

## CONTRIBUTION TO E-TOURISM DEMAND MODELLING

## DOPRINOS MODELIRANJU E-TURISTIČKE POTRAŽNJE

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### *Abstract*

The tourism sector has experienced several significant changes over the past decades due to the strong development of the information and communication technologies (ICT). The technological revolution experienced through the development of the Internet has changed dramatically the market conditions for tourism organizations. ICTs evolve rapidly providing new tools for tourism development and rerouting. As known, tourism is defined and characterized by the demand side, it is therefore important to detect and define the various factors that determine it. Tourism demand modeling and forecasting have been an issue under examination in many researches. A large number of econometrics studies used, both time series and econometric approaches to model and forecast tourism demand and its various determinants. As known, tourism demand can be defined as a set of goods and services that people acquire to accomplish their journeys, expressed in term of quantity. Among different factors that influence tourism demand income, prices, substitute prices, and other variable are mentioned as determining measures or explanatory variables that affect the quantity of goods or services purchased. On the other side of the tourism demand function, as the dependent variable, most commonly the number of tourists or the number of tourists overnights are investigated. The paper presents the authors endeavor to express a theoretical e – tourism demand model, as a mathematical function that indicates the presence of a relationship between the dependent variable, expressed by the number of tourists' overnight

### *Sažetak*

Zbog snažnog razvoja informacijskih i komunikacijskih tehnologija (ICT) turistički sektor je u posljednjih nekoliko desetljeća doživio nekoliko značajnih promjena. Tehnološka revolucija prouzročena razvojem interneta dramatično je promijenila tržišne uvjete poslovanja svih turističkih organizacija. ICT se brzo razvija, pružajući nove alate za preusmjeravanje i razvoj turizma. Kao što je poznato, turizam je determiniran i karakteriziran prvenstveno od strane potražnje, stoga je važno definirati i pronaći različite faktore koji ju određuju. Modeliranje i prognoziranje turističke potražnje tema je mnogih istraživanja. Veliki broj ekonometrijskih istraživanja koristi pristup analize vremenskih serija kao i ekonometrijski pristup za modeliranje i prognoziranje turističke potražnje i njezinih različitih odrednica. Kao što je poznato, turistička potražnja može se definirati kao skup dobara i usluga koje ljudi koriste za vrijeme svojeg putovanja, izražen u smislu kvalitete. Između različitih čimbenika koji utječu na turističku potražnju prihod, cijene, cijene supstituta i druge varijable spominju se kao mjere odrednice ili eksplanatorne varijable koje utječu na kvantitetu kupljenih dobara i usluga. S druge strane, u funkciji turističke potražnje kao zavisna varijabla najčešće se istražuje broj turista ili broj ostvarenih turističkih noćenja. Polazeći od snažnog utjecaja, kojega dramatični razvoj ICTa, ima na cjelokupni turistički sektor, ad prikazuje nastojanje autorica da izraze teorijski model e-turističke potražnje, kao matematičku funkciju koja izražava prisutnost veze između zavisne varijable, izražene brojem turističkih dolazaka i najčešće korištenih

stays and a number of commonly used explanatory variables. Due to the growing importance of the information and communication technology and its great influence on the tourism sector, the authors research the possibilities of adding some additional supplementary independent variables i.e. the number of internet users, the number of overnights stays that were booked online or the number of online reservations to stress and represent the significant role play by the information and communication technology in determining the e-tourism demand.

## INTRODUCTION

Information and communication technology is the most important innovation since the development of the railroad, the automobile, radio and television, which had an immeasurable impact on tourism. Tourism industry is one of the first industries which largely accepted and began to use information and communication technology. Tourism is characterized by the participation of a large number of subjects, which requires knowledge of a large amount of information, both on the supply and the demand side. Tourism demand is interested in information such as transportation routes availability, climatic and geographical characteristics of the space, as well as prices of accommodation and food services, while on supply side there is a need for knowledge of guests' preferences, needs and other trends on tourism market. The development and the usage of information and communication technology enable the development and increase of competitiveness of supply and demand. Given the important role of ICT in today's time, the question is: whether or not, and in which amount, the Internet contributes to the increase of tourism demand in Croatia? This paper presents the authors attempt to express an e-tourism demand model as a function that indicates the presence of a relationship between the dependent variable, expressed by some of the usually used measures of tourism demand and a number of commonly used explanatory variables. The authors include variables which indicate the development of information and communication tech-

eksplanatornih varijabli, ali i uključivanjem dodatne nezavisne varijable, primjerice broj internet korisnika, broj noćenja ostvarenih online bookingom ili broj online rezervacija da bi se istaknula i prikazala značajna uloga informacijske i komunikacijske tehnologije u određivanju e-turističke potražnje.

nology, to show the impact of the development on ICT on tourism activity in a specific destination. The structure of the paper reflects the main assumption. At the first, short introduction in information and communication technologies in tourism is given in the first section. The model's foundations are sketched in the second section. In the last part, Conclusions, the key conclusions from researching and writing the paper are summarized.

### 1. THE IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGIES ON TOURISM

Hotel industry has realized that information and telecommunication technology allows achieving their goals easier and faster. The implementation of ICT allows costs reducing in company while, at the same time, provide greater quality service and products. From the customer's point of view, the Internet enables fast access to information and services. For example, it allows online bookings of accommodation facilities, online ticket purchasing, etc.

Three major waves of technological development have established an information technology in hotel companies, and they are /1/:

1. Computer Reservation System (CRS) in the 70s
2. Global Distribution System in the 80s
3. Internet in the 90s of last century.

There are many benefits that arise from the use of ICT, especially in tourism. The basic characteristic of ICT in tourism is that it offers

the possibility of storing, managing and presenting a great number of data which enable the analysis of activities in tourism industry. Consequently, it can be concluded that Internet (as a part of information and communication technology) provides a wide range of activities in the field of tourism, i.e. gathering information on accommodation and food at the destination, booking services, online shopping, etc. Cooperation between tourism and ICT, assuming optimal technology usage, leads to shorter inquiries time response, faster communication with guests and efficient exchange of information between the various participants on tourism market.

### 1.1. THE BENEFITS OF INTERNET USAGE

According to Buhalis and Jun "the emergence and mainstreaming of the Internet empowered the global networking of computers, enabling individuals and organizations to access a plethora of multimedia information and knowledge sources, regardless of their location or ownership, often free of charge." /2/ Therefore, the application of information and communication technology, and particularly Internet, leads to many benefits both for the tourism supply and demand side. These benefits have begun to materialize in the last two decades, but they will increase significantly as ICT expands. Major benefits to organizations are/3/:

- Expands a company's marketplace to national and international markets. With minimal capital outlay, a company can quickly locate more customers, the best suppliers, and the most suitable business partners worldwide.
- Enables companies to procure material and services from other companies, rapidly and at less cost.
- Shortens or even eliminates marketing distribution channels, making products cheaper and vendors' profits higher.
- Decreases the cost of creating, processing, distributing, storing, and retrieving information by digitizing the process.

- Lowers telecommunications costs because the Internet is much cheaper than value-added networks (VANs).
- Helps small businesses compete against large companies.
- Enables a very specialized niche market.

Among the major benefits to customers can be mentioned:

- Frequently provides less expensive products and services by allowing consumers to conduct quick online comparisons.
- Gives consumers more choices than they could easily locate otherwise.
- Enables customers to shop or make other transactions 24 hours a day, from almost any location.
- Delivers relevant and detailed information in seconds.
- Makes it possible for people to work and study at home.
- Makes possible electronic auctions.
- Allows consumers to interact in electronic communities and to exchange ideas and compare experiences.

Unfortunately, information and communication technology has raised a multitude of negative issues also (i.e. surveillance of employees' e-mail files and documents, computers crime, impact on quality of life...).

### 1.2. THE NEW CONCEPT OF TOURISM – THE e – TOURISM

Before proceeding to the discussion, it is necessary to define the concept of tourism, especially its new form; e – tourism.

According to the World Tourism Organization "tourism comprises the activities of persons travelling to and staying in places outside their usual environment, for leisure, business and other purposes." /4/

It can be also defined as "the processes, activities, and outcomes arising from the relationships and the interactions among tourists, tourism suppliers, host governments, host communities, and surrounding environments that are involved in the attracting and hosting of visitors." /5/

Any attempt to define tourism, and describe it fully must consider the various groups that participate in it and are also affected by it.

"By definition "e-tourism is the use of new technologies for activities such as on line booking (hotels, tickets, etc.), portals of touristic destinations that contain information valuable for travelers, etc. Differences between e-tourism and classical tourism are in the large scale savings on traditional activities, such as call centers and information centers. In other words, e-tourism offers the potential to make information and booking facilities available to large numbers of consumers at relatively low cost." /6/

According to the foregoing, the e – tourism demand can be defined as the demand for tourism services whose need are going to be satisfied using information and communication technology achievements, particularly the Internet. For example, e – demand is an issue in the case of reservation or online purchase of tourism excursions. To present the impact of ICT development in this paper the model of e – tourism demand will be expressed, in such a way that the basic model of tourism demand will be extended with indicators of information and communication development.

## 2. MODELLING E-TOURISM DEMAND

This section of the paper deals with the modeling of tourism demand in Croatia. For this purpose, a mathematical model that expresses the relationship between dependent variable (the number of tourism overnight stays in Croats accommodation facilities) and several independent variable has been established. As independent variables in model were involved some indicators of the use of ICT, also.

As an introduction to demand modeling

basics on measurements and determinants of tourism demand are specified below.

### 2.1. MEASURES AND DETERMINANTS OF TOURISM DEMAND

Along with the exponential growth in tourism demand in the world over last several decades there is a growing interest in tourism research. The characteristics of tourism activities lead to the conclusion that tourism demand in a particular country can be explained with a number of factors. Tourism demand is usually measured in terms of tourist's arrivals from an origin country to a destination country, in terms of tourist's overnight stays, or in terms of tourist's expenditure by visitors from the origin country in the destination country. When explaining international tourism demand there can be used different measures also, for example: tourism visits which are usually recorded by frontier counts, registration at accommodation establishment... It's possible to enumerate different determinants which has great influence on tourist to visit some destination. Both people's preferences and their expenditure budgets are the key determinants of tourism demand. According to Frechtling these variables, also called independent variables, can be explained as push, pull and resistance factors. "Push factors, sometimes called emissive factors, are those characteristics of a population in an origin market that encourage travel away from home. Pull factors are those which attract visitors to a certain destination. Resistance factors comprise those variables that constrain travel between an origin and a destination." /7/

Independent variables which can be used in tourism demand forecasting are listed in table below.

Table 1. Potential independent variables in models to forecast tourism demand

1. push factors (of origin)
1.1. population size
1.2. GDP and income trends
1.3. income distribution
1.4. education distribution
1.5. age distribution
...
2. pull factors (of destination)
2.1. friends/relatives
2.2. destination marketing programs
2.3. distribution channels
2.4. commercial ties
2.5. special events
...
3. resistance factors
3.1. prices
3.2. supply capacities
3.2. distance
3.3. competitors actions
3.4. arrival/departure taxes
3.5. physical barriers
...

Source: Adjusted by authors (according to Frechtling, 2001)

After explaining the theoretical starting points of tourism demand modeling, measures and determinants, the issue of e – tourism demand model can be explained.

## 2.2. DATA AND METHODOLOGY

According to data of the Croatian Bureau of Statistics guests who are visiting the Republic of Croatia most frequently are Germans, Italian and Austrians. The same guests realize the largest number of overnight stays in Croatian accommodation facilities. The authors wanted to investigate which factors and in which size affects tourism demand from Germany, Austria and Italy, and in which way information and communication technology affects on tourism demand from those countries? In empirical investigation it was difficult to find exact data about the determinants of tourism

demand due to the lack of data availability, and therefore Italy and Austria were excluded from this investigation.

The data used were obtained from Croatian Bureau of Statistics (which annually publishes the Croatian Statistics Yearbook), Eurostat and World Bank Database. The data were analyzed from year 1995 to 2010.

The number of overnight stays is used as the dependent variable. Independent variables in this study were selected as follows: GDP (as a measure for analyzing income), inflation (as a representatives of the price determinant, the representative of cost of living at the destination), international tourism expenditure (as indicator of expenditure abroad) and finally ICT service exports (% of service export and amount in US\$) and number of internet users as representatives of information and communication development.

For a better understanding of the selected variables and the model presented, the table below describes the variables briefly. The major part of the descriptions was taken from the

databases from which the data on variables were collected.

Table 2. Variables chosen for e – tourism demand modeling

VARIABLE	EXPLANATION
Overnights	<p>A night spent (or overnight stay) is each night a guest / tourist (resident or non-resident) actually spends (sleeps or stays) in a tourist accommodation establishment or non-rented accommodation. Overnight stays are calculated by country of residence of the guest and by year.</p> <p>Data were collected to represent Germans tourism demand in Croatia, and the study will try to determine which of the chosen independent variables affect this dependent variable.</p>
GDP PPP (current international \$)	<p>GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Purchase power parity GDP is gross domestic product converted to international dollars using purchasing power parity rates.</p> <p>Data were collected in current international dollars, as a measure for analyzing income in Germany.</p>
Inflation, consumer prices (annual %)	<p>Inflation reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.</p> <p>Data were included in the model to represent the price; they are component of cost of living in destination (Croatia).</p>
International tourism, expenditures (current US\$)	<p>International tourism expenditures are expenditures of international outbound visitors in other countries, including payments to foreign carriers for international transport. These expenditures may include those by residents traveling abroad as same-day visitors, except in cases where these are important enough to justify separate classification. Data are in current U.S. dollars.</p> <p>Collected data indicate which amount (of earned income) German tourists are willing to spend abroad.</p>
ICT service exports (BoP, current US\$)	<p>Information and communication technology service exports include computer and communications services (communications) and information services (computer data and news-related service transactions).</p> <p>Collected data indicate the progress of Germany in terms of information</p>

	and communication technologies, and they are indicator of ICT development (it was assumed that greater development and usage of information and communication technologies mean higher export of such services).
ICT service exports (% of service exports, BoP)	Information and communication technology service exports include computer and communications services (communications services) and information services (computer data and news-related service transactions).  Collected data indicate the progress of Germany in terms of information and communication technologies, but also which is role of ICT services export in total export of services.
Internet users	Internet users are people with access to the worldwide network.  The number of Internet users in Germany is the variable chosen to represent concrete role played by ICT in tourism demand (achieved volume of tourists overnight) in Croatia.

Source: Authors according to World Development Indicators, World Bank

Data on the number of German tourists overnight were shown graphically, and it was observed that presented function is not linear (see Fig. 1.) The time series shown in Figure 1.

indicates the presence of an upward trend in the total number of tourism arrivals in Croatia for the observed period.

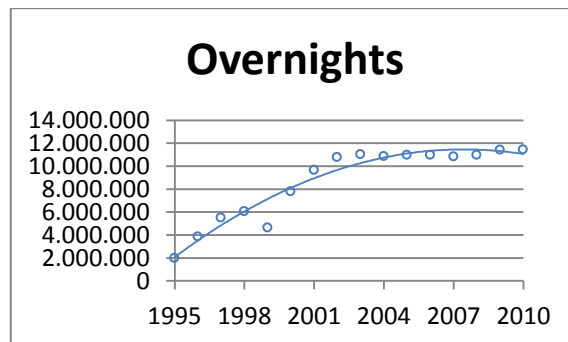


Figure 1. Number of German tourists overnight stays in Croatian accommodation facilities

In practice, the two most common equations for tourism demand assume either linear relationship equation, or an exponential relationship. In this case, is not possible to use linear regression model in tourism demand modeling. The exponential functional form, also known as Cobb – Douglas function, was considered in this analysis. The exponential function is often used in analysis of economic phenomena.

In general, an exponential function may be written as follows:

$$Y_i = \beta_0 X_{i1}^{\beta_1} X_{i2}^{\beta_2} \dots X_{ij}^{\beta_j} \dots X_{iK}^{\beta_K} \varepsilon_i \quad i=1,2,3,\dots,n \quad (1)$$

This function can be linearized by logarithmic transformation.

### 2.3. THE E – TOURISM DEMAND MODEL AND IT'S FUNCTIONAL FORM

Considering the dependent and independent variables in this case, the model to be estimated is as follows:

$$D_{CRO} = \beta_0 \cdot GDP_{GER}^{\beta_1} \cdot INF_{CRO}^{\beta_2} \cdot INT\_EXPEND_{GER}^{\beta_3} \cdot ICT\_EXP\_ABS_{GER}^{\beta_4} \cdot ICT\_EXP\_ \%_{GER}^{\beta_5} \cdot INT\_USER_{GER}^{\beta_6} \cdot \varepsilon \quad (2)$$

where:

$D_{CRO}$  = number of Germans overnight stays in Croatian accommodation facilities

$GDP_{GER}$  = GDP (PPP) in current international \$ in Germany

$INF_{CRO}$  = inflation in Croatia (annual %)

$INT\_EXPEND_{GER}$  = international tourism expenditures of Germans tourists in current US\$

$ICT\_EXP\_ABS_{GER}$  = absolute value of ICT service export of Germany

$ICT\_EXP\_ \%_{GER}$  = ICT service exports as % of service exports of Germany

$INT\_USER_{GER}$  = number of Internet users in Germany

After the logarithmic transformation of the tourism demand function, the following linear function was obtained:

$$\ln D_{CRO} = \ln \beta_0 + \beta_1 \ln GDP_{GER} + \beta_2 \ln INF_{CRO} + \beta_3 \ln INT\_EXPEND_{GER} + \beta_4 \ln ICT\_EXP\_ABS_{GER} + \beta_5 \ln ICT\_EXP\_ \%_{GER} + \beta_6 \ln INT\_USER_{GER}$$

Thus log linearized model can be estimated using least squares method, provided that the data has no negative observations (as it is case with data in this study). Linearized form of the model of tourism demand (actually, number of overnight stays) from the perspective of statistical analysis is equivalent to a multiple regression model.

The following linear function is estimated:

$$\ln D_{CRO} = 187,5773 + 6,0722 \ln GDP_{GER} - 0,1655 \ln INF_{CRO} + 3,1804 \ln INT\_EXPEND_{GER} + 3,4452 \ln ICT\_EXP\_ABS_{GER} + 3,2598 \ln ICT\_EXP\_ \%_{GER} + 0,4836 \ln INT\_USER_{GER} \quad (4)$$

$$(2,469937)(-2,2835365)(2,895762)$$

$$(2,9134681) (2,11274)(3,7024761)^1$$

In nonlinear form it can be written as following:

$$D_{CRO} = 187,5773 \cdot GDP_{GER}^{6,0722} \cdot INF_{CRO}^{-0,1655} \cdot INT\_EXP_{GER}^{3,1804} \cdot ICT\_EXP\_ABS_{GER}^{3,4452} \cdot ICT\_EXP\_ \%_{GER}^{3,2598} \cdot INT\_USER_{GER}^{0,4836}$$

After estimating the parameters, assumptions of the classical linear regression model were tested. There is no occurrence of multicollinearity, autocorrelation and heteroscedasticity.

The signs of the estimated of function parameters are as expected; it is assumed that in the case of GDP (PPP) in current international \$, international tourism expenditures, absolute value of ICT service export, % of service exports, number of Internet users growth (sign +) and lower annual inflation (sign -) results in larger number of German tourists overnight stays in Croatians accommodation facilities.

After estimating the regression (linearized form) it is necessary to test its significance. Primary, a group test of significance of the regression was conducted. The hypotheses of the significance of the explanatory variables are given as follow:

$$H_0 \dots \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0 \\ H_1 \dots \exists \beta_j \neq 0, j = 1, 2, \dots, 6 \quad (6)$$

Null hypothesis contains the claim that there is no significance explanatory variable in the model. Opposite, alternative hypothesis states that there is at least one of the six variables that is significance in model. Given that the empirical F - value is greater than theoretical ( $F = 34,684, F_{0,05; 6,9} = 3,37; F > F_{0,05; 6,9}$ ) the null hypothesis is rejected; assumption that the explanatory variables in the model are not significance is not accepted.

The significance parameters test was two tailed t - test. The null - hypothesis states that each of parameters equals to zero; it assumes that  $X_j$

<sup>1</sup> Numbers in parentheses are the t - values of the estimated parameters, and will be needed in further evaluation of the model.



variable in model is redundant. Alternative hypothesis states the opposite.

Comparing the empirical  $t$  – values with the theoretical value it can be noticed that five of six variables are significance in model because their absolute empirical  $t$  – values are greater than theoretical ( $t_{0,025} = 2,262$ ). Those variables are: GDP (PPP) in current international \$ in Germany, inflation in Croatia (annual %), international tourism expenditures of Germans tourists in current US\$, absolute value of ICT service export of Germany, number of Internet users in Germany. Variable “% of service exports of Germany” is insignificant in our model because the empirical  $t$  – value is smaller than a theoretical one.

The same results were obtained on the basis of  $p$  – value (same variables have  $p$  – values less than the level of significance of 5%, which indicates that they are indeed significance in the model, while in the case of variable “% of service exports of Germany”  $p$  – value is greater than the level of significance and it can be said it’s redundant in the model).

To what extent estimated function reflects the actual data? The answer to this question is given by the coefficient of determination, which in this case is  $R^2 = 0,90854$  (which means that 90,85% of variations in the dependent variable is caused by variations of independent variables). Since adding new explanatory variables to model increases coefficient of determination (even if variables are not significant in the model) for the evaluation of the model adjusted coefficient of determination is used  $\bar{R}^2 = 0,7709$ , which indicates that model is representative (selected explanatory variables are explained 77,09% variations in dependent variable). According to theory, there are several reasons for high coefficient of determination. Testing the hypotheses we excluded the possibility of insignificant explanatory variable and presence of multicollinearity<sup>2</sup>, and it is assumed that the coefficient is high due to small number of observation in sample (sixteen years).

After testing the hypotheses about the significance of the model and the variables which

were chosen for modeling, an overall conclusion can be given. Despite the obstacles encountered during the research (especially the problem with data collection) even five of six variables proved to be significant in explaining the variation of the number of German tourists overnight stays in Croatia. Those variables are: GDP (PPP) in current international \$ in Germany, inflation in Croatia (annual %), international tourism expenditures of Germans tourists in current US\$, absolute value of ICT service export of Germany, number of Internet users in Germany. This paper has shown that development of ICT, especially the number of Internet user in observed period, has great role in this model.

## CONCLUSIONS

In this paper author wanted to show the effects of selected independent variables on dependent variable, using an exponential model (concretely, Cobb Douglas model). Research showed that the explanatory variables which are significant are GDP (PPP) in current international \$ in Germany, inflation in Croatia (annual %), international tourism expenditures of Germans tourists in current US\$, absolute value of ICT service export of Germany, number of Internet users in Germany. This paper confirms the assumption that the usage of Internet (as an important part of information and communication technology) plays an important role in tourism demand estimating. The results of estimating e – tourism demand model, using exponential functional form, show that Internet and technological development have encouraged the increasing demand for tourism.

Also, it can be concluded that a limiting factor in this study was data (un)availability. This has been a considerable limitation, given that either no data on independent variable was available or available data were sometimes of questionable quality.

In domestic scientific community there is still small number of researches on this topic, so this study (irrespective of difficulties which were encountered during research) is certainly a good foundation and starting point for other similar research. The accelerating and syner-

<sup>2</sup>High coefficient of linear correlation between the explanatory variables indicates the existence of multicollinearity, but only if it is a model with two variables.

gistic interaction between technology and tourism in recent times has brought changes in the tourism industry.

#### Notes

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