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Changes in the Structure of Agricultural Production in the European Union with Particular Emphasis on Poland and Latvia

Abstract. Many of phenomena, their growth or trend, are dependent on the interactions between neighboring areas. Model of shift-share analysis represent a growth rate (rate of change) of the different options phenomenon by taking into account the phenomenon of increase in the neighbouring area. The aim of the study is to analyze the changes in the commodity structure of agricultural production in the European Union according to the selected types of agricultural products using of shifts share analysis. The study assesses the rate of change the size of the phenomenon and identified and estimated the share of structural, sectoral and regional (local spatial) in the size of the effect of the global (agricultural production in the European Union overall) in the EU countries.

Key words: structure of agricultural production, European Union

Introduction

Agriculture of EU member states is characterized by diverse natural conditions, which largely determines the nature of agricultural production. A common feature for most countries is that agricultural production is mechanized, modern and agricultural producers use of industrial means of production. Another and perhaps the most important common characteristic of EU agriculture is the fact that it is the subject to the common political-legal regulation which are strictly and clearly defined within the framework of the Common Agricultural Policy (Nowak, Wójcik, 2013; Wilkin, 2009; Tłuczak, 2016). Diversification of nature and relatively high level of development of agriculture has contributed to the fact that in most EU countries is dominated by specialized farms, with directions appropriate for the conditions of the natural of the country (Adamowicz, 2008; Poczta et al 2009).

In those countries where is dominated by permanent grassland, the farms rearing of animals grazing are very important, this applies primarily in countries such as Austria, Belgium, the Netherlands, Ireland, Hungary and the United Kingdom. In the Mediterranean area (Cyprus, Greece, Spain, Italy) countries are specializing in permanent crops. Field crops are this type of agricultural production, which has a large share in total agricultural production, but in any country is not in the advantage. The largest share of field crops are in Sweden, where they account for more than 40%).

Differences in the level of development of agriculture between the EU-15 and EU-12 can be seen, among other things by the fact that in the first case, a greater proportion are farms belonging to different types of specialist. In the old countries, their share is a total of more than 87% are very important, while in the new countries is less than 65% (although the highest percentage of entities specializing exists in Hungary and in Slovenia, reaching more than 90%).

In Poland, farms specializing in field crops are very important, in 2010 was about 40%, and the share of multi-stakeholders is at a level similar to the average for all EU-12

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(Tłuczak, 2106). Agricultural land of Latvia occupy 27% of the country area (of which 14% of arable land, meadows and pastures 13%), including approx. 2 million hectares are swamp. Dominates breeding cattle milk type, pigs, fur animals. Cereal crops mainly include barley, wheat, rye, oats.

Today's economic conditions which are related to the operation and regional development within the European Union make it necessary to take on new diagnostic tests for the prospects of economic development of regions (Rozpędowska-Matraszek, 2010; Tłuczak 2015).

The main aim of this article is to analyse the changes in the structure of agricultural production in the European Union in the period 2005-2014, according to the selected agricultural products (wheat, rye, potatoes, pork, beef) using the method of shifts-share analysis. The study evaluated the rate of growth of the size of the phenomenon. In addition, the author identified the share of structural and competitiveness effect of global cross-section of countries.

Materials and Methods

The subject of this research is structure of agricultural production, which was divided into wheat, rye, potatoes, beef and veal meat, and pork meat. The adopted time range of research covers the period 2005–2014. The analysis covers 26 EU countries. The necessary statistical information was obtained from Eurostat database. Structural and geographic analysis of agricultural production was conducted by using classical shift-share analysis.

Methods and models of shift share analysis (*Shift-Share Analysis – SSA*) belong to the group of structural and geographical analyzes (Tłuczak, 2016). Dunn and Perloff, Lampard and Muth (1960) were the first who describe classic shift – share analysis. This method was modified since the 60s of the XIX century, the spatial factor was included to the research. Doing research the spatial distribution/intensity/changes in the level of the studied phenomenon the fact that each unit/region/country does not exist as a separate geographic area must be taken into consideration. The development of many phenomena depends on the spatial interaction with neighbouring areas. Observing the spatial relationship and interaction we should remember the first law of geography (spatial econometrics) formulated in 1970 by W. Tobler: “Everything is related to everything else, but near things are more related than distant things” (Tobler, 1970).

SSA method allows testing and assess the level of development of the region (province) on the background the level of development of the reference area (country). Changes of regional growth of the analyzed phenomena are assessed in the context of the analysis of changes in the structure of phenomena (Antczak, 2014; Grzybowska, 2013; Mayor, Lopez, 2008).

The variable TX quantified in the form of a complex of absolute growth or the rate of change is tested in the classic shift-share analysis (Trzpiot et al, 2013). The use in research the shift share analysis is based on the decomposition of the total change in the variable for the three components (Szewczyk, Zygmunt, 2011):

$$tx_{ri} = tx_{..} + \sum_i w_{r.(i)}(tx_{.i} - tx_{..}) + \sum_i w_{r.(i)}(tx_{ri} - tx_{.i}) \quad (1)$$

where:

$$m = tx_{..} = \frac{\sum_{r=1}^R \sum_{i=1}^S (x_{ri}^* - x_{ri})}{\sum_{r=1}^R \sum_{i=1}^S x_{ri}} - \text{national (global) share effect};$$

$$e_i = tx_{.i} - tx_{..} = \frac{\sum_{r=1}^R (x_{ri}^* - x_{ri})}{\sum_{r=1}^R x_{ri}} - \frac{\sum_{r=1}^R \sum_{i=1}^S (x_{ri}^* - x_{ri})}{\sum_{r=1}^R \sum_{i=1}^S x_{ri}} - \text{structural share effect};$$

$$u_{ri} = tx_{ri} - tx_{.i} = \frac{x_{ri}^* - x_{ri}}{x_{ri}} - \frac{\sum_{r=1}^R (x_{ri}^* - x_{ri})}{\sum_{r=1}^R x_{ri}} - \text{regional competitiveness share effect};$$

$$w_{r.(i)} = \frac{x_{ri}}{x_{r.}} - \text{regional weight};$$

x_{ri} – the value of the variable in the r -th region of the i -th group of the cross-sectional distribution of the initial period;

x_{ri}^* – the value of the variable in the r -th region of the i -th group of the cross-sectional distribution of the final period.

Transforming the equation (1) to formula (Szewczyk, Zygmunt, 2011):

$$tx_{ri} - tx_{..} = \sum_i w_{r.(i)} (tx_{.i} - tx_{..}) + \sum_i w_{r.(i)} (tx_{ri} - tx_{.i}) \quad (2)$$

we received the regional growth ($tx_{ri} - t_{..}$) defined as the difference between regional and national growth rate. The relation described by equation (2) is called structural and geographical equation where geographic diversity of the regional average growth rate is decomposed into two effects:

- structural: $s_r = \sum_i w_{r.(i)} (tx_{.i} - tx_{..})$ – which is the weighted arithmetic mean deviations of the average tempos of growth in the sector and the growth rate of national and indicates that the regions are differentiated by variations in the location;
- regional: $g_r = \sum_i w_{r.(i)} (tx_{ri} - tx_{.i})$ – defined as the weighted arithmetic mean of regional variations prescribing categories of cross-cutting qualitative criterion to the respective regions.

Results and discussion

Analysing the changes in the structure of agricultural production according to the regarding agricultural products it must be stated that the biggest changes have occurred on the rye market, production growth reached 33%. This was due primarily by large increase in rye production in Denmark, Spain and Germany (in the case of this the country area an increase of over 150%). The decrease in agricultural production it's can be noted on the potato and beef markets. Despite the increase in potato production in France by 150%, in the EU there was a decline in production by 9%.

Meat production depends largely on the size of number of livestock and the price level, which should provide profitability. On the beef market, in the years 2005-2014, it was recorded 9% decrease in production but on the market in pigmeat 3% increase. Bulgaria and Romania are the countries where the production of beef decreased the most (by 36% in Bulgaria and 49% in Romania), while in Germany over the period considered the biggest increase in pork production (22%).

Table 1. Structure of changes in agricultural production in EU 2005-2014 (%).

wheat	rye	potatoes	beef and veal meat	pork meat
6	33	-9	-9	3

Source: author's own calculation based on Eurostat database.

Table 2. Structure of agricultural production in EU, Latvia and Poland in 2005-2014 (%)

Countries	EU		Latvia		Poland	
	2005	2014	2005	2014	2005	2014
wheat	58	60	46	80	35	43
rye	3	4	6	4	14	15
potatoes	27	24	44	13	42	32
beef and veal meat	3	3	1	1	1	2
pork meat	9	9	3	2	8	8

Source: author's own calculation based on Eurostat database.

The structure of agricultural production in Latvian and Poland are similar, but there are some differences. In Latvia, the largest share of agricultural production is wheat, in 2014 it's 80% of the total agricultural production, while beef production is marginal (barely 1%). Agricultural production in Poland has changed in the years 2005-2014. In 2005, the largest share in agricultural production were the potatoes while in 2014 it was wheat. Comparing the production of pork in Poland the share of this species in agricultural production total was four times higher than in Latvia.

Comparing the period 2005-2014 the rate of growth of the regional individual member countries with an average, EU growth of 1.8%. We can specify the countries with the growth of agricultural production higher by more than 30% of the EU (Bulgaria, Lithuania, Spain) and a group of countries with production growth agricultural much lower than the average for the EU (Slovenia, Greece, Sweden). These changes may have resulted from changes in both the structure of production according to the endpoint of agricultural

products in particular countries (structural effects), as well as from changes in the internal situation of the competitiveness of a given area (competitiveness effects).

Table 3. The results of the shift-share analysis of changes in agricultural production in the EU by countries and types of agricultural products in the years 2005-2014.

Country	Total effects	Structural effects	Competitiveness effects
Austria	0.0143	0.0021	0.0122
Belgium	0.1250	-0.0437	0.1688
Bulgaria	0.3378	0.0227	0.3151
Croatia	0.2503	-0.0080	0.2583
Czech Republic	-0.0346	0.0173	-0.0518
Denmark	-0.0828	0.0068	-0.0896
Estonia	0.1098	-0.0146	0.1244
Finland	-0.0479	-0.0260	-0.0219
France	0.0770	0.0118	0.0652
Greece	-0.1656	-0.0033	-0.1623
Spain	0.3208	-0.0120	0.3328
Netherlands	-0.0040	-0.0750	0.0710
Ireland	-0.1461	-0.0352	-0.1110
Lithuania	0.3484	-0.0072	0.3556
Luxembourg	0.1036	0.0121	0.0915
Latvia	0.1917	-0.0147	0.2064
Germany	0.0319	0.0093	0.0225
Poland	-0.1270	0.0096	-0.1366
Portugal	-0.0977	-0.0558	-0.0419
Romania	-0.0740	-0.0117	-0.0622
Slovakia	-0.0800	0.0220	-0.1020
Slovenia	-0.3477	-0.0335	-0.3142
Sweden	-0.1648	0.0010	-0.1657
Hungary	-0.0660	0.0241	-0.0901
United Kingdom	-0.1587	-0.0073	-0.1514
Italy	-0.1006	0.0000	-0.1007

Source: author's own calculation based on Eurostat database.

The biggest changes in the size of agricultural production was recorded in Lithuania (34.8%), Bulgaria (33.8%) and Spain (32%). In the case of these three countries, this increase was caused primarily by internal changes related to competitiveness with other regions.

These changes amounted to 35.5% - Lithuania, 31.5% - Bulgaria, 33.2% - Spain. Changes in the structure of agricultural production marginally influenced the growth of total agricultural production in those countries. In countries where the growth in agricultural production was positive (total effect greater than zero) it was mainly due to

changes in the internal changes in these countries and their competitive position in the international arena.

The largest decrease in agricultural production was recorded in Slovenia, Greece and Sweden. As previously, so in these cases, these decreases were due to the negative internal changes related to the competitiveness of these countries.

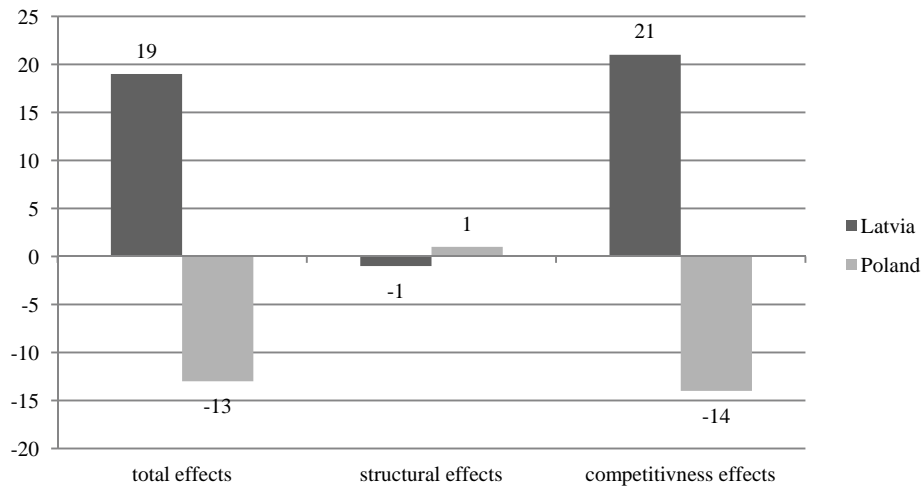


Fig. 1. Structural and competitiveness effects of shift share analysis in Latvia and Poland (%).

Source: author's own calculation based on Eurostat database.

In Poland and in Latvia, the situation is different in the years 2005-2014 in Poland decreased agricultural production by 13%, while in Latvia increased by 19%. In Latvia these changes were due to the positive internal changes related to the competitiveness of other regions (+ 21% - the effect of geographical). In the case of Poland but by unfavorable changes in the structure of regional agricultural production (- 14% - the effect of geographical). The results indicate a better competitive position Latvia's, then Poland, on the European Union arena.

Conclusions

Since 2005 EU countries recorded an increase in agricultural production by 1,8%. the changes in rye production resulted in an average rate by 31,3% in 2005-2014. An increase in wheat production (6%), rye (33%) and pork meat (3%) also was recorded. In the case of other products which were taken under consideration, the decrease of share in total agricultural production it was observed.

The most favorable changes related to structural factors in agricultural production occurred in Hungary, Bulgaria and Slovakia. In this countries the biggest share of rye in total agricultural production could be observed. In this sector the changes were the biggest in these countries. The most favorable competitive effects took place in Spain, Bulgaria and Latvia, whereas the least favorable ones Lithuania, Spain and Bulgaria. It should be noted

that structure of agricultural production depend on agricultural prices. In 2005-2014 the downward trend of pig meat production could be observed, because of low supply of pork and beef. In 2014 due to the improvement of the economic situation in EU countries, as well as due to a decrease in crop prices, the future for meat sector seem to be better. Finally classic shift-share analysis and dynamic shift-share analysis approved to be a useful method in identifying changes related to structure and dynamics of size of agricultural production in EU countries.

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