/head)	Labour productivity compared to EU-25 average (%)					
		(1) 2 000 - < 8 000 EUR	(2) 8 000 - < 25 000 EUR	(3) 25 000 - < 50 000 EUR	(4) 50 000 - < 100 000 EUR	(5) 100 000 - < 500 000 EUR	(6) >= 500 000 EUR
2004	34889	34.2	47.5	95.8	136.7	209.4	219.9
2011	52676	20.7	40.1	78.1	125.7	201.0	202.9
Group of countries	Variation of labour productivity from EU average (%) (2011)						
EU-15	2004	111.6	96.2	107.3	108.9	106.8	123.6
	2011	127.4	109.8	107.6	108.2	107.3	118.7
EU-10(8)	2004	96.2	72.8	62.1	70.5	55.4	49.6
	2011	73.7	69.5	65.9	67.8	61.8	61.2
EU-25	2004	100.0	100.0	100.0	100.0	100.0	100.0
	2011	100.0	100.0	100.0	100.0	100.0	100.0
Change of relative situation compared to EU-15 countries							

Source: on the basis of FADN, own calculation

By analysing the productivity of farms and changes according to production lines, it can be concluded that the labour productivity of field crop farming – which is determinant in the performance of agriculture – is outstanding, which is due primarily to the technical equipment of the sector but it belongs to weakly performing sectors (among others wine production, granivores, other permanent crops) in regards to capital productivity.

Discussion

As regards the whole European Union, the value of labour productivity more than doubled during the period following the accession in 2004. The development was typically

extensive due to the growth of equipment supply, at permanent (sometimes deteriorating) capital productivity. The field crop farming – which has a key role in the agriculture of the European Union – has achieved the leading labour productivity with technical equipment which is outstanding even compared to the other sectors. Most of the labour intensive sectors can be characterized with substantially lower specific output, at a capital productivity indicating variable asset efficiency. The growth of labour productivity indicates the improvement of competitiveness in regards to agriculture of the EU-10(8) countries during the examined period. The agricultural enterprises of the EU-10(8) countries, however, are still far behind the leading member countries of the European Union.

Table 4 Technical equipment in field crop farms

Year	EU-25 average (EUR/head)	Technical equipment compared to EU-25 average (%)					
		(1) 2 000 - < 8 000 EUR	(2) 8 000 - < 25 000 EUR	(3) 25 000 - < 50 000 EUR	(4) 50 000 - < 100 000 EUR	(5) 100 000 - < 500 000 EUR	(6) >= 500 000 EUR
2004	23901	44.9	66.8	98.5	140.1	191.0	140.5
2011	32404	33.5	57.1	89.0	130.7	179.9	145.5
Group of countries	Variation of technical equipment from EU average (%) (2011)						
EU-15	2004	161.5	122.0	109.2	110.4	105.0	108.7
	2011	131.4	103.4	99.8	99.9	101.2	109.0
EU-10(8)	2004	80.8	84.6	84.3	91.9	63.7	56.9
	2011	50.9	69.4	79.8	83.9	71.4	60.8
EU-25	2004	100.0	100.0	100.0	100.0	100.0	100.0
	2011	100.0	100.0	100.0	100.0	100.0	100.0

Source: on the basis of FADN, own calculation

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References

Gorton, M. and Davidova, S. (2001). 'The international competitiveness of CEEC agriculture', *The World Economy*, Vol.24, No.2, pp.185-200

Husti I. (1998): *Problems and possibilities of the Hungarian agricultural innovation*. Budapest: In Hungarian Agricultural Engineering. (11) 39-41. p.

Erdeiné Késmárki-Gally Sz. (2008*): Effect of agricultural technical progress on the competitiveness (in Hungary)*. Annals of the Polish Association of Agricultural and Agribusiness Economists. 10:(5) pp. 71-76.

Magó L. (2006): *Present Situation of the Mechanization of Small and Medium Size Farms*, Journal of Science Society of Power Machines, Tractors and Maintenance. 11 (11) pp. 66-73

Takács-György K (2012): *Technological answers for environmental challenges in crop production*. Annals of the Polish Association of Agricultural and Agribusiness Economists. 14:(6) pp. 267-271.

Vásáry M, Vasa L, Baranyai Zs (2013): *Analysing competitiveness in agro-trade among Visegrad countries*. Actual Problems of Economics 150: (12) pp. 134-145.

Vásáry M. (2012): *Trends of competitiveness in the agro-trade of Visegrad countries*. Studia Ekonomiczne i Regionalne 5: (2) pp. 5-13.