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ANALYSIS OF THE ROMANIAN TOURISM SPECIFIC PHENOMENA THROUGH ECONOMETRICAL METHODS

Abstract. *The paper presents the non-stationary time series components and the methods used in the foreign and Romanian specialized literature for their estimation. In the specialized literature, the non-stationary time series are approached as having the following components: trend, periodical (cyclical and/or seasonal) component, residual component. In the paper are presented approaches of the statistical and econometrical calculation and analysis methods of time series and the mode in which these are applied in various domains. The paper presents the methodology of the central tendency determination in the time series, using the linear and 2nd degree parabola models and the forecasting methodology. The study of the Romanian tourism consists in the analysis of the tourism demand indicators (tourist arrivals, overnight stays, average length of stay) evolution in the years 1995-2011, the parameters estimation of the two models of regression and forecasting of the time series terms formed of the tourist arrivals in Romania and by regions of development, on the horizon of prognosis 2012-2014, the determination of the adjustment quality and the verification of the prognosis accuracy.*

Key-words: *time series, central tendency, forecasting, tourism, Romania.*

JEL Classification: C220, L830, R110

Introduction

In the most general sense, any economic variable measured over time (annual profits, quarterly production, monthly tourist number, weekly sales, daily exchange rate a.s.o.) in sequential order is called time series. Analysis of the time series means the identification of their components, of variation nature, which gives an image of the variables behavior over time and gives the possibility to provide terms values forecasts. This analysis begins with the graphical representation, that highlights the variety of movements, some with systematic nature - the tendency, others with a more or less systematic variation, in relation with long time periods - the cyclicity or with subperiods within an year - the seasonality and others with a random appearance - the residue (Isaic-Maniu, Mitrut and Voineagu, 1999; Biji, Lilea, Rosca and Vatui, 2010). In addition to the applicability domains of the analysis methods of the time series components, derived from the specialized literature study, in this paper was approached the utilization of the least squares analytical method for the study of the evolution tendency in the Romanian tourism demand into a period of 17 years (1995-2011) and the identification of future development tendency, on the horizon of prognosis 2012-2014.

Application of the time series components methods of calculation and analysis in the studies and researches. Usefulness in the study of the economic and social phenomena evolution of the time series components analysis methods is highlighted by the variety of domains and the multitude of studies where they find their applicability (Mark, Reichardt and Sanna, 2000; De Gooijer and Hyndman, 2006). Remarkable from this point of view is the work of De Gooijer and Hyndman (2006), in which the authors realized a very useful systematization of the articles published in the time series forecasting domain in the period 1985-2005 in the publications of the International Institute of Forecasters, namely: the Journal of Forecasting (1982-1985) and the International Journal of Forecasting (1985-2005). They analyzed more than 940 articles, from 380 magazines and 20 books and monographs, which they systematized on domains such as: exponential smoothing, ARIMA models (autoregresive integrate moving average models), seasonality, non-linear models, ARCH (autoregresiv conditional heteroskedastic models) and GARCH (generalized ARCH models) models, evaluation, forecasting and precision of measurements and others. Researches highlight two important domains in the time series analysis, that of the time and that of the frequencies (Brillinger, 1982; Rua, 2010). Classical model of the time series analysis with linear trend is the autocorrelation model, used in many studies as basis for the elaboration of some more general techniques, smoothing models, applicable for the structural identification of the non-linear series models, for correlation functions a.s.o., which tend to become significant additional analysis instruments (Nielsen and Madsen, 2001). Dagum and Quenneville (1993) modeled the time series unobserved components (tendency of cycle, seasonality, variations of daily tendency and random oscillations) and they calculated the mean square error of the unobserved components, estimated by the applying of a Kalman filter. Time series methods were used also by Asteriou and Agiomirgianakis (2001) for the study of correlation between human capital and economic development in Greece. Starting from the premise that the principal institutional mechanism for the workplaces development is education, authors analyzed the relationship among educational variables and long-term GDP and the causal dependence among these. Their conclusions were that there is a cointegration relation between education, measured by the rates of matriculations in primary, secondary and higher education and GDP/capita, causality manifesting from the educational variables to the economic growth, with the exception of the higher education which is an inverse causality.

In macroeconomics, the application of the calculation and interpretation methods of the time series components has in view the highlighting of the dynamics of macroeconomic results aggregates, their comparison in time, which raises also the problem of construction and use of some adequate price indices. In some cases the time series methods are correlated with other statistical methods, such as the method of production functions, for the highlighting of some factorial dependencies between the evolution of macroeconomic aggregates and the intensity of some production factors (Zaman and Goschin, 2007) or for the highlighting the evolution of the relations among variables in econometric models (Dosescu and Raischi, 2008). The trend and the cyclicity in the macroeconomic data series were modeled also in Bayesian approach, using developments of the Markov’s chain and Monte Carlo methods in univariate and multivariate models (Harvey, Trimbur and Van Dijk, 2007).

A new domain of the time series application is the political science, where it registered a revival in the 1970s. Many analysis tools commonly used by economists are reproduced in the political science domain. Thus, for example, the Box-Jenkins ARIMA models became very popular, especially among the researchers concerned with the impact of some major events such as: shock of energy price, policy of interventions, external crises or wars on some variables such as: presidential approval or governmental support. After 1990, number of studies focused on the methodology of cointegration and error of correction for the dynamics study of some non-stationary variables, for the development of some concepts such as that of fractional integration or recently that of fractional cointegration increased. Forecast in the political sciences bases on the models of autoregressive vector (VAR) or ARCH, while a great importance is given to EITM initiative (Empirical Implications of Theoretical Models), by which is attempting the achievement of links among the development of some formal models and the empirical testing with time series statistical methods (Clarke and Granato, 2005).

An ARIMA model is used to create an instrument of the environment prognosis, exactly to forecast the maximum concentration of ozone in Athens, Greece, goal in which they used the observations on the air quality recorded for a period of 9 years. Research results highlighted a good index of agreement, but also some weaknesses of the forecasting method, for which the authors proposed improvements (Slini, Karatzas and Moussiopoulos, 2002).

Time series analysis methods (characterization, explanation, prediction and control of the selected variables variation through time) are used also in the spatial analysis (Mitrut and Constantin, 2009), by elaboration of some autoregressive time series models through which are calculated the correlations between terms located at different distances in time or they are made forecasts on the base of the previous values evolution, using autoregressive techniques. Such types of estimations can be applied in different domains, from the economical one to the medical, tourism domains (Robinson, 2009), environmental and climatic domains (Kyriakidis, Miller and Kim, 2004; Emery and Thomson, 2001; North, 2003) a.s.o. Carvalho and Harvey (2005) applied the time series components models for data concerning the real income/capita in 8 regions in USA in order to obtain information regarding the cyclicity and the convergence. Their conclusion is that while the cycles are highly correlated, the two richest regions were divergent in recent years and they developed a new model for the convergent behavior of the six richest regions.

Using a mixed technique of estimation, for the simultaneous determination of the additive and multiplicative coefficients of trend and seasonality for a time series with linear trend, Bourbonnais and Vallin (2007) studied the mobile telephony market in France and they concluded that there is a double seasonality: an additive seasonality for the enterprises and a multiplicative seasonality for the individuals and also they demonstrated the superiority of mixed, additive and multiplicative, scheme of the seasonality coefficients, compared with the multiplicative scheme, in this case. Zarnowitz and Ozyildirim (2006) applied the decomposition methods of the time series components on the quarterly values of the real GDP and on the Coincident Index of USA, monthly. They highlighted that the study of business cycle does not require the trend estimation and its elimination, unlike the study of the economic growth cycle. They compared several trend estimations and deviations from trend, deterministic or stochastic, linear and non-linear and the corresponding series of deviations from these tendencies by several methods but these led to similar conclusions on the business cycle and economic growth cycle in the post-war period. Cyclical component was studied by Watson (2001), too who used a spectral function of density for the decomposition of a stochastic process into its periodic components and he approached the time series cyclical properties using an autoregressive moving average model (ARMA).

Cimino, Del Duce, Kadonaga, et al. (1999) applied the time series analysis on geological data: rings of trees, sea water analysis and El Niño phenomenon. First, they applied ARMA models on data that allows, for the stationary series, the construction of a stochastic model that can be used at the future values forecast and subsequent they applied R/S analysis (Rescaled Range analysis) which allowed the identification of the short or long-term dependence from data and separation of the random from non-random series. Their contributions at the statistical approach of the geological data refer to: recognition of the qualitative changes into a given set of data, evaluation of the independence/dependence of increments, characterization of the random processes that describe the data evolution, cycle recognition.

Time series seasonality was studied by Maravall (1989), which approached the dynamic structure of the time series seasonal component, highlighting a new idea linked by the structure, namely that the seasonal component itself supports a decomposition in trend, seasonal and random components and he proposes also an adequate model for this alternative of approach. Seasonal component adjustment consists in the elimination from the raw data of the seasonal variations which results as a common effect of the climateric and institutional events that repeat more or less regularly every year. The most known seasonal adjustment methods, in the stochastic processes, are grouped in: methods based on the stochastic model, that involve autoregressive integrated moving average models and moving average methods, that have not explicit parametric models and that are used in official statistics for the adjustment of the time series seasonality (Dagum, 2001). Ghysels, Osborn and Rodrigues (2006) have dealt with the methods of seasonal series forecast and also with the forecast implications on the seasonal adjustment. They highlighted that, currently, the economists consider that the adjustment of seasonal time series removes the seasonality from them, but this opinion can be discussed and that the decisions based on seasonally adjusted data affect future results.

Holt (2004) was concerned with the seasonality and trend forecasting through the method of exponentially weighted moving averages, applied to series without trend, with additive or multiplicative trend, to the series with or without seasonality, with additive or multiplicative error of structure. Koopman and Ooms (2006) have dealt with the daily time series forecast using the models of periodic unobserved components for the estimation of the future evolution of the Dutch daily tax revenues, that seemed to have periodic dynamic properties. Cornillon, Imam and Matzner-Løber (2008) propose two new methods of time series forecast, both based on a factor analysis method, called the principal component analysis, on the instrumental variables, the first being a simple application of the mentioned method and the second a modified version, but proving that both adapt well to the time series analysis. Bell (1984) uses the ARIMA models of time series in forecast and regarding these he approaches the difficulties of forecast by extrapolating a deterministic function of time, the importance of the finding of some reasonable measures for the forecasting accuracy and the necessity to incorporate the subject of knowledge with the time series models when they are predicted.

Residual component is also approached in the time series components modeling. Mauricio (2008) refers to three types of residues, namely: "conditioned residuals", „nonconditioned residuals" and "innovations", which are defined, computed by an estimation model, approximated their distribution properties in finished samples and presented the potential applications of their properties in the verification of the diagnostic model, in the case of the univariate stationary autoregressive moving average models.

A distinct approach, in the specialized literature, knows the categorical time series, whose methods of analysis having visual nature, especially. Weiß (2008) synthesizes the instruments of this analysis namely: the simbol-by-simbol representation, the graph of rate evolution, the Visual Tree Representation, the Circle Graph, the pattern histograms, the Categorial Control Charts and he applies them (Weiß and Göb, 2008).

Analysis methodology applied in the study of the tourism demand of Romania. Analysis of the tourism activity in Romania, in the years 1995-2011 was realized using the tourism demand indicators (tourist arrivals and overnight stays in the tourism accommodation establishments) on the whole country and by regions of development. The analysed data form time series with a length of 17 years $\left(T = 17\right)$. It was calculated and analysed the average length of stay, on regions of development, in the considered period, using the relation: $\bar{z} = \sum zt \Big/ \sum t$. They were applied analytical methods of trend determination for the series formed from the tourist arrivals in tourism accommodation establishments in Romania, on the country and by regions of development, in the years 1995-2011 (Anghelache, 1999; Isaic-Maniu, Mitrut and Voineagu, 1999; Biji, Lilea, Rosca and Vatui, 2010). In the case of the analytical methods utilization, time series is considered a time function of the form $y_t = f\left(t\right)$, in which the variable y depends on the time evolution, meaning depends on an ensemble of factors whose evolution over time can be synthesized in the increase of the variable t in arithmetic progression.

Models of regression with time variable used for the visualizing of the evolutive trajectory of the series terms are found in the Table 1 (Baron, Biji, Tövissi et al., 1996; Biji, Lilea and Voineagu 1994; Pecican, 1996).

Table 1. Analytical form and regression models estimators used in the calculation of the tourist arrivals trend in Romania, by regions of development, in years 1995-2011

Type of the regression model	Regression model with time variable	Estimators of the regression model
linear	$\hat{y}_t = \hat{a}_0 + \hat{a}_1 t$	$\hat{a}_0 = \frac{\sum_t y_t}{n};\ \hat{a}_1 = \frac{\sum_t y_t t}{\sum_t t^2}$
2nd degree parabola	$\hat{y}_t = \hat{a}_0 + \hat{a}_1 t + \hat{a}_2 t^2$	$n\hat{a}_0 + \hat{a}_2 \sum_t t^2 = \sum_t y_t$ $\hat{a}_1 \sum_t t^2 = \sum_t y_t t \rightarrow \hat{a}_1 = \frac{\sum_t y_t t}{\sum_t t^2}$ $\hat{a}_0 \sum_t t^2 + \hat{a}_2 \sum_t t^4 = \sum_t t^2 y_t$

Tendency obtained using the model represents an "in average" evolution and the empirical values y_t are situated around tendency, describing the systematic fluctuations affected by perturbation, in the case of evolutions with seasonality or cyclicity or simple random deviations, determined by the action of some random factors. For presented models, at the parameters estimation it can be used the least squares method, in this analysis being respected the conditions $\sum t = 0$ and $\sum t^3 = 0$. Calculation relations of the regression models estimators are presented in the Table 1. With these models they can be realized punctual forecasts, as in the case of this analysis or by variation intervals. Necessities to ensure the model accuracy require the utilization of a reasonable forecast horizon, in this case being recommended a $(+ h)$, where $h = 1, 2\ or\ 3$ (Andrei, Stancu and Pele, 2002; Rosca, 2000). Since at the trend determination, for the same time series they can be applied more methods, it is recommended the application of the procedures for the adjustment quality establishing based on the comparison of the real terms deviations from the adjusted terms (Korka, Begu, Tusa and Manole, 2005; Jaba, 1998). Thus, they were used the calculation and interpretation of the:

- coefficient of variation [%]: $v_t = \frac{\bar{d}_{y_t}}{\bar{y}} \cdot 100$;
- standard deviation: $S_{y_t/\hat{y}_t} = \sqrt{\frac{\sum (y_t - \hat{y}_t)^2}{n}}$;
- coefficient of error [%]: $e = \frac{S_{y_t/\hat{y}_t}}{\bar{y}} \cdot 100$.

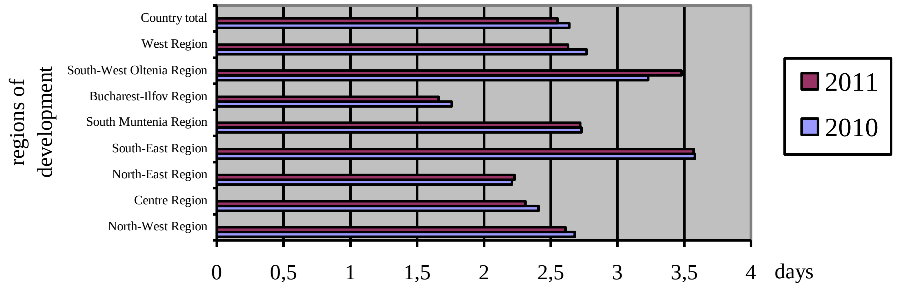
As these indicators have smaller values, with so the selected regression model is more adequate to characterize the real movement of the analysed variable.

Using the adjustments results of the time series regarding the tourist arrivals in Romania, by regions of development, in the years 1995-2011, it was selected the most adequate regression model, for each territorial entity under study (total country and 8 regions of development), which was used also at the time series terms forecasting on the prognosis horizon 2012-2014. In order to measure the prognosis accuracy, the most used method is that of the calculation and analysis of two coefficients namely: mean absolute deviation, given by the formula: $MAD = \frac{\sum_{t=1}^{n} |y_t - \hat{y}_t|}{n}$ and sum of squares for forecast error, given by the formula: $SSE = \sum_{t=1}^{n} (y_t - \hat{y}_t)^2$. As a rule, SSE highlights the greater deviations of the forecasted values from real values, due to the amplification by squaring (Keller, Warrack and Bartel, 1988; Niculescu-Aron and Mazurencu-Marinescu, 2007).

Analysis of the tourism activity evolution in the years 1995-2011 and the tendency estimation on the horizon 2012-2014.

In this analysis, they are considered as representative indicators for the tourism activity from Romania the tourist demand indicators namely: tourist arrivals and overnight stays in the tourist accommodation establishments, in the period 1995-2011. Total number of the tourist arrivals in the considered period had an oscillatory evolution, with values in continuous decreasing until the year 2002 and with increase tendency in the next years. Overnight stays in the tourism accommodation establishments, on country have had an oscillatory tendency in the analyzed period, but the trend is decreasing, with an average annual rate of -1.82%. On regions of development, three regions have significant weights in the country tourist arrivals, in the year 2011, namely: Centre-20.4%, Bucharest-Ilfov-18.2% and South-East-16.1%. Centre Region includes the districts: Alba, Brasov, Covasna, Harghita, Mures and Sibiu, characterized by the practice of the cultural tourism (visiting of cultural objective, participation at cultural events a.s.o.), mountain tourism, in various forms: rest and recreation, hiking, winter sports, rural holidays a.s.o. South-East Region includes the districts: Braila, Buzau, Constanta, Galati, Tulcea and Vrancea, characterized by the practice of the littoral tourism and tourism on Danube and in Danube Delta, mainly. Bucharest-Ilfov Region is attractive for multiple forms of tourism, among which are the cultural tourism, that for participation to the scientific, business, sports, religious events a.s.o. Using the two indicators it was determined the average length of stay on country and by regions of development, in the period 1995-2011, which evolution in two consecutive years is illustrated in Figure no. 1.

Figure no. 1. Average length of stay in Romania, by regions of development, in the years 2010 and 2011



High values of the average length of stay, higher than the country level, are registered in the South-East Region, visited by tourists during the holidays period, when the tourist products have a longer length and South-West Oltenia Region, which includes the districts: Dolj, Gorj, Mehedinti, Olt and Valcea, zone which specific is the balneary tourism, characterized by a longer length of stay. They are noted also regions with a low level of the average length of stay, such as: Bucharest-Ilfov Region, due to the practicing of the tourism for events and North-East Region, which includes the districts: Bacau, Botosani, Iasi, Neamt, Suceava and Vaslui, where specific is the cultural tourism, usually practiced as itinerant tourism and characterized by short stays, at a tourist destination.

In the Figure no. 2 is illustrated the evolution of the tourist arrivals on regions of development, in Romania, in the period 1995-2011.

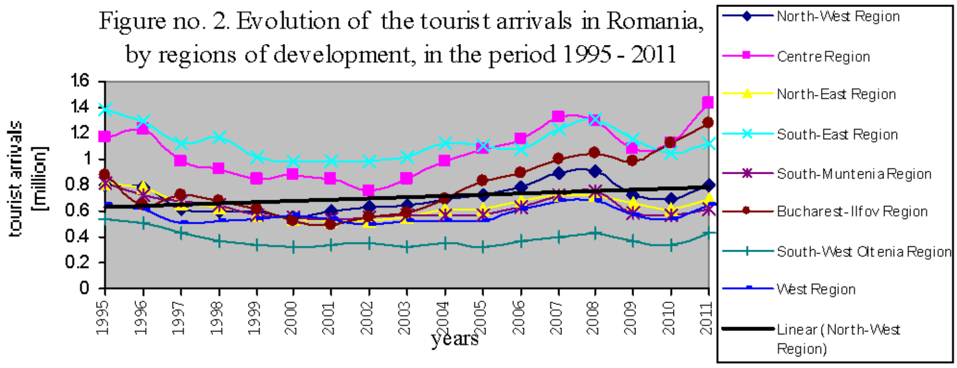


Figure no. 2. Evolution of the tourist arrivals in Romania, by regions of development, in the period 1995 - 2011

In comparison with the linear trend, illustrated in graph, the tourist arrivals evolution seems to register a parabolic trend, with a reduction in the years 2001 and 2002 and a slow increase, with a peak in 2007 and 2008. To identify more characteristics of the tourist arrivals evolution in Romania, by regions of development, in the period 1995-2011, it was determined and analysed the time series central tendency, using the analytical method, based on the linear and 2nd degree parabola regression models. Results of the method application are presented in the Table 2.

Table 2. Forecasted values of the tourist arrivals, on country and by regions of development, in the years 2012-2014

\- Million tourists

Region of development	Linear model			Model of the 2nd degree parabola		
	2012	2013	2014	2012	2013	2014
Country total	6.38	6.43	6.48	7.78	8.31	8.88
North-West	0.80	0.81	0.82	0.90	0.94	0.99
Centre	1.23	1.25	1.27	1.53	1.65	1.78
North-East	0.64	0.64	0.64	0.79	0.84	0.90
South-East	1.10	1.09	1.09	1.28	1.33	1.40
South-Muntenia	0.59	0.59	0.58	0.71	0.74	0.78
Bucharest-Ilfov	1.10	1.13	1.16	1.43	1.58	1.74
South-West Oltenia	0.35	0.35	0.34	0.46	0.50	0.53
West	0.60	0.60	0.60	0.66	0.69	0.72

According to criterion $\sum_{t=1}^{17} y_t = \sum_{t=1}^{17} \hat{y}_t$, the best adjustments with the model of the 2nd degree parabola were obtained for the development regions North-West, Centre and West and for the whole country and rest of regions better results gives the linear regression model. For the country and regions North-West, Centre, Bucharest-Ilfov and West, because $b \succ 0$, exists an increase tendency of the tourist arrivals. For the country and the same development regions, because also $c \succ 0$, it is estimated that, over the period, it held an accelerated growth. It was verified the adjustment quality for the two models using the criterion: $\sum_{t=1}^{17} (y_t - \hat{y}_t)^2 = \min$ and it is found that the best adjustment is given by the model of the 2nd degree parabola, both on the country and by regions of development. In the Table 3 are presented the verifying indicators of the analytical adjustment quality.

Table 3. Assessment indicators of the regression model quality

Region of development	Linear model				Model of the 2nd degree parabola			
	v_t [%]	$S_{y_t/\hat{y}_t}$	e [%]	SSE_{2012}	v_t [%]	$S_{y_t/\hat{y}_t}$	e [%]	SSE_{2012}
A	1	2	3	4	5	6	7	8
Country total	10.61	0.76	12.78	1.70	7.87	0.53	8.92	0.01
North-West	10.76	0.09	12.88	0.00*	10.28	0.08	11.64	0.00*
Centre	13.60	0.17	16.17	0.18	9.70	0.12	11.37	0.07
North-East	10.79	0.08	12.94	0.01	8.25	0.06	9.05	0.00*

South-East	8.47	0.12	10.43	0.03	7.23	0.09	8.43	0.00*
South-Muntenia	10.26	0.08	12.52	0.01	7.99	0.06	10.24	0.00*
Bucharest-Ilfov	15.21	0.15	19.10	0.06	8.57	0.07	9.43	0.01
South-West Oltenia	12.69	0.06	14.99	0.01	7.61	0.03	9.24	0.00*
West	8.71	0.05	9.74	0.00*	7.19	0.05	8.54	0.00*

** values under 0.01.*

Analysis of these indicators highlights that the model of the 2nd degree parabola provides a better adjustment of the time series terms under study, both on the total country and by regions of development. It is found that two from the three criteria used for the assessing of the adjustment quality highlight the model of the 2nd degree parabola as being the most adequate model for the analytical adjustment of the analysed indicator. However, since an economic variable does not support long-term parabolic growth, even if its dynamics is supported exogenous, the utilization of the parabolic models in analysis being recommended to be done with caution, for the forecasting on the next three years were used the both models. Thus, the both models indicate an increasing trend of total tourist arrivals on the whole country and in the regions: North-West, Centre, Bucharest-Ilfov and West, for the considered forecasting horizon, if the conditions from the period 1995-2011 remain the same. For the regions of development North-East, South-East, South-Muntenia and South-West Oltenia the model of the 2nd degree parabola indicates an increasing tendency of the tourist arrivals, while the linear model describes a decreasing tendency, in the years 2012-2014. Verification of the accuracy in the regression models with time variable using the MAD and SSE indicators can be realized for the year 2012, for which the tourist arrivals real data on the whole country and by regions of development are known. Both on the total county and by regions of development, the indicators have lower values for the model of the 2nd degree parabola. Values of the SSE are presented in the Table 3, columns 4 and 8.

Conclusions

From the analysis of the Romanian and foreign studies and articles in the domain, it was found that both in the theory and practice, the analysis methods of the time series components and those of forecasting are frequently used for the study of the economic and social activities evolution and, not less, permanent enriched with new theoretical and methodological approaches. Applying some of these methods on the tourist demand indicators in Romania, by regions of development, in the period 1995-2011 they could be detached conclusions such as: a well described evolution of the tourist arrivals in Romania using the regression model of the 2nd degree parabola, on the country and by regions of development, in the considered period, as it results from the graphical representation of this indicator, in the Figure no. 2 and from the parameters estimation of the linear and 2nd degree parabola models; a decreasing tendency of the overnight stays number, on the country with an annual average rate of -1.82% and on development regions; a decrease tendency of the average length of stay, both on the whole country and by regions of development, in the considered period; regression model of the 2nd degree parabola, analytical identified as being the most adequate for the time series adjustment, highlights an increasing tendency of the tourist arrivals, both on the country and by the development regions, in the prognosis horizon 2012-2014; verification of the prognosis model accuracy, for 2012, identifies the model of the 2nd degree parabola as being the most adequate.

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