Analysis of the efficiency of the management of protected natural areas in Romania from the perspective of the possibility of making forecasts regarding their management as well as the impact of the evolution of these destinations on tourism

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Abstract. The approach pursued in this article aims to analyse the possibility of making a forecast, depending on the historical evolution of the surface of protected natural areas, with the aim of managing them as efficiently as possible, as well as the impact of the evolution of these areas on tourism. With the help of the EViews program, the possibility of elaborating forecasts was made, based on historical information (period 1992-2019), regarding the ANP area indicator in Romania and a forecast of this indicator for the period 2020-2025 was made. Also, the chapter ends with the realization of a forecast regarding the evolution of the number of tourists in tourist reception structures, in the period 2020-2025, made with the help of simple regression analysis between tourist number indicators in tourist reception structures and ANP area, indicators related to Romania.

Keywords: *efficiency of the management, protected natural areas, forecasts, impact, tourism*

Introduction

Starting from the premise that the environment is a subsystem of the economy, the development of a sustainable environment is vital in sustaining the well-being of humanity.

This article is a reflection on the current challenges of the natural environment, starting from the analysis of the literature that generated an information pool, able to demonstrate the complexity of the relationship between environment, man and economic development.

In this context, the use of software for econometric analysis, forecasting and simulation EViews may prove to be a welcome solution for the management of protected natural areas (NPAs), serving as a decision support system in the management of this field. The formulation of hypotheses in the scientific approach is based on the investigation of the institutional capacity of ANP management, starting from the application of community and national strategies, as well as the investigation of existing management measures and the protection needs of ANP and ecosystems.

1. Testing the seasonality of the time series regarding the indicator of the surface of the protected natural areas in Romania

The forecast of the evolution of the economic phenomena represents, most of the times, the final objective of the econometric modeling. It is also a real test of the validity of the model developed. Unlike the predictions based on the study of time series, whose inertial character is recognized, the predictions generated by the econometric model with simultaneous equations aim to foreshadow the future of

important economic variables in relation to the direct and indirect influences exerted on them by exogenous variables[10].

In order to facilitate the calculations involved in making forecasts based on econometric models, the use of specialized programs is indicated. One such program is EViews, the application of which, in addition to significantly reducing the time spent on econometric analysis, also ensures a high accuracy of the calculations, and the interpretation of the results is easy[9].

EViews software provides researchers, corporations, government agencies, and students with access to statistics, powerful forecasts, and modelling through an innovative, easy-to-use, object-oriented interface. The software supports a wide range of statistical analysis elements, covering everything from simple, descriptive to parametric and nonparametric testing.

The characteristics of mean, variance, and covariance (constant mean and variance; covariance depends on the number of delays) define a weak stationary stochastic process, namely stationary on average, covariance, and dispersion, which are invariant over time.

The conditions that must be met for a time series to be stationary are: the mean of the time series must be constant or in other words, the observations must fluctuate around the mean and f the variance of the series must be constant. Economically, a series is stationary if a series shock is temporary (absorbed over time) and not permanent.

The two techniques for verifying the stationarity of a time series are the use of the estimated ACF (autocorrelation function) and unit root tests - Dicky Fuller tests. In this sense, the stationarity will be verified using the series of simple annual returns related to the indicator of the surface of the protected natural areas in Romania.

This indicator, according to O.U.G no. 57/2007, as subsequently amended and supplemented, "represent terrestrial, aquatic and / or underground areas, with the established legal perimeter and having a special regime of protection and conservation, in which there are species of wild plants and animals, biogeographical elements and formations or of another nature, of special ecological, scientific or cultural value "and include: biosphere reserves, national parks, nature parks, science reserves, nature reserves, nature monuments, wetlands of international importance, special avifauna protection sites, Community importance and natural sites of universal natural heritage.

Although 28 observations were identified related to the ANP surface indicator in Romania, from the period 1992 - 2019, we will work with only 27 observations because a value was lost when the simple returns were calculated. Regarding the surface of ANP in Romania in the period 1993-2019, the graph of simple annual returns is represented in figure 1.:
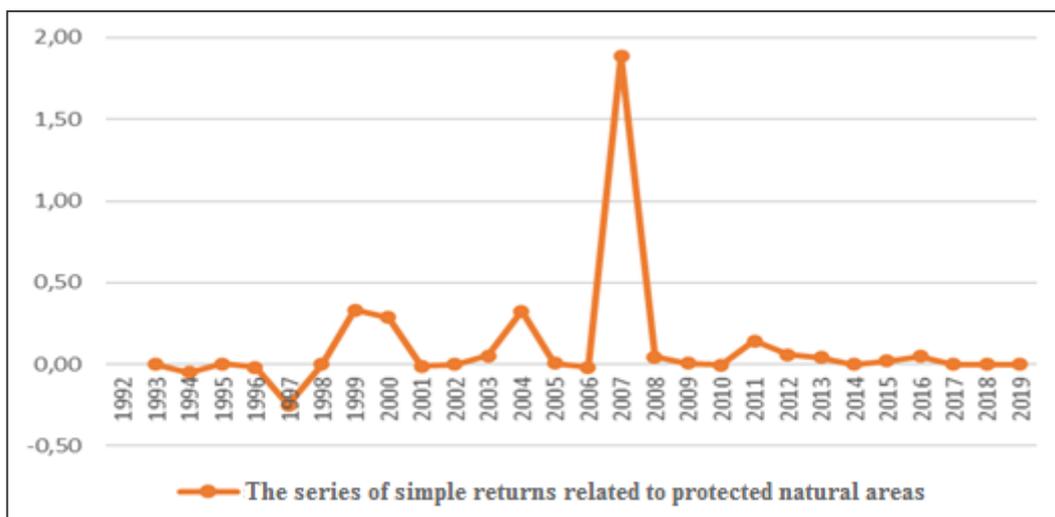

Figure 1: Graph of simple annual returns

Using the correlation / graph of the autocorrelation function, with the help of the Eviews tool, the stationary of the time series of the simple returns on the surface of ANP in Romania related to the 27 observations was verified (figure 2).
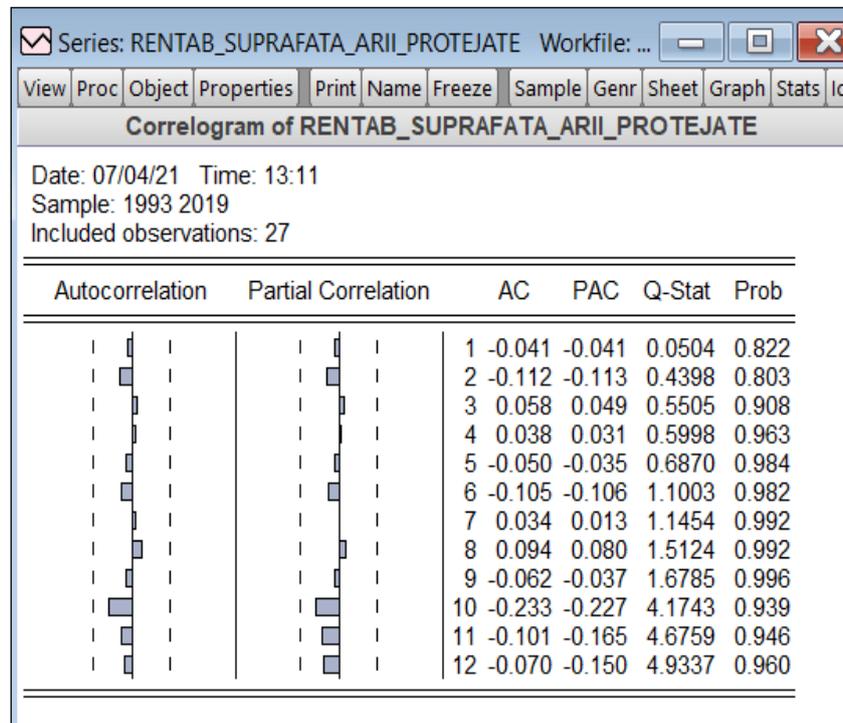

Figure 2: Correlogram for the series of simple returns on the surface of protected natural areas in Romania

Thus, as a result of the correlation analysis, the estimated autocorrelation coefficients (column AC) have values close to zero, negative and positive, this indicating non-existent or weak autocorrelations for all delays. Also, the PAC column (estimated partial autocorrelation coefficients) is close to zero, negative or positive.

It is possible to construct the 95% confidence interval, for T = 10 observations (-1.96 * 1 / √T; 1.96 * 1 / √T), namely (-0.37720; 0.37720). Given that the ACs found in the above range can be assimilated to the value zero and that the series must be stationary (white noise), then the ACs must be found in the above range (i.e. to be zero / to tend to zero).

In our case it can be seen that all CAs are in the 95% confidence interval and thus, the null hypothesis is not accepted and from the perspective of CA, the series is not stationary. Checks on the series' stationarity continue.

The test decision can also be made based on the Q statistic, present in the Eviews output (figure 2), by using p-value. Thus, it can be seen that p-value has high values starting with lag 3, so the risk assumed in rejecting the null hypothesis is too high. The conclusion is that the null hypothesis is accepted: then the series comes from a white noise, so it is stationary.

The next step is to apply unit root tests. In this sense, the Dickey Fuller test starts from the random walk hypothesis, and the results of this test, generated by the Eviews tool, are presented in figure 3.

Figure 3. Dickey Fuller test results
Source: table created by the author using the Eviews tool

Given that the t-statistic has the value -5.104933, being lower than the critical values corresponding to the confidence thresholds of 5% (-2.981038) or 10% (-2.629906), then the null hypothesis is rejected and the time series is not a random walk process, it is stationary.

The model can be written as follows:

rentab_suprafata_arii_protejate = 0,115896 - 1,041157 * rentab_suprafata_arii_protejate (-1) + wn

with the help of the Eviews tool, the ARMA model (1,1), in ideal conditions (without other influences), we made a forecast of the indicator of the surface of the protected natural areas in Romania, represented in the figure 4, for the period 2020-2025.
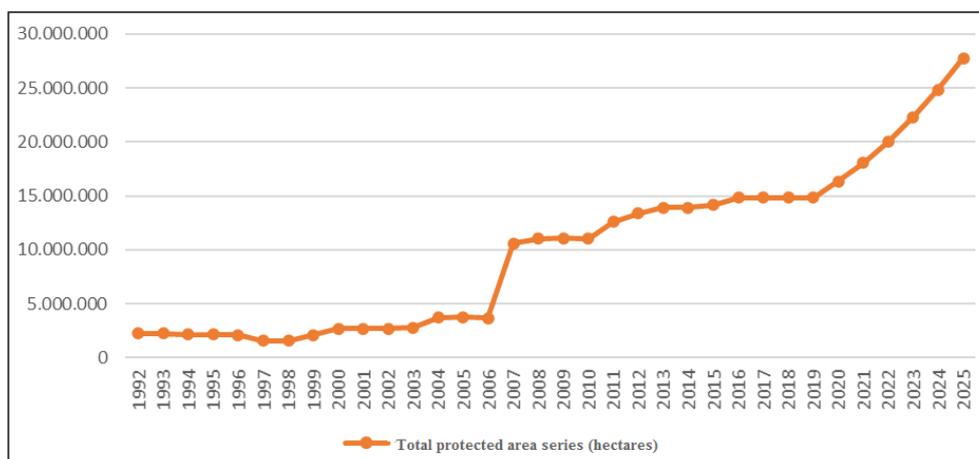

Figure 4. Forecast of the areas of protected natural areas in Romania for the period 2020-2025, values obtained using the EViews tool - ARMA forecast model (1,1)
Source: table created by the author using the Excel tool

2. Forecast of the evolution of the number of tourists in tourist reception structures in the period 2020-2025, with the help of the simple regression analysis between the indicators of number of tourists in tourist reception structures and the surface of protected natural areas, related to Romania

Regression analysis (in English regression analysis, French rėgression (statistiques)) is a statistical modeling tool, used to determine a model of the links that are established between pairs of numerical data. Although linear regression can be done manually, the calculations are much easier to perform if specialized software is used.

The analysis will generate a graph of a straight regression line, which best fits the respective data, as well as a table with statistics.

In our case we used the Excel tool, the Regression component (from Tools> Data Analysis), on the 2 data series identified for the period 1992-2019 on the official website of the National Institute of Statistics (http://statistici.insse.ro : 8077 / tempo-online /) namely

- Data series of the indicator number of tourists in tourist accommodation structures in Romania (the number of tourists accommodated in tourist accommodation units includes all persons, Romanians and foreigners, who travel outside the localities where they have their permanent residence, for a shorter period for 12 months and stay at least one night in a tourist accommodation unit in the visited areas of the country; the main reason for the trip is other than to carry out a paid activity in the visited places[3];

- Data series of the indicator of the surface of the protected natural areas in Romania.

The data thus obtained were processed in order to be able to make a comparison / analysis between the 2 indicators and to establish the association between them with the help of simple linear regression.

To summarize how Y's changes (number of tourists in tourist accommodation structures) are associated with X's changes (ANP area), the mathematical method used is the "least squares method."

The quantification of the trend and the replacement of the real terms with the terms of the theoretical series, calculated by the trend, which expresses the legitimacy according to which the phenomenon illustrated by the researched data evolved, considered the use of the least squares method (MCMMP) be used in forecasting studies as well. [2]

The least squares method is an analytical method that offers the possibility to determine the precise trend with the help of an elementary statistical-mathematical function considering that the studied phenomenon is a function of time. In essence, this method involves choosing a function that best expresses the nature of the researched phenomenon and is consistent with the actual data of the time series, then using as a methodological basis the least squares method to calculate the theoretical values to be minimal.

$$\sum_i [(y_{ti} - Y_{ti}])^2 \to \min.$$

Those theoretical values that satisfy the condition imposed by the expression of the least squares method will in fact be the theoretical series of the central tendency.

The equations used to adjust the time series can be as the case may be: the equation of the linear function, the parabola, the hyperbola, the exponential function or a polynomial of some degree.

The most important issue to consider when applying trend analytical methods is choosing the most appropriate model for the observed data.

Its choice is usually made on the basis of the schedule, or by performing preliminary statistical processing. If the changes to the chain base are found to be approximately equal, then the most appropriate adjustment model is certainly the linear one. When the changes with the chain base form approximately a straight line and the increments of the increments (absolute changes of the second order) are approximately equal, the second degree parabola is used as a model. If the terms of the series show approximately constant relative increases, then the exponential model is recommended.

After choosing the adjustment function, the estimation of its parameters is performed with the least squares method, which involves minimizing the sum of the squares of the deviations from the theoretical values, calculated Yti and the real, empirical values yti.

Another important issue to consider immediately after choosing the adjustment model is the quantification of time in order to facilitate the calculations for determining the parameters of the model starting from the condition imposed by the least squares method.

If several methods are used for the same series, the one that reflects the real trend of the studied phenomenon is chosen based on the fulfillment of some criteria and this will be used in the forecast calculations. Applied in our case, the association between X and Y is represented by a line drawn between the points of the scatter plot (point cloud) in figure 5.
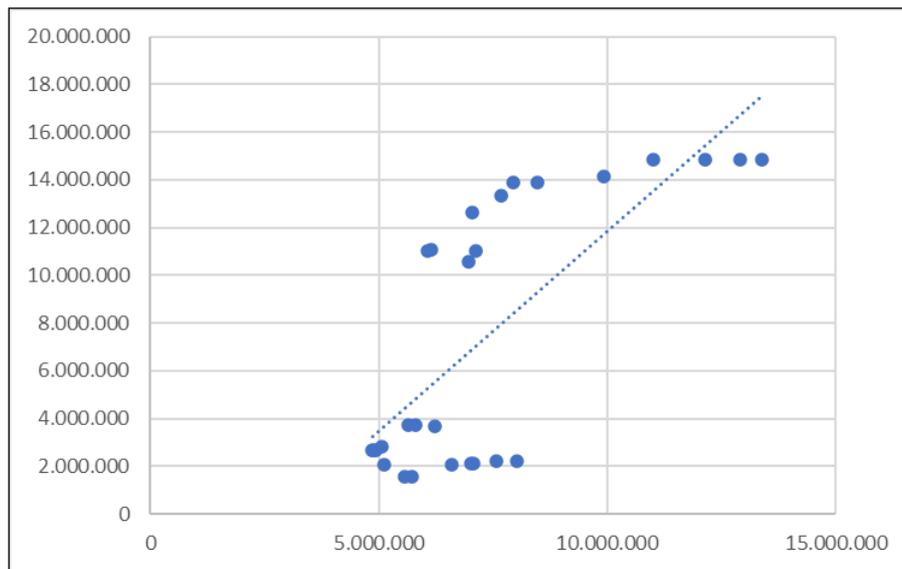

Figure 5. Distribution diagram of the 2 indicators, number of tourists in tourist reception structures and the area of protected natural areas, related to Romania

Source: created by the author as a result of the data collected from the official website of the INS

The line thus estimated (trend) is "the best" in the sense that it expresses the most central path among the points, in common terms being also called the regression line. Distances are referred to as errors (residues). Consequently, since any other line produces a larger sum of squares, the regression line achieves the minimum value of the squares of the errors. It can be said that the regression line represents the equilibrium point in a bivariate distribution, just as the mean represents the equilibrium point for a univariate distribution of scores.

The utility of the regression line is that it serves as a basis for predicting the values of Y (number of tourists in tourist reception structures) associated with the values of X (ANP area). Thus, given a value of x0, the predicted value for Y is y0, ordered on the regression line corresponding to the abscissa x0.

The output of the regression function is represented in figure 6. Given the fact that the confidence interval, (0.1977; 0.4386), does not include the value 0, we can say that the relationship between the 2 indicators is statistically valid.

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0,728843348							
R Square	0,531212627							
Adjusted R Square	0,513182343							
Standard Error	1684905,7							
Observations	28							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	8,36406E+13	8,36406E+13	29,46224466	1,09024E-05			
Residual	26	7,38116E+13	2,83891E+12					
Total	27	1,57452E+14						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	5.009.441,4872	541.256,0326	9,2552	0,0000	3.896.873,7783	6.122.009,1962	3.896.873,7783	6.122.009,1962
X Variable 1	0,3182	0,0586	5,4279	0,0000	0,1977	0,4386	0,1977	0,4386

Figure 6 - Output of the simple linear regression function of the 2 indicators, number of tourists in tourist reception structures and the area of protected natural areas, related to Romania

We also reach the same conclusion when we analyze P-value, whose value of 0% is less than 5%.

Conclusions

Using the series of simple annual returns related to the indicator of the area of protected natural areas in Romania, using the techniques for verifying the stationarity of a time series, namely the use of the estimated autocorrelation function (estimated ACF) and unit root tests (unit root tests) - Tests Dicky Fuller, it was concluded that the series comes from a white noise process / is not a random walk process, being stationary.

Analyzing the series of observed and predicted values, both regarding the dynamic and the static forecast, we can see that both variants of forecasts sometimes deviate from the point cloud (reality), but in the case of static forecast the line is much closer to reality. . Thus, as a result of the econometric analysis performed on the series of simple annual returns, related to ANP areas in Romania, in the period 1993-2019, it emerged that, given the historical data, a forecast close to its reality can be made.

This is possible because in order to establish new legal perimeters with a special regime of protection and conservation, in which there are species of wild plants and animals, biogeographical or other elements and formations, with special ecological, scientific or cultural value, are detailed analyzes were carried out and clear procedures were followed, the conclusions of which could be foreseen in the light of historical information.

Thus, the actors interested in a possible realization of forecasts regarding the surface of ANP in Romania, with the help of a realistic and stable forecasting model, they could evaluate the management decisions accordingly. Given that it has been shown that, based on historical information on the area of ANP in Romania, with the help of the Eviews tool it was possible to make forecasts close to reality, using the same forecasting tool, we made a forecast of the indicator area of ANP in Romania. Romania, for the period 2020-2025.

Thus, for the ANP area in Romania, the forecast was made, with the help of the same ARMA model (1,1), because it was indicated by all the informational criteria mentioned above.

Figure 4 graphically represents the forecast series and the series of observed values in terms of dynamic forecasting. It is observed the continuation of the series of values observed with moments 28-33 (period 2020-2025) related to the forecast.

In conclusion, with the help of the Eviews instrument, the ARMA model (1,1), in ideal conditions (without other influences), we were able to make a forecast of the ANP surface indicator in Romania, represented in figure 4, for the period 2020-2025.

Also, with the help of the simple regression equation and using the Excel tool, the Regression component (from Tools> Data Analysis), in ideal conditions (without other influences), the time series regarding the number of tourists indicator in tourist reception structures was obtained, starting from to the independent variable (controllable and known), namely the area of protected natural areas in Romania. In conclusion, the evolution of the indicator of the surface of the protected natural areas in Romania, influences the evolution of the indicator number of tourists in tourist reception structures in Romania.

References

[1] Appleton M.R., 2003 The process of elaborating the management plans for the protected areas in Romania, *World Bank Project no. Ro-GE-44176,* pp 14-16

[2] Babucea G., 2002 Methodological statistics *Spirit Românesc Publishing House, Craiova,* pp.153-1585

[3] Balog A., Cristescu I., 2009 Theories and models of accepting new technologies, *Romanian Journal of Human - Computer Interaction, Vol.2, No.2, 2009,* pp. 147-160

[4] Drăgulescu I.V, Drăgulescu N., 2013, Some theories of ecological sustainability, *Publishing House ....*

[5] Hockings, M., Stolton, S. and Dudley, N., 2000. Evaluating effectiveness: a framework for assessing the management of protected areas *Adrian Phillips Series Editor,* Best Practice Protected Area Guidelines Series No. 6, The World Conservation Union;

[6] Jula, Dorin, Methods and techniques for testing hypotheses in economics. Paper presented within the Project "Routes of academic excellence in doctoral and postdoctoral research - READ", http://mone.acad.ro/wp-content/uploads/2014/12 /JulaTestarea-ipotezelor.pdf

[7] Newbold, T., Hudson, LN, Hill, SL, Contu, S., Lysenko, I., Senior, RA, Börger, L., Bennett, DJ, Choimes, A., Collen, B. and Day, J., 2015. Global effects of land use on local terrestrial biodiversity. *Nature,* 520 (7545), pp.45-50;

[8] Petcu M., Miron D., Sobolevschi I. D., 2012, Determinism in assessing the ecological behavior of the consumer, Vol. XIV, *ASE Publishing House, Bucharest,* no. 31, 2012, p.3

[9] Stancu, Stelian. Econometrics: theory and applications using Eviews. *Bucharest: ASE Publishing House*, 2011, p.550

[10] Tomescu Dumitrescu C., 2009 Forecasts in economics based on econometric models using EViews 5, *Annals of the "Constantin Brâncuşi" University of Târgu Jiu, Economics Series, Nr. 1/2009,* p. 277

[11] Institute for European Environmental Policy, 2013, study "Estimation of the financing needs to implement target 2 of the EU biodiversity strategy".