THE ASSESSMENT OF AGRICULTURAL SECTOR IN TURKEY AND SELECTED EU COUNTRIES

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Turkish agricultural sector plays an important role in the global market. After the accession to EU Turkey will become important competitor to those countries where export of agricultural and food products are comparatively large. This suits to Lithuania and for this reason it is necessary to compare agriculture sector of those countries, which significantly influence global market. There have been several studies aiming to compare agricultural sector in Turkey and other European countries. However, all those studies did not use multiple criteria methods. The aim of the paper is to propose the methodic to assess agricultural sector of Turkey and selected EU countries. The ranks of the countries yielded by the four methods differ insignificantly. The comparison of economic indicators in 2013 as compared to 2007 had growing tendency, but ranks become almost the same with the exception of Romania and Latvia.
Key words: multicriteria methods, Turkey, agriculture.
JEL codes: C02, Q10.

1. Introduction

Turkey is already well integrated with the European Union in particular in the agricultural sector and plays an important role in foreign trade. After the accession to EU Turkey will become important competitor to those countries where export of agricultural and food products are comparatively large. This suits to Lithuania and for this reason it is necessary to compare agricultural sector of those countries, which influence global market. There have been several attempts to compare agricultural sector in Turkey and other European countries. F. Şelli et al. (2010) measured competitive powers of Turkey and EU-27 for wheat. It was shown that the international competitive power of Turkey for wheat market is lower than that of Malta, Portugal, Italy, and Belgium. M.A. Şahinli (2013) analysed comparative advantage of agriculture in Turkey and EU. The analysis revealed that EU has more comparative advantage in agricultural items than Turkey.

Š. Bojnec (2011a) analysed land markets in Croatia, the Former Yugoslav Republic of Macedonia and Turkey. The study showed that the land productivity varies between the three countries. In another study, Š. Bojnec (2011b) compared agricultural and rural labour markets in Croatia, the Former Yugoslav Republic of Macedonia and Turkey. This study investigated the labour market structures and the factors driving them. Considerable differences were found among these countries in the importance of the agricultural labour force, between rural and urban labour, and in poverty and living conditions in rural areas. M. A. Köse (2012) pointed out that agricultural sector in Turkey comprises 8.3% of GDP. This represents almost the same share of GDP as in Bulgaria and Romania. Employment in agriculture (% of total employment) in Turkey is 24%, whereas the EU's average is only 5.5%.

Scientific problem. There have been several studies aiming to compare agricultural sector in Turkey and other European countries. However, all those studies did not use multiple criteria methods.

The **aim** of the paper is to propose the methodic to assess agricultural sector of Turkey and selected EU countries. In order to increase the reliability of the research, we use four methods: SAW, COPRAS, VIKOR, and TOPSIS.

2. Methods of the research

In recent years, multicriteria methods have been widely applied to the areas of choosing the best alternative for investment (Larichev, 2003), efficiency of investments in construction (Ustinovičius, 2003), financial state of construction enterprises (Ginevičius, 2006), competitive environment in the oligopolic market (Ginevičius, 2009), product quality (Pabedinskaitė, 2009), apartments blocks maintenance contractors (Zavadskas, 2009), financial markets development (Žvirblis, 2010), farm efficiency (Baležentis, 2011), investment funds (Jokšienė, 2011; Stankevičienė, 2012). Multicriteria methods integrate the values of the criteria describing a particular process and their weights into a single value. However, all of these methods are based on different logical principles, have different complexity levels and the inherent features. Therefore, it is recommended to use of several methods and average of the values obtained. In this section SAW, COPRAS, TOPSIS and VIKOR methods are introduced.

These methods are based on the matrix $R = \|r_{ij}\|$ of the criteria, describing the objects A_j $(j = 1,2, \ldots, n)$ compared, statistical data and the criteria weights $\omega_i (i = 1,2, \ldots, m)$, where m is the number of criteria and n is the number of objects compared. The statistical data were obtained from the Eurostat database. The criteria weights were determined by the experts of the Lithuanian Institute of Agrarian Economics.

SAW (Simple Additive Weighting) is one of the most popular and most widely used methods (Ginevičius, 2004a, b, 2008a, b; Hwang, 1981; Ustinovičius, 2004).

The main positive characteristics of the method SAW are as follow: the criterion S_j integrates the criteria values and weights into a single magnitude, the calculation algorithm is not complicated and normalized values of criterion S_j help visually determine the differences between the alternatives compared. However, SAW also

has some disadvantages: all the values of the criteria should be maximizing and positive, so the value of the criterion S_j depends on the type of their transformation.

The criterion of the method S_j is calculated by the formula:

$$S_j = \sum_{i=1}^{m} \omega_i \widetilde{r_{ij}}, \tag{1}$$

where ω_i is the weight of the i-th criterion, $\widetilde{r_{ij}}$ is the normalized i-th criterion's value for j-th alternative.

COPRAS (Complex Proportional Assessment) method can be used for multicriteria evaluation of both maximizing and minimizing criteria value (Zavadskas, 1996). In this method, the influence of maximizing and minimizing criteria on the evaluation result is considered separately. The advantage of the method COPRAS is that it allows us easily compare and check the results of calculations. The main disadvantages are as follow: COPRAS may be less stable than other methods in the case of data variation, while the ranks may differ more than those estimated by other methods.

The criterion of the method Z_j is obtained by the formula:

$$Z_j = S_{+j} + \frac{S_{-min} \sum_{j=1}^{n} S_{-j}}{S_{-j} \sum_{j=1}^{n} \frac{S_{-min}}{S_{-j}}}, \tag{2}$$

where S_{+j} is the sum of maximizing weighted normalized criteria values:

$$S_{+j} = \sum_{i=1}^{m} d_{+ij}, \tag{3}$$

S_{-j} is the sum of minimizing weighted normalized criteria values:
$$S_{-j} = \sum_{i=1}^{m} d_{-ij}, \tag{4}$$

S_{-min} is the minimal S_{-j} value of minimizing criteria of all alternatives.

The basic principle of TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) method is that the best alternative should have the shortest distance from the ideal solution and the farthest distance from the negative-ideal solution (Opricovic, 2004). The main advantages of the method TOPSIS are that it accounts for both the best and worst alternatives simultaneously and it has a simple computation process.

The ideal and negative-ideal solutions are determined by formulas:

$$V^* = \{V_1^*, V_2^*, \dots, V_m^*\} = \{(\max_j \omega_i \tilde{r}_{ij}/i \in I_1), (\min_j \omega_i \tilde{r}_{ij}/i \in I_2)\}, \tag{5}$$
$$V^- = \{V_1^-, V_2^-, \dots, V_m^-\} = \{(\min_j \omega_i \tilde{r}_{ij}/i \in I_1), (\max_j \omega_i \tilde{r}_{ij}/i \in I_2)\}, \tag{6}$$

where I_1 is associated with benefit criteria, I_2 is associated with cost criteria.

The criterion of the method C_j^* is calculated by the formula:

$$C_j^* = \frac{D_j^-}{D_j^* + D_j^-},\qquad(7)$$

where D_j^* is the separation of each alternative from ideal solution:

$$D_j^* = \sqrt{\sum_{i=1}^m (\omega_i \tilde{r}_{ij} - V_i^*)^2},\qquad(8)$$

D_j^- is the separation from negative-ideal solution:

$$D_j^- = \sqrt{\sum_{i=1}^m (\omega_i \tilde{r}_{ij} - V_i^-)^2}.\qquad(9)$$

The VIKOR (serb. VlseKriterijumska Optimizacija I Kompromisno Resenje) method focuses on ranking and selecting from a set of alternatives in the presence of conflicting criteria. It introduces the multicriteria ranking index based on the particular measure of "closeness" to the "ideal" solution (Opricovic, 1998).

The main advantages of the method VIKOR are as follow: it ranks alternatives by closeness to the positive idea solution and farness from the negative ideal solution, the best alternative is preferred by maximizing utility group and minimizing regret group. However, VIKOR also has some disadvantages: the performance rating is quantified as crisp values, which are in adequate to model real-life situations, in case of conflicting situation or criteria, a decision maker must also consider imprecise or ambiguous data.

The compromise ranking algorithm VIKOR has the following steps:

1) determine the ideal f_i^* and negative-ideal f_i^- values of all criterion functions;

2) compute the values S_j and R_j for each alternative:

$$S_j = \sum_{i=1}^n \frac{\omega_i (f_i^* - f_{ij})}{(f_i^* - f_i^-)},\qquad(10)$$
$$R_j = \max_i [\omega_i (f_i^* - f_{ij})/(f_i^* - f_i^-)],\qquad(11)$$

where ω_i is the weight of the i-th criterion;

3) compute the values Q_j:

$$Q_j = v \frac{S_j - S^*}{S^- - S^*} + (1 - v) \frac{R_j - R^*}{R^- - R^*},\qquad(12)$$

where $S^* = \min_j S_j$, $S^- = \max_j S_j$, $R^* = \min_j R_j$, $R^- = \max_j R_j$, v is the weight of the strategy of "the majority of criteria" (or "the maximum group utility") and usually set to 0.5 (Opricovic, 2004).

Seven countries were selected for the research: Bulgaria, Croatia, Latvia, Lithuania, Poland, Romania, and Turkey. The level of self-sufficiency of agricultural products in those countries is very high and they have great impact on global market.

The main attention is paid to Turkey due to the fact that this country is preparing to join EU.

Following key indicators were selected to compare agricultural activities: Gross Domestic Product (GDP) in Purchasing Power Standard (PPS) per capita, Gross Value Added (GVA) per Utilized Agriculture Area (UAA), the share of export o of agricultural and food products in total export, the share of import of agricultural and food products in total import, and subsidies in agriculture. One indicator (the share of import o of agricultural and food products in total import) was minimizing, while the rest of indicators were maximizing.

3. Results

The results of the evaluation are given in Table 1 and Table 2. The ranks of the countries yielded by the four methods differ insignificantly.

Table 1. The results obtained in comparing agricultural sector of selected countries in 2007

Method		Country						
		Bulgaria	Croatia	Latvia	Lithuania	Poland	Romania	Turkey
SAW	Value	0.3219	0.8687	0.4940	0.6274	0.5723	0.2977	0.6224
	Rank	6	1	5	2	4	7	3
COPRAS	Value	0.0803	0.2388	0.1255	0.1602	0.1527	0.0769	0.1657
	Rank	6	1	5	3	4	7	2
VIKOR	Value	0.8440	0.0000	0.6997	0.5312	0.4194	1.0000	0.3601
	Rank	6	1	5	4	3	7	2
TOPSIS	Value	0.1446	0.7856	0.3706	0.5278	0.4437	0.1598	0.5417
	Rank	7	1	5	3	4	6	2
Average Rank		6.25	1	5	3	3.75	6.75	2.25
Final Rank		6	1	5	3	4	7	2

As it has been shown in Table 1, the best rank according all methods has Croatia and Turkey. The main reason for Croatia is comparatively large amount of support in agriculture, while the main reason for Turkey is comparatively high level of production intensity with rational cost, which reflects GVA per UAA. The meteorological conditions for agricultural production in Bulgaria and Romania are almost the same, but those countries possessed the 6 and 7 ranks (Table 1). Such positions were caused by worse macro and agricultural indicators. The rank of Lithuanian agriculture is better than Polish and Latvian despite the lower amount of support and comparatively high share of import of agricultural and food products. It should be also noted that macroeconomic situation and competitiveness of agricultural and food products in global markets had positive impact.

Table 2. The results obtained in comparing agricultural sector of selected countries in 2013

Method		Country						
		Bulgaria	Croatia	Latvia	Lithuania	Poland	Romania	Turkey
SAW	Value	0.5408	0.7392	0.5018	0.6902	0.7039	0.5896	0.7044
	Rank	6	1	7	4	3	5	2
COPRAS	Value	0.1195	0.1694	0.1046	0.1470	0.1601	0.1313	0.1681
	Rank	6	1	7	4	3	5	2
VIKOR	Value	1.0000	0.0671	0.8474	0.2121	0.5944	0.5045	0.5427
	Rank	7	1	6	2	5	3	4
TOPSIS	Value	0.2649	0.6390	0.1691	0.3812	0.5070	0.3668	0.6412
	Rank	6	2	7	4	3	5	1
Average Rank		6.25	1.25	6.75	3.50	3.50	4.5	2.25
Final Rank		6	1	7	3	4	5	2

Macro situation in all analyzed countries became better in 2013 as compared to 2007. The GDP per capita in PPS increased on average by one fifth. GVA increased in all counties with the exception of Croatia and Latvia. Subsidies increased in all countries with the exception of Croatia. The share of export of agricultural and food products increased in all analyzed countries, especially in Turkey, while the share of import of agricultural and food products increased in all countries with the exception of Poland and Lithuania. Due to these changes the ranks of Romania and Latvia have changed. As it has been shown in Table 2, the worst situation in 2013 was observed in Latvia. The main cause responsible for those changes is decreasing GVA.

Despite the fact that all the indicators in Lithuania were better in 2013 as compared to 2007, the rank remains the same. The competitiveness of Lithuanian agriculture increased because of growing share of export of agricultural and food products in the analyzed period.

The rank of Turkey remains in same second position. After accession to EU where amount of support will be higher, agricultural sector of Turkey will have more significant impact on EU countries as compared to current period.

4. Conclusions

1. Turkey is already well cooperated with the European Union in particular in the agriculture and plays still an important role in foreign trade. The comparison of agricultural sector of Turkey and selected EU countries showed good situation (second rank) of Turkish agriculture.

2. In order to increase the reliability of the research, there were used four multicriteria methods: SAW, COPRAS, VIKOR, and TOPSIS. The ranks of the countries yielded by the four methods differ insignificantly. The most important indicator for multicriteria evaluation was Gross Value Added per hectare.

3. The comparison of economic indicators, which were selected for the assessment in 2013 as compared to 2007 had growing tendency, but ranks become almost the same with the exception of Romania and Latvia.

4. Agricultural sector of Turkey might have significant impact on EU countries, so we propose to pay more attention on that issue in the future.

5. The methodic of the research could be used for similar empirical research. Each multicriteria method has its advantages and disadvantages, therefore, simultaneous use of several methods is more reliable.

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TURKIJOS IR PASIRINKTŲ ES ŠALIŲ ŽEMĖS ŪKIO SEKTORIŲ PALYGINIMAS TAIKANT DAUGIAKRITERINIUS METODUS

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Santrauka

Turkijos žemės ūkio sektorius užima svarbią vietą globalizuotoje rinkoje. Turkijai įstojus į ES, ši šalis taptų svarbiu konkurentu toms šalims, kuriose žemės ūkio ir maisto produktų eksportas yra palyginti didelis. Tai būdinga ir Lietuvai, dėl to aktualu vertinti žemės ūkio sektorių tose šalyse, kurios turi įtakos pasaulinei rinkai. Užsienio šalių mokslinėje literatūroje buvo lyginama Turkijos ir kitų Europos šalių žemės ūkio sektoriai, tačiau nebuvo naudoti daugiakriteriniai metodai. Straipsnio tikslas – pasiūlyti Turkijos ir pasirinktų ES šalių žemės ūkio sektoriaus įvertinimo metodiką. Gauti rezultatai pagal taikytus metodus skiriasi nežymiai. Šalių rangai 2013 metais, palyginti su 2007-aisiais, nepasikeitė, išskyrus Rumuniją ir Latviją.

Reikšminiai žodžiai: daugiakriteriniai metodai, Turkija, žemės ūkis.

JEL kodai: C02, Q10.