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- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

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- Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

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EMPIRICAL RESEARCH OF MOUNTAIN TOURISM DEMAND IN CROATIA USING POLYNOMIAL REGRESSION MODEL WITH AUTOREGRESSIVE ERRORS

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ABSTRACT

In Croatian economy tourism plays a great role, but tourists mostly choose seaside resorts, while mountain resorts have low number of guests. Aim of the research is to explain the dynamics of the mountain tourism demand. We found that second order polynomial model with first order autoregressive error explains the dynamic of the mountain tourism arrivals and nights in Croatia in post-war period from 1995 to 2014.

KEYWORDS

mountain tourism, modelling tourism demand, polynomial model with autoregressive errors, tourist arrivals, tourist nights.

JEL CLASSIFICATION

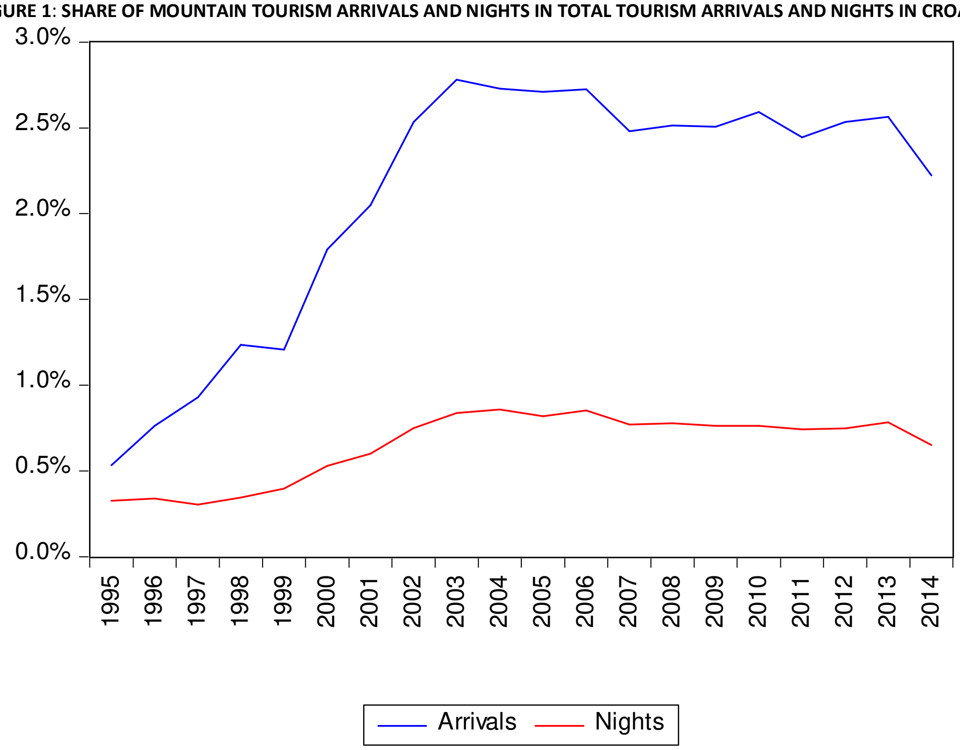
Z30, Z32, C22, C51.

INTRODUCTION

Tourism is important economic activity in Croatia. Croatia is one of the most visited tourist destinations. With 11.6 billion international tourist arrivals in 2014, Croatia is ranked 26th world destination and 13th European destination (Barrientos and Soria, 2016).

Croatian tourism is highly seasonal and most tourists opt for seaside resorts, while mountain areas have low number of visitors. Even though Croatia has favourable conditions for development of mountain tourism, it is still underdeveloped in Croatia. The share of tourist arrivals in total arrivals is less than 3%, while share in overnight stays in total overnight stays is less than 1% in 2014. The dynamic of share of mountain tourism arrivals and overnight stays for the post-war period from 1995 to 2014 is presented on figure 1.

FIGURE 1: SHARE OF MOUNTAIN TOURISM ARRIVALS AND NIGHTS IN TOTAL TOURISM ARRIVALS AND NIGHTS IN CROATIA



Source: authors' calculation based on Croatian Bureau of Statistics (1996, 2006, 2010, 2015)

In order to help mountain areas to develop in economic and demographic way and to raise the standard of living, Croatia offers incentives that are established by the Law on hilly and mountainous areas. Hilly - mountainous areas are areas that have difficult conditions for life and work of the population due to altitude, slope, climate or other natural wonders.

Croatia has about 10 000 km^2 of mountainous region, of which 5,600 km^2 is over 1000 m above sea level. In Croatia, not a single peak is higher than 2,000 meters, but Croatia is still competitive because of the mountains that have rounded peaks so that tourists can safely climb to the top of each (Ministry of Tourism, 2006). An advantage that Croatia also has is good climatic characteristics that make it a pleasant stay in summer and winter. Croatia has eight national parks and four are located in mountainous areas.

REVIEW OF LITERATURE

Reviewing literature, we can find a lot papers about tourism in Croatia. Some of the research are of quantitative nature and includes building different types of models for Croatian tourism. Some of the empirical research and methods used in those researches are further listed. Some researcher like Mihaljević (2003) and Bahovec et al. (2008) use multiple linear regression models and ordinary least square (OLS) to build the models. Part of the papers deal with nonlinear models that are linearised and then ordinary least square are implied. The example of these papers is Baldigara et al. (2013) that use Cobb Douglas function and Baldigara and Koić (2015) that use polynomial regression model.

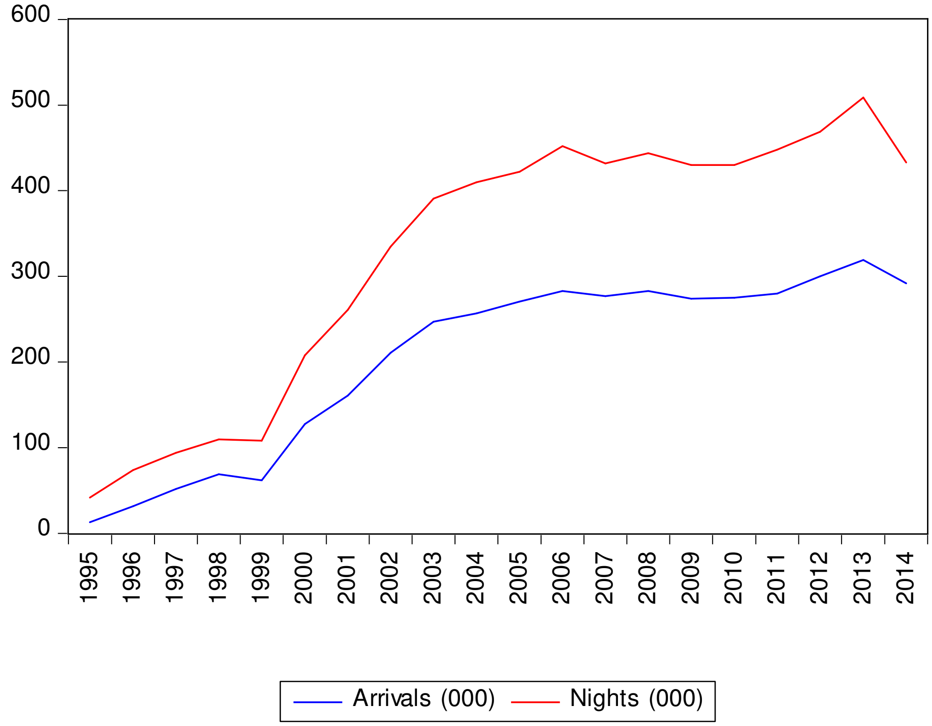
There are also papers that use advanced methods. Stučka (2002) compares OLS and SUR methods in tourism models. Bellulo and Križman (2000) use cointegration method of Johansen and of Engle and Granger, while Payne and Mervar (2010) investigates long run causality with Toda-Yamamoto method. Mervar and Payne (2007) use ARDL method. ARIMA methods use Payne and Mervar (2007), Mamula (2015), and Apergis et al. (2015). Škrinjarić (2011) uses panel method. Štambuk (2002a) uses artificial neural network, while Štambuk, (2002b) use multiparametric hierarchical model.

In line with small share of mountain tourism in total tourism, there is a small share of papers about mountain tourism. Mountain tourism in Croatia is object in Stanković (1988, 1991), Knežević, (1998, 2003), Vrdoljak-Šalamon (2006), Petrić (2008). Those works are not using models. This work is a contribution to the research area of mountain tourism, especially to the empirical research of the mountain tourism demand.

DATA AND METHODOLOGY

Tourism demand in mountain area is measured by tourism arrivals and tourism nights. The period after the war in Croatia is in focus, so data from 1995 to 2014 are used. Arrivals and overnight stays in mountain places are presented in the figure 2.

FIGURE 2: TOURISM ARRIVALS AND TOURISM NIGHTS IN MOUNTAIN PLACES IN CROATIA



Source: Croatian Bureau of Statistics (1996, 2006, 2010, 2015)

Figure 2 exhibits nonlinear pattern so polynomial regression is estimated. Polynomial regression fits nonlinear relationship between dependent and independent variables in form of n^{th} order polynomial. From statistical estimation point of view, it is linear estimation problem (Dielman, 2013, Aczel, 1989) because the functional form of the polynomial regression is linear, and although independent variable(s) are raised to the k^{th} power, regression function is linear in the parameters. Polynomial equation is of the form:

$$Y_t = \beta_0 + \beta_1 x_t + \beta_2 x_t^2 + \cdots + \beta_n x_t^n + \epsilon \quad (1)$$

Polynomial regression is a type of multiple regressions and there are several assumptions for this method. The major assumptions are (Levine et al., 2014):

- errors of the model are normally distributed
- errors have a constant variance
- errors are independent.

Polynomial models of arrivals and overnight stays of the mountain tourism in Croatia are estimated using ordinary least squares method and different statistical tests of the models are performed. Since there was a problem with serial correlation, polynomial models with autoregressive errors are built. The new models performed well under statistical tests. All tests are evaluated at significance level α = 0.05.

RESULTS

For both series, arrivals and overnight stays in the mountain places in Croatia, polynomial regression of second order is fitted.

RESULTS OF MODEL BUILDING FOR TOURISM ARRIVALS IN MOUNTAIN RESORTS

Polynomial model for arrivals of the tourists is estimated as follows:

$$Arrivals_t = -15.873 + 38.193x_t - 1.155x_t^2 + \epsilon \quad (2)$$
$$(14.140)\ (3.450)\ (0.175)$$

Where:

x_t =0 in 1995 and unit for x_t is 1 year

Arrivals are measured in thousands of tourist arrivals

Standard errors are in parentheses

F-test shows that regression is significant: F (2,17) =184.437, p < 0.001. R^2 = 0.956, $R^2_{adjusted}$ =0.951so there is a high degree of determination.

Parameters for both time terms: x_t and x_t^2 are significant at chosen significance level of α=0.05: t(19) = 11.072, p < 0.001 for x_t, and t(19) = -6.591, p < 0.001 for x_t^2. Significance of time and squared time justifies hierarchical model. Hierarchical models contain all orders of polynomial regression and only they are invariant under linear transformation (Montgomery et al., 2012).

After this basic diagnostic tests of model and variables significance, additional test of assumptions for polynomial regressions are performed. Assumptions of normality of errors of the model are tested using Jarque-Bera test which tests whether errors have the skewness and kurtosis of a normal distribution. Results of Jarque-Bera test: $\chi^2(2, N = 20) = 1.312$, p = 0.519 indicates that errors are normally distributed. Next assumption checked is those that errors have a constant variance. Equality of variance is also called homoscedasticity while inequality of variance is called heteroscedasticity. White heteroscedasticity test is performed and results of the test: $\chi^2(4, N = 20) = 2.515$, p = 0.642 imply homoscedasticity. The assumption of independence of errors is tested by checking autocorrelation. Autocorrelation is tested by Breusch-Godfrey LM test. Results for the autocorrelation up to 2nd order are: $\chi^2(2, N = 20) = 8.12$, p = 0.017 which indicates presence of the autocorrelation. Multiocollinearity is not an issue for polynomial models (Allison, 2012).

To correct for the autocorrelation, we can add ARMA model, in this case we have added AR (1) term and we got polynomial regression of the 2nd order with autoregressive errors of order 1. The form of the model is:

$$Y_t = \beta_0 + \beta_1 x_t + \beta_2 x_t^2 + \epsilon_t \quad (3)$$

$$\text{with errors } \epsilon_t = \Phi\epsilon_{t-1} + \omega_t \quad (4)$$

Model is estimated using generalized least squares (GLS) algorithm. Fitted polynomial regression with autoregressive errors of arrivals in mountain places in Croatia is as follows:

$$Arrivals_t = -0.281 + 34.759x_t - 1.009x_t^2 + \epsilon_t \quad (5)$$
$$(23.515)\ (5.445)\ (0.273)$$

$$\text{with } \epsilon_t = 0.673\epsilon_{t-1} + \omega_t \quad (6)$$
$$(0.188)$$

Where

x_t =0 in 1995 and unit for x_t is 1 year

Arrivals are measured in thousands of tourist arrivals

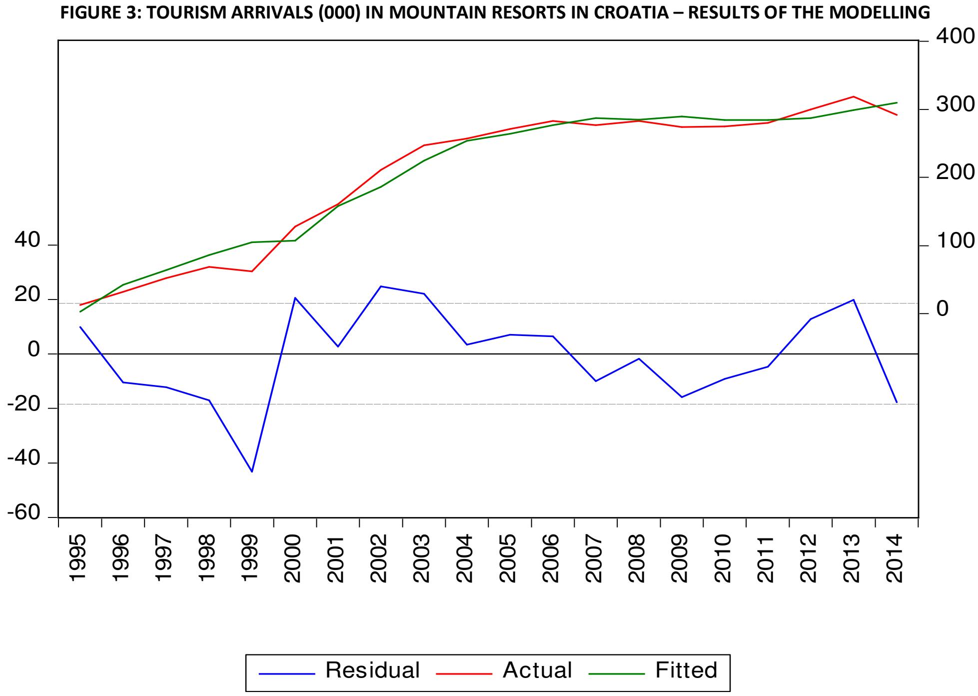
Standard errors are in parentheses

Goodness of fit of the model indicates that model is significant, results of the F-test is: F(2,17) =197.372, p < 0.001 with R^2 = 0.974 and $R^2_{adjusted}$ = 0.969. The t-test for the time, squared time and for the autoregressive term is significant at 0.05, which can be seen from the results of the t-test: t(19) = 6.383, p<0.001 for time, t(19) = -3.697, p < 0.002 for time squared and t(19) = 3,576, p < 0.003 for AR(1).

Model is further evaluated by testing assumptions. Normality is checked with Jarque-Bera test and results: $\chi^2(2, N = 20) = 0.773$, p = 0.679 suggest not rejecting the assumption of normality of errors. White test of heteroscedasticity with results of $\chi^2(9, N = 20) = 8.189$, p = 0.515 indicates equality of variances. Finally, autocorrelation is tested with Breusch-Godfrey LM test and results for order up to 2 are: $\chi^2(2, N = 20) = 4.642$, p = 0.098.

Figure 3 presents results of the modelling arrivals of tourist in mountain area in Croatia: actual, fitted and residual values of the polynomial model with autoregressive error are shown.

FIGURE 3: TOURISM ARRIVALS (000) IN MOUNTAIN RESORTS IN CROATIA – RESULTS OF THE MODELLING



Source: authors' calculation

Forecasting errors of the model averaged in different ways are shown in table 1:

TABLE 1: FORECASTING ERROR OF THE POLYNOMIAL MODEL WITH AUTOREGRESSIVE ERRORS FOR TOURIST ARRIVALS

Averaging method	RMSE	MAE	MAPE	SMAPE	Theil U1	Theil U2
Error	23.55737	19.15916	16.71476	13.97874	0.050468	0.970682

Source: authors' calculation

RESULTS OF MODEL BUILDING FOR TOURISM NIGHTS IN MOUNTAIN RESORTS

Similar to the modelling of arrivals of tourists in mountain resorts in Croatia, overnight stays of tourists are at first estimated using polynomial regression model of 2nd order. Estimated model:

$$Nights_t = -7.318 + 58.115x_t - 1.779x_t^2 + \epsilon \quad (7)$$
$$(23.343)\ (5.695)\ (0.289)$$

Where
x_t = 0 in 1995 and unit for x_t is 1 year
Nights are measured in thousands of tourist nights
Standard errors are in parentheses

Model is evaluated and F-test shows the overall significance of the model: F(2,17) =152.707, p < 0.001. Coefficient of determination R^2 = 0.947 and adjusted coefficient of determination $R^2_{adjusted}$ =0.941 are high. Parameters for time and time squared are tested with t-test. Results of the t-test show that parameters are significant: t(19) = 10.205, p < 0.001 for time and t(19) = -6.148, p < 0.001 for time squared.

Assessment of the model continuous with testing assumptions of the model. Normality of errors is evaluated with Jarque-Bera test and results: χ^2(2, N = 20) = 0.733, p = 0.693 imply that we do not have to reject hypothesis of normality of error. The assumption of equality of variances of errors is tested with White heteroscedasticity test. Results of the test: χ^2(4, N = 20) = 2.804, p = 0.591 are consistent with the hypothesis of homoscedasticity. Finally, autocorrelation of errors is checked with Breusch-Godfrey LM test. Results for autocorrelation up to 2nd lag are: χ^2(2, N = 20) = 7.138, p = 0.028. Those results suggest presence of autocorrelation so adjustment of the model is needed.

Same as model for arrivals, the model for overnight stays is changed with adding ARMA model, precisely autoregressive 1st order term. The new model is polynomial regression of the 2nd order with 1st order autoregressive errors. We used generalized least squares algorithm again and we got estimated model as follows:

$$Nights_t = 13.991 + 54.312x_t - 1.651x_t^2 + \epsilon \quad (8)$$
$$(37.860)\ (8.924)\ (0.452)$$

$$\text{with } \epsilon_t = 0.627\epsilon_{t-1} + \omega_t \quad (9)$$
$$(0.205)$$

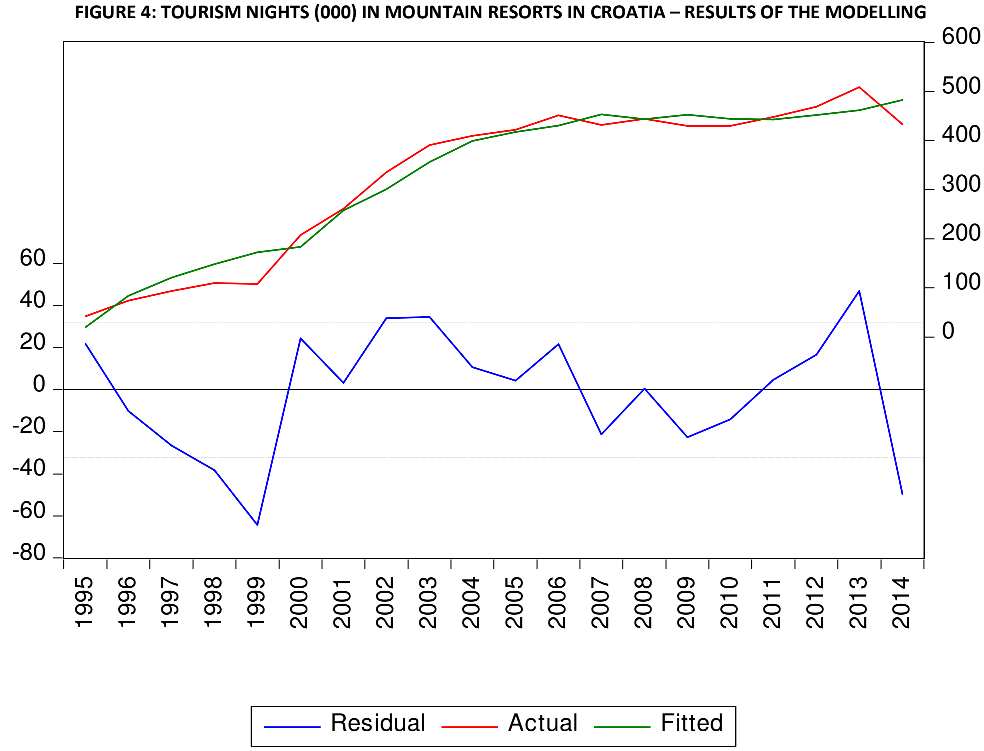
Where
x_t = 0 in 1995 and unit for x_t is 1 year
Nights are measured in thousands of tourist nights
Standard errors are in parentheses

Assessment of the model starts with estimating overall significance of the model. F-test is: F (2,17) =147.415, p < 0.001 indicating that model is significant. R^2 = 0.965 and $R^2_{adjusted}$ =0.959 so there is a high degree of determination.

Assumptions of the model are tested next. Normality of error distribution is tested with Jarque-Bera test. Results of the test are: χ^2(2, N = 20) = 0.861, p = 0.650 so we can conclude that errors are normally distributed at chosen significance level of 0.05. Equality of variances is tested with White heteroscedasticity test and results: χ^2(9, N = 20) = 13.486, p = 0.142 imply equality of variances. Autocorrelation that was the problem in model (7) is solved which can be seen from Breusch-Godfrey LM test with results for 2nd order autocorrelation: χ^2(2, N = 20) = 4.739, p = 0.094.

Results of the polynomial model with autoregressive errors for tourism nights in mountain resorts in Croatia is presented in figure 4.

FIGURE 4: TOURISM NIGHTS (000) IN MOUNTAIN RESORTS IN CROATIA – RESULTS OF THE MODELLING



Source: authors' calculation

Errors of the model are averaged in different ways are given in table 2.

TABLE 2: FORECASTING ERROR OF THE POLYNOMIAL MODEL WITH AUTOREGRESSIVE ERRORS FOR TOURIST NIGHTS

Averaging method	RMSE	MAE	MAPE	SMAPE	Theil U1	Theil U2
Error	38.48742	30.91019	15.71998	13.25061	0.052410	1.183613

CONCLUSION

Tourism is of great importance for Croatia, but not all type of tourism is developed. Although there are potentials for mountain tourism in Croatia, they are not used as they could be. As a contribution to the development of mountain tourism in Croatia, econometric model of mountain tourism demand is built. Aim of the research is to explain the dynamics of the mountain tourism. We found that second order polynomial model with first order autoregressive error explain the dynamic of the mountain tourism in Croatia. At first, two second order polynomial models for arrivals of tourist where built, but those model did not pass the diagnostic check because of the presence of autocorrelation. To account for the autocorrelation two models of second order polynomial model with first order autoregressive error were built. Assumptions for the models are reached and models reasonably well explain the dynamics of mountain tourism demand in Croatia. In this way results of the study can help in development of mountain tourism in Croatia.

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