SPECIFIC DIFERENCIES OF THE CEREALS PRODUCTION WITHIN THE CENTRAL AND EASTERN EUROPE COUNTRIES

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This paper presents a comparative analysis of the performances achieved by the Central and Eastern Europe Countries concerning the specific efficiency of the cereals production. Starting from the assumption that for the evaluation of the differences among the countries the differences, as absolute values, have to be completed with aspects linked to the stability of the average productions, there were used statistical criteria of evaluation. A conventional scale then converted the ranking grades so calculated where the most well performing country was considered as the comparison base having allocated 100 points.

***Keywords**: cereal production; ranking grades; t criteria; performance scale.*

The technologic expertise transfer represents an essential target for the harmonization of the development strategies of the economy in general, and of the agriculture production in special. The often very different results obtained by the agricultural production are in a very rigorous manner correlated with the aggregate economic development of the different countries. That represents a pleading for the truth that the agriculture development can be conceived only within a general development strategy of the aggregate economy of the country. The differences among different countries have usual very old historical roots, the stratification being a conspicuous reality that is emphasized by all the written sources from the human history. In accordance with such a truth it is coming out very clear the reality that the globalization may represent a general strategic solution for the harmonization of the parties' interests and for removing the discrepancies, under the condition that the strategies are based on a rigorous support concerning the specific performances of the different countries for different activity fields.

MATHERIAL AND METHOD

The testing of the difference between the averages of two samples of small volume can be done using the t (Student) criteria or the F (Fisher) criteria. The use of those criteria for the analysis of some economic indicators is less seen due to reasons that are linked to the rigors of the application of such criteria, and also due to a kind of conservatism. It is true that the economic data do not arise in controlled conditions and the elements that a generating the differences among them are often difficult to be

inventoried but, despite all of that the evaluation of the ranking grade of the technique or economic performances against of a comparison reference using the statistical tests doubtless brings a surplus of rigor in the formulation of some opinions.

The research done refers to the comparative analysis of the performances achieved in the central and eastern European countries concerning the cereals production over a 12-year period. The data concerning the average production for 5 different cereals crops within 7 countries from the central and Eastern Europe a presented below (Table 1, Table 2):

RESULTS AND DISCUTIONS

As an example are presented in detail the calculations for the results obtained by Czech Republic for the average production of maize compared to those obtained by Bulgaria, under the assumption that the two countries are representing the variants to be compared and that the given 12 years are representing the repetitions (Table 3).

Table 3

Average production of maize

Variant	Years												Total per country
	1	2	3	4	5	6	7	8	9	10	11	12	
Bulgaria	18.6	28.1	38.2	21.8	35.8	27.3	38.2	17.2	24.7	42.4	28.0	55.4	375.8
Czech Rep	48.7	33.9	42.8	50.9	69.3	60.9	66.0	64.3	66.0	87.3	55.8	61.3	707.3
Total per year	67.4	62.0	81.1	72.7	105.0	88.3	104.3	81.5	90.7	129.7	83.8	116.7	1083.1

The significance between the average productions of maize obtained by the two countries was tested with the t criteria (Student) and with the F (Fisher) criteria taking into account that the data are representing two selections of small volume.

a. The selection is of small size. The really deviations are not known. In those conditions we formulate the hypothesis $H_0 : \overline{x}_1 = \overline{x}_2$, to examine the difference between the means was calculated the Student variable by the formula:

$$t_c = \frac{\tilde{\overline{x}}_1 - \tilde{\overline{x}}_2}{s_{\bar{d}}} = \frac{\tilde{\overline{x}}_1 - \tilde{\overline{x}}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}};$$ cu ($n_1 + n_2 - 2$)sau (n - v) degrees of freedom

$n_1 = n_2 = b$, the number of years under analysis.

Table 1

The evolution of the wheat average production

Specification	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Bulgaria	28.58	28.45	29.09	18.82	29.50	28.06	27.35	28.42	30.08	30.12	23.83	38.10
Czech Rep	42.35	45.80	46.02	46.67	44.10	42.14	46.46	42.09	48.48	45.60	40.68	58.42
Poland	33.28	31.82	36.02	34.57	32.06	36.24	35.04	32.27	35.34	38.54	34.05	39.05
Romania	23.29	25.44	30.90	17.65	29.71	25.96	27.99	23.11	30.56	20.67	17.69	33.75
Slovakia	38.47	48.52	44.38	41.30	45.72	41.73	40.13	30.95	42.54	38.30	30.31	47.99
Slovenia	38.43	43.32	42.30	39.00	41.56	48.28	37.09	42.49	46.04	48.94	34.54	45.34
Hungary	30.65	46.03	41.64	32.78	42.15	41.39	35.95	36.04	43.11	35.21	26.41	51.32

Source: Food and Agriculture Organization of the United Nations (FAO), FAOSTAT data, 2005.

Table 2

The evolution of the maize average production

Specification	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Bulgaria	18.6	28.1	38.2	21.8	35.8	27.3	38.2	17.2	24.7	42.4	28.0	55.4
Czech Rep	48.7	33.9	42.8	50.9	69.3	60.9	66.0	64.3	66.0	87.3	55.8	61.3
Poland	53.2	37.5	49.6	50.5	54.0	58.3	57.5	60.6	60.7	61.6	52.9	53.1
Romania	26.1	31.3	31.9	29.3	41.8	28.0	36.4	16.1	30.7	29.0	29.9	46.9
Slovakia	46.2	41.4	49.0	57.5	59.5	55.1	60.0	30.4	53.6	53.7	41.2	58.3
Slovenia	40.2	63.7	51.4	62.9	74.8	73.1	69.4	58.8	54.1	81.6	50.8	77.8
Hungary	35.0	38.5	45.3	56.9	64.5	60.1	64.1	41.8	62.5	50.8	39.6	70.0

Source: Food and Agriculture Organization of the United Nations (FAO), FAOSTAT data, 2005.

$$\tilde{\bar{x}}_1 = \frac{375.8}{12} = 31.31 \quad \text{q/ha}; \qquad \tilde{\bar{x}}_2 = \frac{707.3}{12} = 58.94 \quad \text{q/ha}$$

$$s_1^2 = \frac{1}{n_1 - 1}\sum (x_{1j} - \tilde{\bar{x}}_1)^2 = \frac{1}{11}[(18.6 - 31.31)^2 + ... + (55.4 - 31.31)^2] = \frac{1349.07}{11} = 122.64$$

$$s_2^2 = \frac{1}{n_2 - 1}\sum (x_{2j} - \tilde{\bar{x}}_2)^2 = \frac{1}{11}[(48.7 - 58.94)^2 + ... + (61.3 - 58.94)^2] = \frac{2114.75}{11} = 192.25$$

$$t_c = \frac{\tilde{\bar{x}}_1 - \tilde{\bar{x}}_2}{\sqrt{\frac{s_1^2 + s_2^2}{b}}} = \frac{58{,}94 \quad - 31.31}{\sqrt{\frac{122{,}64 \quad + 192{,}25}{12}}} = \frac{27{,}63}{5.1} = 5.394$$

The theoretical value (tabular) of t will be:

$(p = 5\%; \quad g = 22) \Rightarrow t_{p,g} = 2{,}074;$ $(p = 1\%, \quad g = 22) \Rightarrow t_{p,g} = 2{,}819;$

$(p = 0{,}1\%, \quad g = 22) \Rightarrow t_{p,g} = 4{,}587;$ $\quad |t_c|(5{,}394) > t_{p,g}(4{,}587)$

The calculated value of t is greater than the theoretical value of t even for a probability error of 0,1%, meaning that the difference between the average productions of maize achieved in Czech Rep is very significant compared with that one achieved by Bulgaria.

b. Testing the equality of the average productions of maize was done also by the analysis of the variance calculating for that:

- the sum of the square of total deviations (SPT);
- the sum of the square of the variables (SPV);
- the sum of the square of errors (SPE);

For the example under consideration will result:

$$SPT = \sum x^2 - \frac{(\sum x)^2}{n} = (18.6^{\ 2} + 55.4^{\ 2} + ... + 48.7^{\ 2} + 61.3^{\ 2}) - \frac{(1083.1\ )^2}{24} =$$

$$= 56924.6 \quad - 48879.9 \quad = 8044.7$$

$$SPV = \frac{\sum V^2}{T_i} - \frac{(\sum x)^2}{n} = \frac{375.8^{\ 2} + 707.3^{\ 2}}{12} - 48879\ ,9 = 53460.8 \quad - 48879\ ,9 = 4580.8$$

T_i – the number of the sum terms out of which are resulting the terms of the numerator

SPE = SPT – SPV = 8044,7 – 4580,8 = 3463.8

The component of the estimators of the dispersion for the correspondent degrees of freedom has the tabular form as follows:

Table 4

Type of variation	SP	g	s^2
Total	8044,7	23	349.8
Variant	4580,8	1	4580.8
Error	3463,8	22	157.4

The F value, calculated as the rate of the variation among the countries and the error variation (the hazardous component) is:

$$F_c = \frac{s_v^2}{s_E^2} = \frac{4580\ ,8}{157\ ,4} = 29\ ,1$$

Obtaining the theoretical value of F for a probability of error of 5% and the correspondent grades of freedom it results:

$$F_{0,01;\ 1;\ 10} = 7,88$$

$$F_c(29,1) > F_{p,g_1g_2}(7,88)$$

That means that between the average productions of maize achieved by the two countries it exist a very significant difference. The relation that exists between the t variable of Student and the F variable of Fisher confirms that fact also:

$$t = \sqrt{F} = \sqrt{29.1} = 5,394$$

c. After the analysis of the dispersion, the Student criteria can also be applied by means of the error component. For that purpose, for calculating the error of the difference ($s_{\bar{d}}$) , it is very convenient to use the error variation (s_E^2) because that is nothing else that mean of the variances caused by the hazardous factors. As consequence the error of the difference can be calculated as against with the error variation by the relation:

$$s_{\bar{d}} = \sqrt{\frac{2\,s_E^2}{b}} = \sqrt{\frac{2 \cdot 157,4}{12}} = 5.122 \quad ; \quad t_c = \frac{\tilde{\bar{x}}_1 - \tilde{\bar{x}}_2}{s_{\bar{d}}} = \frac{27\ ,63}{5.122} = 5,394$$

Comparing the value of t obtained (5,394) with its theoretical value (4,587) it results the same conclusion.

The bilateral results after applying the t test for the maize crop in all the 7 countries is presented as in the table 5.

Table 5

The significance of the differences among the average productions of maize, by country

The theoretical value for t for a probability value of							
5%		1%			0,1%		
2.074		2.819			4,587		
The calculated values of t, in pairs, for the countries under analysis							
The country	Bulgaria	Czech Rep	Poland	Romania	Slovakia	Slovenia	Hungary
Bulgaria	0	-5.394	-6.120	-0.033	-5.926	-6.592	-4.266
		***	***	~	***	***	***
Czech	5.394	0	1.089	5.996	1.766	- 0.791	2.965
	***		~	***	~	~	***
Poland	6.120	-1.089	0	7.697	1.115	2.218	0.428
	***	~		***	~	*	~
Romania	0.033	-5.996	-7.697	0	-5.501	-7.444	-5.066
	~	***	***		***	***	***
Slovakia	5.926	-1.766	-1.115	5.501	0	-2.838	-0.443

The theoretical value for t for a probability value of							
	***	~	~	***		**	~
Slovenia	6.592	0.791	2.218	7.444	2.838	0	2.148
	***	~	*	***	**		*
Hungary	4.266	-2.965	-0.428	5.066	0.443	-2.148	0
	***	***	~	***	~	*	

Knowing the grade of difference of each country in comparison with the other countries it is finally represented on a conventional scale concerning the comparative performance achieved by each country in comparison with all the other countries (table 6).

Table 6

The grade of difference of the countries concerning the average production of maize

The country	Bulgaria	Czech	Poland	Romania	Slovakia	Slovenia	Hungary	The sum	Scale
Slovenia	6.592	0.791	2.218	7.444	2.838	0	2.148	22.031	100.0
Poland	6.12	-1.089	0	7.697	1.115	2.218	0.428	16.489	93.5
Czech Rep	5.394	0	1.089	5.996	1.766	-0.791	2.965	16.419	93.4
Slovakia	5.926	-1.766	-1.115	5.501	0	-2.838	-0.443	5.265	80.3
Hungary	4.266	-2.965	-0.428	5.066	0.443	-2.148	0	4.234	79.1
Bulgaria	0	-5.394	-6.12	-0.033	-5.926	-6.592	-4.266	-28.331	41.0
Romania	0.033	-5.996	-7.697	0	-5.501	-7.444	-5.066	-31.671	37.1

Based on the same methodology it was carried out also an analysis of the performances realized by the 7 countries concerning the wheat production and other cereals crops. The grade of difference of the countries in a bilateral analysis for the average production of wheat using the t (Student) criteria is presented in the table 7. The grades of the difference among the performances of the 7 countries are converted in that case also into a conventional scale in which the maximum performance is equivalent to 100 points and on that base were calculated the corresponding points that corresponds to each of the other countries.

Table 7

The significance of the differences among the average productions of wheat, by country

The theoretical value for t for a probability value of							
	5%		1%			0,1%	
	2.074		2.819			3.089	
The calculated values of t, in pairs, for the countries under analysis							
The country	Bulgaria	Czech Rep	Poland	Romania	Slovakia	Slovenia	Hungary
Bulgaria	0	-9.810	-4.677	1.478	-6.190	-8.018	-4.455
		***	***	~	***	***	***
Czech Rep	9.810	0	7.568	10.423	2.372	1.947	3.096
	***		***	***	**	~	***
Poland	4.677	-7.568	0	5.836	-3.463	-5.326	-1.814
	***	***		***	***	***	~
Romania	-1.478	-10.423	-5.836	0	-7.067	-8.784	-5.376
	~	***	***		***	***	***
Slovakia	6.190	-2.372	3.463	7.067	0	-0.700	0.917
	***	**	***	***		~	~
Slovenia	8.018	-1.947	5.326	8.784	0.700	0	1.624
	***	~	***	***	~		~
Hungary	4.455	-3.096	1.814	5.376	-0.917	-1.624	0
	***	***	~	***	~	~	

The comparative situation for the performances that were achieved by the 7 countries concerning the average production of wheat points out in the main the same hierarchies. The most notable performances are specific to the countries less developed from the economic point of view, as it's the Czech Republic, Slovenia, Slovakia, and the poorest results are registered in the case of Romania and Bulgaria (table 8). In that context can be noticed that Romania's performance is of only 34.4% in comparison with that realized by Czech Republic.

Table 8

The grade of difference of the countries concerning the average production of wheat

Czech Rep	9.810	0.000	7.568	10.423	2.372	1.947	3.096	35.216	**100.0**
Slovenia	8.018	-1.947	5.326	8.784	0.700	0.000	1.624	22.505	**88.8**
Slovakia	6.190	-2.372	3.463	7.067	0.000	-0.700	0.917	14.565	**81.7**
Hungary	4.455	-3.096	1.814	5.376	-0.917	-1.624	0.000	6.008	**74.2**
Poland	4.677	-7.568	0.000	5.836	-3.463	-5.326	-1.814	-7.658	**62.1**
Bulgaria	0.000	-9.810	-4.677	1.478	-6.190	-8.018	-4.455	-31.672	**40.9**
Romania	-1.478	-10.423	-5.836	0.000	-7.067	-8.784	-5.376	-38.964	**34.4**

CONCLUSIONS

The research made concerning the performances realized by the different countries of the world concerning different sort of agricultural products confirms the truth that it exist a correlation with a logic mean among those performances and the degree of the general economic development of each country.

Based on such an incontestable truth it results that any development strategy for the agriculture has to be designed into a general plan, global, of economic strengthening of the countries being impossible to realize a good performing agriculture within a non-performing economic context of the secondary and tertiary sector of the national economies.

The efforts made at national or different regional groups' level will have no chance of success if those will be not included into a general strategic approach, with the support of the well economic performing countries and beneficiaries of a more favorable historical circumstance.

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