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# Production and Trade of Honey in Selected European Countries: Serbia, Romania and Italy

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## Abstract

The beekeeping sector is very complex, because of not only the diversity of bee products obtained but also the environmental services through pollination. Even if its direct impact on domestic economy and trade varies across countries, at micro-level, beekeeping creates well-being for communities, providing health products for population and decent revenues for farmers. It also supports the sustainability of rural livelihoods. In this context, the research subject is the analysis of production and trade of honey in three European Union Countries—Romania, Italy and Serbia—with a goal to consider the dynamic of supply and trade of honey and deduce potential opportunities for producers. The goal of the study is to draw implication from the results obtained, suggesting the concrete measures to improve the existing situation. Trade data are examined to get a picture of honey sector trends. An entire set of trade indicators related to honey were computed over the period 2006–2015 and are presented in the chapter: value, amount, growth rate and geographic structure of export and import in the world and in selected countries for which the level of comparative advantages of exported honey was also measured using the Balassa index.

**Keywords:** honey, production, international trade, competitiveness

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## 1. Introduction

Honeybees play a crucial role for the well-being of the humanity: on the one hand, they have the amazing capacity to produce honey and other secondary products (pollen, propolis, royal jelly, venom and wax) and on the other hand, they provide pollination services for plants, bringing an important contribution to the agricultural activities and food production. The

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bees represent a bio barometer for the preservation of the environment. In addition, their economic, cultural and religious values are very important [1].

The European Union is one of the most important honey producers of the world. Nevertheless, according to some official bodies, production levels seem to be declining [2]. Such decrease is attributable to the diminution of honeybee colonies, which is mostly related to the colony collapse disorder, but also to imports. The number of beehives, the quantity and quality of honey obtained are the main aspects evaluated at European level, to measure the impact of supporting policies.

Beekeeping—as agricultural activity—could be considered as multifunctional, because it performs several functions that contribute to society's welfare. At macro-level, beekeeping may play an essential economic role, creating a competitive advantage through innovation and improving the balance trade. This may be particularly true in some countries, rather than in others; however, even in those areas where the contribution of honeybee products to value added and trade of food product is limited, they represent an interesting alternative or complementary entrepreneurial activity. At micro-level, in fact, beekeeping creates well-being for communities, providing health products for population and decent revenues for farmers [1]. It also supports the sustainability of rural livelihoods, as, given the relatively low investment requirements, it is more easily engaged, compared to other rural and agricultural activities.

The key functions of beekeeping are: food security, environmental function, economical function and socio-cultural function. Beekeeping contributes to ensuring food security when people have physical and economic access to honey and other honeybee products or to other typical dishes that use honey as ingredient. The availability of honeybee products depends on local/national production and the capacity of import. The access to honeybee products depends on purchasing power of consumers and proximity to the markets. The food security has two main components: the quantity and the quality.

The quality of honey is one of the main aspects related to food security function of beekeeping. Three main components are usually taken into account in the case of honey quality: the organoleptic properties, the physical and chemical properties and the hygienic aspects (the latter is usually defined “food safety”).

The organoleptic properties—aspect, consistency, colour, taste and smell are evaluated using the sensory analysis. This scientific method is used to establish the botanical origin of honey and its authenticity, but also to classify and define product standards. In addition, the method helps to identify the consumer preferences for different types of honey [3]. In EU countries, the evaluation of physical and chemical parameters of honey is made according to international legislation (Codex Alimentarius Standard), to European Union Directives and to National Legislation [4]. These parameters characterise the naturalness, maturity and unaffectedness of honey [5].

Unfortunately, the quality control of honey on the international market is sometimes vulnerable. According to Strayer et al. [6], the adulteration of honey could be economically motivated and influenced by several factors such as: the decrease of domestic production, lack of identity standards, scarce of analytical methods and trade policies. In the context of global market, there is a stringent need for finding solutions to limit the repercussions of the unfair

practices on producers and consumers. The identification and characterisation of different types of honey via quality schemes and logos represent a protective solution that creates new opportunities for producers and consumers.

Even if compositional, sensory and safety characteristics of food are essential elements of food quality, they do not necessarily exhaust this feature, that goes beyond the observable characteristics of a product. In the last decades, the concept of quality in food (this applies also to honey) has enlarged from intrinsic attributes to extrinsic ones, focussing on some features of the production process such as its social and environmental impacts, animal welfare issues and the link of the food with a certain agricultural area. The latter aspect has received particular emphasis and attention in European countries. The quality recognition of honey (as for all food products) at European Union level can be achieved by obtaining two designations: Protected Designation of Origin and Protected Geographical Indication) [7]. According to Bertozzi [8] the use of geographical name for an agricultural product date from ancient times, "honey from Sicily" being a good example in this sense.

Protected Designation of Origin and Protected Geographical Indication tools, created within the Common Agricultural Policy, help beekeepers (and all farmers) to improve the marketing of honeybee products and to guarantee their authenticity and reputation. In the same time, they help consumer to have more trust they are buying high quality products that are connected to special places. Authenticity and traceability are the main aspects in the case of Protected Designation of Origin/Protected Geographical Indication recognition process [9]. The honey authenticity is linked to the specificity of the geographical area where it is produced: environmental factors (climate, soil and flora) and human factors (beekeeping knowledge and skills, traditional/innovative practices). There are several European countries where protected honeys with Protected Designation of Origin/Protected Geographical Indication status could be found: Greece, Spain, France, Italy, Luxembourg, Malta, Poland, Portugal and Ukraine.

Honey produced in Serbia, Romania and Italy reflects the rich diversity of melliferous plants but also the particular characteristics of regions. The quality recognition of honey is a volunteer system for beekeepers that allow valorising regional honey at European Union level. Obtaining Protected Designation of Origin and Protected Geographical Indication designation is made in compliance with European Union legislation.

In Italy, there are three types of honey with Protected Designation of Origin certification [10]: "Miele della Lunigiana", registered from 2004 [11], "Miele delle Dolomiti Bellunesi" registered from 2011 [12] and "Miele Varesino", registered, in 2014 [13]. "Miele della Lunigiana" belongs to Toscana Region (central Italy) and it is reserved for two types of honey: acacia honey and chestnut honey (one of the healthiest honeys due to its mineral content, antioxidant and antimicrobial properties). "Miele delle Dolomiti Bellunesi" is produced in the mountains of Belluno (in Veneto Region, North-East Italy) and could be found for various types: wildflower, acacia, lime, chestnut, rhododendron and dandelion. It is very appreciated not only for the floral variety, but also for other qualities such as purity, wholesomeness and lengthy shelf life. "Miele Varesino" is an acacia honey from the province of Varese (Lombardy Region, North-West Italy) with a high level of purity, due to the quality of acacia trees that grows widely in this region.

For the moment, in Serbia and Romania, there is no Protected Designation of Origin/Protected Geographical Indication certified honey, but there is a huge potential for developing this protection in the future. In the case of Romania, the Ministry of Agriculture and Rural Development encourages the Protected Designation of Origin/Protected Geographical Indication honey certification and support this process by using the following arguments: the increase of value added of Romanian types of honey, the rise of consumer trust in the reliability of beekeepers who take care of the quality of honey, the creation of a balance between supply and demand by maintaining the quality, the facilitation of traceability and controls and the acceleration to attracting European Union funds [14]. Such strategies implemented by the Ministry of Agriculture and Rural Development could significantly contribute to the development of beekeeping sector.

In the case of Serbia, there is also a huge potential for Protected Designation of Origin/Protected Geographical Indication certification of honey and other food products. An illustrative example is "Vlasina honey". A study about the attitudes of Vlasina honey producers towards geographical indications reveals that a small part of them know about this certification system, the results indicating the need for education and information in order to familiarise beekeepers with the procedure and the advantages of Protected Designation of Origin/Protected Geographical Indication system [15]. "Vlasina honey" is on the list of local products supported by the European Union and the Government of Switzerland to receive technical assistance for the certification procedure. The specificity of "Vlasina honey" is given by the exceptional qualities of the region: the variety of medicinal plants and the clean environment. This type of honey is unique due to its flavour and therapeutic properties. The European recognition of "Vlasina honey" will increase the competitiveness of the beekeepers' association "Matica" and will open the opportunity to sell on international markets [16].

At present, a very small quantity of honey produced in Serbia, Romania and Italy is Protected Designation of Origin/Protected Geographical Indication protected. Hence, a question arises: what other tools could be developed to measure the quality of honey produced in these three countries? The price of different types of honey could be a real barometer for evaluating the quality? Or the high demand for export of local honey demonstrates its value?

Providing a good quantitative proxy able to describe honey quality is a hard task, as such concept and perception is heterogeneous across consumers. The widely used index to approach quality attributes of a food product is its unit value (price). It is worth remembering that price differences across products may be influenced (along with preferences for quality) by other factors, for instance, production costs and disposable income of consumers; nevertheless, price remains the most available datum that may be related to product quality, even if such correlation may be variable. In the case of honey, its quality is strictly related to product differentiation: the availability of different kind of honeys enlarges the choice set of consumers, increasing their satisfaction.

The above-mentioned considerations on honey would suggest analysing and comparing price trends for a set of different kind of honey, over time and across the three countries examined. Such a comparison would allow grasping some insights on the relative quality of each honey examined, assuming some price-quality relationship. Unfortunately, this strategy cannot be

followed, mainly for a matter of data availability on comparability across countries and over time: price data on differentiated honey typology are rarely accessible and even when present, they are usually not gathered by official statistical bodies and are discontinuous over time. It is then clear that for any attempt to renders the concept of quality are necessary data continuous over time that are gathered and processed with homogeneous criteria over countries.

Such characteristics are fully satisfied by trade data, which are available at a high level of detail. Unfortunately, the maximum level of disaggregation for which data on traded products are released refers to “natural honey”, without any further specification about the typology or characteristic of that food item. Even if the lack of information on product differentiation represents a limitation in examining quality differences among honey typologies in each country, using trade data has many advantages.

Such positive aspects are mainly due to both the opportunity to observe trade movements knowing both the value of honey traded (imported and exported) and its quantity. From this information we can derive the unit values (prices) of exchanged honey. Knowing the volume of trade, along with average import and export prices is highly valuable information as it allows analysing trade flows using a set of indexes. Such indexes, developed within the traditional trade theory of comparative advantage, tell us, among others, to what extent the honey sector in each country is competitive in its export performances, compared to the whole export of the same country. Also this trade index, along with export and import prices, may be an indirect measure of quality of honey exchanged by the selected countries.

It is quite intuitive that the ability of a product (honey) to be demanded beyond its domestic market, overcoming trade cost and cultural barriers may be seen as a combination of factors like its perceived quality that meets preferences of foreign consumers. For the same reason measures of competitiveness in trade are related on one hand to honey quality and on the other to the efficiency of beekeepers (and of their bees) to yield a product that satisfy consumers beyond the domestic market. For this reason the rest of the chapter is focussed on such topic, with the twofold objective to provide a description, even though indirect, of both the quality of the honey traded and the competitiveness of beekeepers and honey sector in the selected countries (Serbia, Romania and Italy).

The research subject is the analysis of production and trade of honey in three European Union countries: Romania, Italy and Serbia, with a goal to consider the dynamic of supply and trade of honey and point out the problem faced by producers. The goal of the study is to give a practical implication to the results obtained, by proposing concrete measures to improve the existing situation.

## 2. Methods

In the following sections, we analysed the level and growth rate of honey production. An entire set of trade indicators related to honey were dynamically presented in the paper: value, amount, growth rate and geographic structure of export and import in the world, European Union and selected countries. The authors also measured the level of comparative advantages

of exported honey from the selected countries by using the Balassa index. Research included a 10-year period. For this purpose, there were used data from Faostat, UN Comtrade and ITC (0409 product code), but also data provided by National Statistics Bodies.

The main body of our analysis deals with computation and comparison of the honey sector competitiveness in Serbia, Romania and Italy, to measure the comparative advantage of the honey export. The existence and extent of correlations among trade indexes is also performed. The basic concept of comparative advantage was erected in 1965 and the original Balassa model is given in Ref. [17]:

$$B = \frac{\frac{X_{ij}}{X_{it}}}{\frac{X_{nj}}{X_{nt}}}, \quad (1)$$

where  $X_{ij}$  is export of product  $j$  (honey in this case) from countries (Serbia, Romania and Italy, in this analysis);  $X_{it}$  is total export of Serbia, Romania and Italy;  $X_{nj}$  is total export of honey from world and  $X_{nt}$  is total export of the world. For values  $B > 1$ , the comparative advantage in honey export of the country examined is revealed. In other words, there is comparative advantage in honey export by the country when the share of honey exported on total export of the country ( $X_{ij}/X_{it}$ ) is bigger than the share of honey world export on total world export ( $X_{nj}/X_{nt}$ ). Ref. [18] made the correction of the index of comparative advantage and he presented it as relative trade advantage (RTA). Relative trade advantage (RTA) stands for the difference between the relative advantages of export (RXA) and the relative merits of import (RMA).

$$RTA = RXA - RMA, \quad (2)$$

$$RXA = B, \quad (3)$$

$$RMA = \frac{\frac{M_{ij}}{M_{it}}}{\frac{M_{nj}}{M_{nt}}}, \quad (4)$$

where  $M_{ij}$  is import of honey from Serbia, Romania and Italy,  $M_{it}$  is total import from Serbia, Romania and Italy,  $M_{nj}$  is total import of honey from the world and  $M_{nt}$  is total import from world. The interpretation of the relative import advantage index is symmetrical with respect to the relative advantages of export (or  $B$ ) Index: the country examined is relatively more "vulnerable" to honey import (compared to its entire economy) when the share of honey imported on total import of the country ( $M_{ij}/M_{it}$ ) is bigger than the share of honey world import on total world import ( $M_{nj}/M_{nt}$ ). Calculating more accurate comparative advantages, Ref. [18] has created another index as the natural logarithm ( $\ln$ ) of the relative advantages of exports and imports ( $\ln RXA$  and  $\ln RMA$ ). The difference obtained between the relative advantages of exports and imports is the revealed competitiveness (RC) and is expressed as:

$$RC = \ln RXA - \ln RMA. \quad (5)$$



From the above-mentioned formula, Refs. [19, 20], has developed the following, to calculate the explicit comparative advantage:

$$RCA = \ln \left[ \frac{X_i}{M_i} \right] \times \left[ \sum_{i=1}^n X_i \div \sum_{i=1}^n M_i \right] \times 100,$$

where  $X$  is the value of export,  $M$  is value of import, index  $i$  presents honey sector.

### 3. Honey exports and imports of Serbia, Romania and Italy

Results of the research show that within the analysed period the value of exports and imports increased on both the global level and in the analysed countries (**Table 1**). Comparing the change in import and export along the time span we have used the average annual growth rate ( $g$ ), computed as:

$$g = \left( \sqrt[n]{\frac{f}{i}} \right) - 1,$$

where  $f$  is the final value of the series (year 2015),  $i$  is the initial value of the series (2006) and  $n$  is the time length (9 years). The interpretation of this formula is: a 5% of average growth rate means that, starting from the initial value (at 2006)  $i$ , it is necessary an annual increase of 5% to obtain the final value (at 2015)  $f$ . Average annual export growth rates in value show that Serbia had the highest average growth—37.9%. However, even with such a high value, Serbia did not achieve significant results in absolute terms, so that the average annual export amounted to USD 6.5 million with considerable oscillations per years. Romania had the highest average value of export amounting to USD 38.6 million, although over the last few years, exports increased considerably, at 9% per year, on average. The value of honey exports from Italy was growing at the rate higher than Romania but far lower than Serbia (15.1% per year) with the average value of exports being USD 31.7 million. Import data, in value, shows that Romania had the highest average annual growth rate—50.2% with average annual imports of USD 3.6 million that is however lower than the export value, with positive trade balance (export-import) of USD 35 million, on average. This makes Romania a net exporter of honey in value. Serbia imported certain quantities of honey in some years; however, they were insignificant, amounting to the average of USD 76,000. Also Serbia is a net exporter with a positive trade balance of USD 65,000, on average. Italy had the highest average value of imports amounting to USD 56.9 million with a considerable increase in imports over the last few years. Unlike Romania and Serbia, Italy is a net importer, in value, of honey with the average (2006–2015) value of import exceeding by UDS 25 million the export.

Switching from values to quantity traded (**Table 2**), the research show that over 2006–2015 period the quantity of exports and imports increased on both the global level and in the selected countries. In terms of export and import quantities, Serbia had the highest average annual growth rate—32.8%. Note that, as export quantity has grown less than export value, the unit value of exported Serbian honey grown, in nominal terms, over that period. However, the average annual quantity of honey exported from Serbia falls considerably behind Romania



Exporters	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average	Growth rate (%)	
							<b>Exported value</b>						
World	830,290	894,356	1,294,224	1,252,091	1,488,906	1,701,343	1,768,323	2,076,365	2,329,733	2,355,486	1,599,111.7	12.3	
Romania	20,593	16,322	24,933	41,802	41,953	41,230	44,593	54,572	53,919	46,020	38,593.7	9.3	
Italy	12,339	16,038	19,478	17,674	31,236	32,639	38,392	59,117	46,385	43,800	31,709.8	15.1	
Serbia	537	1,221	2,116	3,220	7,537	5,120	12,908	14,881	8,690	9,670	6,590	37.9	
							<b>Imported value</b>						
<b>Importers</b>											<b>Average</b>	<b>Growth rate (%)</b>	
World	828,801	921,846	1,251,716	1,281,993	1,508,615	1,717,049	1,760,692	2,037,321	2,325,266	2,327,362	1,596,066.1	12.2	
Italy	28,305	25,098	44,864	51,967	53,363	57,967	56,116	75,188	91,183	84,534	56,858.5	12.9	
Romania	159	775	2,006	1,545	2,383	3,656	5,144	5,546	8,302	6,183	3,569.9	50.2	
Serbia	24	45	21	59	158	74	9	240	10	120	76	19.6	

Table 1. Exported and imported value in period 2006–2015 (US dollar thousand).

Exporters	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average	Growth rate (%)
	Exported quantity tons											
World	427,991	393,733	471,037	412,160	472,577	492,269	N/A	585,045	623,878	667,599	505,143.2	5.1
Romania	9606	6255	7087	10,654	11,017	9899	11,542	12,649	11,116	10,863	10,068.8	1.4
Italy	3669	3994	4082	3454	6960	6444	8352	11,507	8093	8882	6543.7	10.3
Serbia	159	390	638	913	1916	1108	2966	3368	1804	2045	1530.7	32.8
Importers	Imported quantity											
	Average											
World	439,322	422,411	452,659	439,810	499,914	501,863	531,285	583,653	625,577	646,299	514,279.3	4.4
Italy	13,785	10,781	13,584	15,261	14,560	15,152	15,220	18,493	21,174	23,549	16,155.9	6.1
Romania	63	315	777	516	880	1067	1824	2967	2577	2450	1343.6	50.2
Serbia	8	16	3	9	43	15	1	61	0	15	17.1	7.2

Table 2. Exported and imported quantity in period 2006–2015 (tons).

and Italy amounting to 1530 tons. Romania had the highest average value of exports amounting to 10,000 tons. Within the analysed period, only small oscillations in exported quantities are shown, which points to the fact that production and supply on international market were balanced. The quantity of honey exports from Italy was growing at the rate of 10.3% per year with average quantity of exports amounting to 6544 tons.

Average annual growth rates of the quantity of honey imports show that Romania had the highest value—50.2% with average annual imports of 1343 tons. Nevertheless, the quantity exported from Romania is higher of 8725 tons than the imported (80% of total Romanian trade of honey). Serbia imported certain quantities of honey in some years, however, they are quite insignificant amounting to the average of 17.7 tons and confirming that Serbia is a net exporter of honey. Italy had the highest average quantity of imports amounting to 16,200 tons, far bigger than its export quantity of 9600 tons, making evident that Italy is a net importer of honey.

**Table 3** emerges in the analysed period that there was an increase in the average price of honey at the rate of 7% per year on the global level. Within such period, Italy reached, on average, the highest export price of honey amounting to USD 4722 per ton, with considerable increase over the last few years. Serbia was exporting honey at the average price of USD 4023 per ton and had very low growth rate within the analysed period. Romania had the lowest average export price of honey amounting to USD 3746 with an average growth rate of 7.9% per year. At the end of the first section, we discussed on the relation between quality and price, suggesting that the former may be somehow reflected in the latter. Even if this concept is reasonable and commonly accepted, this may not apply when comparing prices across countries. In other words, the three-time series of unit value of exported honey are not comparable, that in turn means that higher export prices from a country does not necessarily imply higher quality. Even if quality is a component of the export price this may be also strongly affected by inflationary dynamics and by disposable income of the partners (importers) countries where honey is exported; also transport and other trade costs may play a role in determining export price. For these reasons, time series of exported honey unit values may be interesting if compared, for the same country, over time (and not across countries).

Italy's exports represent 1.86% of world exports for this product its ranking in world exports is 17 (**Table 4**). The average distance of importing countries is 1530 km and the export concentration is 0.22. Serbia's exports represent 0.41% of world exports for this product its ranking in world exports is 32. The average distance of importing countries is 1199 km and the export concentration is 0.17. Romania's exports represent 1.96% of world exports for this product its ranking in world exports is 15. The average distance of importing countries is 1635 km and the export concentration is 0.26. Italy's imports represent 3.65% of world imports for this product its ranking in world imports is 7. The average distance of supplying countries is 2577 km and the market concentration is 0.18. Serbia's imports represent 0.01% of world imports for this product its ranking in world imports is 110. The average distance of supplying countries is 4438 km and the market concentration is 0.34. Romania's imports represent 0.27% of world imports for this product its ranking in world imports is 37. The average distance of supplying countries is 2096 km and the market concentration is 0.2.

Exporters	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average	Growth rate (%)
	Exported unit value US dollar/tons											
World	1940	2271	2748	3038	3151	3456	N/A	3543	3782	3565	3054.89	7.0
Romania	2144	2609	3518	3924	3808	4165	3891	4314	4851	4236	3746.00	7.9
Italy	3363	4016	4772	5117	4488	5065	4597	5137	5731	4931	4721.70	4.3
Serbia	3382	3131	3317	3527	3934	4621	4352	4418	4817	4729	4022.80	3.8

**Table 3.** Exported unit value US dollar/tons.

Importers	Exported value 2015 (USD thousand)	Trade balance 2015 (USD thousand)	Share in countries exports (%)	Exported quantity 2015	Quantity unit	Unit value (USD/unit)	Exported growth in value between 2011 and 2015 (%)	Exported growth in quantity between 2011 and 2015 (%)	Exported growth in value between 2014 and 2015 (%)	Share of partner countries in world imports (%)	Total import growth in value of partner countries between 2011 and 2015 (%)
Exported by Italy	43,800	-40,734	100	8882	Tons	4931	8	6	-6	100	9
Exported by Serbia	9670	9550	100	2045	Tons	4729	9	8	11	100	9
Exported by Romania	46,045	39,880	100	10,863	Tons	4239	4	1	-15	100	9
Exporters	Imported value 2015 (USD thousand)	Trade balance 2015 (USD thousand)	Share in Italy's imports (%)	Imported quantity 2015	Quantity unit	Unit value (USD/unit)	Imported growth in value between 2011 and 2015 (%)	Imported growth in quantity between 2011 and 2015 (%)	Imported growth in value between 2014 and 2015 (%)	Share of partner countries in world exports (%)	Total export growth in value of partner countries between 2011 and 2015 (%)
Imported by Italy	84,534	-40,734	100	23,549	Tons	3590	13	13	-7	100	10
Imported by Serbia	120	9550	100	15	Tons	8000	11	0	1100	100	10
Imported by Romania	6165	39,880	100	2450	Tons	2516	16	22	-26	100	10

**Table 4.** List of importing markets and list of importing markets for the product for the product 0409 natural honey.

#### 4. Comparative advantage of honey exports of Serbia, Romania and Italy

Studying comparative advantage in exports of honey from Serbia, we applied five indexes: relative advantages of export, relative import advantage, relative trade advantage, the revealed competitiveness and the Balassa index. **Table 5** shows the indexes for all analysed years. The research found a positive comparative advantage of all five indices. Empirical research results of comparative advantage in exports of honey from Serbia in the period 2006–2015 are shown in **Table 5**.

Results of the research of comparative advantage of honey exports from Serbia show that all the five indexes have achieved positive values. The highest level has been achieved with relative export advantage, which has caused a high positive relative trade advantage. Relative import advantage has very low, however positive value and points to negative trends and the presence of some quantities in imports.

By analysing the variance (**Table 6**), we wanted to determine whether the mean variables vary in relation to the group. In Serbia case, empirical  $F$  value is 10.141 and  $p = 6.13308E-06$ , indicating that the differences between the indexes are statistically significant.

According to research conducted [19, 21, 22], we performed a correlation analysis of the obtained indexes, to examine the extent to which the indices related to the identification of comparative advantages (**Table 7**). By using Pearson ( $r_p$ ) and Spearman ( $r_s$ ) test of correlation, we have proved the existence of correlation between 10 paired samples, that is, found how much the Balassa index values covariate. For Serbia, we have two pairs with strong positive correlation with  $p$ -value below .01 so we can conclude that a correlation exists and the variables covariate. Test of connection of the Balassa index using Spearman formula shows that there is a correlation in three pairs with  $p$ -value below .1 and one pair with  $p$ -value below .05, so we can conclude that a correlation exists and that the variables covariate. It is interesting to conclude that there is a correlation right between relative export advantage and relative trade advantage, as well as between the found competitiveness and the found comparative advantage, which points to the conclusion that each growth in honey exports has positive effects on the growth of comparative advantage of exports.

	N	Minimum	Maximum	Mean	Std. deviation	Variance	
RXA	10	1.20	11.93	5.2830	3.40314	11.581	RXA
RMA	10	0.00	.11	.0420	.03765	.001	RMA
RTA	10	1.18	11.93	5.2440	3.39224	11.507	RTA
RC	10	3.80	7.78	5.0950	1.30715	1.709	RC
RCA	10	1.52	4.87	2.7480	1.11179	1.236	RCA

Source: ITC and calculation of the author.

**Table 5.** Descriptive statistics for RXA, RMA, RTA, RC and RCA indexes of exports of honey from Serbia in the period 2006–2015.

ANOVA		SS	df	MS	F	p-value	F crit	Indexes	t (Dt = 9)	Sig. (2-tailed)	Mean difference
Between groups	211.2157	4	52.80392	10.14101	6.13308E-06	2.578739	RXA	4.909	.001	5.28300	
Within groups	234.3136	45	5.206969				RMA	3.527	.006	0.04200	
							RTA	4.889	.001	5.24400	
Total	445.5293	49					RC	12.326	.000	5.09500	
							RCA	7.816	.000	2.74800	

**Table 6.** ANOVA and one sample test for RXA, RMA, RTA, RC and RCA indexes for Serbia in the period from 2006 to 2015.



		Pearson correlation					Spearman's correlation				
		RXA	RMA	RTA	RC	RCA	RXA	RMA	RTA	RC	RCA
RXA	Pearson correlation	1	.268	1.000**	.537	.589	1.000	.228	1.000**	.455	.794**
	Pearson correlation										
	Sig. (2-tailed)		.455	.000	.110	.073		.527		.187	.006
RMA	N	10	10	10	10	10	10	10	10	10	10
	Pearson correlation	.268	1	.258	-.612	-.347	.228	1.000	.228	-.579	-.160
	Sig. (2-tailed)	.455		.472	.060	.326	.527		.527	.080	.659
RTA	N	10	10	10	10	10	10	10	10	10	10
	Pearson correlation	1.000**	.258	1	.545	.594	1.000**	.228	1.000	.455	.794**
	Sig. (2-tailed)	.000	.472		.104	.070	.527		.527	.187	.006
RC	N	10	10	10	10	10	10	10	10	10	10
	Pearson correlation	.537	-.612	.545	1	.883**	.455	-.579	.455	1.000	.758*
	Sig. (2-tailed)	.110	.060	.104		.001	.187	.080	.187		.011
RCA	N	10	10	10	10	10	10	10	10	10	10
	Pearson correlation	.589	-.347	.594	.883**	1	.794**	-.160	.794**	.758*	1.000
	Sig. (2-tailed)	.073	.326	.070	.001		.006	.659	.006	.011	
N	10	10	10	10	10	10	10	10	10	10	10

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

Table 7. Pearson ( $r_p$ ) and Spearman ( $r_s$ ) test of correlation indexes for Serbia.

	N	Minimum	Maximum	Mean	Std. deviation	Variance
RXA	10	5.26	10.12	7.4340	1.53225	2.348
RMA	10	.05	.87	.4690	.27111	.073
RTA	10	4.63	9.84	6.9660	1.65515	2.740
RC	10	1.97	5.30	3.0000	.98958	.979
RCA	10	1.50	3.08	2.0330	.47070	.222

Source: ITC and calculation of the author.

**Table 8.** Descriptive statistics for RXA, RMA, RTA, RC and RCA indexes of exports of honey from Romania in the period 2006–2015.

In a study of comparative advantage in exports of honey from Romania, we applied five indexes: relative advantages of export, relative import advantage, relative trade advantage, the revealed competitiveness and the Balassa index, as for Serbia. **Table 8** shows the indexes for all analysed years. The research found a positive comparative advantage of all five indices. Empirical research results of comparative advantage in exports of honey from Romania in the period 2006–2015 are shown in **Table 8**.

Results of the research of comparative advantage of honey exports from Romania show that all the five indexes reached positive values (**Table 9**). The highest level has been achieved with relative export advantage, which caused a high positive trade advantage. Relative import advantage has very low, however positive value, which points to the presence of small quantities in imports. We have concluded that Serbia and Romania have similar export structure regarding the honey exports, which points to high values in comparative advantage. Analysis of variance in the case of Romania shows the following: empirical  $F$  value is 74.51792 and  $p = 2.91E-19$ , indicating that differences between groups are statistically significant, systematic.

By using Pearson ( $r_p$ ) and Spearman ( $r_s$ ) test of correlation, we have proved the existence of correlation between 10 paired samples (**Table 10**). For Romania, we have six pairs with strong correlation with  $p$ -value below .01 so we can conclude that correlation exists and the variables covariate.

ANOVA							Indexes	$t$ (Dt = 9)	Sig.	Mean
	SS	Df	MS	$F$	$p$ -value	$F$ crit		(2-tailed)	difference	
Between groups	379.2464	4	94.8116	74.51792	2.91E-19	2.578739	RXA	15.342	.000	7.43400
							RMA	5.471	.000	.46900
Within groups	57.25498	45	1.272333				RTA	13.309	.000	6.96600
Total	436.5014	49					RC	9.587	.000	3.00000
							RCA	13.658	.000	2.03300

**Table 9.** ANOVA and one sample test for RXA, RMA, RTA, RC and RCA indexes for Romanian the period from 2006 to 2015.

		Pearson correlation					Spearman's correlation				
		RXA	RMA	RTA	RC	RCA	RXA	RMA	RTA	RC	RCA
RXA	Correlation	1	-.386	.988**	.574	.803**	1.000	-.261	.964**	.467	.891**
	Sig. (2-tailed)		.271	.000	.083	.005		.467	.000	.174	.001
	N	10	10	10	10	10	10	10	10	10	10
RMA	Correlation	-.386	1	-.521	-.901**	-.557	-.261	1.000	-.430	-.952**	-.430
	Sig. (2-tailed)	.271		.122	.000	.094	.467		.214	.000	.214
	N	10	10	10	10	10	10	10	10	10	10
RTA	Correlation	.988**	-.521	1	.679*	.834**	.964**	-.430	1.000	.624	.903**
	Sig. (2-tailed)	.000	.122		.031	.003	.000	.214		.054	.000
	N	10	10	10	10	10	10	10	10	10	10
RC	Correlation	.574	-.901**	.679*	1	.792**	.467	-.952**	.624	1.000	.588
	Sig. (2-tailed)	.083	.000	.031		.006	.174	.000	.054		.074
	N	10	10	10	10	10	10	10	10	10	10
RCA	Correlation	.803**	-.557	.834**	.792**	1	.891**	-.430	.903**	.588	1.000
	Sig. (2-tailed)	.005	.094	.003	.006		.001	.214	.000	.074	
	N	10	10	10	10	10	10	10	10	10	10

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

**Table 10.** Pearson ( $r_p$ ) and Spearman ( $r_s$ ) test of correlation indexes for Romania.

One pair showed negative correlation, which points to the fact that the increase of imports, that is, relative import advantage has negative effects upon revealed competitiveness. Test of connection of the Balassa index using Spearman formula shows that there is a correlation in four pairs with  $p$ -value below .1, so we can conclude that correlation exists and that the variables covariate. There is also a negative correlation with relative import advantage and revealed competitiveness.

In a study of comparative advantage in exports of honey from Italy, we applied five indexes: relative advantages of export, relative import advantage, relative trade advantage, the revealed competitiveness and the Balassa index, as for Serbia and Romania. **Table 11** shows the indexes for all analysed years. In our research, we have found positive average value for relative advantages of export and relative import advantage. Empirical research results of comparative advantage in exports of honey from Italy in the period 2006–2015 are shown in **Table 11**.

Results of the research of comparative advantage of honey exports from Italy show that positive values have been achieved in two indexes, that is, relative export and import advantage have positive average values (**Table 12**). As the relative import value grows, the level of relative trade openness, as well as the revealed competitiveness and the Balassa index become negative. Analysis of variance in the case of Italy shows the following: empirical  $F$  value is 139.512 and  $p = 9.51E-25$ , indicating that differences between groups are statistically significant, systematic.

	N	Minimum	Maximum	Mean	Std. deviation	Variance
RXA	10	.43	1.04	.6360	.19540	.038
RMA	10	.75	1.57	1.1880	.25354	.064
RTA	10	-.86	-.26	-.5520	.20460	.042
RC	10	-1.06	-.34	-.6450	.24451	.060
RCA	10	-1.06	-.26	-.6260	.24139	.058

Source: ITC and calculation of the author.

**Table 11.** Descriptive statistics for RXA, RMA, RTA, RC and RCA indexes of exports of honey from Italy in the period 2006–2015.

	ANOVA			$F$	$p$ -value	$F$ crit	Indexes	$t$ (Dt = 9)	Sig. (2-tailed)	Mean difference
	SS	Df	MS							
Between groups	29.28445	4	7.321112	139.5118	9.51E-25	2.578739	RXA	10.293	.000	.63600
Within groups	2.36145	45	0.052477				RMA	14.817	.000	1.18800
Total	31.6459	49					RTA	-8.532	.000	-.55200
							RC	-8.342	.000	-.64500
							RCA	-8.201	.000	-.62600

**Table 12.** ANOVA and one sample test for RXA, RMA, RTA, RC and RCA indexes for Italy in the period from 2006 to 2015.

		Pearson correlation					Spearman's correlation				
		RXA	RMA	RTA	RC	RCA	RXA	RMA	RTA	RC	RCA
RXA	Correlation	1	.602	.197	.669*	.741*	1.000	.503	.311	.775**	.801**
	Sig. (2-tailed)		.066	.585	.034	.014		.138	.382	.008	.005
	N	10	10	10	10	10	10	10	10	10	10
RMA	Correlation	.602	1	-.664*	-.160	-.062	.503	1.000	-.590	-.037	.024
	Sig. (2-tailed)	.066		.036	.658	.866	.138		.072	.920	.947
	N	10	10	10	10	10	10	10	10	10	10
RTA	Correlation	.197	-.664*	1	.826**	.772**	.311*	-.590	1.000	.761*	.750*
	Sig. (2-tailed)	.585	.036		.003	.009	.382	.072		.011	.012
	N	10	10	10	10	10	10	10	10	10	10
RC	Correlation	.669*	-.160*	.826**	1	.986**	.775**	-.037*	.761*	1.000	.976**
	Sig. (2-tailed)	.034	.658	.003		.000	.008	.920	.011		.000
	N	10	10	10	10	10	10	10	10	10	10
RCA	Correlation	.741*	-.062	.772**	.986**	1	.801**	.024	.750*	.976**	1.000
	Sig. (2-tailed)	.014	.866	.009	.000		.005	.947	.012	.000	
	N	10	10	10	10	10	10	10	10	10	10

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

**Table 13.** Pearson ( $r_p$ ) and Spearman ( $r_s$ ) test of correlation indexes for Italy.

By using Pearson ( $r_p$ ) and Spearman ( $r_s$ ) test of correlation (**Table 13**), we have shown that for Italy we have six pairs with strong correlation, at the level of  $p < .01$  and  $.05$  so we can conclude that the correlation exists and variables covariate. One pair showed negative correlation, which points to the fact that the increase in imports, that is, relative import advantage has negative effects upon revealed competitiveness. Test of connection of the Balassa index using Spearman formula shows that there is a correlation in five pairs with  $p < .01$  and  $.05$ , so we can conclude that correlation exists and that the variables covariate. There is also a negative correlation with relative import advantage and revealed competitiveness (RC).

In our further research, we wanted to determine the value of importance of the difference between the comparative advantage indexes (RCA) for all three countries (**Table 14**). The variance analysis shows the following: the empirical  $F$  value is 62.554 and  $p = 7.32E-11$ , which points to the fact that differences between the groups are statistically significant.

Source of variation	SS	df	MS	$F$	$p$ -value	$F$ crit	$t$ (Dt = 9)	Sig. (2-tailed)	Mean difference
Between groups	63.21794	2	31.60897	62.55435	7.32E-11	3.354131	RCA SRB 7.816	.000	2.74800
Within groups	13.64321	27	0.505304				RCA RO 13.658	.000	2.03300
Total	76.86115	29					RCA IT -8.201	.000	-.62600

**Table 14.** ANOVA test RCA index for Serbia, Romania and Italy.

Results of further analysis show that there is statistically significant difference between the levels of comparative advantage of exports between Serbia and Italy and Romania and Italy (**Table 15**). If we consider that Serbia and Romania are producing surplus in international honey trade, while for Italy, imports are more important, then the empirical results prove the absence of the comparative advantage in honey exports in Italy.

Paired samples test		Paired differences				$t$	df	Sig. (2-tailed)
		Mean	Std. deviation	Std. error mean	95% confidence interval of the difference Lower Upper			
Pair 1	RCA_SRB- RCA_RO	.71500	1.40725	.44501	-.29168 1.72168	1.607	9	.143
Pair 2	RCA_SRB- RCA_IT	3.37400	1.09891	.34751	2.58789 4.16011	9.709	9	.000
Pair 3	RCA_RO- RCA_IT	2.65900	.57922	.18317	2.24465 3.07335	14.517	9	.000

**Table 15.** Paired samples test RCA index for Serbia, Romania and Italy.

## 5. Discussion and concluding remarks

Research results point to a mild increase in world production. The production increase has positive consequences in the expansion of honey exports in some European Union countries. Honey trade and competitive patterns presented in previous tables (Sections 3 and 4) have shown clearly different trends and exchange structures in the three selected countries examined (Serbia, Romania and Italy). While Serbia and Romania are net exporter, with a positive trade balance, Italy is a net importer, with negative balance given the deficit of export compared to import. Romania and Serbia differ for the trade volume (import + export) that is about seven times bigger in Romania (on average 2006–2015). Romania has a growing market and a lot of opportunities for export. Nevertheless, even if Serbia has a smaller market, the low levels of import may suggest that domestic beekeeping industry is able to cover both internal and foreign demand (even if some other causes, like trade barriers, may have a role). Such surprising low impact of import is confirmed by previous analysis on honey consumers in Serbian regions. Ref. [20], in fact, suggest: “While researching consumer attitudes, we have come to the conclusion that the majority of consumers, as many as 83%, are willing to try Fruska Gora’s lime honey that is of above average quality and is certified, regardless of the fact that lime honey does not belong to the type of honey which consumers buy. The reason for this lies in the fact that consumers prefer a high quality of honey because it is linked to better taste and better healing properties of honey, which is in line with the motivations of consumers. For such a quality and certified honey, consumers are willing to pay even a 30% higher price than the average market price of lime honey.”

Apparently the opposite applies to Italy whose internal demand for honey is covered to a relevant extent by imports. This may be seen as a source of potential unexplored demand to be covered by Italian beekeepers. Both, Romania and Serbia have a high coverage of imports by exports and a positive comparative advantage of export. Such evidences are also confirmed by previous studies on competitiveness of Countries in the Danube regions. For example the study [23] concluded that “In the following commodity groups in Serbia an increase of positive comparative advantage is present: milk and products, except butter and cheese; butter and other fats from milk; dairy spreads, cheese and curd, products of cereals, flour, starch; vegetables, roots and tubers, processed; fruit prepared and products; sugar, molasses and honey; chocolate and other food preparations with cocoa”. In another analysis [21] have been using D’Agostino and Pearson omnibus normality test showing that the Balassa index value distribution in Romania does not deviate significantly from normality ( $K2 = 2.46$  and  $p = .29$ ).

Romania is a net exporter of honey, well known at international level. The introduction of quality standards and the certification of honey will increase the prices of commercialised honey, mostly for the external market. Beekeepers should maintain the quality of honey by preserving the environment and the traditional practices. The production of organic honey is another sector that brings a comparative advantage for Romania and creates the possibility to develop a niche market. Anyway, Romania could represent a model of good practices for Serbia to improve the competitiveness of the beekeeping sector through innovation and associative forms [24–26].



Research has also shown that the majority of European Union countries imported honey. Italy is a net importer and has a large trade deficit in terms of value and volume, even if such gap is slightly declining. Italian beekeeping industry should take actions to recover market shares of domestic demand, developing more effective promotional activities towards consumers. The conclusion of the study reveals the fact that innovation through the whole value chain is one of the key factors for increasing competitiveness of honey production and trade. Interestingly, the results of the present analysis are also confirmed and mirrored by previous studies that point out the importance of honey quality improvement as an essential way to pursue both sector innovation and product promotion.

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