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Modeling Of Foreign Tourists Arrived By Land And Sea In Albania Using Logistic And Gompertz Models

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***Abstract*— Travel &Tourism is forecast to grow as fast, or faster, than the economies overall in every major European region. The impact of tourism is crucial in the economic progress of a country. Tourism contributes to the integration of Albania, a great generator of foreign exchange, promotes the precious and varied cultural tradition of Albania. The importance of travel and tourism in Albania is growing. In 2016, the sector contributed 6% to the total GDP (almost 80% leisure, and more than 20% business spending). The sector of travel and tourism is forecasted to grow with more than 5% per annum (WTTC, 2016). The aim of this research is to model and forecast the number of foreign tourist arrivals by means of transports in Albania using yearly data for the period 2001-2018. Gompertz model fits best to the actual data and is the best model to predict the number of tourists arrived by land and also the number of tourists arrived by sea in Albania. The carrying capacity of foreign tourists arrived by land in Albania is predicted to be achieved after year 2035; whereas the carrying capacity of tourists arrived by sea in Albania is predicted to be achieved after year 2050. The findings of this study are useful for tourists, travel agencies, and government.**

Keywords—*international tourists, carrying capacity, forecasting, Albania*

I. INTRODUCTION

Tourism is a social, cultural and economic phenomenon, related with the movement of people to destinations outside the country where they live, being driven particularly by the motive of satisfaction. Tourism affects the economy, natural environment and the local population of the countries visited and its visitors (Memaj, 2009).

In the past few decades, tourism has emerged as one of the major industries in the world economy, by being advantageous to transportation, accommodation, catering, entertainment, retailing and many other sectors. Each country attempts to develop tourism industry and increase the number of incoming visitors for several reasons. It is a source of economic growth and influences the balance of payments. Consequently, the contribution of worldwide tourism industry to the global economic development is remarkable important. So, planning and estimating tourism demand becomes highly important. With an appropriate forecasting model that could effectively predict the tourism demand, the government would be able to plan properly tourism development in order to choose an appropriate strategy for its economic welfare. Therefore, accurate estimations of tourism demand are essential for efficient tourism planning. Tourism demand is a key determinant of business profitability and its estimations constitute a very important element in the whole planning process. Estimation of tourism demand can be helpful to economic planners in reducing the risk of decisions regarding the future and also it is important to the tourism manager and to those who depend on that manager, since more accurate estimations reduce the risks of decisions more than do less accurate ones.

During the first years of transition in Albania, tourism has been a priority for the development of its economy and the country. During these years, Albania has made numerous attempts to develop this industry in various regions within the country and fortunately it really has opportunities for a successful tourism. The country has a considerable potential for tourism development, it provides security and stability, but on the other hand has deficiencies in management issues and environmental protection, investment conditions have very lack nesses and there are problems with the property issues and infrastructure.

The general literature on tourism demand modelling and forecasting, tourism demand is usually measured by the number of tourist arrivals. Tourist volumes are important for tourism service suppliers such as hotels, airlines and visitor attractions, because the volume has direct relevance to capacity management. Tourist expenditure (i.e., the receipts of the tourism industry in a destination) is the main concern of governments and central banks because it is the foundation on which the economic impact of tourism activities is assessed, and tourism policies are made. Furthermore, different evolution patterns in tourist arrivals time series emerge for most destination/origin country pairs.

The development of the tourism sector has been a major component of the Albanian public policy. Steadily public institutions have seen the tourism

sector as one of the only elements that can affect economic growth and increase employment level (Stone, 2009). Like all other Mediterranean countries, Albania shows growth potential in this sector. This is clear from the publications of the Institute of Statistics or those of the Ministry of Tourism, Culture, Youth and Sports (Chus & Caca, 2010). According to the latest data from the Ministry of Tourism, Culture, Youth and Sports and Institute of Statistics, coastal tourism sector is the most developed in the tourism industry.

In the first part of the paper we try to forecast the tourist number in the obvious prospective, by means of interlocking the logistic growth S-shaped curve with the environmental saturation level (carrying capacity). The estimation of parameters of logistic S-shaped curve: rate of change and carrying capacity is the crucial moment in the following paper. It has the great priority in improving forecast prevision to apply the logistic growth curve to adapt the evolving tendency of the touristic market and to get forecast.

II. LITERATURE REVIEW

There are studies that model the tourist arrivals (Lundtorp and Wanhill, 2001[1] and 2006[2]; Moore & Whitehall, 2005[3]; Cole, 2009[4] and 2012[5]; Albaladejo and Martínez-García, 2014[6]; Zhang and Xue, 2009[7]; Tan, 2013[8], Zhang-Ganga, 2011[9]; Yang and Wu, 2012[10]) by means of the estimation of S-shaped growth curves, such as the Logistic and the Gompertz curves.

Lundtorp and Wanhill (2001) find that, in Bornholm, the logistic growth model represents the first phases of the Tourism Area Life Cycle (TALC) model. The logistic curve fits to the data of the number of tourists from 1912 to 1967. In their data analysis, they explain that the change in the life cycle of Bornholm was due to growth in alternative markets for the island. Thus the Butler curve fits best when there is a dominate market of repeat visitors.

Moore & Whitehall (2005) test the concept of area lifecycle using Markov-switching models and quarterly observations for Barbados over the period 1957–2002. The key finding of the paper is that the framework does adequately represent the growth in arrivals from individual markets. However, there does not exist a common lifecycle relationship, which is applicable to all source markets. This suggests that policies aimed at rejuvenating growth for a particular destination should take into account the specific peculiarities of individual source markets.

Zhang and Xue (2009) make an analysis of the Logistic and Gompertz Models in the internal mathematical logic of the S-shaped curve of Tourism Area Life Cycle (TALC). With the statistics of inbound tourists in province-level administrative regions, some important tourist cities in the past 30 years, this paper explores into the adaptability of the two models to fit with the various tourist areas. It concludes that TALC has a universal applicability to the evolution of Chinese tourism destinations in various geographical scales and it is found that the Logistic model performs better to large-scale destinations while Gompertz model suits small ones better.

Tan (2013) proposed the calculation method of K value of the logistic curve according to the characteristics of curve symmetry. Based on this, a and r parameter values can be calculated and the logistic curve model of China's inbound market can be fitted. Fitting logistic curve regression meets the requirements. So logistic curve can be used as a general method for forecasting the tourist market.

Zhang-gang (2011) based on the number of tourists these years, by the fittest mathematical model, they forecast the tourists' number from 2011 to 2013. It is proposed that, in the next phase, they should enrich tourist products, improving facilities, strengthening the advertising work, and let it evolve to the stage of development.

Yang and Wu (2012) selected Langde village as research target and studied the principles of nonlinear dynamic evolution of ethnic village tourism using logistic curve model in combination with life cycle theory of tourist destination and tried to explore the way to manage sustainable development through system analysis, comparative analysis, qualification and quantification analysis, dissipative structure theory and coordination theory.

Shehu and Toshkollari (2014)[12] used logistic model and time series analysis to predict the number of tourist arrivals in Albania using data for the period 2000-2014. The results of Albania Tourist Area Life Cycle indicated that the midpoint of Life Cycle is year 2010, the duration of growth time is 13.6 years and the Carrying Capacity is 4,886,858 tourists. The time series analysis showed that the best model was ARIMA (2,1,2), and according to this model the number of tourists is expected to be 3,101,692 for year 2015.

Shehu et al (2016) [13] applied logistic and Bi-logistic growth model for long term predictions of tourist arrivals during the period 1995-2014. Simple logistic growth model gave the information of 44% increase of foreign arrivals during the future 10 years. The estimated carrying capacity was 5,309 million is expected to be around 2025. Other results give the application of Bi-logistic growth model, the saturation value of 4,083 million arrivals is expected to be around 2031.

Albaladejo and Martínez-García (2017) [14] show that the widely accepted mathematical model by Lundtorp and Wanhill (2001) can be extended by introducing a dynamic market ceiling and this extension can be

mathematically formulated using an increasing multi-logistic growth model. This mathematical formulation allows increases in the ceiling, as a result of purposive efforts by entrepreneurs and/or governments. If no effort is made, obsolescence and depreciation can drive a decline period. They tested a multi-logistic growth model with data of visitors to Bornholm from 1912 to 2014. They have found that in the case of multiples markets a multilogistic model fits the entire series of data better.

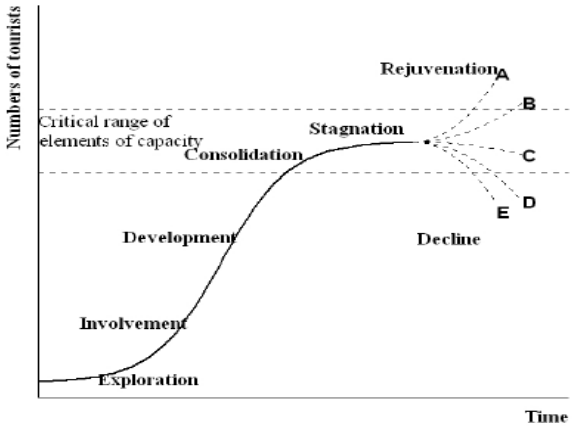

FIGURE 1. EVOLUTION OF TOURIST AREA ACCORDING TO THE TALC (SOURCE BUTLER (1980)).

III. RESEARCH METHODOLOGY

A. *Models*

Applying S-shaped logistic curve, Butler (1980) [15] bring the idea of Tourism Area Life Cycle (TALC). The evolution of a touristic area exhibits an S-curve during its lifetime. The area lifecycle concept postulates that a destination should enjoy varying levels of popularity over time and, as a result, the growth in arrivals should follow an s-shaped path. The rising of logistic curve coincides with the development and growth of the tourist market. It has great advantages in improving forecast precision to use the logistic growth curve to fit the developing trend of the tourist market and to make forecast.

The TALC model argues for the existence of an S-shaped lifecycle in the growth of the destinations with six key phases: exploration, involvement, development, consolidation, stagnation, and decline and/or rejuvenation.

Lundtorp and Wanhill (2001) find that this sinusoidal development of a tourist destination can be theoretically approximated by a logistic growth model. The logistic growth model, first proposed by Verhulst in 1838 as a population model, says that the growth rate is proportional to the number of tourist arrivals at the time t, T(t) and the number of other people which may visit the destination:

$$\dot{T}(t) = \alpha T(t)\left(1 - \frac{T(t)}{C}\right);\ T(0) > 0 \qquad (1)$$

where T(t) is number of tourists at time *t*, $\alpha > 0$ is a parameter that expresses the speed of expansion of the number of tourists at the destination and *C* is the carrying Capacity or maximum tourist capacity of tourist destination and $\dot{T}$ the derivation of tourists' number with respect to time.

The solution of the differential equation (1) is

$$T(t) = \frac{C}{1+e^{-\alpha(t-t_0)}} \quad \text{with } t_0 = \frac{1}{\alpha}\ln\left(\frac{C-T(0)}{T(0)}\right) \qquad (2)$$

which is a sinusoidal curve with a turning point at $t = t_0$ ($T(t) = \frac{C}{2}$ *at* $t = t_0$). As the number of tourists T approaches the carrying capacity C the growth vanishes.

Function (2) is a quite good theoretical representation of the first five stages established by the TALC theory (exploration, involvement, development, consolidation and stagnation), in Figure 1. Then, if a logistic curve fits to the data (arrivals, accommodation or receipts), the slope of the curve at any particular period of time would identify the phase of TALC where the destination is situated.

Another S-shaped model, Gompertz model is represented by the differential equation:

$$\dot{T}(t) = aT(t)[\ln c - \ln T(t)] \qquad (3)$$

The solution of the Gompertz model (3) is given by:

$$T(t) = ce^{-e^{-a(t-t_0)}} \qquad (\alpha > 0) \qquad (4)$$

where *c* is the carrying capacity or maximum tourist capacity; *a* is the speed of expansion of the number of tourists; t_0 is the moment of time when the number of tourists achieved the share 1/e ≈ 36.8% of its maximum level.

Both the Gompertz and Logistic curves involve the estimation of three parameters, and range between a lower asymptote of 0 and an upper asymptote of c.

B. *Data*

The data about the number of tourists in Albania, for the period 2001-2018, are taken from the database of Albanian Institute of Statistics[16]. Tourist arrivals at a particular time is the most common variable to measure tourism demand and usually given by the total number of tourist arrivals from an origin to a destination (Song and Li, 2008). The STATA software is used to obtain the parameters of the logistic model and the predicted values from logistic function and gompertz function.

Performance of out-of-sample forecasts is used to help for the selection of a diffusion model. The out-of-sample data cover the period 2016-2018.

To evaluate the performance of the best fitted or forecasted model was used the Root Mean Square Error (RMSE): $RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}$.

IV. RESULTS AND DISCUSSION

The number of foreign tourists arrived by land and sea in Albania during the study period, shown in figure 1, each following a S-curve pattern. The number of foreign tourists arrived by land (figure 1) is increased from 160000 tourists in 2001 to 3060470 tourists in

2012 and then in year 2013 is decreased at 2760120 tourists and then the number is increased at 4795922. At the end of 2018, the number of tourists arrived by land in Albania was 15.65% higher compared to 2017, and 3.6% higher in 2017 compared to 2016.
The number of foreign tourists arrived by sea (figure 1) is increased during the period under study, from 91000 tourists in 2001 to 691550 tourists in 2018. At the end of 2018, the number of tourists arrived by land in Albania was 19.68% higher compared to 2017.

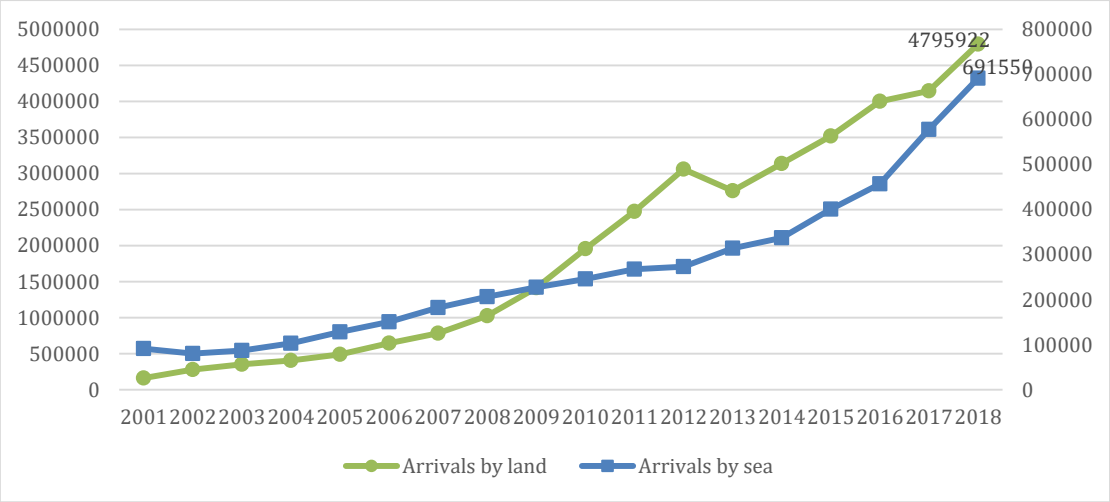

FIGURE 1: NUMBER OF FOREIGN TOURISTS ARRIVED BY LAND AND SEA IN ALBANIA

Results of Logistic and Gompertz models

The models obtained in the study are statistically significant and the parameters of the models are statistically significant at 1% level (tab. 1 and tab 2).
The results of Logistic model for the number of tourists arrived by land indicate a maximum of 3906892 tourists and the speed of expansion of the number of tourists to the carring capacity is 0.408. Number of tourists arrivals by land has achieved half of its maximum level in 2010.
The results of Gompertz model indicate a maximum number of tourists of 5774921, the speed of expansion of the number of tourists to the carring capacity is achieved in 2010.
The fit of each model is measured by the value of RMSE. The results of both models show that Gompertz model has the best performance in modeling the number of tourist arrivals by land, and the best to predict the number of tourists arrived by land in Albania.

TABLE I: RESULTS OF MODELS FOR ARRIVALS BY LAND

Parameter	Arrivals by land	
	Logistic	Gompertz
c	3906892*	5774921*
α	0.408*	0.164*
t_0	2010.03	2010.59*
R^2 R^2 adj	0.9937 0.9921	0.9909 0.9886
RMSE		
In-sample	150996.69	181107.703
Out-of-sample	694262.198	308544.972

TABLE II: RESULTS OF MODELS FOR ARRIVALS BY SEA

Parameter	Arrivals by sea	
	Logistic	Gompertz
c	738899	2050608
α	0.158	0.049
t_0	2014.62	2025.661
R^2 R^2 adj	0.9970 0.9963	0.9972 0.9965
RMSE		
In-sample	12449.9	12083.046
Out-of-sample	155563.49	145945.195

The results of Logistic model for the number of tourists arrived by sea indicate a maximum of 738899 tourists and the rate of growth of touristic area is 0.158. Number of tourist arrivals by sea has achieved half of its maximum level in 2014.

The results of Gompertz model indicate a maximum number of 2050608 tourists, the rate of growth of touristic area is 0.049 and half of its maximum number of tourists can be achieved in 2025.

The fit of each model is measured by the values of RMSE. The results of both models show that Gompertz model has the best performance in modeling the tourists arrivals by sea, and is the best to predict the number of tourists arrived by sea in Albania.
Logistic model is found appropriate to model the tourism demand in China (Zhang and Xue, 2009), Albania (Shehu and Toshkollari, 2014).

Prediction of tourists' arrivals by land and sea in Albania

Tab. III indicate the predictions of number of tourists arrived by land and sea, obtained from Logistic and Gompertz models.
The carrying capacity (or ceiling demand) of foreign tourists arrived by land in Albania (5774921 tourists), generated by Gompertz model, is predicted to be achieved after year 2035.

TABLE III: PREDICTION OF TOURISTS' ARRIVALS

	Arrivals by land		Arrivals by sea	
Year	Logistic	Gompertz	Logistic	Gompertz
2019	4493083	4493083	492815	514132
2020	4667375	4667375	518104	549094
2021	4820530	4820530	541834	584601
2022	4954395	4954395	563874	620552
2023	5070872	5070872	584154	656848
2024	5171831	5171831	602652	693389
2025	5259057	5259057	619391	730082
2026	5334208	5334208	634430	766833
2027	5398805	5398805	647854	803555
2028	5454221	5454221	659769	840165
2029	5501679	5501679	670290	876583
2030	5542264	5542264	679537	912737

The carrying capacity of tourists arrived by sea in Albania (2050608 tourists), generated by Gompertz model, is predicted to be achieved after year 2050.

CONCLUSIONS

The number of tourists has significant impacts on Albania economy. These impacts can be counted as both of negative and positive effects. The most important effect of tourism on economy can be known as number of changes on supply and demand chain in the destination which is the host of tourists. Tourists demand or simply tourist consumption contributes to GDP, increasing the employment rate, making new source of revenue for local people, private and public sectors and destination's government and so on.
In this study, the diffusion of the tourists' arrivals is analysed using S-Shaped growth curve models such as Logistic and Gompertz models. This study examines the number of tourists arrived by land and sea during the period 2001-2018 in Albania using INSTAT data.
Results of descriptive analysis indicated that the data for each means of transport follow a S-shaped curve. The results of estimated models indicated that: Gompertz model fits best to the actual data and is the best model to predict the number of tourists arrived by land and also the number of tourists arrived by sea in Albania.
The findings of this study are particularly useful for new investors and developers as well as longer term planners and government departments.
In the future research, factors influencing the tourism demand can be studied.

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