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CHARACTERISTICS OF THE HUNGARIAN AGRICULTURAL INVESTMENTS AFTER THE EUROPEAN UNION ACCESSION[1]

CHARAKTERYSTYKA INWESTYCJI ROLNYCH NA WĘGRZECH PO PRZYSTĄPIENIU DO UNII EUROPEJSKIEJ

Key words: technical development, modernization, technology, capacity, competitiveness

Słowa kluczowe: rozwój techniczny, modernizacja, technologia, wielkość, konkurencyjność

JEL codes: E22, Q55

Abstract. During the two decades after the transition the technical and technological development of the Hungarian agriculture was determined by the preparation for the EU accession and the adequacy to the performance and technological requirements of the new farm structure of the post-transition era. After the accession the quality based change of farm equipment was characteristic by modern, high performance units which were suitable to meet the requirements of the environmental sustainability, improving the competitive production of farms. In the small scale private farms the rollout of the old and depreciated tools were slower than the investments. This was unfavorable for the expected decrease of the average age of the farm assets. The research is based on the database of the censuses of the Hungarian Central Statistical Office.

Introduction

Most of the Central and Eastern European countries that joined the European Union in 2004 started to conquer the common market with the same heritage, and in case of most of them the agriculture had considerable relevance in the national economy. After the transition and before the accession to the European Union (EU) was the period of the technical and technological preparation, which on the one hand supplied the farms with adequate tools for the newly formed farm structure and ownership (except for Poland) and on the other hand aimed to close the technological gap up through following the international trends.

After the accession most of the countries in the region were able to increase the outputs of the agriculture above the average of the European Union (tab. 1), but the growth of the outputs of the animal husbandry lagged behind the plant production. The ratio of outputs of plant production became higher than the ratio of animal husbandry which resulted in a decreasing level of the processing of the agricultural products.

In the focus of the paper is examining the processes of the technical development of the Hungarian agriculture during the two decade period of the preparation of the accession to the European Union and the years after it. The farm structure that came into being after the transition resulted not only in restructuring the ownership of farms, but a new concept of development and investment was required from the government as well as the business sphere and as a consequence of this situation new financial forms and new financial resources were needed. The Hungarian plan to join the European Union was declared at the beginning of the 1990s and after a long preparation it was realized with another nine countries in 2004. Before the accession the improvement of technical supply of farms in quantity as well as in quality means was one of the preferred target of the national and EU resources including PHARE and SAPARD subsidies for growing the production and improving the competiveness of agricultural products.

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Table 1. Change of production value at producer price between 2005 and 2016
Tabela 1. Zmiana wartości produkcji w cenach producenta między rokiem 2005 a 2016

Countries/*Kraje*	Value in 2016/*Wartość w 2016 roku [mln EUR]*	Ratio/ *Udział [%]*	Rate/*Wskaźnik*		
			2016/2005	2016/2010	2010/2005
Agriculture/*Rolnictwo*					
EU-28/*UE-28*	395,924.3	100.0	1.3	1.1	1.2
Hungary/*Węgry*	8,066.0	2.0	1.4	1.3	1.1
Poland/*Polska*	21,923.1	5.5	1.6	1.2	1.3
Plant production/*Produkcja roślinna*					
EU-28/*UE-28*	205,443.5	100.0	1.3	1.1	1.2
Hungary/*Węgry*	4,968.6	2.4	1.6	1.4	1.1
Poland/*Polska*	10,364.0	5.0	1.7	1.2	1.5
Animal husbandry/*Hodowla zwierząt*					
EU-28/*UE-28*	155,180.0	100.0	1.2	1.1	1.1
Hungary/*Węgry*	2,511.9	1.6	1.2	1.2	1.0
Poland/*Polska*	10,946.8	7.1	1.4	1.2	1.2

Source: own study based on [EUROSTAT 2017]
Źródło: opracowanie własne na podstawie [EUROSTAT 2017]

Despite of all governmental efforts and pre-accession funds during the first decade after the transition the technical supply of the Hungarian agriculture was not satisfying [Takács 2003]. The former large scale farming was characterized by high technical efficiency. The modern and high performance machines were used with up to date logistic approaches on large, several hundred plots. As a consequence of it the average utilization of tools was high and the specific pieces to unit of area was low in an international comparison.

This farm equipment however was not able to supply the demands of the new farm structure that was formed after the transition. On the one hand there were not enough machines, and on the other hand the machines designed for large size plot cultivation were not able to serve the demands of small size plot cultivation. There was surplus and lack of capacity at the same time [Takács 2004].

Capacity demand of the small scale farms is higher than the large scale ones for technological, logistical and psychological reasons. This conclusion is confirmed by former researches [Takács, Bojar 2003] as well as by recent experiences.

After the accession the national and European Union funds aimed to contribute to improving the competitiveness of farms and developing the technical level of farm assets. An examination after the transition already measured the effects of the pre-accession funds [Takács et al. 2008]. The current research examines the effects of the period after the accession by measuring the realization of development aims, estimating the technical and technological modernization of farms, and their contribution to the change of competitiveness of Hungarian farms, and to the domestic outputs of agriculture.

The research questions were: Have the agricultural investments during the last two decades changed or modified the age structure of the key machines? Has the share of tools fitting into to modern technologies grown by the new investments? Has the average age of the farm assets decreased? And has the potential performance of farm assets grown by the new equipment?

The aims of research were to analyze the structure of farms assets and agricultural investments on national level, based on the database of agricultural censuses of the Hungarian Central Statistical Office, by evaluating the machinery supply and their modernity from technical and technological perspective, furthermore to estimate the statistical connection between the agricultural outputs and agricultural investments.

Material and methods

The research is based on open access databases. The components and structure of farm assets were examined through the data of 2000, 2005 and 2013 censuses of the Hungarian Central Statistical Office (HCSO). The figures of agricultural outputs are from the annual reports of HCSO for each year of the examined period.

Measurement of changes was based on comparative analysis of time series: calculation of relative growth, indexes, descriptive statistics, Pearson's correlation analysis. The impact of agricultural investment on agricultural outputs was estimated by linear regression models.

Research results

An earlier research found that the real value of the agricultural investments in the 1990s were less considerable than the former ones, as a result the growth of farm assets was not able to cover the surplus demands from the shortfall because of the aging of farm equipment and the surplus capacity demands from the change of production methods. This resulted in the general aging of farm assets (tab. 2). The age structure of farm assets refers to both its technical condition and technological level. The technological level of a machine is also determined by the country of origin, with regards to the typical production quality of a country. According to the survey in 2000 80.9% of the tractors (with the domestic production 87.9%) are produced in Central and Eastern European countries. From these 93.2% (with the domestic 95.1%) of the largest number used tractors with 41-60 kW engine output originated from this region. Also a key machine of agricultural production is the combine harvester and in case of it the situation is relatively better, because only 51.3% were CEE products. And in the trucks 69.8% were produced in CEE countries. The decade after the EU accession the structure of agricultural machine import changed, the Western European and the North American products became the largest number sold, and the customer demand moved to high performance and ability to serve the modern technological requirements (this is underpinned by the fact that in 2015 the share of tractors with engine over 60 kW was approximately 70%) [Boldog 2016] (tab. 3). At the same time a positive change in the average age of the farm assets could not be recognized because in case of most types of machines the average age of the groups increased. Characteristically the average age of the farm assets of the private farms were 5 to 8 years older than in the agri-

Table 2. Change of the average age of the farm equipment between 2000 and 2013
Tabela 2. Zmiana przeciętnego wieku sprzętu rolniczego w latach 2000 i 2013

Specification/*Wyszczególnienie*	Average age of the farm equipment [years]/*Przeciętny wiek sprzętu rolniczego [lata]*						Change/ *Zmiana* (2013 – 2000)		
	2000*			2013**					
	A	P	E	A	P	E	A	P	E
Tractor/*Ciągnik*	14.9	16.4	11.7	19.0	20.2	13.6	4.1	3.8	1.9
Combine harvester/*Kombajn zbożowy*	14.5	18.3	11.5	15.2	17.2	10.7	0.7	-1.1	-0.8
Other self-propelled harvester/*Inne kombajny*	13.2	13.6	13.1	15.4	17.1	13.9	2.2	3.5	0.8
Other self-propelled agricultural machineries/ *Inne samobieżne maszyny rolnicze*	12.3	14.8	11.5	14.8	18.4	10.4	2.5	3.6	-1.1
Truck/*Ciężarówka*	12.1	11.9	12.4	14.3	15.0	12.9	2.2	3.1	0.5
Warm-winded crop dryer/*Suszarnia ciepłym powietrzem*	16.4	16.5	13.8	15.4	11.9	16.4	-1.0	-4.6	2.6

A – all holdings/*wszystkie gospodarstwa*, P – private farms/*prywatne gospodarstwa*, E – agricultural enterprises/*przedsiębiorstwa rolnicze*
Source: own study based on: * [HCSO 2000], ** [HCSO 2015]
*Źródło: opracowanie własne na podstawie: * [HCSO 2000], ** [HCSO 2015]*

cultural enterprises (except for the warm winded crop dryers which are the heritage of former large scale farms) (tab. 2).

The machine supply of agriculture (tab. 3 and 4) required considerable amount of investments. In case only the tractor supply of the farms is considered, nearly every 10th farm had a tractor in 2000 in case of private farmers, and nowadays, mainly because of the farm concentration with same machine supply, every 5th farm has a tractor, but as it could be seen, with a higher engine output. The tendency is similar at the other types of farm machines. It should be mentioned that the growth of the farm assets are limited by the rationality, meaning all small scale farms equipping all the technologically required machines is not rational because of the low productivity of equipment and higher production costs as its negative influence. Analyzing the capacity changes the development of solid and liquid manure management technologies and fodder production could be recognized.

Table 3. Change of the technical supply of the agriculture between 2000 and 2013
Tabela 3. Zmiana zaopatrzenia technicznego rolnictwa w latach 2000 i 2013

Technical supply/*Sprzęt rolniczy*	Year/*Rok*						Change/*Zmiana* (2013-2010)		
	2000			2013					
	A	P	E	A	P	E	A	P	E
Tractors per 1000 ha, in this/ *Ciągniki na 1000 ha, w tym:*	26.5	42.0	11.1	26.4	40.2	10.3	-0.1	-1.8	-0.8
- do/to 20 kW	6.1	11.5	0.6	3.1	5.5	0.3	-3.0	-6.0	-0.3
- 20.1-60 kW	16.2	25.5	7.1	13.0	21.0	3.8	-3.2	-4.5	-3.3
- 60.1 kW and more/*i więcej*	4.2	5.0	3.4	10.3	13.8	6.2	6.1	8.8	2.8
Combine harvester per 1000 ha/ *Kombajny zbożowe na 1000 ha*	2.6	2.8	2.3	2.4	3.0	1.6	-0.2	0.2	-0.7
Trucks/*Ciężarówki [t/1000 ha]*	20.4	19.3	21.5	13.4	13.8	12.9	-7.0	-5.5	-8.6

Remarks – see tab. 2/*Oznaczenia jak w tab. 2*
Source: own study based on Farm Structure Survey of 2013
Źródło: opracowanie własne na podstawie Farm Structure Survey of 2013

Years before the accession the experts' estimations was that at least one thousand Billion HUF (approx. 3.3 Billion EUR) should be invested into the agriculture during a 3-5 year period in order to decrease the differences amongst the farms in Hungary, it means that yearly at least 1 Billion EUR on real value should have been spent for development. Between 2000 and 2015 on current prices the amounts of agricultural investments grew with approx. 0.04 Billion EUR and only at the beginning of the 2010s investment expenditure managed to reach a yearly 300 Billion HUF (1 Billion EUR). It means the investment expenditures decreased yearly in average with 315 Million HUF (approx. 1 Million EUR) on real value, meaning the expectation was not realized (fig. 1).

Examining the connections between the agricultural investment and the agricultural outputs (tab. 5) it could be recognized that the Pearson's correlation shows a strong significant connection between them. At the same time it is clear that the immediate effect of investments could not be expected, it might as well take several years. This statement has also been confirmed by shifting the data series of outputs with one, two and multiple years. The result is that the one year shifting shows the best correlation but further increasing the years of shifting provides worse correlations.

For estimating the effect of agricultural investments by linear regression model (Table 6) it was concluded that the regression models explain approx. 90% of the variance of data. The best estimation is at the one year shifting. It means that during the analyzed period 1 unit of the investments resulted 6.3 unit nominal growth of the agricultural outputs. Certainly the investments have to be efficiently spent to get the adequate effects. The value of the standardized

Table 4. Change of the average capacity of agricultural buildings between 2000 and 2013
Tabela 4. Zmiana średniej wielkości budynków rolniczych w latach 2000 i 2013

Agricultural buildings/*Budynki rolnicze*	Rok/*Year*						Change/*Zmiana* (2013-2000)		
	2000			2013					
	A	P	E	A	P	E	A	P	E
Cow shed [places]/*Obora [miejsca]*	14.0	6.4	114.7	29.8	15.3	134.2	15.8	8.9	19.5
Horse stable [places]/*Stajnia [miejsca]*	4.0	3.6	22.4	5.5	5.2	22.1	1.5	1.6	-0.3
Pigsty [places]/*Tuczarnia [miejsca]*	9.7	6.3	441.5	16.8	8.0	602.4	7.1	1.7	160.9
Poultry house/*Kurnik [m²]*	14.8	9.5	835.3	31.0	16.9	1316.8	16.2	7.4	481.5
Sheep fold [places]/*Owczarnia [miejsca]*	84.4	63.5	448.4	71.9	63.2	402.2	-12.5	-0.3	-46.2
Solid manure storage/*Płyta obornikowa [m²]*	16.7	8.7	743.2	49.7	17.5	967.4	33.0	8.8	224.2
Liquid manure storage/ *Zbiornik na gnojowicę [m³]*	263.3	8.2	2065.4	1238.0	56.9	4070.3	974.7	48.7	2004.9
Milking parlour [places]/ *Stanowiska do dojenia [miejsca]*	18.2	11.6	22.3	19.1	11.9	30.0	0.9	0.3	7.7
Silo/*Silos [m³]*	320.1	57.6	1167.2	1057.7	247.6	1468.3	737.6	190.0	301.1
Cold-winded crop dryer/ *Suszarnia zimnym powietrzem [t]*	61.2	10.9	114.6	136.9	76.0	252.2	75.7	65.1	137.6
Warm-winded crop dryer [t/hour]/ *Suszarnia ciepłym powietrzem [t/godz.]*	9.2	3.3	11.7	25.8	22.8	27.4	16.6	19.5	15.7
Fodder mixer [t/hour]/ *Mieszalnik pasz [t/godz.]*	3.2	2.1	4.6	10.6	11.2	8.8	7.4	9.1	4.2

Remarks – see tab. 2/*Oznaczenia jak w tab. 2*
Source: see tab. 3
Źródło: jak w tab. 3

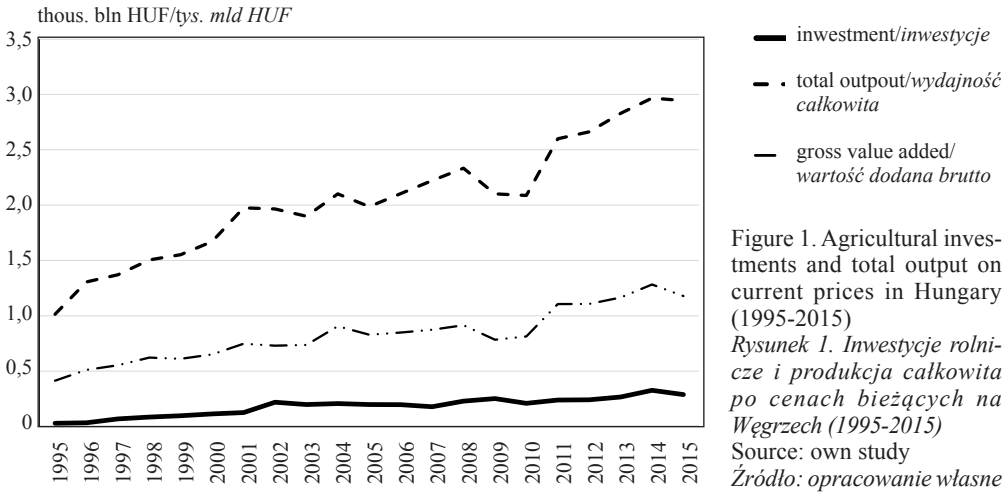

Figure 1. Agricultural investments and total output on current prices in Hungary (1995-2015)
Rysunek 1. Inwestycje rolnicze i produkcja całkowita po cenach bieżących na Węgrzech (1995-2015)
Source: own study
Źródło: opracowanie własne

Table 5. Correlations of the agricultural investments (INV), the outputs (OUT) and the gross value added (GVA) for estimating the effect of the investments (1995-2015)
Tabela 5. Korelacje inwestycji rolnych (INV), wydajności (OUT) i wartości dodanej brutto (GVA) w celu oszacowania wpływu inwestycji (1995-2015)

Variables/*Zmienne*	INV	OUT	GVA	INV_ OUT_+1	INV_ OUT_+2	INV_ GVA_+1	INV_ GVA_+2
INV	1	0.935**	0.910**	0.956**	0.932**	0.912**	0.895**
OUT	0.935**	1	0.988**	0.950**	0.906**	0.939**	0.894**
GVA	0.910**	0.988**	1	0.914**	0.867**	0.913**	0.853**
INV_OUT_+1	0.956**	0.950**	0.914**	1	0.950**	0.988**	0.939**
INV_OUT_+2	0.932**	0.906**	0.867**	0.950**	1	0.914**	0.988**
INV_GVA_+1	0.912**	0.939**	0.913**	0.988**	0.914**	1	0.913**
INV_GVA_+2	0.895**	0.894**	0.853**	0.939**	0.988**	0.913**	1

** significant at 0.000/*istotne przy at 0.000*
Source: own study
Źródło: opracowanie własne

Table 6. Linear regression model for estimating the effect of agricultural investments on agricultural outputs
Tabela 6. Model regresji liniowej do szacowania wpływu inwestycji rolnych na produkty rolne

Variables/ *Zmienne*	R^2	Unstandardized coefficients/ *Współczynnik niestanadardowy*	Standardized Coefficients/ *Współczynnik standardowy*	Significant/ *Istotność*
INV-OUT	0.874	6.065	0.935	0.000
INV-OUT+1	0.915	6.332	0.956	0.000
INV-OUT+2	0.868	6.290	0.932	0.000

Source: own study
Źródło: opracowanie własne

coefficient is less than 1, meaning 1 unit relative change of investments results less than one unit change of agricultural outputs, representing an inefficient use of the invested amounts.

Conclusion

After the examination of the effects of agricultural investments in Hungary during the decades after the EU accession the followings could be concluded:

1) the increase of the average age of farm equipment has continued and the agricultural investments has not been able to contribute to the general renewal of farm assets yet;
2) the machinery supply has been improved a little bit, the newly invested machines has contributed to the technical and technological modernization of the agriculture;
3) the annual amounts of agricultural investments have decreased on fixed (real) value in Hungary;
4) the effect of investments on the outputs seems to be advantageous on nominal prices (approx. six times of investments are produced);
5) the effectiveness of the investments has remained behind the expected extent, because the relative effect on the outputs has been less than the investments change in Hungary.

Bibliography

Boldog Valéria. 2016. Főbb mezőgazdasági gépek forgalma (Rotations of main agricultural machines). *Agrárgazdasági Kutató Intézet* 26 (1): 12.

EUROSTAT. 2017. *Output of the agricultural industry – basic and producer prices*, http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tag00102&plugin=1, access: 02.04.2017.

HCSO (Hungarian Central Statistical Office). 2000. *Agriculture in Hungary. Regional data*. Budapest: Hungarian Central Statistical Office.

HCSO (Hungarian Central Statistical Office). 2015. *Farm structure survey of 2013*. Budapest: Hungarian Central Statistical Office, http://www.ksh.hu/agricultural_census_fss_2013(gszo2013_final_tables), accessed: 02.04.2017.

Takács Istvan. 2003. Some aspects of the asset supply and the asset efficiency of Hungarian agriculture. *Bulletin of the Szent István University (Gödöllő)* 3: 193-204.

Takács Istvan. 2004. Efficiency problems of farm assets in Europe. *Annals of the Polish Association of Agricultural and Agribusiness Economists* VI (6): 68-73.

Takács Istvan, Zsolt Baranyai, Emese Takács. 2008. Factors of efficiency change of assets on the EU-15 and Hungarian farms from 1990s. [In] *Agricultural economics and transition: what was expected, what we observed, the lessons learned,* eds. Cs. Csáki, Cs. Forgács, 581-590. Halle: Institute of Agricultural Development in Central and Eastern Europe (IAMO).

Takács Istvan, Waldemar Bojar. 2003. *Challenges and opportunities for agriculture of Central Europe according to farm structure and abounding with capital*. [In] Proceedings of the 14th IFMA Congress. 10-15 August, 2003. Perth, Australia.

Streszczenie

Celem artykułu jest charakterystyka inwestycji rolnych na Węgrzech po przystąpieniu do Unii Europejskiej. Na podstawie danych Węgierskiego Urzędu Statystycznego stwierdzono, że w latach poakcesyjnych starzenie się sprzętu rolniczego postępowało szybciej niż następowały inwestycje odtworzeniowe. Zakupy sprzętu wpłynęły jednak korzystnie na konkurencyjność gospodarstw i jakość produkcji.

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