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THE STATISTICAL MODELING OF THE TREND CONCERNING THE ARRIVALS OF THE FOREIGN VISITORS IN ROMANIA

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The modeling concerning the arrivals of the foreign visitors in Romania reflects through by means of the „Least Squares Method" the architecture of the trend for these international travels. Each country offers a different importance for tourism because this represents an important source for the growth of G.D.P. and for this reason we must to research him dynamics and influence over the economic development.

Key words: statistical pattern, trend, foreign visitors, international travels.

JEL Code: C1, C12, C2.

1. Introduction

This research reflects a personal contribution, namely a statistical analysis of the evolution concerning the number of the arrivals for the foreign visitors in Romania, during the years 2005-2012, in order to reflect the trend of the international travels border of our country. The purpose of the research consists in to identify a potential of exploit which cans to contribute at the recovery of the economy, through by means of the modeling concerning the trend of arrivals for the foreign visitors in Romania. The statistical methods used are the coefficients of variation method and the „Least Squares Method" applied for to calculate the parameters of the regression equation. The sections 2 expresses the methodology for to achieve the architecture concerning the model of trend for the arrivals of the foreign visitors, in Romania, in the period 2005-2012, with the help of the „Least Squares Method". The section 3 reflects how we can to select the best model of trend for the arrivals of the foreign visitors on the base of the coefficients of variation method. The state of the art in this domain is represented by the essential research belongs to Carl Friederich Gauss, who elaborated the „Least Squares Method" [3].

2. The modeling of the trend concerning the arrivals of the foreign visitors, in Romania, between 2005-2012

In the period 2005-2012, we observe the next evolution concerning the arrivals of the foreign visitors in Romania, according to the table no. 1:

Table no. 1 The evolution of the number concerning the foreign visitors in Romania, in the period 2005-2012

Years	The arrivals concerning the foreign visitors in Romania (thousands)
2005	5.839
2006	6.037
2007	7.722
2008	8.862
2009	7.575
2010	7.498
2011	7.611
2012	7.937
Total	59.081

Source: dates debated from „Romania in dates 2013", page 69.

On the base of the table no. 1, we want to identify the model of trend for the arrivals of the foreign visitors in Romania, in the period 2005-2012.

- if we formulate the null hypothesis H_0 *:* who mentions the assumption of the existence for the model of tendency of the factor *X = the arrivals of the foreign visitors in Romania,* right the function $x_{t_i} = a + b \cdot t_i$, then the parametres *a* and *b* of the adjusted function of the premier degree, can to be calculated by means of the next system [3]:

$$\begin{cases} n \cdot a = \sum_{i=-m}^{m} x_i \\ b \cdot \sum_{i=-m}^{m} t_i^2 = \sum_{i=-m}^{m} t_i \cdot x_i \end{cases}$$

Therefore,
$$a = \frac{\sum_{i=-m}^{m} x_i}{n}$$

and

$$b = \frac{\sum_{i=-m}^{m} t_i \cdot x_i}{\sum_{i=-m}^{m} t_i^2}$$

Table no. 2 The estimate of the value for the variation coefficient in the case of the adjusted function of the premier degree, in the hypothesis concerning the linear evolution for the arrivals of the foreign visitors in Romania, between the years 2005-2012

Years	The arrivals concerning the foreign visitors in Romania (thousands) (x_i)	LINEAR TREND				
		t_i	t_i^2	$t_i x_i$	$x_{t_i} = a + bt_i$	$\lvert x_i - x_{t_i} \rvert$
2005	5.839	-4	16	-23.356	6.626,525	787,525
2006	6.037	-3	9	-18.111	6.816,175	779,175
2007	7.722	-2	4	-15.444	7.005,825	716,175
2008	8.862	-1	1	-8.862	7.195,475	1.666,525
2009	7.575	1	1	7.575	7.574,775	0,225
2010	7.498	2	4	14.996	7.764,425	266,425
2011	7.611	3	9	22.833	7.954,075	343,075
2012	7.937	4	16	31.748	8.143,725	206,725
TOTAL	59.081	0	60	11.379	59.081	4.765,850

If we calculate the statistical dates for to adjust the liniar function, we obtain for the parametres *a* and *b* the values:

$$a = \frac{59.081}{8} = 7.385{,}125$$

$$b = \frac{11.379}{60} = 189{,}65$$

Hence, the coeficient of variation for the adjusted function of the premier degree is:

$$v_I = \left[\frac{\sum_{i=-m}^{m} \left| x_i - x_{t_i}^I \right|}{n} : \frac{\sum_{i=-m}^{m} x_i}{n} \right] \cdot 100 = \frac{\sum_{i=-m}^{m} \left| x_i - x_{t_i}^I \right|}{\sum_{i=-m}^{m} x_i} \cdot 100 = \frac{4.765,850}{59.081} \cdot 100 = 8,07\%$$

- in the situation of the alternative hypothesis H_1 *:* who specifies the assumption of the existence for the the model of tendency of the factor *X = the arrivals of the foreign visitors in Romania*, right the parabolical function $x_{t_i} = a + b \cdot t_i + ct_i^2$, the parametres *a*, *b* şi *c* of the adjusted function of the second degree, can to be calculated by means of the system [3]:

$$\begin{cases} n \cdot a + c \sum_{i=-m}^{m} t_i^2 = \sum_{i=-m}^{m} x_i \\ b \cdot \sum_{i=-m}^{m} t_i^2 = \sum_{i=-m}^{m} t_i \cdot x_i \\ a \cdot \sum_{i=-m}^{m} t_i^2 + c \sum_{i=-m}^{m} t_i^4 = \sum_{i=-m}^{m} t_i^2 \cdot x_i \end{cases}$$

Consequently,

$$a = \frac{\sum_{i=-m}^{m} t_i^4 \cdot \sum_{i=-m}^{m} x_i - \sum_{i=-m}^{m} t_i^2 \cdot \sum_{i=-m}^{m} t_i^2 \cdot x_i}{n \cdot \sum_{i=-m}^{m} t_i^4 - (\sum_{i=-m}^{m} t_i^2)^2}$$

$$b = \frac{\sum_{i=-m}^{m} t_i \cdot x_i}{\sum_{i=-m}^{m} t_i^2}$$

$$c = \frac{n \cdot \sum_{i=-m}^{m} t_i^2 \cdot x_i - \sum_{i=-m}^{m} t_i^2 \cdot \sum_{i=-m}^{m} x_i}{n \cdot \sum_{i=-m}^{m} t_i^4 - (\sum_{i=-m}^{m} t_i^2)^2}$$

Table no. 3 The estimate of the value for the variation coefficient in the case of the adjusted function of the second degree, in the hypothesis concerning the parabolic evolution for the arrivals of the foreign visitors in Romania, between the years 2005-2012

Years	The arrivals concerning the foreign visitors in Romania (thousands) (x_i)	PARABOLIC TREND					
		t_i	t_i^2	t_i^4	$t_i^2 x_i$	$x_{t_i} = a + bt_i + ct_i^2$	$\left\| x_i - x_{t_i} \right\|$
2005	5.839	-4	16	256	93.424	5.884,90	45,90
2006	6.037	-3	9	81	54.333	6.685,30	648,30
2007	7.722	-2	4	16	30.888	7.311,20	410,80
2008	8.862	-1	1	1	8.862	7.762,60	1.099,40
2009	7.575	1	1	1	7.575	8.141,90	566,90

Years	The arrivals concerning the foreign visitors in Romania (thousands) (x_i)	PARABOLIC TREND					
		t_i	t_i^2	t_i^4	$t_i^2 x_i$	$x_{t_i} = a + bt_i + ct_i^2$	$\lvert x_i - x_{t_i} \rvert$
2010	7.498	2	4	16	29.992	8.069,80	571,80
2011	7.611	3	9	81	68.499	7.823,20	212,20
2012	7.939	4	16	256	127.024	7.402,10	536,90
TOTAL	59.081	0	60	708	420.597	59.081,00	4.092,20

If we calculate the statistical dates for to adjust the second function, we obtain for the parametres *a*, *b* and *c* the next values:

$$a = \frac{708 \cdot 59.081 - 60 \cdot 420.597}{8 \cdot 708 - 3.600} = 8.039,5$$

$$b = \frac{11.379}{60} = 189,65$$

$$c = \frac{8 \cdot 420.597 - 60 \cdot 59.081}{8 \cdot 708 - 3.600} = -87,25$$

So, the coeficient of variation for the adjusted function of the second degree has the value:

$$v_{II} = \left[\frac{\sum_{i=-m}^{m} \left| x_i - x_{t_i}^{II} \right|}{n} : \frac{\sum_{i=-m}^{m} x_i}{n} \right] \cdot 100 = \frac{\sum_{i=-m}^{m} \left| x_i - x_{t_i}^{II} \right|}{\sum_{i=-m}^{m} x_i} \cdot 100 = \frac{4.092,20}{59.081} \cdot 100 = 6,93\%$$

- in the case of the alternative hypothesis H_2 *:* who describes the supposition the assumption of the existence for the the model of tendency of the factor *X = the arrivals of the foreign visitors*, right the exponential function $x_{t_i} = ab^{t_i}$, then the parametres *a* and *b* of the adjusted exponential function, can to be calculated by means of the next system [3]:

$$\begin{cases} n \cdot \lg a = \sum_{i=-m}^{m} \lg x_i \\ \lg b \cdot \sum_{i=-m}^{m} t_i^2 = \sum_{i=-m}^{m} t_i \cdot \lg x_i \end{cases}$$

Thus,

$$\lg a = \frac{\sum_{i=-m}^{m} \lg x_i}{n}$$

and

$$\lg b = \frac{\sum_{i=-m}^{m} t_i \cdot \lg x_i}{\sum_{i=-m}^{m} t_i^2}$$

Table no. 4 The estimate of the value for the variation coefficients in the case of the adjusted exponential function, in the hypothesis concerning the exponential evolution for the arrivals of the foreign visitors in Romania, between the years 2005-2012

Years	The arrivals concerning the foreign visitors in Romania (thousands) (x_i)	EXPONENTIAL TREND						
		t_i	t_i^2	$\lg x_i$	$t_i \lg x_i$	$\lg x_{ti} = \lg a + t_i \lg b$	x_{ti}	$\lvert x_i - x_{t_i} \rvert$
2005	5.839	-4	16	3,766338475	-15,0653539	3,815287727	6535,6	696,6
2006	6.037	-3	9	3,780821176	-11,34246353	3,827651945	6724,4	687,4
2007	7.722	-2	4	3,887729797	-7,775459595	3,844001616	6918,6	803,4
2008	8.862	-1	1	3,947531746	-3,947531746	3,852380381	7118,4	1743,6
2009	7.575	1	1	3,879382637	3,879382637	3,877108817	7535,4	39,6
2010	7.498	2	4	3,874945436	7,749890872	3,889473035	7753,1	255,1
2011	7.611	3	9	3,881441722	11,64432517	3,901837253	7977,0	366
2012	7.939	4	16	3,899765802	15,59906321	3,914201471	8207,3	268,3
TOTAL	59.081	0	60	30,91795679	0,741853118		58769,8	4860

Consequently, if we calculate the statistical dates for to adjust the exponential function, we obtain for the parametres *a* and *b* the values:

$$\lg a = \frac{30,91795679}{8} = 3,864744599$$

$$\lg b = \frac{0,741853118}{60} = 0,012364218$$

Accordingly, the coeficient of variation for the adjusted exponential function has the next value:

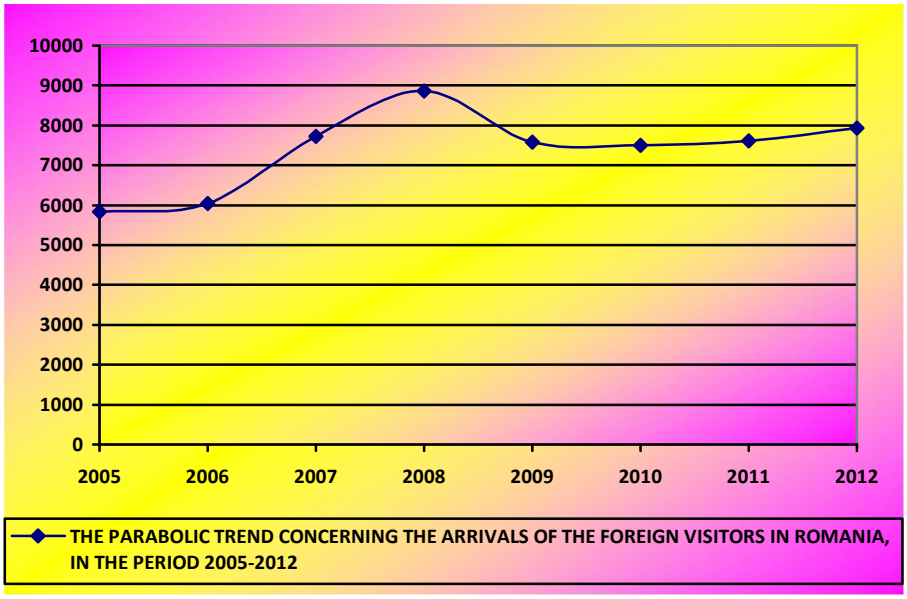
$$v_{\exp} = \left[\frac{\sum_{i=-m}^{m} \left| x_i - x_{t_i}^{\exp} \right|}{n} : \frac{\sum_{i=-m}^{m} x_i}{n} \right] \cdot 100 = \frac{\sum_{i=-m}^{m} \left| x_i - x_{t_i}^{\exp} \right|}{\sum_{i=-m}^{m} x_i} \cdot 100 = \frac{4.860}{59.081} \cdot 100 = 8,23\%$$

3. The selection of the best model of trend for the arrivals of the foreign visitors on the base of the coefficients of variation method.

We apply the coefficients of variation method as criterion of selection for the best model of trend.
We notice that:

$$v_{II} = 6,93\% = v_I = 8,07\% < v_{\exp.} = 8,23\%$$

So, the road reflected by the X factor,which represents the arrivals of the foreign visitors in Romania in the period 2005-2012, is a parabolic trend of the shape $x_{t_i} = a + bt_i + ct_i^2$, with other words it confirms the hypothesis H_1.



The type no. 1 The model of trend concerning the values for the arrivals of the foreign visitors, in Romania, in the period 2005-2012

We notice that, the cloud of points which represents the values concerning the arrivals of the foreign visitors in Romania, in the period 2005-2012, it carrying around a parabolic model of trend, according to the type no.1. Consequently, the selection of the trend, concerning the evolution of the arrivals for the foreign visitors in Romania, involved the construction of a conceptual model that has been validated on the base of the testing of the hypotheses using the appropriate statistical tools.

4. Conclusions

After the statistical analysis concerning the evolution for the arrivals of the foreign visitors in Romania, we can to synthesize that the development of the tourism represents an alternative that must be exploited during this period for to obtain future benefits and a foothold in reviving of the economy. Thus, through the exploitation of the natural resourses, respectivelly of the human and financial resourses which are at the disposal of the tourism, this will generate economic and social effects that will lead to the growth of the economic efficiency, respectivelly of the progress and civilization, considering that the manifestation concerning the demand and the dynamic of the tourism in Romania are determinated by a number of demographic, psychological, organizational factors, which play a decisive role in the various segments of tourism.

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