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COMPARATIVE ADVANTAGES IN AGRO-FOOD TRADE OF CENTRAL EUROPEAN AND BALKANS' COUNTRIES WITH THE EUROPEAN UNION

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INTRODUCTION

Limited research is available to investigate revealed comparative advantages in Central and Eastern European (CEE) countries (Bojnec, 2001; Fertő and Hubbard, 2003). Similarly, research on competitiveness of agriculture in CEE countries employing trade data is also scarce. Both of the analyses are particularly relevant for the new European Union (EU) member countries, which during the last fifteen years have undergone transition from central planning to a market economy and rapid adjustments to the EU membership. While one might expect that trade opening, free trade and association agreements, and the EU membership have induced substantial changes in structures of agro-food trade flows, there is limited evidence on the magnitude and patterns in comparative trade advantages potentially caused by these processes. Therefore, the aim of this paper is to investigates comparative trade advantages/disadvantages in agro-food trade of five new members of the EU from Central Europe (CE-5) (the Czech Republic, Hungary, Poland, Slovakia, and Slovenia), and the selected Balkans' countries (Bulgaria, Croatia, and Romania) with the EU members employing comparative trade advantage measures. Thus, we apply in practical empirical work recent theoretical and methodological developments in international trade with an aim to evaluate agro-food sector comparative trade advantages and their implications for sustainable rural development.

The paper contributes to the existing literature in at least four significant directions. Firstly, the paper contributes to a better understanding of the comparative trade advantages and associated challenges of CE-5 and Balkans' countries for agro-food product groups comparative trade advantages/disadvantages in the EU markets. Secondly, the paper aims to indicate ways in which agro-food trade and comparative trade advantages/disadvantages for the analyzed countries have developed and is likely to evolve or change and how this might influence magnitude and directions in agro-food sector restructuring and rural development. Thirdly, we analyze agro-food trade comparative advantages/disadvantages and associated rural development of European countries at different stages of EU

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integration: the CE-5 that entered the EU-25 in 2004 and the two Balkans countries, namely Bulgaria and Romania that entered the EU-27 in 2007, and Croatia that is searching to become EU member. Finally, the research and empirical results may be of a broader relevance to those with a direct involvement in commercial trading and to strategy and policy makers in rural development as the empirical results are evaluated with policy implications for competitive agro-food trade of these analyzed countries that have recently joined the EU and Croatia and other Balkans' countries that so far are outside the process of EU integration and the Single European Market (SEM).

The structure of the paper is organized as follows. In the second section we present the various indices of revealed comparative trade advantages and explain methodology. In the third section there are described data used and presented empirical results. The final section concludes.

METHODOLOGY

The concept of 'revealed' comparative advantage was introduced by Liesner (1958), but refined and popularized by Balassa (1965). Therefore, it is known as the 'Balassa index', which is widely used empirically to identify a country's weak and strong export sectors. Porter (1990) uses it to identify strong sectoral clusters, Amiti (1998) analyses specialization patterns in Europe, Proudman and Redding (2000) and Redding (2002) focus on the dynamics of comparative advantage, Bojnec (2001) analyses agricultural trade, Hinloopen and Van Marrewijk (2001, 2004) study the dynamics of the empirical distribution of European and Chinese trade, and Fertő and Hubbard (2003) analyze competitiveness in Hungarian agro-food sectors. The Revealed Comparative Advantage (RCA) index is defined by Balassa (B) (1965) as follows:

$$B = (Xij / Xit) / (Xnj / Xnt)$$

where X represents exports, i is a country, j is a commodity, t is a set of commodities and n is a set of countries. B is based on observed trade patterns; it measures a country's exports of a commodity relative to its total exports and to the corresponding export performance of a set of countries, e.g., the EU-15. If B>1, then a comparative export advantage is revealed.

Vollrath (1991) offered an alternative specification of revealed comparative advantage, called by the relative trade advantage (RTA), which accounts for imports as well as exports. It is calculated as the difference between relative export advantage (RXA), which equates to the Balassa index, and its counterpart, relative import penetration or relative import advantage (RMA):

$$RTA = RXA-RMA$$

where, RXA = B and

$$\text{RMA} = (\text{Mij} / \text{Mit}) / (\text{Mnj} / \text{Mnt})$$

where M represents imports. Thus,

$$\text{RTA} = [(\text{Xij} / \text{Xit}) / (\text{Xnj} / \text{Xnt})] - [(\text{Mij} / \text{Mit}) / (\text{Mnj} / \text{Mnt})]$$

If RTA>0, then a comparative trade advantage is revealed.

We also analyse the duration of comparative trade advantage. Thus, it is a natural that we approach this issue by using duration analysis. We estimate survival functions across product types by using the nonparametric Kaplan-Meier product limit estimator. The survival function, S(t), is usually estimated non-parametrically using the Kaplan-Meier product limit estimator. Derivation is as follows. It is assumed that a sample contains n independent observations denoted (ti; ci), i = 1, 2, ..., n, where ti is the survival time, while ci is the censoring indicator variable C (taking on a value of 1 if failure occurred, and 0 otherwise) of observation i. Moreover, it is assumed that there are m < n recorded times of failure. Then we denote the rank-ordered survival times as $t(1) < t(2) < \cdots < t(m)$. Let nj denotes the number of subjects at risk of failing at t(j) and let dj denotes the number of observed failures. The Kaplan-Meier estimator of the survival function is then:

$$\hat{S}(t) = \prod_{t(i)<t} \frac{n_j - d_j}{n_j},$$

with the convention that $\hat{S}(t) = 1$ if t < t(1). Given many observations are censored then we note the Kaplan-Meier estimator is robust to censoring and uses information from both censored and non-censored observations.

We also check the equality of survival functions across product groups using two non-parametric tests: log-rank test and Wilcoxon test. The log-rank test is $E_{ij}=n_{ij}d_j/n_j$, where the expected number of failures in group *i* at time t_j, under the null hypothesis of no difference in survival among the *r* groups. The chi squared test statistic is calculated as quadratic from $\mathbf{u}'\mathbf{V}^{-1}\mathbf{u}$ using the row vector.

$$\mathbf{u}' = \sum_{j=1}^{k} W(t_j)(d_{1j} - E_{1j},...,d_{rj} - E_{rj})$$

and the *r x r* variance matrix **V**, where the individual elements are calculated by

$$V_{il} = \sum_{j=1}^{k} \frac{W^2(t_j) n_{ij} d_j (n_j - d_j)}{n_j (n_j - 1)} \left(\delta_{ij} - \frac{n_{ij}}{n_j} \right)$$

where i=1,…,r, l=1,…,r, and δ_{il}=2 if i=l and 0 otherwise. The weight function (W_{tj}) is what characterises the different flavours of the tests. In the case of the log-rank test, W_{tj}=1 when n_{ij} is non-zero. The Wilcoxon test is also a rank test and constructed in the same way as the log-rank test, except for this test we set W_{tj}= n_{ij} in $\mathbf{u}'$and $\mathbf{V_{il}}$ functions (Cleves et al. 2004).

DATA AND RESULTS

To conduct the empirical analysis on comparative trade advantages/disadvantages in the CEE and Balkans' countries agro-food trade with the EU, we use detailed trade data from OECD by the years 1995-2003. Agro-food trade is defined by EU-Commission (1999). Sample consists of 255 items at four-digit level in Standard International Trade Classification (SITC) system. Following Chen et al. (2000) we classify agro-food trade flows into four commodity groups: bulk raw commodities (1), processed intermediates (2), consumer-ready food (3), and horticulture (4).

Comparative advantage in CEE and Balkans' countries

CEE and Balkans' countries experienced comparative export advantage in the EU-15 markets, except Slovenia. This is seen in Table 1 from the mean B value, which is greater than 1, particularly for Bulgaria, Hungary as well as for other analyzed countries. For Slovenia it is close, but less than one. The standard deviation suggests variability in the B values by countries and over time for the same country. The number of products with relative comparative export advantages is lower than the number of products with relative comparative export disadvantages. This result might be biased by the size of agro-food sectors and trade, where the EU-15 is much bigger than any individual CEE or Balkans' countries. The differences across countries are found also in the B values by the analyzed agro-food product groups. Except of Poland, the B values are the highest for bulk raw commodities. For Poland, the highest B-value is found for consumer-ready food. It is interesting to note that Bulgaria, Hungary and Croatia experienced comparative export advantages (B greater than 1) for the each agro-food product groups, which does not hold for Romania for consumer-ready food, for Poland for horticulture, for Slovakia and Slovenia for consumer-ready food and horticulture, and for the Czech Republic except of bulk raw commodities for other three agro-food product groups (processed intermediates, consumer-ready food and horticulture).

Table 1 Descriptive statistics for B (average for the period 1995-2003)

	Czech Republic	Hungary	Poland	Slovakia	Slovenia	Bulgaria	Croatia	Romania
Maximum B value	139.07	644.31	266.59	138.55	62.73	512.85	208.41	600.25
Minimum B value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Standard deviation in B value	10.20	45.40	24.73	10.44	5.10	43.78	18.54	39.33
Median value	0.02	0.06	0.05	0.00	0.00	0.00	0.00	0.00
Mean B value	**1.81**	**7.05**	**4.91**	**1.78**	**0.98**	**7.62**	**3.44**	**4.31**
B<1 (number of SITC items)	1592	1703	1522	1709	1517	1576	1477	1676
B=0 (number of SITC items)	264	301	270	573	369	573	430	458
B>1 (number of SITC items)	703	592	773	586	778	719	818	619
Mean B value								
Bulk raw commodities	**6.63**	**15.44**	**4.20**	**4.60**	**1.90**	**20.91**	**11.35**	**5.24**
Processed intermediates	0.86	**9.88**	**2.70**	**2.13**	**1.26**	**2.10**	**1.10**	**8.61**
Consumer-ready food	0.52	**1.87**	**7.62**	0.43	0.49	**5.82**	**2.03**	0.83
Horticulture	0.82	**3.22**	0.96	0.76	0.21	**7.38**	**1.33**	**3.46**

Source: Own calculations on the basis of OECD dataset.

High dispersion is seen for the estimated values of the import penetration index (RMA) (Table 2). The mean values of the RMA suggest a lack in import penetration, which is concentrated on a smaller number of imported agro-food products, but they prevail over the imports of agro-food products with successful import penetration. The number of products without imports (RMA = 0) vary by the analyzed countries. The mean of the RMA values are in general, except for Bulgarian and Romanian horticultural products, greater than one indicating a lack in successful import penetration.

Table 2 Descriptive statistics for RMA (average for the period 1995-2003)

	Czech Republic	Hungary	Poland	Slovakia	Slovenia	Bulgaria	Croatia	Romania
Maximum RMA value	1734.25	544.48	1876.07	941.51	2793.25	4927.05	1492.28	922.43
Minimum RMA value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
standard deviation in RMA value	115.83	35.83	128.25	60.75	190.11	314.29	104.99	62.88
Median value	0.30	0.16	0.37	0.15	0.32	0.18	0.30	0.14
Mean RMA value	12.49	4.42	13.97	6.14	20.93	26.54	14.96	8.15
RMA<1 (number of SITC items)	1962	1807	1814	2026	2099	1857	1975	1934
RMA=0 (number of SITC items)	234	271	241	480	361	474	398	387
RMA>1 (number of SITC items)	333	488	481	269	196	438	320	361
Mean RMA value								
Bulk raw commodities	12.50	1.65	13.99	5.84	6.15	1.07	2.07	1.18
Processed intermediates	8.09	3.71	10.36	3.13	21.36	11.12	16.92	8.20
Consumer-ready food	17.62	6.57	18.39	9.48	30.93	54.31	21.78	12.66
Horticulture	2.57	2.31	4.69	1.04	1.15	**0.68**	1.47	**0.50**

Source: Own calculations on the basis of OECD dataset.

Only Hungary with the mean of RTA value greater than zero experienced relative comparative trade advantage in agro-food products in the EU-15 markets (Table 3). The results of the RTA measures indicate large variations as seen from the maximum and minimum RTA values and from the standard deviation in the RTA value. In the consumer-ready food no any analyzed country experienced relative comparative trade advantage in the EU-15 markets. These groups of products are mainly result of more sophisticated food processing, which requires both quality in food processing and developed marketing channels for such products. For the other three groups of agro-food products, only Hungary experienced relative comparative trade advantage in the EU-15 markets. For the bulk commodities besides Hungary the RTA greater than one is for Bulgaria, Croatia and Romania. The relative comparative advantages for this group of products on the EU-15 markets are likely to be result of advantages in natural factor endowments such high quality agricultural land resources important for crop production. In the processed

intermediates besides Hungary relative comparative trade advantage in the EU-15 markets is identified for Romania, whereas for horticultural products besides Hungary and Romania also for Bulgaria. Whereas for the former, this is likely to be an outcome of combination of competitive production of agricultural products that are used in processing and food processing itself, the latter is likely to be results both previous mention factors as well as tradition in horticultural production and available relatively a cheap labour that is used in horticultural production.

Table 3 Descriptive statistics for RTA (1995-2003)

	Czech Republic	Hungary	Poland	Slovakia	Slovenia	Bulgaria	Croatia	Romania
Maximum RTA value	138.8	644.27	266.6	138.5	62.6	512.64	208.34	600.23
Minimum RTA value	-1734.2	-544.48	-1876.1	-941.5	-2793.2	-4927.04	-1492.28	-922.43
Standard deviation in RTA value	145.9	77.18	184.2	92.3	248.9	325.53	107.34	76.68
Median value	-0.2	-0.03	-0.1	-0,26	-0.47	-0.01	-0.10	-0.04
Mean RTA value	-13.2	**4.02**	-10.5	-6.6	-23.9	-18.91	-11.52	-3.84
RTA<0	1455	1219	1304	1306	1525	1188	1420	1352
RTA=0	234	271	241	480	361	474	398	387
RTA>0	606	805	750	509	409	633	477	556
Mean RTA value								
Bulk raw commodities	-5.87	**13.79**	-9.79	-1.23	-4.24	**19.84**	**9.28**	**4.05**
Processed intermediates	-7.22	**6.16**	-7.65	-1.00	-20.09	-9.01	-15.82	**0.41**
Consumer-ready food	-17.10	-4.70	-10.77	-9.04	-30.43	-48.49	-19.75	-11.82
Horticulture	-1.74	**0.91**	-3.73	-0.28	-0.93	**6.70**	-0.13	**2.96**

Source: Own calculations on the basis of OECD dataset.

Duration of comparative advantage

We calculate the average lifetime of comparative advantage for those product groups having comparative advantage at least one year (Table 4). Using both the RTA and B indices the average lifetime is between 5 and 6 years for all countries, except Slovenia. Note that there is no significant difference in average lifetime

between the RTA and B indices. However we observe larger difference by product groups in aver age lifetime within and across RTA and B indices. Last column in

Table 4 Average lifetime of comparative advantage by product groups (year)

	Bulk raw commodities	Processed intermediates	Consumer-ready food	Horticulture	Total	Share of RTA*
Czech Republic						
RTA>0	5.81	4.76	4.90	6.67	5.53	35.4
B>1	7.05	5.59	4.91	4.00	5.67	41.7
Hungary						
RTA>0	5.83	5.59	5.61	5.78	5.67	40.8
B>1	5.96	5.74	5.82	6.50	5.87	44.2
Poland						
RTA>0	6.14	5.13	6.20	6.00	5.86	40.6
B>1	5.73	5.81	5.77	5.71	5.77	39.4
Slovakia						
RTA>0	5.79	5.14	4.37	6.20	5.14	30.3
B>1	5.81	4.46	5.25	7.00	5.19	28.8
Slovenia						
RTA>0	4.73	4.58	4.96	6.25	4.81	25.9
B>1	4.53	4.19	4.56	3.25	4.33	25.0
Bulgaria						
RTA>0	5.29	5.39	5.51	5.00	5.36	29.7
B>1	4.61	4.78	6.96	5.57	5.40	31.9
Croatia						
RTA>0	6.08	4.83	4.75	5.00	5.13	36.6
B>1	5.50	4.60	4.79	5.25	5.01	34.2
Romania						
RTA>0	5.06	5.87	4.77	4.18	5.15	32.4
B>1	4.75	4.88	5.80	5.50	5.13	30.3

* Share of RTA > 0 or B > 1 = 9 year to total number RTA > 0 or B > 1

Table 4 shows the share of product with comparative advantage every year during the nine year period in total number of products with comparative advantage at least one year. This ratio is the highest in Hungary, Poland and the Czech Republic (around 40 per cent), whilst this ratio is about 30 per cent or less in Bulgaria, Romania, Slovakia and Slovenia. The better the ratio, the better is the comparative agro-food export and/or trade performance in the EU-15 markets.

Table 5 Kaplan-Meier Survival Rates for comparative advantage indices

	1 year	5 year	9 year	Product groups (9 year)			
				Bulk raw commodities	Processed intermediates	Consumer-ready food	Horti-culture
Czech Republic							
RTA>0	0.93	0.61	0.09	0.20	0.09	0.06	0.05
B>1	0.91	0.52	0.02	0.08	0.02	0.02	0.01
Hungary							
RTA>0	0.94	0.66	0.14	0.29	0.14	0.12	0.07
B>1	0.92	0.55	0.04	0.07	0.04	0.03	0.03
Poland							
RTA>0	0.93	0.61	0.10	0.17	0.06	0.12	0.08
B>1	0.91	0.55	0.05	0.06	0.03	0.06	0.03
Slovakia							
RTA>0	0.92	0.56	0.06	0.22	0.06	0.02	0.04
B>1	0.90	0.50	0.01	0.06	0.01	0.00	0.01
Slovenia							
RTA>0	0.91	0.54	0.03	0.07	0.03	0.02	0.01
B>1	0.90	0.49	0.01	0.03	0.01	0.00	0.01
Bulgaria							
RTA>0	0.94	0.68	0.16	0.37	0.15	0.11	0.15
B>1	0.91	0.53	0.04	0.10	0.04	0.03	0.03
Croatia							
RTA>0	0.93	0.61	0.11	0.25	0.10	0.08	0.05
B>1	0.90	0.50	0.03	0.07	0.02	0.02	0.01
Romania							
RTA>0	0.94	0.63	0.11	0.22	0.10	0.08	0.09
B>1	0.90	0.51	0.02	0.06	0.02	0.01	0.02

We test whether comparative advantage RTA and B indices are stable over time using the duration analysis. The survival rates for years 1, 5 and 9 and the survival rates for year 9 by product groups are reported in Table 5. In general, our results confirm our priory expectations, namely that the duration of RTA indices is longer than Balassa (B) indices. The results imply that the RTA indices, which capture simultaneous export and import flows, are of longer duration than the B indices, which are based only on export flows. However, the duration of comparative advantage based on RTA index is generally low, as the Kaplan-Meier survival rates are less than 0.2 for all countries. Interestingly, Balkans' countries (Bulgaria, Croatia and Romania) have higher survival rates comparing to the Czech Republic, Slovakia and Slovenia indicating agro-food trade potentials of the former countries in the EU-15 markets. The survival rates of Balassa (B) indices are very low, below 6 per cent for every country. The estimations based on product groups for the 9 year interval show a similar picture in general. The duration is longer for RTA indices than Balassa (B) index for each product categories. The duration of comparative trade advantages is the highest for bulk raw commodities each country. The survival rates of horticultural products are the lowest based on both RTA and B indices for majority of countries except of Bulgaria and Romania. The next lowest category in terms of duration of RTA and B indices is the consumer-ready goods in every country. Therefore, the analyzed countries explored higher comparative advantages in trade and their duration for bulk primary raw agricultural commodities and processed intermediates, but less so for consumer-ready goods that are results of more sophisticated food processing and marketing and for horticultural products that are more sensitive on both weather and market conditions.

Table 6 Wilcoxon and log-rank tests for equality of survival function across product groups (p values)

	Czech Republic		**Hungary**		**Poland**		**Slovakia**	
	Wilcoxon test	Log rank test	Wilcoxon test	Log rank test	Wilcoxon test	Log rank test	Wilcoxon test	Log rank test
RTA>0	0.000	0.000	0.0001	0.0000	0.0069	0.0001	0.0000	0.0000
B>1	0.0004	0.0000	0.0426	0.0103	0.6901	0.4047	0.0011	0.0000
	Slovenia		**Bulgaria**		**Croatia**		**Romania**	
	Wilcoxon test	Log rank test	Wilcoxon test	Log rank test	Wilcoxon test	Log rank test	Wilcoxon test	Log rank test
RTA>0	0.0329	0.0134	0.0000	0.0000	0.0000	0.0000	0.000	0.000
B>1	0.3673	0.2019	0.0127	0.0013	0.2672	0.0429	0.097	0.016

We also check the equality of survival functions across product groups by countries using two nonparametric tests (log rank and Wilcoxon test). For RTA indices our results using both tests show that we can reject the hypothesis of equality of survival function across product groups for all of countries at 1 per cent level of significance, except of Slovenia (Table 6). However, estimations for Balassa (B) indices provide different results. Namely, we can accept the hypothesis of equality of survival function across product groups for majority of countries, except the Czech Republic and Slovakia, at 1 per cent level of significance regarding to both tests.

CONCLUSIONS

We analyze the comparative agro-food trade advantages of CEC-5 and Balkans' countries on the EU-15 markets using Balassa index and relative comparative trade advantage variant. Results suggest considerable differences both across product groups and across countries. Export performance for bulk of raw commodities is the best and except of the Czech Republic, relative good export performance is found for processed intermediates. Mixed results by countries are found for consumer-ready food (good performing countries are Poland, Bulgaria, Croatia and Hungary) and for horticultural products (good performing countries are Bulgaria, Romania, Hungary and Croatia). These differences in the results can be explained by natural factor endowments and agricultural structures for bulk of raw commodities, additional climatic conditions and lower labour import costs for horticultural products, and food processing and food supply marketing chains for consumer-ready food and for processed intermediates.

Note, there is no any analyzed country found efficient in import penetration in agro-food products from the EU-15 markets. Bulgaria and Romania were only efficient in import penetration of horticultural products. This evidence suggests that during the adjustments to EU membership strategy of import penetration has not been considered as a real option. The effects of import liberalisation prevail over effects of structural adjustments in the analyzed countries.

Simultaneous export and import performance is reflected in relative comparative trade advantage (RTA), which is only found for agro-food trade of Hungary with the EU-15 markets. The most striking, there is no any CEC-5 or Balkan's country that experienced relative comparative trade advantage in consumer-ready food with the EU-15 markets. Processed intermediates are found with relative comparative trade advantage with the EU-15 markets for Hungary and Romania, horticultural for Bulgaria, Romania and Hungary, and bulk raw commodities for Bulgaria, Hungary, Croatia and Romania. This reflects a situation when better trade performance is for raw agricultural products than for consumer-ready food. The former are associated with favourable natural agricultural factors endowments and other agricultural structures, whereas the latter with agro-food processing, marketing, export and supply chain management.

The average lifetime of the RTA and B indices is found between five and six years, except for Slovenia, with more variations across product groups than between countries. The duration of RTA indices is longer than B indices and Balkans' countries (Bulgaria, Croatia and Romania) have higher survival rates. The analyzed CEC-5 and Balkans' countries explored higher and more stable RTA for bulk primary raw agricultural commodities and less for consumer-ready foods. Long term sustainable agro-food development can only be assured when agro-food products are competitive in trade within the Single European Market (SEM) as well as in external EU trade with the rest of the world. This holds also for CEC-5, Bulgaria and Romania, which are already the members of the EU-27 as well as for other Balkans' countries that are searching for EU membership.

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