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AN ECONOMETRIC APPROACH TO TOURISM DEMAND: EVIDENCE FROM TURKEY

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Abstract. This study focuses on modelling tourism demand with using number of tourists who came to Turkey between the years 1966-2012 (47 years) and bed numbers belonging to accommodation facilities with tourism operation licensed. The number of tourists and beds have only been reached dealing with the years 1966-2012. Except from these variables, many variables such as states investment incentives on tourism, tourism revenues, the annual average temperature, the parity of foreign currency like Euro, dollar and power of purchasing in the country could be taken into account. The aim of this paper is to create a forecasting model about the number of coming tourists and to provide prior information for tourism policies by regarding introduced models. In this sense, forecasting of international tourist arrivals for 2013-2020 is purposed.

1. Introduction

Turkey's tourism development process shows a significant improvement especially after 1980 and "Tourism Encouragement Law" which was enacted in 1982 was a turning point for this development. Increasing number of tourists with encouragement provided in Turkey's tourism sector has increased tourism revenue and had a considerable amount in countries' income. By providing of encouragement measures, bed numbers which belong to accommodation facilities with tourism operation licensed rose to 325.168 from 56.044 between 1980 and 2000 and in this process the number of tourists increased to 10.412.000 to 1.288.000 with eight-fold increase. The end of 2012 the number of beds increased to 715.692 and the number of tourists is also 31.782.832. ([10].)

Because the developments in the tourism sector is very important for many countries in order to forecast the number of tourists is vital importance to plan investment in this sector and for touristic businesses who wants to better prepare themselves for the next year. In order to determine a forecasting model on the basis of countries the factors such as the countries' geographical location, the situation of social, political

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and technological, the width of countries' seasonal range and the efficient use of resources season by season, the cultural and historical richness should be taken into consideration. In addition to these factors, the countries' advertising network, the distance to other countries, the relative exchange rates [2], the presence of tourism promotion, the number of tourism companies and the number of tourist facilities with tourism operation licensed and the capacity of beds are also important elements for the number of tourists arriving in the country.

For nearly 30 years, researches have proposed regression models with parametric and non-parametric methods modelling and forecasting the tourism demand. It is found that over 130 studies which are scanned index are related to tourism demand and forecasting this demand since 2000. Usually in these studies linear and nonlinear dynamic models (Autoregressive (AR)), Autoregressive Integrated Moving Average (ARIMA) and seasonal autoregressive (SAR) are used [8]. Because tourism revenue keep a significant place in countries with a wealth of tourist attractions, modeling the number of tourists and tourism income on the basis of countries is important. For example [9] have proposed both static and dynamic models in their studies with variables such as capita national income of tourists and the Money they spend etc. For modelling the number of tourists who arrived to Hong Kong. [3] has combined linear and nonlinear models to forecast tourism demand. [4] has mentioned a detailed compilation of some of the works done so far for prediction model.

In this study, forecasting of the number of tourists has been purposed with using number of tourists who came to Turkey and number of beds which belong to accommodation facilities with tourism operation licensed in 1966-2012. Because the number of beds isn't known on the forecasting period, time series and exponential smoothing model suggestions have been studied to forecast these numbers. According to basic economic law, the service has a certain threshold point and however how much the service increases after this point, the number of tourists will reach a saturation point. In the literature the models which test this law are called as inverse models. In this study, reverse models have been handled firstly and in addition to these mixture models have been proposed. In these models, the models with econometric problems have been examined. Finally the number of tourists who may come to Turkey between the years of 2013-2020 have been forecasted with determining the model used in forecasting by computing $RMSE$ values with ex-post forecasting.

2. Model Suggestions

Primarily, variables such as "number of beds for tourism operation certified resorts" and "the number of foreign tourists" have been plotted in a scatter plot by using IBM SPSS 2.0 software package. On this chart curve fitting options have flagged as linear, quadratic, cubic, logarithmic etc. and then the analysis has been conducted. As a result of this analysis the following 10 models have been proposed in the first

Table 1. Augmented Dickey-Fuller tests and Johansen Cointegration Test of LB and TOURIST

Augmented Dickey-Fuller test	
Augmented Dickey-Fuller test for LB	Prob.*
Null Hypothesis: LB has a unit root	0.9987
Null Hypothesis:$\nabla(LB))$ has a unit root	0.0042
Augmented Dickey-Fuller test for TOURIST	
Null Hypothesis: TOURIST has a unit root	0.9977
Null Hypothesis: $\nabla(TOURIST))$ has a unit root	0.0000

*MacKinnon (1996) one-sided p-values.

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. Of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.251739	17.22511	25.87211	0.3983
At most 1 *	0.088603	4.174947	12.51798	0.7167

Trace test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

place by using E-views 6.0 package program. During making these proposals the models which have a high percentage of explanation (R^2) is based on by ignoring assumptions of the error terms. Because of encountering different information criteria despite the high value of R^2 whether it is a spurious regression relationships between $TOURIST$ and LB variables have been investigated. For this investigation firstly unit root test has been made and then the cointegration test has been applied (see Table1). In Augmented Dickey Fuller Test (ADF) options of trend and constant term have been marked and it is found that both $TOURIST$ and LB have one unit root.

As it can be seen that there is no cointegration and there is no coexistence for these two variables that act behavior against time, so it can be said that there isn't any spurious relationship. In order to see that long term effects of these two variables on each other, the variance decomposition of the first differences has been made. The purpose of variance decomposition is to show that the effect of random shocks on the variables. Calculating the explanation rate of the shocks on a variable by the other variables will provide a better understanding of economic relations between variables.

Table 2. Variance Decomposition of ∇(LB) and ∇(TOURIST)

Variance Decomposition of $\nabla(LB)$				Variance Decomposition of $\nabla(TOURIST)$			
Period	Standard Deviation	$\nabla(LB)$	$\nabla(TOURIST)$	Period	Standard Deviation	$\nabla(LB)$	$\nabla(TOURIST)$
1	8331.634	100.0000	0.000000	1	1050649	18.18588	81.81412
2	9849.885	95.35022	4.649777	2	1109817	21.53251	78.46749
3	11021.22	94.72456	5.275436	3	1116763	21.66398	78.33602
4	12028.01	94.95489	5.045112	4	1267475	35.25953	64.74047
5	13472.32	95.67258	4.327418	5	1299848	38.32217	61.67783
6	14496.14	95.97823	4.021771	6	1312619	39.01058	60.98942
7	15282.49	96.10308	3.896916	7	1363875	43.48508	56.51492
8	16307.16	96.56853	3.431471	8	1400705	46.41218	53.58782
9	17182.71	96.84548	3.154520	9	1425813	48.10511	51.89489
10	17939.80	96.97797	3.022032	10	1457227	50.27353	49.72647

It can be said that at the end of 10^{th} period, 97% of effect of unit shock on $\nabla(LB)$ can be explained by itself. $\nabla(TOURIST)$ can explain approximately 80% of the effect of the shock by itself in the first period, this rate has declined to 50% at the end of the period. The number of beds is not impressed by the number of tourists in long term so it is more related to the value in the previous periods. The reason for this can be economic shocks such as tourism promotion in 1982, terror attacks in the 90s and restricting the promotion that provided to the tourism sector since 1992 etc. It can be said that considering the variance decomposition for the number of tourists, the effect may be associated with number of beds in long term and the number of tourists cannot be affected as much as the number of beds regarding with the experienced economic shocks.

According to these, the models (linear, logarithmic and inverse) where $TOURIST$ is described only with LB are given in Table 3; the models which are explained by $LOG(LB)$ and time trend are given in Table 4; the dynamic models which include the lagged value of $LOG(TOURIST)$ and a mixture of $LOG(LB)$ and time trend are given in Table 5. Also in these tables, the value of R^2 and AIC and the results of model assumptions are given.

Table 3. Proposed Linear, Logarithmic and Inverse Models by Ignoring Assumptions on Residuals

	MODEL	R^2	AIC	Heteroscedas -ticity (White Test) p value	Auto-Correlation (Breusch-Godfrey Test) p value	Normality (Jarque Berra) p value
1	$LOG(TOURIST_t) = \beta_0 + \beta_1 LOG(LB_t) + \epsilon_t$	0.984	-0.732	0.263	0.000	0.416
2	$LOG(TOURIST_t) = \beta_0 + \beta_1 \frac{1}{LOG(LB_t)} + \epsilon_t$	0.966	-0.014	0.003	0.000	0.287
3	$LOG(TOURIST_t) = \beta_0 + \beta_1 \frac{1}{LB_t} + \beta_2 LB_t + \beta_3 LB_t^2 + \epsilon_t$	0.991	-1.214	0.289	0.004	0.828

Table 4. Proposed Including Time Trend Models by Ignoring Assumptions on Residuals

	MODEL	R^2	AIC	Heteroscedas -ticity (White Test) p value	Auto-Correlation (Breusch-Godfrey Test) p value	Normality (Jarque Berra) p value
1	$LOG(TOURIST_t) = \beta_0 + \beta_1 LOG(LB_t) + \beta_2 t + \epsilon_t$	0.984	-0.840	0.355	0.000	0.399
2	$LOG(TOURIST_t) = \beta_0 + \beta_1 LOG(LB_t) + \beta_2 t^2 + \epsilon_t$	0.991	-1.246	0.414	0.003	0.889
3	$LOG(TOURIST_t) = \beta_0 + \beta_1 LOG(LB_t) + \beta_2 t^2 + \beta_3 t^3 + \epsilon_t$	0.992	-1.383	0.813	0.027	0.564

Table 5. Proposed Lagged Models by Ignoring Assumptions on Residuals

	MODEL	R^2	AIC	Heteroscedas -ticity (White Test) p value	Auto-Correlation (Breusch-Godfrey Test) p value	Normality (Jarque Berra) p value
1	$LOG(TOURIST_t) = \beta_0 + \beta_1 LOG(TOURIST_{t-1}) + \epsilon_t$	0.988	-1.066	0.178	0.236	0.614
2	$LOG(TOURIST_t) = \beta_0 + \beta_1 LOG(TOURIST_{t-1}) + \beta_2 LOG(LB_t) + \epsilon_t$	0.991	-1.297	0.756	0.185	0.711
3	$LOG(TOURIST_t) = \beta_0 + \beta_1 LOG(TOURIST_{t-1}) + \beta_2 LOG(LB_t) + \beta_3 t^3 + \epsilon_t$	0.992	-1.453	0.521	0.960	0.717
4	$\frac{1}{LOG(TOURIST_t)} = \beta_0 + \beta_1 \frac{1}{LOG(LB_t)} + \beta_2 \frac{1}{LOG(TOURIST_{t-1})} + \epsilon_t$	0.989	-12.01	0.402	0.992	0.501

In order to apply Least Squares Method for parameter estimation error terms should be uncorrelated, should have homoscedasticity and have a distribution with zero mean. On the other hand in order to make statistical conclusion about the suggested models, the error terms should be normally distributed or at least should be asymptotically normal. The normality assumption on the error terms is usually ignored in time series models because the size of data set is more than the regression model [1]. Therefore, as long as the error term is a white noise process, parameter estimators are usually considered to be asymptotically normally distributed estimators.

It is shown that models in Table 3 and Table 4 cannot meet the assumptions. The reasons and solutions will be investigated. Overall conclusion about the existence

of problems that variables should be taken in the model hasn't located in model or incorrect functional form has selected. Besides this explanatory variable(s) may have a functional effect on the error terms directly [6]. In the first case, there isn't any intervention because complete data which belong to other explanatory variables such as number of travel agencies, the countries share in advertising, tourism investments etc. On the period of covering analysis cannot be obtained.
Problems arising from the second case will attempt to resolve by taking new variables that involved lagged values of $TOURIST$ and LB. However models that have still unsolved problems will be eliminated at later stage. Models in Table 5 include the stationarity condition in addition to the assumptions. Because long term forecasts of non-stationary models have large standard errors, forecasts will be meaningless in terms of statistical inference. In the following section will also be taken to remedy this problem.

3. Handling The Problems Of Models

In application in order to solve the autocorrelation or heteroscedasticity problems of residuals, proposed transformations can eliminate these problems that exist at present or can also lead to occur new problems. In this study the problem of autocorrelation of residuals is solved with the Hildreth-Lu scanning procedure that is based on the generalized difference method. The method is as follows; suitable generalized difference transformation is done for model with the idea that residuals have the first order autocorrelation problems. The value of autocorrelation that makes the sum of squares minimum is used to transform the model by making successive adjustments in correlation according to the direction of correlation between residuals.
A point to be noted here is to find the appropriate value that can't deteriorate other assumptions of the model. Sometimes other assumptions may be corrupted at SSE's lowest value. Following steps will be taken to resolve the heteroscedasticity problem; explanatory variables or their functions that may cause heteroscedasticity problem will be determined by Breusch-Pegan-Godfrey Test and the problem will be considered whether it is resolved with White test by making suitable transformations in the troubled model. For details of autocorrelation and heteroscedasticity problems and their methods of adjusting in Chapter 11 and 12 of [6].
Autocorrelation problem of Model 1 and Model 3 in Table 3 has derived from residuals' autoregressively related with the first degree. Therefore, transformed models have been proposed by taking first difference. Model 2 in Table 3 has both autocorrelation and heteroscedaticity problems. Initially autocorrelation problem on residuals has been trying to resolve because its application is easier. Residuals of Model 2 have also autoregressive relationship with first degree, autocorrelation and heteroscedasticity have been eliminated by taking difference one time with the transformed model. The transformed models for models in Table 3 are given below with their RMSE values.

Table 6. Transformed Models for Model in Table 3

	TRANSFORMED MODEL	R^2	AIC	RMSE
1	$LOG\,(TOURIST_t) - 0.6LOG\,(TOURIST_{t-1}) =$ $\beta_0 + \beta_1\,(LOG\,(LB_t) - 0.6LOG\,(LB_{t-1})) + \epsilon_t$	0.942	-1.326	2071756
2	$LOG\,(TOURIST_t) - 0.83LOG\,(TOURIST_{t-1}) =$ $\beta_0 + \beta_1 \left(\frac{1}{LOG(LB_t)} - 0.83\frac{1}{LOG\left(LB_{t-1}\right)} \right) + \epsilon_t$	0.729	-1.260	2434917
3	$LOG\,(TOURIST_t) - 0.45LOG\,(TOURIST_{t-1}) =$ $\beta_0 + \beta_1 \left\{ \left(\frac{1}{LB_t}\right) - 0.45\left(\frac{1}{LB_{t-1}}\right) \right\} + \beta_2\,\{(LB_t) - 0.45\,(LB_{t-1})\} +$ $\beta_3 \left\{ \left(LB_t^2\right) - 0.45\left(LB_{t-1}^2\right) \right\} + \epsilon_t$	0.974	-1.413	786374.5

With analyzing Table 4 the models don't have heteroscedasticity problems, whereas they have autocorrelation problem on their residuals. Autocorrelation problem will be solved by the Hildreth-Lu scanning process as in the previous models. The autocorrelation value that makes SSE minimum and eliminates autocorrelation can't create the heteroscedasticity problem as well, will be taken into account. The transformed model for Model 1 in Table 4 is same as Model 1 in Table 6. The transformed model for Model 3 in Table 4 rejects all variable associated with time trend. When these variables are removed from model the model is the same as Model 1 in Table 6. Thus Model 1 and Model 3 in Table 4 are eliminated from the proposed models. The final version of the proposed Model 2 in Table 4 is shown in the following table. Here to ensure the assumptions, coefficient of t is excluded from this model.

Table 7. Transformed Models for Model in Table 4

	TRANSFORMED MODEL	R^2	AIC	RMSE
1	$LOG\,(TOURIST_t) - 0.2LOG\,(TOURIST_{t-1}) =$ $\beta_0 + \beta_1 LOG\,(LB_t) - 0.2LOG\,(LB_{t-1})$ $+\beta_3 t^2 + \epsilon_t$	0.987	-1.399	974368.1

Generally speaking for Table 5 the residuals of the four models provide the necessary assumptions. However the stationarity condition is necessary for long-term forecast to be desirable. In addition the assumption of stationarity is important for statistical inference. Because of this the natural logarithm of $TOURIST$ has carried out unit root test. p value has found 0.8297 by applying ADF test in E-views Package Programme and has understood that the $LOG(TOURIST)$ has unit root with first degree. p value has found 0.0000 by taking difference one time for $LOG(TOURIST)$ with the same test. Therefore the series contains one unit root. It's revealed that LB has two unit roots by taking natural logarithm according to ADF test. $LOG(LB)$ has been adjusted from unit root with ADF test. If LB is taken with unit root to regression model, this may cause spurious regression [5], [7]. Transformed model for Model 1 includes lagged model adjusted from unit root. The coefficient of $\nabla^2 LOG(LB)$ is rejected in transformed model for Model 2 and when this variable is removed from the model, the model is same as transformed model for Model 1. Similarly time trend and $\nabla^2 LOG(LB)$ variables in transformed model for Model 3 are rejected and when these variables are removed from the model, the model is same as transformed model for Model 1, too. The coefficient of $\nabla^2(1/LOG(LB))$ variable is rejected in Model 4 and this variable is removed from the model. According to this transformed models for Model 1 and Model 4 are given in following table.

Table 8. Transformed Models for Model in Table 3

	TRANSFORMED MODEL	R^2	AIC	RMSE
1	$\nabla^2 LOG\,(TOURIST_t) = \beta_0 + \beta_1 \nabla LOG\,(TOURIST_{t-1}) + \epsilon_t$	0.598	-1.095	1301644
2	$\nabla^2 \frac{1}{LOG\,(TOURIST_t)} = \beta_0 + \beta_1 \nabla \frac{1}{LOG\,(TOURIST_{t-1})} + \epsilon_t$	0.594	- 11.881	2327446

4. Forecasting

It is necessary that values of LB for forecast period (2013-2020) should be predicted or known to forecast with all transformed six models except for the models in Table 8. For this reason a model that will forecast the future values of LB is also needed. The primary aim of this section is to identify such a model. Various models have been tried for LB and the model which has the minimum RMSE value (ignoring other assumptions) is found as $LB_t = \beta_0 + \beta_1 t + \beta_2 t^2 + \varepsilon_t$ because residuals of this model have autoregressively related with second degree the problem has been tried to resolve with generalized difference methods. Constant term and time trend variables have been removed because they are unnecessary. Additionally, considering the following recursive residuals chart the deviations are concentrated after 1985. The reason for this, it is possible to see that as the impact of intense terror events in the 1990s and Encouragement of Tourism Law enacted in 1982. With the aim of to purify this effect, dummy variable has been put between the years of 1985-1995 then a second dummy variable has been put from 1996 to present day.

Both dummy variables have found individually significant for either the constant term or the slope. The most suitable model has been obtained by adding second dummy variable as constant term with regarding to RMSE and model is as follows,

$$LB_t - LB_{t-1} + 0.1LB_{t-2} = \beta_1 DUM2 + \beta_2 t^2 + \epsilon_t \tag{4.1}$$

Making long-term forecasting is inconvenient because LB's predicted model is non-stationary. Prediction equation for LB is as follows

$$LB_t - LB_{t-1} + 0.1LB_{t-2} = -16132.83859 + 59.65046t^2 \quad (RMSE = 13903.47) \tag{4.2}$$

Holt's Double Parameter Linear Exponential Smoothing Model is taken into considerations as an alternative forecasting model to the model above. Exponential

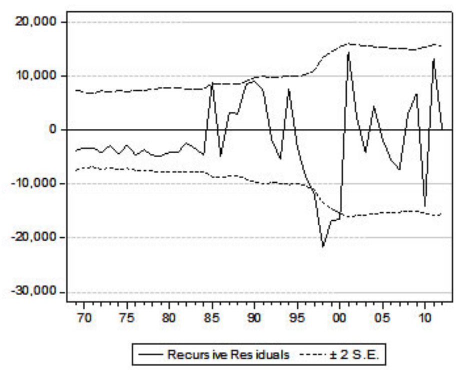

Figure 1. Recursive Residual Time Series Chart

Smoothing Method is used for $\nabla(LB)$ because two unit root and trend are in the model when unit root test is applied for LB with time trend. Smoothing equation,

$$L_t = 0.722617\nabla(LB_t) + (1 - 0.722617)(L_{t-1} + b_{t-1}) \tag{4.3}$$

Trend equation,

$$b_t = 0.068487\,(L_t - L_{t-1}) + (1 - 0.068487)b_{t-1} \tag{4.4}$$

Forecasting equation,

$$F_t = L_t + b_t \ , \ t \leq 2012 \tag{4.5}$$

$$F_{2012+k} = L_{2012} + kb_{2012} \ , \ k = 1, ..., 8 \ (RMSE = 8670) \tag{4.6}$$

Since smoothing factor is close to one, forecasts are weighted related to actual values so the trend is less impact. Making 8 periods forecast of LB, two Parameter Linear Exponential Smoothing Model whose RMSE is smaller has chosen from two models above. However it should be reminded that short term forecast should be made because two proposed models for LB have a trend effect.

With the aim to make comment about problems that may arise in the forecasting process estimates of coefficients in the proposed transformed six models are given in the table below.

Although Model 1 and Model 2 in Table 6 comparison with other models have a higher value in terms of RMSE, more acceptable forecast has been obtained from these models. On the other hand Model 3 has minimum RMSE value but forecasts have increased until 2017, in later years have showed a decreased.

5. The Conclusions And Proposals

In generally as if forecast with these two models has an increase this situation is due to the increase of number of beds as 45000 each year in average. While making

Table 9. Estimations of Coefficients for Transformed Models

Coefficients	Std. Dev.	t-Stat.	p value
TABLE6-MODEL1			
0.846362	0.200167	4.228280	0.0001
1.112676	0.041663	26.70688	0.0000
TABLE6-MODEL2			
4.992336	0.213971	23.33180	0.0000
-165.9087	15.26599	-10.86787	0.0000
TABLE6-MODEL3			
7.955256	0.089705	88.68265	0.0000
-28563.15	5340.652	-5.348251	0.0000
6.56E-06	8.37E-07	7.834913	0.0000
-3.53E-12	1.02E-12	-3.461605	0.0012
TABLE7-MODEL1			
4.259928	0.522739	8.149247	0.0000
0.809699	0.061085	13.25524	0.0000
0.000421	8.33E-05	5.051655	0.0000
TABLE8-MODEL1			
0.106823	0.024755	4.315294	0.0001
-1.186619	0.148264	-8.003424	0.0000
TABLE8-MODEL2			
-0.000458	0.000111	-4.106769	0.0002
-1.162159	0.146578	-7.928626	0.0000

forecasting modelling factors as developments of world economy, geographical and political situations of Turkey. Terror events in the country which effect tourism activities directly negative of positive have been ignored.
In order to increase forecast accuracy related to the LB tourism areas which has been allocated to the tourism sector can be identified with the approval of the Ministry of Tourism and Culture. Thus the number of beds' saturation point can

Table 10. Forecasts for Chosen Models

		TOURIST(FORECASTS)	
YEAR	LB($_{SMOOTHF}$)	TABLE6MODEL1	TABLE6MODEL2
2010	629465	28511000	28511000
2011	677572	31456076	31456076
2012	715692	31782832	31782832
2013	756494	31728059	32228511
2014	798466	32434867	32827566
2015	841609	33614459	33556220
2016	885922	35105361	34395598
2017	931406	36812684	35330458
2018	978060	38678907	36348306
2019	1025885	40668525	37438767
2020	1074880	42759423	38593126

be determined in the long-term. In this way the long-term forecasts of number of tourists by reducing the present momentum of LB can be made a little more sense with expost forecasting values.

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