Jakub Staniszewski

Poznan University of Economy, Poland

EFFICIENCY OF AGRICULTURAL STRUCTURES IN "OLD" AND "NEW" MEMBER STATES OF THE EUROPEAN UNION IN THE YEARS 2000-2013

EFEKTYWNOŚĆ STRUKTUR WYTWÓRCZYCH ROLNICTWA W STARYCH I NOWYCH PAŃSTWACH CZŁONKOWSKICH UNII EUROPEJSKIEJ W LATACH 2000-2013

Key words: productivity, EU member states, production structures, convergence
Słowa kluczowe: produktywność, państwa UE, struktury wytwórcze, konwergencja

Abstract. The article focus on changes taking place in the EU-27 in the period 2000-2013 in the field of the factor productivity in agriculture and production structures, understood as the relations between factors of production. Partial productivity ratios and structure indicators have been calculated on the basis of the Economic Accounts for Agriculture, available in Eurostat database. Thesis on convergence in productivity of factors of production between EU-12 and EU-15 countries is not confirmed in the case of land factor. In addition, only beta convergence, can be taken into consideration, because despite the higher growth rate of the value of certain variables in the countries characterized by their lower levels, the overall variation of the group remains over the period high and stable

Introduction

Accession to the European Union, triggers a number of opportunities for agricultural producers, mainly due to participation in the Single European Market (SEM) and implementation of economic support under the Common Agricultural Policy (CAP). Integration of national agricultural markets with the markets of the "old" member states stimulates increase in demand and price levels, and incorporate agriculture in the system of the external tariff protection [Tomczak, Wilkin 2003]. However, to be able to compete within the Single European Market, in the agriculture of the new Member States some adjustments, leading towards increase in the efficiency of resources, are necessary. In terms of microeconomic, adjudication about efficiency or lack of it requires the comparison of resources (inputs) and results (outputs) in the given economic system [Kulawik 2007, p. 4]. In macroeconomic terms, this efficiency is determined to a large extend by the production structure [Pajestka 1981, p. 36]. The concept of structures, understood as "an integrated system of distinguishable yet mutually constitutive elements", lies at the root of structuralism – theoretical approach pointing the economy structure as the primary determinant of the differences in countries development level [Blankenburg et al. 2008]. Therefore, a prerequisite for more efficient use of production factors in agriculture is change in its production structures. However, the evolution of structure is progressing slowly, especially in the case of agriculture, where immobile and highly specific land factor plays an important role, and where its lower efficiency adversely affect the efficiency of other factors of production and reduces the competitiveness of the whole sector [Kusz 2012, p. 59]. What's more, CAP implemented by the EU is currently based on the paradigm of sustainable development[1] and is no longer pushing production efficiency, to the formerly common extend. Improving agricultural productivity is linked to the

[1] As indicate Czyżewski and Stępien [2011, p. 30] „EU agricultural policy, initially focused on increasing productivity and structural problems in the sector of agricultural production, in the course of reforms has become a policy on various importance of agriculture in society, in particular challenges that need to be taken not only in economic but in a broader, social and environmental rural context".

sustainable management of natural resources. It implies that too rapid economic growth is seen as a potential threat to the maintenance and growth of agricultural productivity in future periods [Floriańczyk, Rembisz 2012, p. 54]. For now, the new Member States still diverge significantly from the EU-15 in the field of agriculture productivity, what affects their competitiveness in this field. Hypothesis adopted in the paper assumes progressive convergence within efficiency and shape of the production structures in agriculture, proceeding faster for productivity.

Material and methods of the research

In the literature, there are two main concepts of convergence. The sigma convergence, that occurs when the dispersion of per capita income (or other studied phenomenon) between regions or countries is reduced over time, and the beta convergence – concerning relationship between the average growth rate and the initial level of the given variable [Wójcik 2008, p. 42]. To quantify dynamic of convergence process classic statistical measures will be used:

– coefficient of variation, to illustrate sigma convergence,
– harmonic mean of dynamic indexes of each year, to illustrate beta convergence,
– average annual rate of change, to illustrate beta convergence in the case of the variables associated with land factor.

Their higher value for countries with a lower level of the tested feature indicates convergence. Indicators of productivity and structure used in the research are presented in the Table 1. The calculations used data from Economic Accounts for Agriculture, available in Eurostat database, concerning 27 Member States and the years 2001 to 2013[2]. The data were aggregated for the EU-

Table 1. Productivity and structure indicators – estimation methods
Tabela 1. Wskaźniki produktywności i struktury – metoda szacowania

Indicators/*Wskaźnik*		Exuation/*Wzór*		Unit/*Jednostka*
Productivity/*Produktywność*	land/*ziemi*	agricultural output / utilised agricultural area	*produkcja rolnictwa / powierzchnia użytków rolnych*	euro/ha
	labor/*pracy*	agricultural output / total labour force input	*produkcja rolnictwa / całkowite nakłady pracy*	euro/AWU
	capital/*kapitału*	agricultural output / total intermediate consumption + fixed capital consumption	*produkcja rolnictwa / całkowite zużycie pośrednie+amortyzacja*	euro of output/euro of input
Structure/*Struktura*	capital per 1 ha of UAA/ *techniczne uzbrojenie ziemi*	total intermediate consumption + fixed capital consumption / utilised agricultural area	*całkowite zużycie pośrednie+amortyzacja / powierzchnia użytków rolnych*	euro/ha
	capital per AWU/*techniczne uzbrojenie pracy*	total intermediate consumption +fixed capital consumption / total labour force input	*całkowite zużycie pośrednie+amortyzacja / całkowite nakłady pracy*	euro/AWU
	AWU per 1000 ha of UAA/ *pełnozatrudnieni na 1000 ha UR*	total labour force input / utilised agricultural area	*całkowite nakłady pracy / powierzchnia użytków rolnych*	AWU/1000 ha

Source/*Źródło*: [Poczta et al. 2009, p. 47, Baer-Nawrocka, Markiewicz 2013, p. 9]

[2] Data on total agricultural production in Cyprus cover the period 2003-2013; data on capital in agriculture in Bulgaria cover the period 2002-2013, in Ireland period 2003-2013, in Cyprus years 2002-2013; data on the area of agricultural land are available for years 2005, 2007 and 2010.

15 ("old" EU – Belgium, Netherlands, Luxembourg, France, Germany, Italy, United Kingdom, Denmark, Ireland, Greece, Spain, Portugal, Finland, Austria, Sweden) and the EU-12 ("new EU" – Poland, the Czech Republic, Slovakia, Lithuania, Latvia, Estonia, Hungary, Slovenia, Cyprus, Malta, Romania, Bulgaria). To isolate the effect of changes in prices of agricultural production values are presented in constant prices of 2005.

Research results

So far, the determinants of differences in the level of productivity have been studied relatively rare[3]. Floriańczyk [2008] quantified the efficiency of resources use in agriculture of EU countries in the years 1999-2005 and pointed out that although progress in this area has performed in most EU countries, its sources were different. In the old Member States growth was caused mainly by technical progress, while new countries still had reserves in the field of more efficient use of existing resources. Baer-Nawrocka and Markiewicz [2013] perceive the primary determinants of the effectiveness of the use of production factors in their mutual relations. Among the studies of the consequences of the international variation in agricultural productivity the study of Poczta and Kołodziejczak [2002] must be mentioned. The authors argue that the untapped potential of Polish agriculture is the consequence of the low factors productivity. Floriańczyk and Rembisz [2012] examine how agricultural productivity growth determines its profitability, and to what extent it is a function of increasing transfers. Results from the EU countries in 2002-2010 indicate a growing share of transfers in incomes in the new member states and the relative stability in the "old EU" in this field in the conditions of decreasing factors productivity. Studies of Gopinath et al. [1997] refer to relations between factors productivity and agriculture competitiveness, comparing the selected EU countries and the United States. Analyzing agricultural GDP growth and its input, pricing and productivity component, they conclude that the most significant is the productivity component. The work Luden et al. [2007] examine convergence of the agriculture total factor productivity on a global scale, basing on data from the years 1961-2001. The authors prove the convergence between developed and developing countries in the area of crop production and non-ruminant animals breeding and divergence in the area of ruminants breeding. In their opinion the main cause of the observed divergence is the deepening technological barrier. On the other hand Coelli and Prasada Rao [2005], investigate the convergence processes of agricultural productivity basing on the data from 93 countries, from the years 1980-2000. They identify that countries far from the optimal use of resources in 1980 reached higher total productivity increase rate than the states earlier close to the optimum.

Beta convergence is a necessary but not sufficient condition for the existence of the sigma convergence [Wójcik 2008, p. 42]. The size of the average productivity growth of individual factors of production, is presented in Table 2.

Obtained results justify cautious conclusion that beta convergence occurred within the factor productivity in the agriculture of „old" and „new" EU Member States. Among the countries joining the EU in 2004 and 2007, characterized at the beginning of the research period by relatively lower productivity of all factors, in the years 2000-2013, higher dynamic in productivity growth was identified particularly according to labor and capital. This dynamic made it possible to reduce the differences in the productivity of these resources. While in 2000 one person employed (1 AWU) in old EU countries produced almost 9.5-fold greater value in agriculture than the same person employed in the EU-12, in 2013, this value was only 5.7-fold higher. This progress was possible because of a significant reduction in employment in agriculture in the new Member States (a decrease of over 45%), in the terms of increasing production (by 25%).

To increase production volumes, along with the decline in employment, essential is labor substitution by capital. Interestingly, increase in capital input in the both groups was similar (5.6% for the EU-12 and 5.7% for the EU-15), although higher growth of the production in the "new" Member States meant faster growth of capital productivity in this group. Moreover, in the analyzed

[3] More often, conducted research focus on the problem of changes in agriculture producitivity. Examples of such reserch, carried out in Poland are works of Rusielik [2014], Kapusta [2015] and Jankowiak et al. [2013].

Table 2. Average dynamic of factor productivity and change in production structures in agriculture of EU-12 and EU-15 countries
Tabela 2. Przeciętna dynamika produktywności i zmian struktur wytwórczych w rolnictwie państw UE-12 i UE-15

Specification/ *Wyszczególnienie*	Countries/*Kraje*					
	EU/*UE*-12	EU/*UE*-15	EU/*UE*-12	EU/*UE*-15	EU/*UE*-12	EU/*UE*-15
	2000		average dynamic/ *przeciętna dynamika*		2013	
Labor productivity/ *Produktywność zasobów pracy*	4 539,16	42 691,09	105,915	102,188	10 017,78	56 808,53
Land productivity/ *Produktywność zasobów kapitału*	1,20	1,41	101,320	99,388	1,43	1,36
Capital per AWU/ *Techniczne uzbrojenie pracy*	3,78	30,38	104,665	102,459	7,03	41,69
	2005		average dynamic/ *przeciętna dynamika*		2010	
Land productivity/ *Produktywność zasobów ziemi*	964,68	2 199,88	99,447	100,110	938,29	2 211,97
Capital per 1 ha of UAA/ *Techniczne uzbrojenie ziemi*	104,78	358,55	100,696	100,936	108,48	375,65
AWU per 1000 ha of UAA/ *Pełnozatrudnieni na 1000 ha UR*	143,36	46,65	93,404	97,593	101,92	41,30

Source: own research based on Eurostat data [http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=aact_eaa03&lang=en, access: 09.04.2015]

Źródło: opracowanie własne na podstawie danych Eurostat [http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=aact_eaa03&lang=en, access: 09.04.2015]

period capital invested in agriculture in the "new" Member States has become more productive than in EU-15. This may prove overinvestment in the agriculture of EU-15, especially in the context of data indicating that the productivity of capital in these countries decreased. On the basis of the presented results it is hard to conclude on convergence within the land productivity. Due to the low mobility of the land factor and the related slow processes of structural change, any conclusions based only on the observations from 5 years period would be burdened with the high margin of error. These statement confirms, lowest of the surveyed indicators, land productivity dynamic. If, however, we attempt to conclude under these restrictions, we identify progressive divergence, because with a small increase in land productivity in the EU-15, the EU-12 countries noted slight decrease in this value. Among the structural variables, representing relations between production factors, the strongest convergence was within the capital per AWU.

Beta convergence, however, is not tantamount to the existence of sigma convergence. Evidence to that statement comes from the study of the coefficients of variation of selected features for a group of EU-27 (Fig. 1). First of all, high diversity within most variables must be noted. (exception to that rule is capital productivity for which auxiliary axis has been prepared). Values close to unity indicate that the standard deviation of the sample is almost equal to the average value. What's more, variation in the sample during the period did not decrease, but rather increases for most indicators, which means that sigma convergence does not occured. About slight convergence, we can speak only in the case of labor productivity. In accordance with the previously identified relationships this situation may be explained by assuming that, although the new Member States with lower productivity in agriculture are catching up with the EU-15, the distance remaining between the countries with the lowest and highest rates affects the overall high diversity throughout the all EU countries.

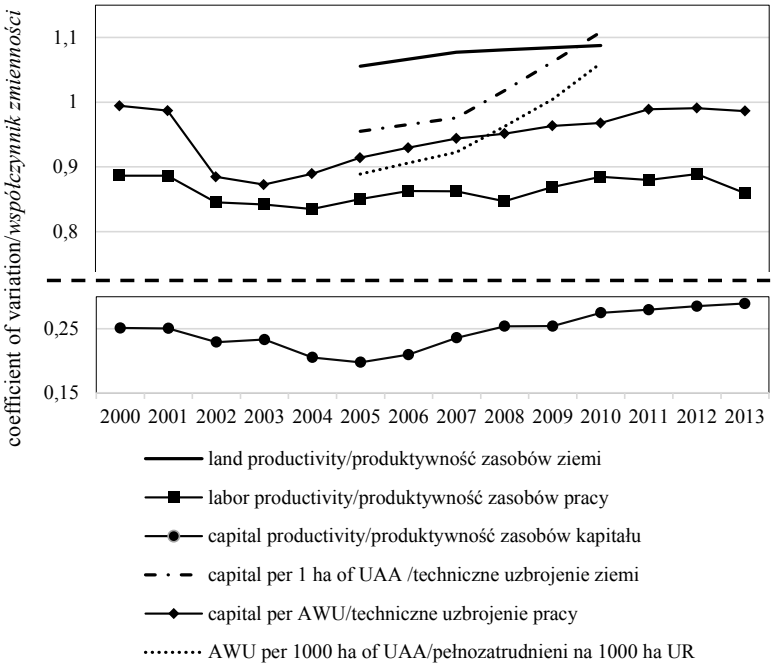

Figure 1. The coefficient of variation of structure and productivity indicators in UE-27 Member States in the years 2000-2013
Rysunek 1. Współczynniki zmienności wskaźników produktywności i struktury w państwach UE-27 w latach 2000-2013
Source: see tab 2.
Źrodło: jak w tab. 2

Conclusions

Conducted research is a prerequisite for conclusion about reduction in differences in productivity and production structures of the EU. However, this process is uneven in accordance to various factors. Catch-up effect is the strongest within the labor factor and capital, as well as capital per AWU. These changes are primarily the result of a systematic decrease of employment in the agricultural sector in the new Member States, as well as decreasing capital productivity in the old Member States. In the case of land factor, the dynamic was much lower, what can be associated with immobility of this factor, though not without importance is limited availability of data and the associated shorter period of research. Progressing beta convergence, is not accompanied by sigma convergence. Slight decreases in the coefficient of variation occurred only in the case of labour productivity and capital per AWU. In other cases, the average diversity was increasing. We cannot forget that currently, agricultural productivity or convergence in this field within Member States, are not included among the objectives of the CAP increasing. In this context, the research results are not surprising. On the other hand, in the interest of Member States, especially the new ones, should be improving the competitive position of domestic agricultural producers on the Single European Market. And one of the crucial conditions of competitiveness boost is effective use of available resources.

Literatura

Baer-Nawrocka A., Markiewicz N. 2013: *Relacje między czynnikami produkcji a efektywność wytwarzania w rolnictwie Unii Europejskiej*, J. Agrib. Rural Devel. No. 3(29), 5-16.

Blankenburg S., Palma J. G., Tregenna F. 2008: *Structuralism*, *The New Palgrave Dictionary of Economics,* Second edition, ISBN 978-0-3337-8676-5.

Coelli T.J., Prasada Rao D.S. 2005: *Total factor productivity growth in agriculture: a Malmquist index analysis of 93 countries, 1980-2000*, Agricultural Economics, no. 32(1), 115-134.

Czyżewski A., Stępień S. 2011: *Wspólna polityka rolna UE po 2013 r. a interesy polskiego rolnictwa*, Ekonomista, nr 1, 9-36.

Floriańczyk Z. 2008: *Produktywność polskiego rolnictwa w pierwszych latach członkostwa w UE na tle wybranych krajów europejskich*, [w:] A. Alińska, Z. Floriańczyk, T. Toczyński (red.), *Zagadnienia produktywności, regionalnego zróżnicowania nakładów pracy i kredytowania produkcji rolniczej w świetle Rachunków Ekonomicznych dla Rolnictwa,* Raport IERiGŻ, 9-22, ISBN 978-83-60798-83-6.

Florianczyk Z., Rembisz W. 2012: *Dochodowość a produktywność rolnictwa polskiego na tle rolnictwa unijnego w latach 2002-2010*, Zesz. Nauk. SGGW, Problemy Rolnictwa Światowego, nr 12(1), 53-62.

Gopinath M., Arnade C., Shane M., Roe T. 1997: *Agricultural competitiveness: The case of the United States and major EU countries*, Agricultural Economics, no. 16, 99-109.

Jankowiak J., Bieńkowski J., Holka M., Dąbrowicz R. 2013: *Zmiany produkcyjności polskiego rolnictwa po wstąpieniu do Unii Europejskiej w ujęciu przestrzennym,* Rocz. Nauk. SERiA, t. XV, z. 4, 146-151. Kołodziejczak M., Poczta W. 2002: *Analiza efektywności wykorzystania czynników produkcji i ich nakładów w rolnictwie polskim i unijnym*, Rocz. Nauk. SERiA, t. IV, z. 2, 132-137.

Kapusta F. 2015: *Zmiany strukturalne środków trwałych w polskim rolnictwie i ich produktywności w okresie przedakcesyjnym i po akcesji do Unii Europejskiej,* Rocz. Nauk. SERiA, t. XVII, z. 1, 100-106. Kulawik J. 2007: *Wybrane aspekty efektywności rolnictwa*, Zag. Ekon. Roln., nr 1, 3-16.

Kusz D. 2012: *Egzogeniczne i endogeniczne uwarunkowania procesu modernizacji rolnictwa*, Roczniki Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich, nr 99(2), 53-67.

Ludena C. E., Hertel T. W., Preckel P. V., Foster K., Nin A. 2007: *Productivity growth and convergence in crop, ruminant, and nonruminant production: measurement and forecasts*, Agricultural Economics, nr 37(1), 1-17.

Pajestka J. 1981: *Czynniki i współzależności rozwoju społeczno-gospodarczego. Determinanty postępu I*, PWE, Warszawa ISBN 83-208-0089-7.

Poczta W., Czubak W., Pawlak K. 2009: *Zmiany w wolumenie produkcji i dochodach rolniczych w warunkach akcesji Polski do UE*, Zag. Ekon. Roln, nr 4, 40-52.

Rusielik R. 2014: *Zmiany produktywności rolnictwa Polski po wstąpieniu do Unii Europejskiej - analiza z wykorzystaniem indeksów TFP Hicksa-Moorsteena,* Rocz. Nauk. SERiA, t. XVI, z. 4, 246-252.

Tomczak F., Wilkin J. 2003: Rolnictwo polskie wobec integracji europejskiej: możliwości rozwojowe, bariery i strategie adaptacyjne, Krajowa Rada Spółdzielcza, Warszawa.

Wójcik P. 2008: *Dywergencja czy konwergencja: dynamika rozwoju polskich regionów*, Studia Regionalne i Lokalne, nr 2 (32), 41-60.

http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=aact_eaa03&lang=en, access: 09.04.2015.

Streszczenie

Przedstawiono zmiany, które zachodziły w państwach UE-27 w latach 2000-2013 w zkaresie produktywności czynników wytwórczych w rolnictwie oraz ich struktur, rozumianych jako relacje pomiędzy czynnikami wytwórczymi. Wskaźniki produktywności cząstkowej i struktury obliczono na podstawie Rachunków Ekonomicznych Rolnictwa, dostępnych w zasobach Eurostat. Teza dotycząca konwergencji w zakresie produktywności czynników wytwórczych pomiędzy krajami UE-12 i UE-15 nie potwierdziła się w przypadku czynnika ziemi. Ponadto można mówić jedynie o konwergencji typu beta, gdyż pomimo większego tempa przyrostu wartości niektórych zmiennych w krajach o niższym ich poziomie, ogólna zmienność zbiorowości utrzymywała się w badanym okresie na podobnym wysokim poziomie.

Correspondence address
Mgr Jakub Staniszewski
Poznan University of Economy, Poland
Al. Niepodległości 10, 61-875 Poznań
phone: (61) 854 30 18, e-mail: jakub.staniszewski@ue.poznan.pl