

Tourism demand modelling and forecasting: an overview

Modelagem e previsão da demanda turística: Uma visão geral

Célia M. Q. Ramos

Professora da Escola Superior de Gestão, Hotelaria e Turismo da Universidade do Algarve –
UAlg, Faro, Portugal
E-mail: cmramos@ualg.pt

Paulo M. M. Rodrigues

Professor do Centro de Estudos e Formação Avançada em Gestão e Economia da
Universidade de Évora – UE, Évora, Portugal E-mail: pmrodrigues@bportugal.pt

Artigo recebido em: 03-07-2014
Artigo aprovado em: 30-12-2014

ABSTRACT

Research about tourism demand in countries or regions is indispensable since tourist demand and economic growth are positively related. Analyses of tourism demand need to start by identifying factors and determinants that explain preference for particular destinations. It is also necessary to identify the most appropriate functional relationship between independent variables in order to define the most representative models for study purposes, which include investigating what influences the demand for a specific tourist destinations while allowing for forecasts of its development. This paper is a review of existing literature and seeks to contribute to a better understanding of the problems associated with the process of modelling tourism demand and forecasting for a given destination.

Keywords: Econometrics Models. Forecasting Accuracy. Temporal Series. Tourism Demand Determinants. Tourism Demand Modelling.

RESUMO

A investigação da demanda turística de um país ou região é indispensável uma vez que o crescimento econômico e a demanda turística estão relacionados de forma positiva. Na análise da demanda turística, que deve ser iniciada pela identificação dos fatores e determinantes que explicam a preferência por um determinado destino, é necessário identificar a relação funcional, mais adequada, entre as variáveis independentes de forma a definir o modelo, mais representativo, para investigar sobre o que condiciona ou motiva a demanda por um determinado destino turístico enquanto possibilita a previsão da sua evolução. Deste modo, o presente artigo trata-se de uma análise de literatura existente e pretende contribuir para uma melhor compreensão da problemática associada ao processo de modelação e de previsão da demanda turística por um determinado destino.

Palavras-chave: Determinantes da Demanda Turística. Modelação da Demanda Turística. Modelos Econométricos. Precisão da Previsão. Séries Temporais.

1. INTRODUCTION

The demand for goods is the basis for the establishment of any business. According to Archer (1994, p. 105) "in economic terms, the demand can be defined as the amount of products or services that people are made use and have capacity to buy during a certain period of time". In tourism, suppliers are interested in the demand for their tourism goods. Their success depends on demand and its management, given the risk of over or under estimating demand (Buhalis & Costa, 2006). Overall, according to Ioannides and Debbage (1998), there is a positive correlation between the economic growth of a country and the level of tourism demand.

In economic terms, the importance of the tourism sector is characterized by the demand side and not by the production of goods and services. Along these lines, it is relevant to present a definition of tourism demand. Uysal (1998, p. 84) suggests that "tourism demand represents the quantity of materials and services that tourists need at any given time". It is, therefore, worthwhile contributing to a better understanding of the problems associated with the process of modelling tourism demand and forecasting trends for a given destination.

In this context, this paper seeks to highlight all aspects to be taken into account in the process of modelling tourism demand and estimation. This needs to identify the determinants and measures that characterize this type of demand, considering these in modelling and forecasting to measure the accuracy of predicted values estimated by each model.

This paper is presented in five sections. The second and third section provides a conceptual framework on the factors that motivate tourism demand, as well as the determinants and measures that explain tourism demand for destinations. Section four reviews models that have been used in the literature to model and forecast tourism demand for destinations. Section five presents methods that have been used to evaluate the accuracy of forecasted results. Finally, section six offers conclusions.

2. TOURISM DEMAND FACTORS

The motivation that causes tourists to visit particular destinations can come from a variety of causes: holidays, business trips, conferences and family visits, among others. The

World Tourism Organization (UNWTO) defines tourists as the visitors¹ who stay at least one night in public or private accommodation in the places they visit. Analyses of tourism demand and the factors that affect it have both been of interest to researchers over the past several decades, at the national or international levels.

At the national level, one of the authors who focus on factors that motivate tourism demand is Cunha (2003, pp. 141-149), who states that there are four kinds of factors that influence demand: socio-economic, technical, random and psycho-sociological. Socioeconomic factor include several components such as income (i.e. the amount of money that consumers have to pay for the costs of their trips), prices, demographics, urbanisation and duration of leisure periods. Technical factor are mainly characterised by two components: technological progress and new information and communication technologies (ICT). Random factors are composed of unpredictable or occasional occurrences related with phenomena, such as natural disasters. Psychosociological factors refer to different aspects, including social, personal and cultural.

At the international level, according to Uysal (1998, p. 87), there are three main factors that influence tourism demand: economic, psychosociological and exogenous. Economics factors include several components such as disposable income, per capita gross domestic product, private consumption, consumer price index, tourism prices, transportation cost, cost of living in destination countries, exchange rates, relative prices between competing destinations, promotion expenses, effectiveness of marketing and physical distances, among others. Psychosociological factors refer to demographics, motivations, destination image, leisure time, travel time, past experience, physical capacity and affinities, among others. Exogenous factors consider components related to social and political environments, recession, technological progress, accessibility, natural disasters, war and terrorism, social and cultural attractions and mega events.

According to Uysal (1998) and Cunha (2003), a relationship exists between tourism demand and variations in income or in the cost of living. These researchers predict that tourism demand is inversely influenced by variations in prices and conditioned by rates of departure or the propensity to travel. Demand is also related directly to the percentage of the total population living in urban areas and to social progress, such as the duration of leisure periods and increase of free time due to technological progress.

¹ For the UNWTO, a visitors are any person who travels to a place that is outside of their usual environment for a period less than 12 consecutive months, and whose main reason for visiting is other than getting money from paid activities.

Technological progress has mainly had a great influence through transportation and ICT, which have greatly increased tourism demand. The evolution of ICT in tourism has improved services, lowered costs and facilitated the decision-making process in the provision of trips by facilitating reservations, payments and ways to obtain information about all aspects of travel (Ramos, Rodrigues, & Perna, 2009).

All the factors mentioned above play important roles in determining tourism demand for destinations. Furthermore, Crouch (1994b) notes that, according to economic theory, factors relating to income and prices play a greater role in determining a destination's tourism demand. This author adds that noneconomic factors are also important, even though these are a set of influences affecting tourism demand that, on their own, are difficult to detect. However, when included in the variable set, these are as important as price or income. This set of influences also affect the phenomena of tourism demand, and they can be defined as a set of invisible forces, such as tastes and preferences, that are difficult to quantify but are as important as economic variables.

After identifying the factors that influence the tourism demand, it is necessary to examine variables that can represent causes of tourists' behaviour. These variables are designated by determinants and measures of tourism demand, which enable an evaluation of this industry - with the objective of defining models and making forecasts for this sector.

3. DETERMINANTS AND MEASURES OF TOURISM DEMAND

For tourists, the choice of places to visit can be based on a variety of reasons, but, overall, what motivates their journeys is to enjoy a holiday. In order to enjoy their holiday in a more satisfactory way, tourists need to find destinations that satisfy their desires. In this context, it is important to detect local characteristics that influence visitors' preferences at tourist destinations, through the identification of variables that possibly quantify, and are appropriate as, explanations and measures of tourism demand.

3.1. Explained or Dependent Variables

Analyses of tourism demand can be quite important tools to detect tourism's contributions to the economic well-being of particular places or countries. They help distribute and allocate tourism resources in appropriate ways (Uysal, 1998).

The definition of tourism demand can be worded and measured in different ways. For instance, it can be stated in terms of the number of tourists who depart or visit countries or regions (Pearce, 1995), tourist' expenditures (Uysal, 1998; Witt & Witt, 1995) or the number of nights spent by tourists (Pearce, 1995; Uysal, 1998; Witt and Witt, 1995). It can also be defined as tourism revenues (Uysal, 1998; Witt & Witt, 1995), the number of visitors who arrive at particular destinations (Uysal, 1998) and the number of passengers using particular types of transport (Pearce, 1995). After defining some of the possible dependent variables, it is also quite important to identify variables that contribute to, and determine, tourism demand for particular locations, in order to explain the phenomena behind tourists' preferences for these tourist destinations.

3.2. Explanatory or Independent Variables

The nature of tourist activities suggests a set of variables that may help to explain tourism demand for particular countries. For Song and Witt (2000), the quantity of tourism demand can be analysed by the tourist prices in destinations, which include the cost of living, cost of travelling to destinations, prices for alternative tourist destinations, salaries of potential tourists, advertising costs and tastes and preferences of potential tourists, among other factors. Li, Song and Witt (2005) examined an extensive number of studies, published from 2000 to 2004, concerning analyses of tourism demand with a focus on econometric models. They concluded that the explanatory variables that most influenced tourism demand are income, relative and substitute prices, cost of travelling, exchange rates trend and dummy variables in analysing events. Crouch (1994a, 1994b), after an analysis of 85 studies, concluded that the most decisive variables in tourism demand at an international level are income, relative and substitute prices, cost of travelling, exchange rates, marketing and trend and dummy variables used to analyse events. Uysal (1998), in his study, argued that the most relevant variables in analyses of tourism demand are income, prices (i.e. the cost of travelling to the destination and of living in the destination), exchange rates, volume of business, marketing variables, characteristics of suppliers and use of dummy variables.

After reviewing a number of studies, we, in turn, listed the determinants that are generally referenced in the literature: population, income, prices (cost of travelling to destinations and of living in destinations), substitute prices, exchange rates and marketing variables. Some relevant researches are Crouch (1994b), Daniel and Rodrigues (2005), Li,

Song and Witt (2005), Ramos and Rodrigues (2013), Song, Witt & Li (2009), Uysal (1998) and Witt and Witt (1995).

In addition to these frequently used determinants, there are others that are also important to incorporate into the characteristics currently being studied, where everything revolves around ICT.

The tourism sector is extremely sensitive to technological environments and progress (Ramos, Rodrigues, & Perna, 2009). Therefore, in addition to the most frequently used variables mentioned above, it is also relevant to analyse variables directly related to ICT (Fleischer & Felsenstein, 2004; Mavri & Angelis, 2009, Ramos & Rodrigues, 2013).

All the variables that measure and explain tourism demand are relevant because they help to identify reasons that may be behind the choice of countries or regions as tourist destinations. After distinguishing these variables, it is also important to find the relationships between them, because these define the behaviour of tourism demand and they can be expressed in terms of equations or functions. These functions can help researchers and professionals examine the demand for tourism destinations and, combined with forecasting models, can detect what can be expected in the future, in the tourism industry.

4. TOURISM DEMAND FORECASTING MODELS

Demand forecast is, according to Archer (1994, p. 105), "the art of predicting the level of demand that can occur in the future or in a given period of time", an essential element in decision-making process for managers of the tourism sector. The importance of making predictions is increasing, Berenson and Levine (1999) argue that predicting future events is extremely relevant since the resulting projections can be incorporated into decision-making processes. This importance becomes even more evident when researchers take into consideration that economic conditions and business patterns change over time, so agents must find ways to detect and prepare for the effects that these changes may have on businesses and economies.

Demand forecast in tourism industry can be a difficult task (Macedo, 1997) for several reasons, such as the instability of tourism demand, lack of data, amplitude of the set of variables related to tourists' intentions and variety of ways in which tourism develops.

Tourism demand forecast currently uses a wide variety of forecasting methods, which run from the most rudimentary approaches to the more complex. However, most forecasting methods are related to how data to be forecast have different characteristics, for example,

periodicity and forecasting horizons. These characteristics determine the forecasting methods to be used.

Forecasting methods can be classified into two categories: quantitative and qualitative; see Archer (1994), Berenson and Levine (1999), Daniel (2000), Macedo (1997), Matos (2000), among others. According to Witt and Witt (1995, p. 448), studies that use qualitative forecasting methods are centred mainly on Delphi technique and development of scenarios.

Quantitative methods are further divided into two sub-categories: non-causal² and causal models. Non-causal models or time series models have as their main objective to identify the standard behaviour of a time series through historical data and to extrapolate this behaviour into the future. Causal models, on the other hand, have the main objective of identifying how dependent and independent variables are related, in general terms, through regression analyses and predictions.

4.1. Time Series Models (Non Causal Models)

A time series can be defined as a set of observations for the same variable, such as the number of tourists departing or visiting countries or regions or the number of passengers who use a particular type of transport, at different points in time or for different periods of time (Chaves, Maciel, Guimarães, & Ribeiro, 2000). Analysis of time series is a procedure based on the decomposition of time-related components.

In classic models, each time series is separated into basic components of variations, which are analysed separately and then finally recombined in order to describe changes observed in the series (Stevenson, 1986). This type of model has two variants: one called "multiplicative", in which the time series results from the multiplication of individual components and the other "additive", in which the time series is the result of the addition of these components (Stevenson, 1986).

Time series integrate some of the following components (Chaves, Maciel, Guimarães, & Ribeiro, 2000, p. 299):

- a) Time trends component (*T*), used to detect the growth or decline of series over time.
- b) Cyclical component (*C*), defined by trends – appearing as waves' average amplitude variations - and associated with periodic changes, but with relatively irregular periods of replication.

² Non-causal models are based on the assumption that a series of data has an underlying pattern of behaviour or a combination of patterns that repeat over time.

- c) Seasonal component (*S*), data changes with particular patterns that repeat themselves regularly.
- d) Irregular component (*I*), after the removal of other components, used to measure the variability of time series.

Analyses or studies of time series are increasingly important because they allow researchers to describe series in terms of their behaviour, to explain variations observed in other series, to produce forecasts and to create some controls. Time series forecasting can be defined as "the projection of future values of a variable based entirely on the values observed in the past and present by variable" (Bereson & Levine, 1999, p. 915).

The general methodology for time series analysis can be structured as follows:

1. Initial selection of methods of analysis/forecast, should be based on analyst's intuition about patterns in available data³.
2. Organization of observations for statistical analysis, in which sets of observations are divided into two groups, one for initialisation and the other for evaluation of forecast quality.
3. Adjustment, in which techniques of analysis/forecast need to be used to obtain adjusted values based on the start-up groups.
4. Evaluation of forecasts' accuracy, in which forecast errors must be determined and evaluated.
5. Decision-making, which may consist of applying techniques in their current form, modifying them or developing forecasts by using one or more alternative techniques.

In the selection of methods for time series analysis, researchers can use several different methods. These include the following: Naïve 1, Naïve 2, Simple Exponential Smoothing, Double Exponential Smoothing or Brown's Method, Triple Exponential Smoothing or Holt and Winters' Method, Trend Curve Analysis, Box-Jenkins or ARIMA (Autoregressive Integrated Moving Average), Transfer Function⁴ or Multivariate Models ARIMA, Decomposition Methods, Gompertz Growth Curves, Logistics Growth Curves⁵, Moving Averages, VAR (Vector Autoregressive), VECM (Vector Error Correction Model) and VARMA (Vector Autoregressive Moving Average); see, for instance, Daniel (2000), Macedo (1997) and Matos (2000).

³ One of the elements used in this intuitive process must be a detailed graphical analysis of the data.

⁴ Transfer function combines causal models with non-causal ones, based on the ARIMA models (i.e. Box-Jenkins models).

⁵ The author refers to this model but adds that it has not been used for tourism demand forecasting.

In time series analyses related to tourism activities, seasonality and stationarity are the two main characteristics that need to be taken into account when modelling series. Seasonality can be analysed through graphical representations. Non-stationary can be analysed either through graphical representations or by inspecting correlograms, but it can also be formally tested by applying unit roots tests; see, for instance, Dickey-Fuller (1979), Elliott, Rothenberg and Stock (1996), Hyleberg, Engle, Granger and Yoo (1990) and Rodrigues and Taylor (2011).

Models considered in time series analyses can be used to explain the relationships between the measures of tourism demand and their explanatory variables or to forecast future values. These models use the data to find mathematical expressions that define historical behaviour in order to forecast future values. Nevertheless, there are other models – also relevant - not about historical behaviour but instead about the possibility of existing relationships between the variables, measuring and explaining tourism demand. These are designated as causal models.

4.2. Econometric Models (Causal Models)

Causal models, also known as econometric models, assume that the dependent variable can be explained by the behaviour of one or more other variables. The estimation of these models is based on historical data, usually time series or panel data⁶. These models offer a great advantage over pure time series models: their ability to analyse causal relationships between variables that measure tourism demand and the factors that influence this (see Song & Li, 2008).

Analyses of tourism demand using causal methods follow an appropriate methodology to estimate models and to forecast future values, which can be summarised as the following steps (Witt & Witt, 1992, p. 14):

1. Select variables that influence tourism demand and specify their relationships in a mathematical form.
2. Organise relevant data for the model.
3. Use data to estimate the quantitative effects of variables that influence the variable to be forecasted.
4. Run tests on the estimated model to analyse the quality of adjustments.

⁶ Panel data is organized on a sectorial and temporal basis, for example, annual presentations of the population of various countries from 1980 to 2005.

5. If tests show that the model is satisfactory, then use it to make forecasts.

Analyses of tourism demand with causal models can use several forecasting methods. These include the AIDS (Almost Ideal Demand System), Cointegration, Correlation Models, ECM (Error Correction Model), Indicator Models of Anticipation, LAIDS (Linear Almost Ideal Demand System), Multiple Equation Regression, Panel Data, Simultaneous Equations system, Single Equation Regression, Spatial Models⁷, TVP (Time Varying Parameter), Univariate Autoregression and VAR (Vector Autoregressive), see, for instance, Daniel (2000), Li, Song and Witt (2005), Macedo (1997), Matos (2000), Ramos and Rodrigues (2013), Song and Witt (2000), Song, Witt and Li (2009).

In their analysis of several studies - published between 2000 to 2004 – on tourism demand with a focus on econometric models, Li, Song and Witt (2005) found that ECM, TVP, VAR, AIDS, LAIDS and advanced time series models of tourism demand were frequently used. It needs to be noted that advanced time series models (Li, Song, & Witt, 2005), which combine the methodology used in econometric models (causal) and time series models (non-causal), include the BSM (Basic Structural Model), the AR(I)MAX (Autoregressive Integrated Moving Average causal-effect Model) and the ARIMA (Autoregressive Integrated Moving Average Model).

Causal models also have the main objective of defining models and making predictions just as non-causal models do. However, the former have advantages that allow researchers to identify and define how dependent and independent variables are related. In non-causal models that consider historical data to define models of the standard behaviour of time series and extrapolate this behaviour into the future, for example, it is possible to make predictions about the number of nights spent by tourists in specific hotels. This is done by taking into consideration historical data on the number of nights spent by tourists in the same hotels.

Causal model's main advantage is their ability to measure tourism demand, analyse data and investigate economic relationships that might explain what motivates and influences tourist's choice of particular destinations. These models can take into consideration various environmental factors, including technical, social and socio-economic aspects, among others.

In this context, causal models - since they allow the inclusion of several variables that characterize the different factors mentioned and permit an analysis of relationships between

⁷ Matos (2000) indicates that spatial models are gravitational models and can also be classified as multiple regression models, because they may consider more than one independent variable.

variables - appear to be more appropriate for modelling tourism demand. This industry is characterised by a combination of information from different sectors, such as restaurants, entertainment, transportation and hotels, among others. In addition, to analyse tourism behaviour, it is currently important to consider the influence of the cost of travelling to destinations, cost of living in destinations, exchange rates and level of income in the destinations, among others factors (see Song & Witt, 2000, Ramos & Rodrigues, 2013).

Moreover, within causal methods, panel data models are an extremely useful estimation method when researchers seek to model economic activities that can be dependent on several factors: social, economic and technical, among others. It is also possible to analyse, at the same time variable changes over time and between different units. These units can be economic or social units, such as sets of countries, regions, companies or consumers, among others (Ramos & Rodrigues, 2013).

Another factor to be taken into consideration is alternative models that make forecasts. In the 200 empirical studies published since 1990 analysed by Song, Witt, and Li (2009), non-causal models were used less than causal models, mainly when applied to annual data. In a ranking that compared forecasts, of the 16 studies positioned at the top, only 6 use non-causal models and, of these, 4 used quarterly data. According to these authors, the use of advanced econometric techniques need to be encouraged, especially in cases where the frequency is annual data. Econometric models, as evidenced by these authors, are Engle Granger ECM, Wickens-Breusch ECM, Johansen's Method, VAR Model, TVP Model, Panel Data Model and the AIDS Method. Of the seven advanced econometric models presented, only the Panel Data method can be used with data that includes, at the same time, sectional data and time series.

These econometric models relate variables that measure tourism demand with a set of variables that explain tourism demand or define the behaviour of variable in forecast (Matos, 2000). After the selection of a model, it is necessary to evaluate its forecast performance.

5. FORECAST EVALUATION

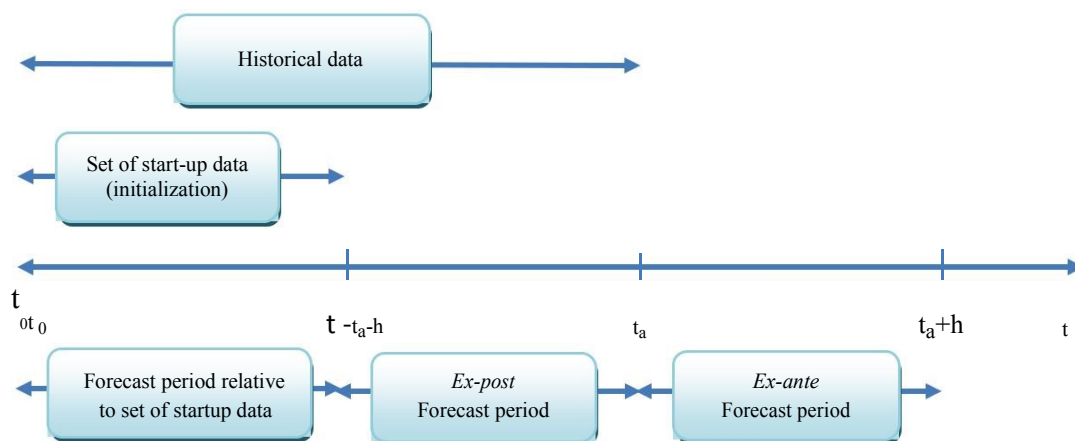
After the selection of a model, it is necessary to evaluate its forecast performance and compare this to the performance of other competing models. Forecast are extremely important in certain economic sectors (Wooldridge, 2006, p. 581), as they predict future values of time series. Data generated for particular entities over time can help answer economic questions relevant to timely planning of resources and activities (Stock and Watson, 2006).

This evaluation is performed by comparing real and forecasted values. A comparison of results allows researchers to analyse model' accuracy in calculating predicted values, by comparing these with real values. In this way, they can choose models that best suit the data by evaluating their results.

The process of evaluating models' accuracy is subdivided into different forecasting periods (see Figure 1). Assuming as a reference point t_a and considering $h>0$, it is possible to make forecasts for the period $]t_a, t_a+h]$. These are designated as *ex ante* forecasts. When researchers analyse how well forecasts produced by methods used for t_a adhere to observations for the period $]t_a-h, t_a]$, these forecasts are designated as *ex-post*.

The forecasting process comprises three periods (Ramos, 2012): estimation of the model, *ex-post* forecast and *ex ante* forecast (see Figure 1). The first period allows estimations produced by tourist demand models to be used in predictions. The second period uses estimated models generated in the first period and presents intended values for tourism demand, evaluating the results of predictions by calculating errors that occur between estimated and predicted values. By applying appropriate measures to these calculated errors, researchers can choose which models are more accurate in terms of their predicted values, taking into account the actual values. Finally, the third period, allows *ex ante* forecasts of tourism demand by considering the models estimated in the first period, according to which features produce the most accuracy results in predicted values.

Figure 1 – Forecasting Periods



Source: Chaves, Maciel, Guimarães and Ribeiro (2000, p. 311).

The *ex post* forecasts allow us to compare results from different forecast models and detect which models produce better results. *Ex ante* forecasts, however, are more relevant for

researchers and professionals as they can generate possible ideas about the future evolution of series (Song, Witt, & Li, 2009).

To measure the magnitude of forecast errors, it is necessary to identify and select appropriate measures to evaluate the performance of forecasting models, detecting the accuracy of predicted values as compared to real values. The accuracy of forecasting models depends on the distance between real and estimates values. The difference between these figures is the forecast error, i.e.,

$$(1)$$

Forecast accuracy can be evaluated by comparing MAPE (Mean Absolute Percentage Errors) as represented in (2), or the RMSPE (Root Mean Square Percentage Errors), as in (3).

$$\frac{\sum}{\quad} \quad (2)$$

and

$$\sqrt{\frac{\sum}{\quad}} \quad (3)$$

where m is the forecasting horizon.

In addition to these measures, performance or prediction accuracy can also be evaluated using the following measures: MAE (Mean Absolute Error), MSE (Mean Square Error), RMSE (Root Mean Square Error) and MSPE (Mean Square Percentage Error), represented by (4) to (7).

$$\frac{\sum}{\quad} \quad (4)$$

$$\frac{\sum}{\quad} \quad (5)$$

$$\sqrt{\frac{\sum}{\quad}} \quad (6)$$

$$\frac{\sum}{\quad} \quad (7)$$

The predominant statistic used to evaluate forecast performance is the MAPE, followed by RMSPE and RMSE (Li, Song, & Witt, 2005; Song, Witt, & Li, 2009), these methods may be used in pairs: MAPE and RMSPE or MAPE and RMSE.

Results about the accuracy of forecasting models are affected by several factors (Song, Witt, & Li, 2009): size of the forecast horizons, frequency of data, geographical regions, alternative models for making forecasts and so on. The forecast power of models is influenced by the size of their forecast horizons, that is, the longer the horizon, the smaller the accuracy

of forecasts. However, each model can present different performances for different horizons and vary according to the data used.

The frequency of data used can also affect the performance of forecast models. Monthly and quarterly data have different characteristics than annual data because the former present seasonality.

Geographical regions considered in forecast exercise or sources and destinations analysed can also affect the accuracy of forecasting model. However, discrepancies identified in the performance of forecasting models can be related to characteristics of the data used, for example, different policies for how to collect data and occurrences of events.

Prediction of values is an excellent tool to support economic decision-makers, as it allows them to implement timely plans while taking into consideration decreases or increases in demand. In the tourism sector, as in other economic sectors, predictions are also extremely important, as they allow those involved to plan the distribution of resources associated with tourism activities, according to predicted values.

6. CONCLUSION

The tourism sector is quite important because, according to some authors, there is a positive correlation between economic growth and the volume of tourism demand. Analysing tourism demand can help to maximise the development of countries' economies. Consequently, it is necessary to identify and analyse factors that play an important role in determining tourism demand for destinations.

Analyses of determinants that can explain tourism demand for particular destinations have attracted the interest of many researchers worldwide. Determinants considered relevant to analyses and measurement of tourism demand include economic, psychosociological and technical aspects, among others.

Tourism demand is measured by several variables, however, the main variables used in the studies surveyed have been the number of overnight stays and tourist arrivals. To explain reasons why tourists are attracted to specific destinations, certain determinants are among the most widely used, such as population, income, the cost of travelling to the destination, the cost living of the destination, exchange rates and marketing, among others. Although, ICT is one of the main engines that potentiates the development of tourist activities, there are few references to variables linked to ICT that help explain tourism demand.

Tourism demand functions are used to explain the relationships among variables that enable the measurement of this demand. Knowledge of these functions and their estimation are relevant to planning activities associated with the economic sector of tourism, for private or public organizations.

Analyses of tourism demand, considering the technological environment that surrounds demand, must take into account measures that allow for the analyses of ICT's impact on tourism. Researchers, as a result, cannot build extremely extensive temporal data series. Nonetheless, this range of factors needs to be included in models, and it is necessary to take this into account when choosing models.

In this context, modelling with panel data is one of the best methods to analyse tourism demand since it includes several variables, as well as short time series. In addition to these advantages, it permits the comparison between different countries (units) with different economic and geographic structures.

ACKNOWLEDGEMENTS

The authors are pleased to acknowledge financial support from Fundação para a Ciência e a Tecnologia and FEDER/COMPETE (grant PEst-C/EGE/UI4007/2013).

REFERENCES

- Archer, B. (1994). Demand Forecasting and Estimation., In Ritchie, J. R. B., & Goeldner, C. R. (Eds.), *Travel, Tourism and Hospitality Research: A Handbook For Managers and Researchers*, (2a ed.), (p. 105-114). New York: John Wiley & Sons, Inc.
- Berenson, M., & Levine, D. M. (1999). *Basic Business Statistics: Concepts and Applications*, (7th 7a ed.) London: Prentice-Hall: London.
- Buhalis, D., & Costa, C. (2006). *Tourism Management dynamics – trends, management and tools*. Oxford: Elsevier: Oxford.
- Chaves, C., Maciel, E., Guimarães, P., & Ribeiro, J. C. (2000). *Instrumentos Estatísticos de Apoio à Economia: Conceitos Básicos*. Amadora: McGraw-Hill: Amadora.
- Crouch, G. (1994a). The Study of International Tourism Demand: A Survey of Practice. *Journal of Travel Rresearch*, 32(4), 41-57.
- Crouch, G. (1994b). The Study of International Tourism Demand: A Review of Findings. *Journal of Travel Rresearch*, 33(1), 12-23.
- Cunha, L. (2003). *Introdução ao Turismo*. (2a ed.) Lisboa: Editorial Verbo: Lisboa.

Daniel, A. C. M. (2000). *Previsão da Procura Turística em Portugal: Cointegração, Modelos ECM e Modelos Univariados*. Tese de Mestrado, Braga: Universidade do Minho: Braga.

Daniel, A. C. M., & Rodrigues, P. M. M. (2005). Modelling and Forecasting Tourism Demand in Portugal: What Was Done and What Can We Do? *In Recent Developments in Tourism Research Conference*: Faro, Outubro de 2005.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, 74, 427–431.

Elliott, G., Rothenberg, T. J., & Stock, J. H. (1996). Efficient Tests for an Autoregressive Unit Root. *Econometrica*, 64(4), 813–836.

Fleischer, A., & Felsenstein, D. (2004). Face-to-face or cyberspace? Choosing the Internet as an intermediary in the Israeli travel market. *Tourism Economics*, 10(3), 345–359.

Hylleberg, S., Engle, E. F., Granger, C. W. J., & Yoo, B. S. (1990). Seasonal Integration and Cointegration. *Journal of Econometrics*, 44, 215-238.

Ioannides, D., & Dabbage, K. (1998). *The Economic Geography of the Tourism Industry*. London: Routledge: London.

Li, G., Song, H., & Witt, S. (2005). Recent Development in Econometric Modeling Modelling and Forecasting. *Journal of Travel Research*, 44, 82-99.

Macedo, M. A. (1997). *Indicador Avançado da Procura Turística em Portugal*, Tese de Mestrado, Lisboa: Instituto Superior de Economia e Gestão: Lisboa.

Matos, A. I. M. (2000). *A Modelização Econométrica da Procura Turística em Portugal*. Tese de Mestrado, Porto: Universidade do Porto: Porto.

Mavri, M., & Angelis, V. (2009). Forecasting the Growth of E-Tourism Sector: The Case Study of Mediterranean Countries. *Tourismos: An Interdisciplinary Journal of Tourism*, 4(3), 113-125.

Pearce, D. (1995). *Tourism Today a Geographical Analysis*. (2a ed.) London: Longman, Scientific & Technical: London.

Ramos, C. M. Q. (2012). *A influência das Tecnologias de Informação e de Comunicação na Procura Turística: Uma abordagem com Dados em Macro Painel*, Tese de Doutoramento, Faro: Faculdade de Economia da Universidade do Algarve.

Ramos, C. M. Q., & Rodrigues, P. M. M. (2013). The Importance of ICT for Tourism Demand: A Dynamic Panel Data Analysis. I, in Matias, A.,; Nijkamp, P., & Sarmiento, M. (Eds.) *Quantitative Methods in Tourism Economics*, (pp.97-112) . Physica-Verlag, 97-112 HD.

Ramos, C. M. Q., Rodrigues, P. M. M., & Perna, F. (2009). Sistemas e Tecnologias de Informação no Sector Turístico. *Revista Turismo & Desenvolvimento, Aveiro*, 12, 21-32.

Rodrigues, P. M. M., & Taylor, A. M. R. (2011). The Flexible Fourier Form and Local GLS De-trended Unit Root Tests. *Oxford Bulletin of Economics and Statistics*, 1-26.

Song, H., & Li, G., (2008). Tourism demand modelling and forecasting - A review of recent research. *Tourism Management*, 29, 203-220.

Song, H., & Witt, S. F. (2000). *Tourism demand modelling and forecasting: Modern econometric approaches*. New York: Pergamon: New York.

Song, H., Witt, S. F., & Li, G. (2009). *The Advanced Econometrics of Tourism Demand*, Routledge: Taylor and Francis: Routledge.

Stevenson, W. J. (1986). *Estatística Aplicada à Administração*. (2a ed.) São Paulo: Editora Harbra: São Paulo.

Stock, J.H., & Watson, M.W. (2003). *Introduction to Econometrics*, Boston: Pearson Education.

Uysal, M. (1998). The determinants of tourism demand: A theoretical perspective. I, in Ioannides, D., & Debbage, K. G: (Eeds.) *The economic geography of the tourist industry: A supply-side analysis*, p. 79-95, New York: Routledge: New York, 79-95.

Witt, S. F., & Witt, C. (1992). *Modelling and Forecasting Demand in Tourism*. San Diego: Academic Press Limited: San Diego.

Witt, S. F., & Witt, C. (1995) Forecasting Tourism Demand: A review of Empirical Research. *International Journal of Forecasting*, 11, 447-475.

Wooldridge, J.M. (2006). *Introdução à Econometria, uma Abordagem Moderna*, São Paulo: Pioneira Thomson Learning.